STORMWATER MANAGEMENT CALCULATIONS

FOR

HABITAT FOR HUMANITY
AIRPORT ROAD TOWNHOMES
REZONING APPLICATION

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VIRGINIA

JULY 3, 2023

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SECTION I: PROJECT NARRATIVE

Project Description

The purpose of this project is the rezoning of 1.10 acres of land for Habitat for Humanity of the New River Valley. The project area is currently made up of two (2) separate parcels with an existing house on each of the parcels. There are two paper street rights-of-way that border the parcels (Airport Drive and Virginia Street) that are to have portions vacated and added to the site. The applicant proposes to rezone the properties from R-4 (Low Density Residential) to a PRD (Planned Residential District) in order to construct a new townhome community.

Existing Site Conditions

The project site[1] is located at a sharp road bend where Airport Road and Hubbard Street meet. The site is bound by Troy Brown to the north and VPI (Virginia Tech Montgomery Executive Airport) to the West and South. Surrounding properties consist of single-family residential, multi-family residential, Dehart Street Tot Lot Park, and the Blacksburg Fire Department. The land owned by the airport directly near the site consists of open space and the runway is about 700 feet southwest of the property.

Existing soil conditions on-site include the types listed below with slopes ranging from 2%-25%. 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.

Existing soil conditions on-site include the following types:
(See attached soils map for specific locations.)

18B - Groseclose-Urban Land Complex, 2 to 7 percent slopes
K-Factor: 0.32
Texture: Loam
HSG: C

18C - Groseclose-Urban Land Complex, 7 to 15 percent slopes
K-Factor: 0.32
Texture: Loam
HSG: C

13C - Groseclose-Urban Land Complex, 15 to 25 percent slopes
K-Factor: 0.32
Texture: Loam
HSG: C

[1] For the purposes of the Project Narrative, "site" shall be defined as the area within the subject property boundary, 1.10 acres, Tax Map #'s 317-2 31, 32, 34A, 317-2 32A, 33, 34, and portions of the Airport Drive and Virginia Street rights-of-way to be vacated (see rezoning documents).

Development Plans

The proposed development will consist of 11 new townhomes with 3-bedrooms each. The townhomes will each be two (2) stories and built slab-on-grade with each unit including a covered front porch. Parking will be provided in a surface parking lot built behind the development. Water main and sanitary sewer main extensions are proposed to serve the development. Stormwater quantity management will be handled by an underground detention system. Water quality requirements will be met by purchasing nutrient credits.

During Construction

Neighboring areas are primarily developed urban land consisting of single- and multi-family 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 drainage area map.

In the pre-development condition, the site contains two houses and a parking area with the rear of the site consisting of grassed and wooded areas. A 25.14 acre area drains through the site and into the Virginia Tech Airport property. The off-site areas have been separated from the drainage that will be managed on-site. A large area northwest of the site consisting of mostly single-family lots is collected in the Dehart Street Park pond and is discharged into the site. A ditch along Airport Road collects drainage from the road and residential lots before flowing into the site. There is also an inlet on the other side of the Airport Road that collects drainage from single-family lots and discharges into the site. All of this off-site drainage converges in the rear of the site and flows southeast through the site. The point of analysis has been set at an existing drop inlet just south of the of site in the airport property, where all site and off-site drainage converges.

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.

Pre-Development Land Cover

Area (acres)	CN	Description (subcatchment numbers)
0.659	79	1 acre lots, 20% imp, HSG C (1S, 3S, 4S)
2.520	80	1/2 acre lots, 25% imp, HSG C (2S, 3S. 4S)
12.913	83	¼ acre lots, 38% imp, HSG C (1S, 2S, 3S)
3.861	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
1.068	98	Paved parking, HSG C (1S)
2.928	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 3S, 4S)
1.188	92	Paved roads w/open ditches, 50% imp, HSG C (2S, 3S)
25.14	**83**	**TOTAL AREA**

Point of Analysis

Total Drainage Area= 25.14 acres

	Peak Flow	Runoff Volume
1-year	17.46 cfs	2.127 af
2-year	24.22 cfs	2.894 af
10-year	42.69 cfs	3.364 af
100-year	70.78 cfs	9.778 af

POST-DEVELOPMENT SUMMARY

Please see Sheet SW4 for drainage area map.

In the post-development condition, the off-site runoff will be captured via storm sewer pipes to bypass the site. The site will be graded to capture site runoff via sheet flow, roof drains, curb inlets, and stormwater piping. Runoff will be collected in an underground detention facility and outflow from this system will be managed by multiple flow control devices. As shown in the enclosed HydroCAD calculations, the underground system has been designed to manage peak flows and meet water quantity requirements. The underground facility will outflow into the storm sewer and converge with the off-site runoff to be discharged at the southern corner of the site. A small area of the site behind units 7-11 will not be captured by on-site methods and will flow directly to the point of analysis, but no impervious improvements will drain directly to the point of analysis.

Outflow from the storm sewer at the point of discharge will flow into the existing drop inlet on the airport property, which is the point of analysis. 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. Where a subwatershed is predominantly impervious, a minimum time of concentration of 6 minutes has been assumed.

Post-Development Land Cover

Area (acres)	CN	Description (subcatchment numbers)
0.659	79	1 acre lots, 20% imp, HSG C (1S, 3S, 4S)
2.520	80	1/2 acre lots, 25% imp, HSG C (2S, 3S. 4S)
12.913	83	¼ acre lots, 38% imp, HSG C (1S, 2S, 3S)
3.507	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
1.422	98	Paved parking, HSG C (1S)
2.928	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 3S, 4S)
1.188	92	Paved roads w/open ditches, 50% imp, HSG C (2S, 3S)
25.14	**84**	**TOTAL AREA**

Point of Analysis

Total Drainage Area= 16.64 acres

The following table summarizes the pre- and post-development peak flow rates for the point of analysis and the percent change for each storm (see HydroCAD report).

	Pre-Dev Peak Flow Rate	Post-Dev Peak Flow Rate
1-year	17.46 cfs	17.23 cfs
2-year	24.22 cfs	23.86 cfs
10-year	42.69 cfs	42.28 cfs

As shown above, the post-development peak flow rates are less than the pre-development peak flow rates for the 1-year, 2-year, and 10-year, thus meeting Town of Blacksburg requirements for stormwater quantity.

Channel Protection

Runoff from the site[2] will be discharged to the existing drop inlet located just beyond the southern site boundary on the airport property. From there, runoff is conveyed by a manmade conveyance system (storm sewer) across the airport before ultimately discharging out of an 8' x 5' concrete box culvert south of Research Center Drive. As shown on Sheet SW4, a watershed containing approximately 238 acres forms at the beginning of the 8' x 5' box culvert. In accordance with Town Code §18-613(b)(4)(i), this point forms the Limits of Analysis for channel protection since the site's contributing drainage area (1.20 acres) is less than 1% of the total watershed area. The entire conveyance system from the site to this point is a manmade conveyance system made up of concrete storm sewer and manhole structures. Because the flow at the point of analysis will be reduced in the post-development condition, no erosion of the manmade system should be expected as a result of this development.

Flood Protection

In accordance with Town Code §18-613(c), concentrated stormwater flows have been discharged to a stormwater conveyance system. The downstream conveyance system is a manmade storm sewer. 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 subsection 2(ii) of the Code. Per subsection (3) of the Code, when subdivision 2(ii) is utilized, the discharge point constitutes the Limits of Analysis and no further analysis of the downstream stormwater conveyance system is required.

[2] In the context of channel and flood protection, "site" shall be defined as the area where work is being performed, including any offsite disturbance (approximately 1.20 acres). See Sheets SW3-SW5.

SECTION III: STORMWATER QUALITY SUMMARY

Water quality compliance will be achieved 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 the area of disturbance is less than 5 acres or the water quality reduction requirement is less than 10 pounds per year. This site qualifies for nutrient credit purchase with a total disturbed area of approximately 1.20 acres and a reduction requirement of 0.94 pounds per year.

The existing site[3] has an impervious land cover of 0.27 acres (23%). The post-development site will have an impervious land cover of .71 acres (59%) resulting in a runoff coefficient (R_v) of 0.65. The required pollutant removal rate is 0.94 lb/year, all of which will be handled with nutrient credits.

[3] In the context of channel and flood protection, "site" shall be defined as the area where work is being performed, including any offsite disturbance (approximately 1.20 acres). See Sheets SW3-SW5.

SECTION IV: DOWNSTREAM ANALYSIS

Runoff from the proposed development is discharged directly into to a series of manmade conveyance systems. These conveyance systems carry flows from the site downstream to the 1% analysis point (120 acres). The post-development peak runoff has been mitigated via underground detention facilities to prevent adverse impacts from this site to downstream properties in the form of channel erosion and flooding.

Per Town Code §18-613 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 should be expected as a result of this development.

SECTION V: 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

Underground Detention Facilities:

1. Every (12) months the responsible party shall complete and document a visual inspection of the underground facility and its components and make any repairs necessary to areas of failure or concern discovered during inspection. Typical maintenance tasks include:
    a. Cleanout of any debris or sediment accumulated in the structure that reduces the storage volume or otherwise hinders the performance of the facility.
    b. Visual inspection for structural deterioration, spalling, or cracking of the structural components.
2. The flow control manholes shall be inspected after each runoff producing storm event to check for debris and/or sediment accumulation that may compromise the performance of the structure. Such debris and sediments shall be removed immediately.

Per the Town of Blacksburg stormwater ordinance, a formal maintenance agreement shall be provided to the Town for review and ultimately recorded at the Montgomery County Courthouse legally binding the identified party to the maintenance/inspection responsibilities listed above.

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

June 23, 2023

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 15, Aug 31, 2022

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
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	28.7	12.6%
29	Udorthents and Urban land	73.0	31.9%
W	Water	0.8	0.3%
Totals for Area of Interest		**228.7**	**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

18B—Groseclose-Urban land complex, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc27
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: Not prime farmland

Map Unit Composition

Groseclose and similar soils: 40 percent
Urban land: 30 percent
Minor components: 3 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
Ecological site: F128XY516WV - Mesic Limestone With Interbedded Sedimentary Uplands
Hydric soil rating: No

Description of Urban Land

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

Minor Components

Purdy

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

18C—Groseclose-Urban land complex, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc28
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: Not prime farmland

Map Unit Composition

Groseclose and similar soils: 40 percent
Urban land: 30 percent
Minor components: 3 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
Ecological site: F128XY516WV - Mesic Limestone With Interbedded Sedimentary Uplands
Hydric soil rating: No

Description of Urban Land

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

Minor Components

Purdy

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

18D—Groseclose-Urban land complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kc29
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: Not prime farmland

Map Unit Composition

Groseclose and similar soils: 40 percent
Urban land: 30 percent
Minor components: 3 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
Ecological site: F128XY516WV - Mesic Limestone With Interbedded Sedimentary Uplands
Hydric soil rating: No

Description of Urban Land

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

Minor Components

Purdy

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

29—Udorthents and Urban land

Map Unit Setting

National map unit symbol: kc2r
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: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent
Urban land: 30 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone, shale, sandstone, or granite residuum

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

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

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone, shale, sandstone, or granite residuum

Minor Components

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

W—Water

Map Unit Setting
National map unit symbol: kc3g
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
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting
Landform: Perenial streams, lakes

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 Chemical Properties

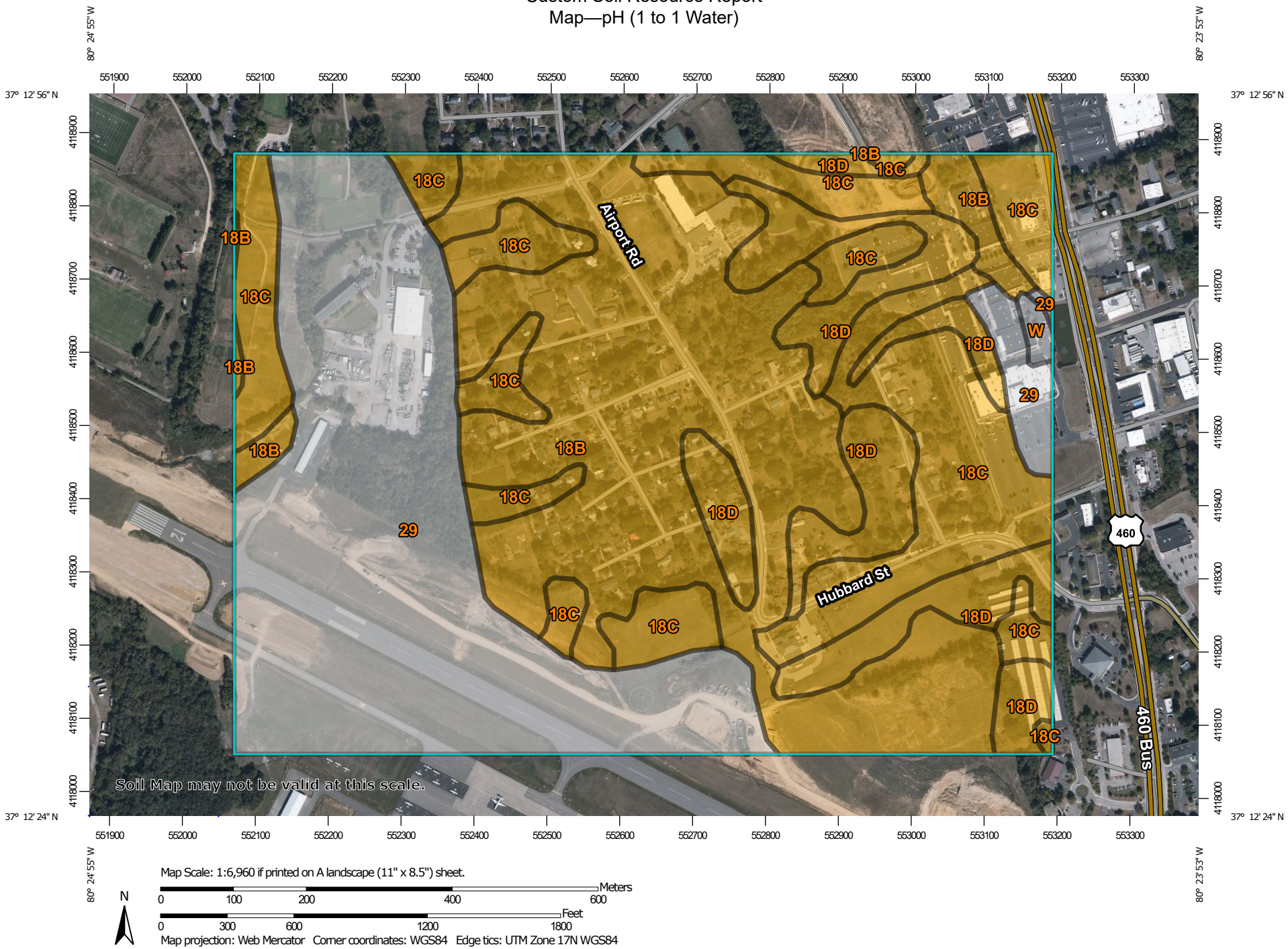
Soil Chemical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

pH (1 to 1 Water)

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion. In general, soils that are either highly alkaline or highly acid are likely to be very corrosive to steel. The most common soil laboratory measurement of pH is the 1:1 water method. A crushed soil sample is mixed with an equal amount of water, and a measurement is made of the suspension.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—pH (1 to 1 Water)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Ultra acid (ph < 3.5)
- Extremely acid (pH 3.5 - 4.4)
- Very strongly acid (pH 4.5 - 5.0)
- Strongly acid (pH 5.1 - 5.5)
- Moderately acid (pH 5.6 - 6.0)
- Slightly acid (pH 6.1 - 6.5)
- Neutral (pH 6.6 - 7.3)
- Slightly alkaline (pH 7.4 - 7.8)
- Moderately alkaline (pH 7.9 - 8.4)
- Strongly alkaline (pH 8.5 - 9.0)
- Very strongly alkaline (pH > 9.0)
- Not rated or not available

Soil Rating Lines

- Ultra acid (ph < 3.5)
- Extremely acid (pH 3.5 - 4.4)
- Very strongly acid (pH 4.5 - 5.0)
- Strongly acid (pH 5.1 - 5.5)
- Moderately acid (pH 5.6 - 6.0)
- Slightly acid (pH 6.1 - 6.5)
- Neutral (pH 6.6 - 7.3)
- Slightly alkaline (pH 7.4 - 7.8)
- Moderately alkaline (pH 7.9 - 8.4)
- Strongly alkaline (pH 8.5 - 9.0)
- Very strongly alkaline (pH > 9.0)
- Not rated or not available

Soil Rating Points

- Ultra acid (ph < 3.5)
- Extremely acid (pH 3.5 - 4.4)
- Very strongly acid (pH 4.5 - 5.0)
- Strongly acid (pH 5.1 - 5.5)
- Moderately acid (pH 5.6 - 6.0)
- Slightly acid (pH 6.1 - 6.5)
- Neutral (pH 6.6 - 7.3)
- Slightly alkaline (pH 7.4 - 7.8)
- Moderately alkaline (pH 7.9 - 8.4)
- Strongly alkaline (pH 8.5 - 9.0)
- Very strongly alkaline (pH > 9.0)
- 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 15, Aug 31, 2022

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—pH (1 to 1 Water)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	4.6	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	4.6	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	4.6	28.7	12.6%
29	Udorthents and Urban land		73.0	31.9%
W	Water		0.8	0.3%
Totals for Area of Interest			**228.7**	**100.0%**

Rating Options—pH (1 to 1 Water)

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 1

Bottom Depth: 5

Units of Measure: Centimeters

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

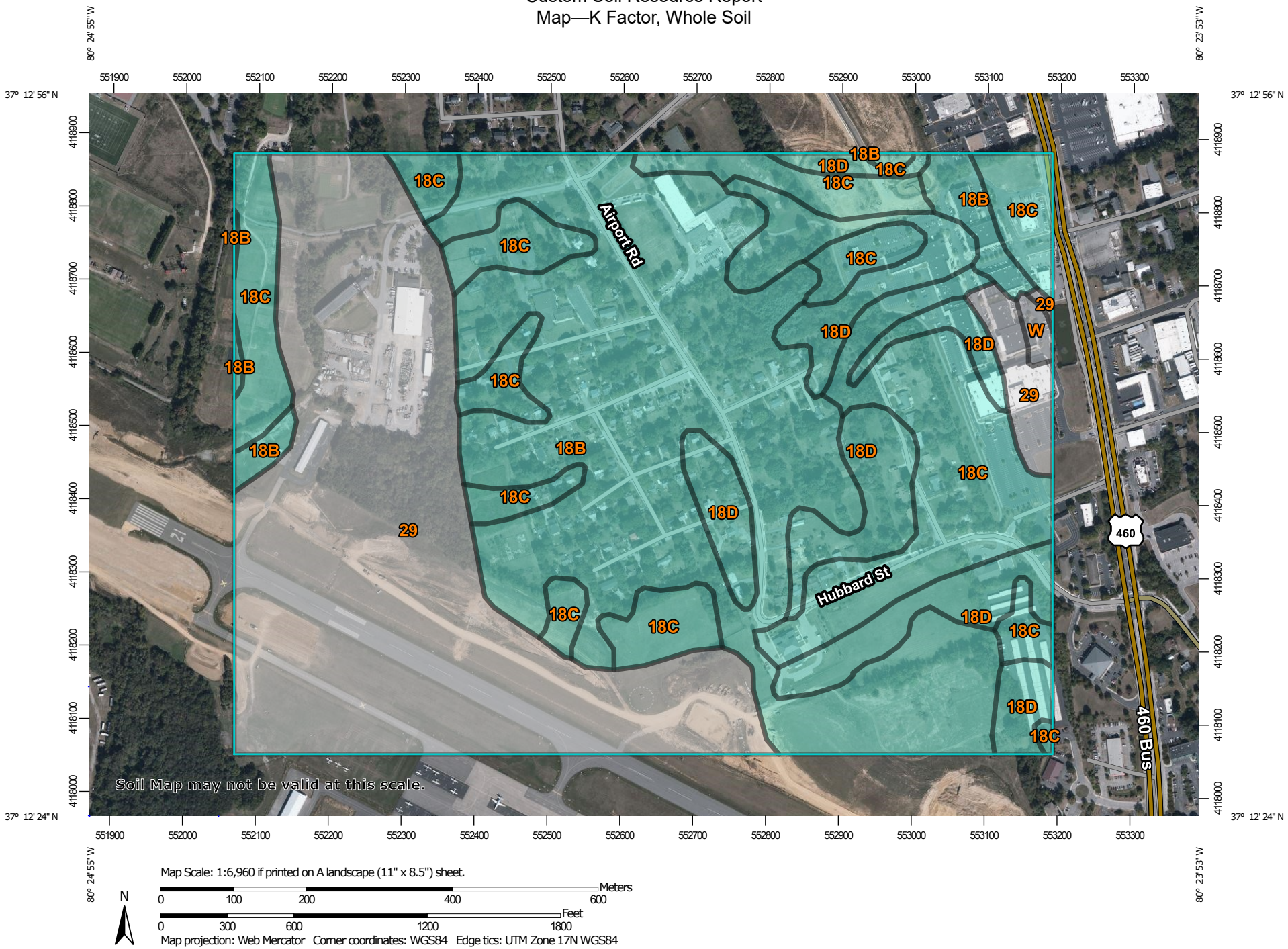
Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in 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.

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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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Survey Area Data: Version 15, Aug 31, 2022

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

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Table—K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	.32	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	.32	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	.32	28.7	12.6%
29	Udorthents and Urban land		73.0	31.9%
W	Water		0.8	0.3%
Totals for Area of Interest			**228.7**	**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."

Custom Soil Resource Report
Map—Surface Texture

Map Scale: 1:6,960 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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

- Loam
- Not rated or not available

Soil Rating Lines

- Loam
- Not rated or not available

Soil Rating Points

- 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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Table—Surface Texture

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	Loam	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	Loam	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	Loam	28.7	12.6%
29	Udorthents and Urban land		73.0	31.9%
W	Water		0.8	0.3%
Totals for Area of Interest			**228.7**	**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.

Custom Soil Resource Report
Map—Hydrologic Soil Group

Map Scale: 1:6,960 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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

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

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Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	C	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	C	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	C	28.7	12.6%
29	Udorthents and Urban land		73.0	31.9%
W	Water		0.8	0.3%
Totals for Area of Interest			**228.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

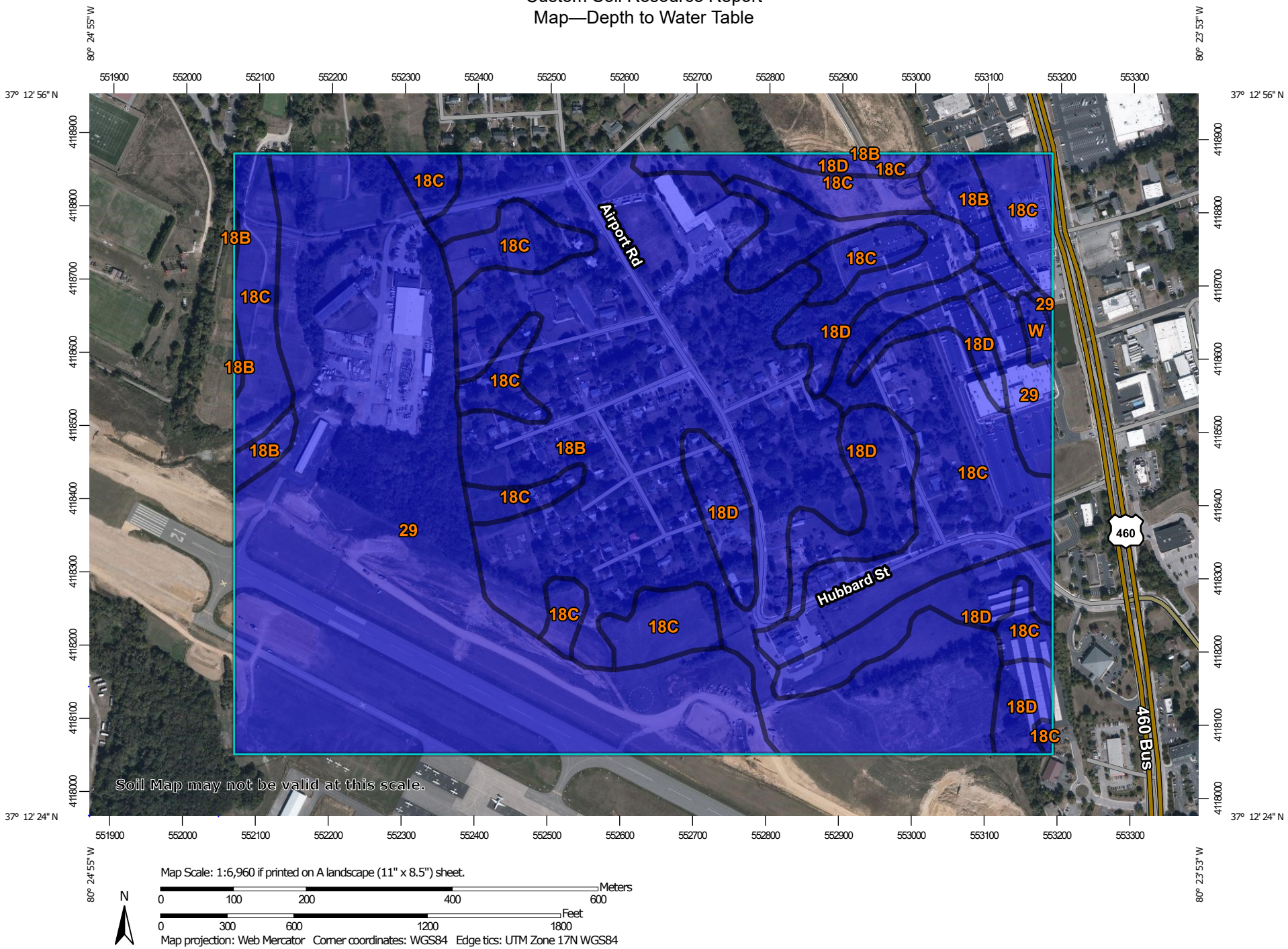
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Water Table



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Lines

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Points

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

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.

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

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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—Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	>200	76.2	33.3%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	>200	50.0	21.9%
18D	Groseclose-Urban land complex, 15 to 25 percent slopes	>200	28.7	12.6%
29	Udorthents and Urban land	>200	73.0	31.9%
W	Water	>200	0.8	0.3%
Totals for Area of Interest			**228.7**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

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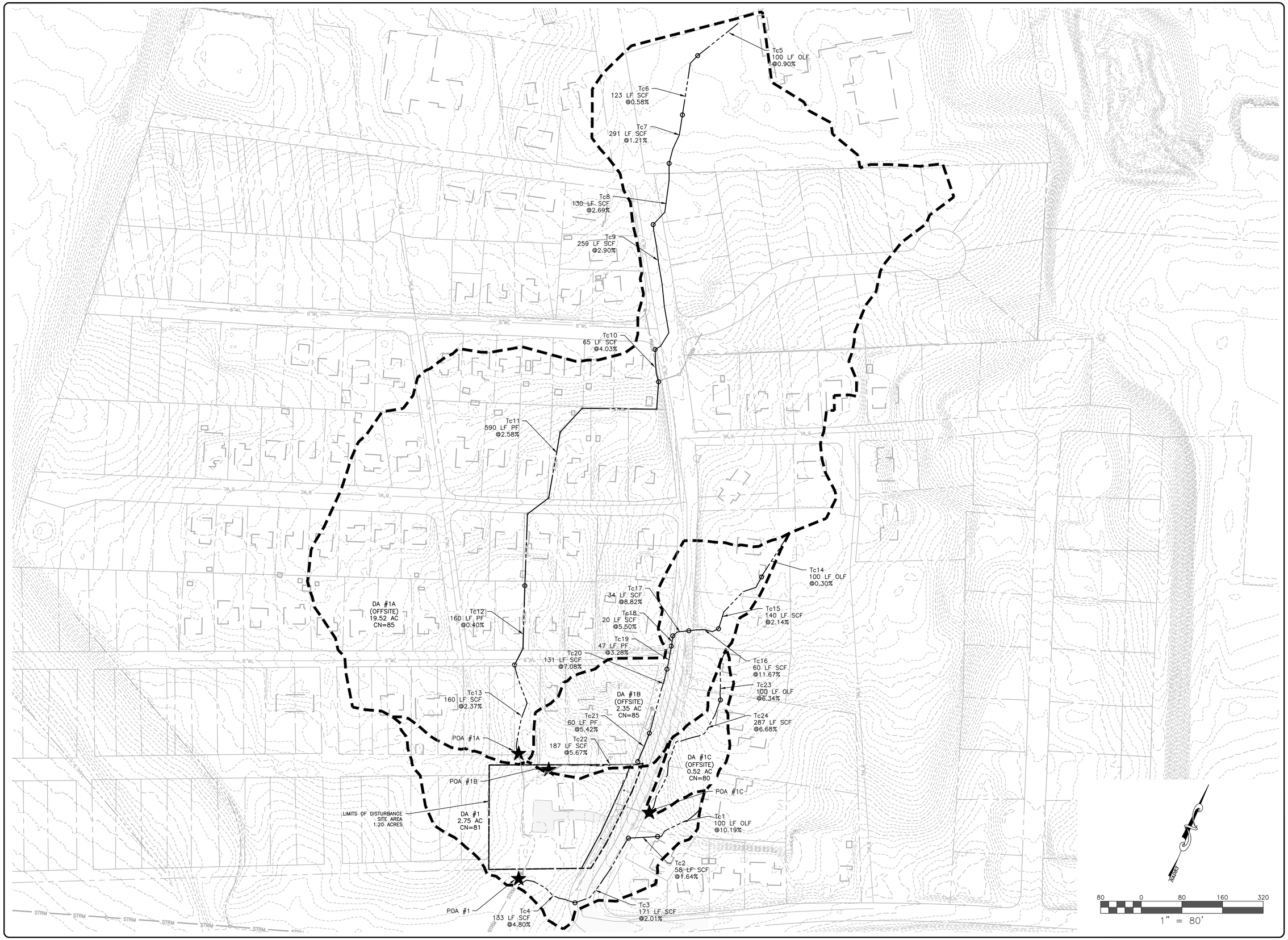
APPENDIX B:
DRAINAGE MAPS



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7/3/23
PROFESSIONAL ENGINEER

HABITAT FOR HUMANITY

AIRPORT ROAD TOWNHOMES

PRE-DEVELOPMENT DRAINAGE MAPS

MOUNT TABOR MAGISTERIAL DISTRICT
PROJECT ADDRESS

DRAWN BY	AWC
DESIGNED BY	AWC
CHECKED BY	JRT
DATE	7/3/2023
SCALE	1" = 80'
REVISIONS	

PROJECT NO. 24230054.00

SW3

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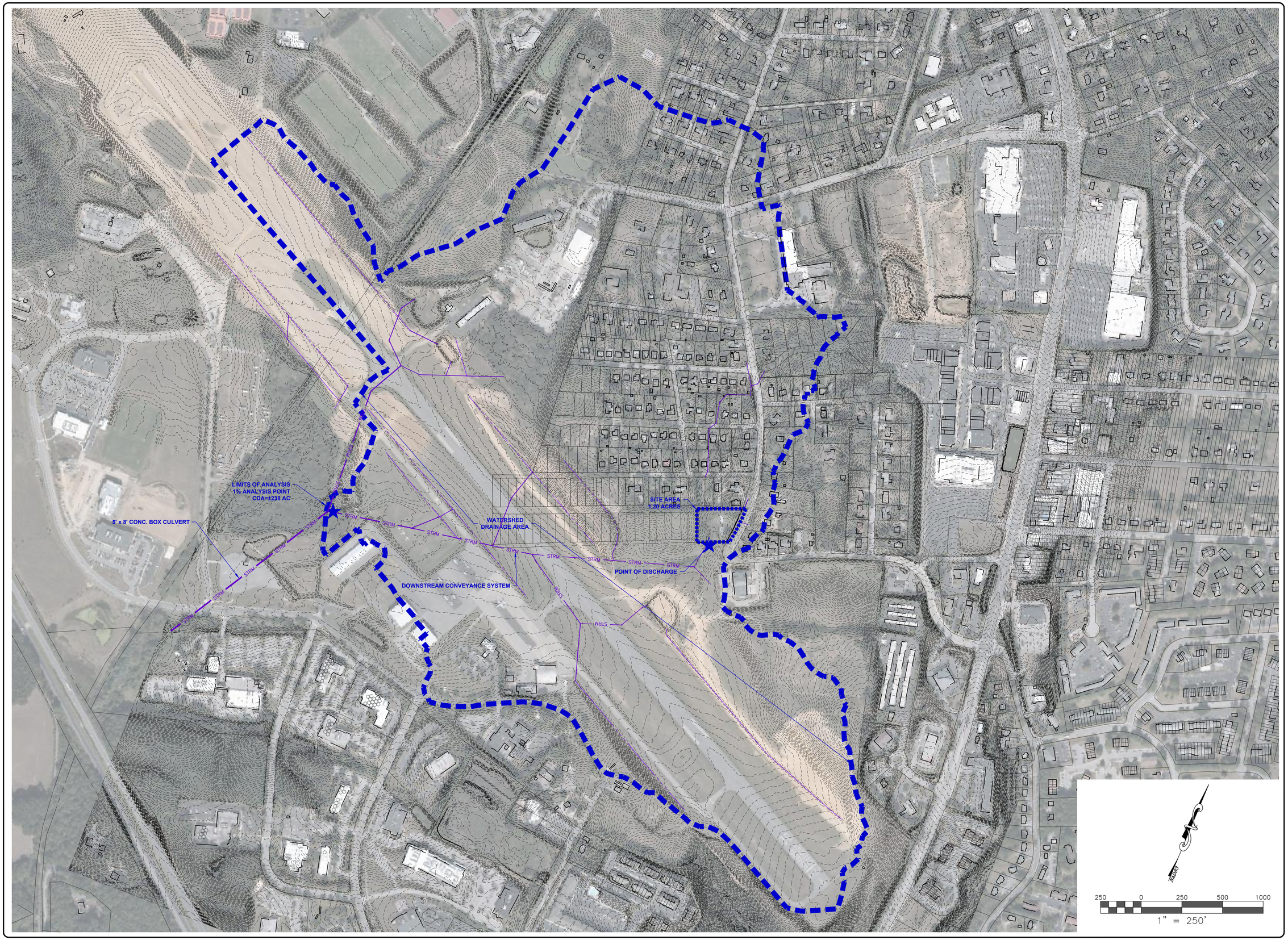

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WATERSHED DRAINAGE AREA

MOUNT TABOR MAGISTERIAL DISTRICT
PROJECT ADDRESS

DRAWN BY	AWC
DESIGNED BY	AWC
CHECKED BY	JRT
DATE	7/3/2023
SCALE	1" = 250'
REVISIONS	

PROJECT NO. 24230054.00

SW4

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AIRPORT ROAD TOWNHOMES

POST-DEVELOPMENT DRAINAGE MAPS

MOUNT TABOR MAGISTERIAL DISTRICT
PROJECT ADDRESS

DRAWN BY	AWC
DESIGNED BY	AWC
CHECKED BY	JRT
DATE	7/3/2023
SCALE	1" = 80'
REVISIONS	

PROJECT NO. 24230054.00

SW5

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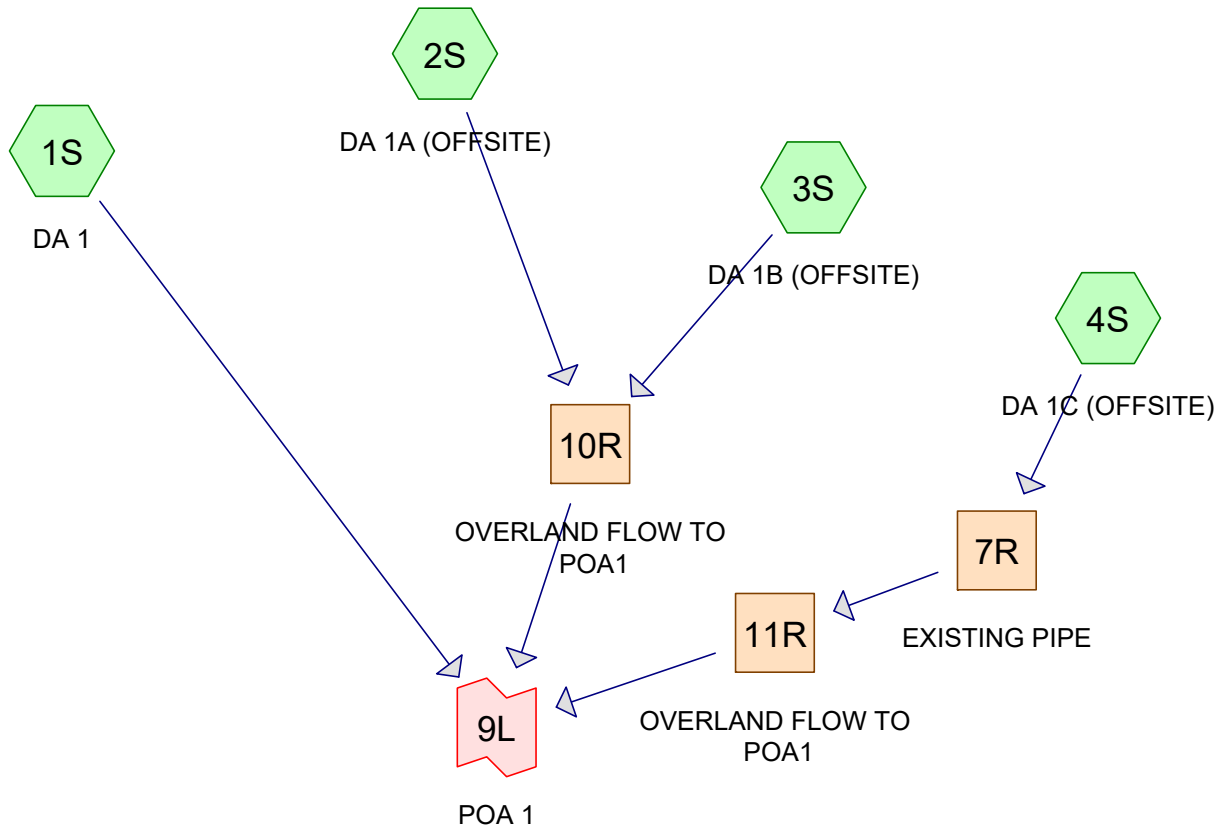
APPENDIX C:
STORMWATER QUANTITY CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for PRE DEV
Prepared by Balzer & Associates, Inc, Printed 6/30/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.659	79	1 acre lots, 20% imp, HSG C (1S, 3S, 4S)
2.520	80	1/2 acre lots, 25% imp, HSG C (2S, 3S, 4S)
12.913	83	1/4 acre lots, 38% imp, HSG C (1S, 2S, 3S)
3.861	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
1.068	98	Paved parking, HSG C (1S, 2S)
2.928	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 3S, 4S)
1.188	92	Paved roads w/open ditches, 50% imp, HSG C (2S, 3S)
25.137	**84**	**TOTAL AREA**

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

Subcatchment 1S: DA 1 Runoff Area=2.750 ac 28.50% Impervious Runoff Depth=0.90"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=2.72 cfs 0.206 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.523 ac 42.65% Impervious Runoff Depth=1.03"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=14.58 cfs 1.681 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.349 ac 43.59% Impervious Runoff Depth=1.06"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=1.69 cfs 0.207 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=0.76"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=0.43 cfs 0.032 af

Reach 7R: EXISTING PIPE Avg. Flow Depth=0.24' Max Vel=2.91 fps Inflow=0.43 cfs 0.032 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=0.43 cfs 0.032 af

Link 9L: POA 1 Inflow=17.46 cfs 2.127 af
Primary=17.46 cfs 2.127 af

Reach 10R: OVERLAND FLOW TO Avg. Flow Depth=0.22' Max Vel=1.58 fps Inflow=16.23 cfs 1.889 af
n=0.025 L=237.0' S=0.0127 '/' Capacity=10,937.20 cfs Outflow=16.11 cfs 1.889 af

Reach 11R: OVERLAND FLOW TO POA1 Avg. Flow Depth=0.02' Max Vel=0.72 fps Inflow=0.43 cfs 0.032 af
n=0.025 L=256.0' S=0.0273 '/' Capacity=1,579.47 cfs Outflow=0.34 cfs 0.032 af

Total Runoff Area = 25.137 ac Runoff Volume = 2.127 af Average Runoff Depth = 1.02"
59.19% Pervious = 14.878 ac 40.81% Impervious = 10.259 ac

Summary for Subcatchment 1S: DA 1

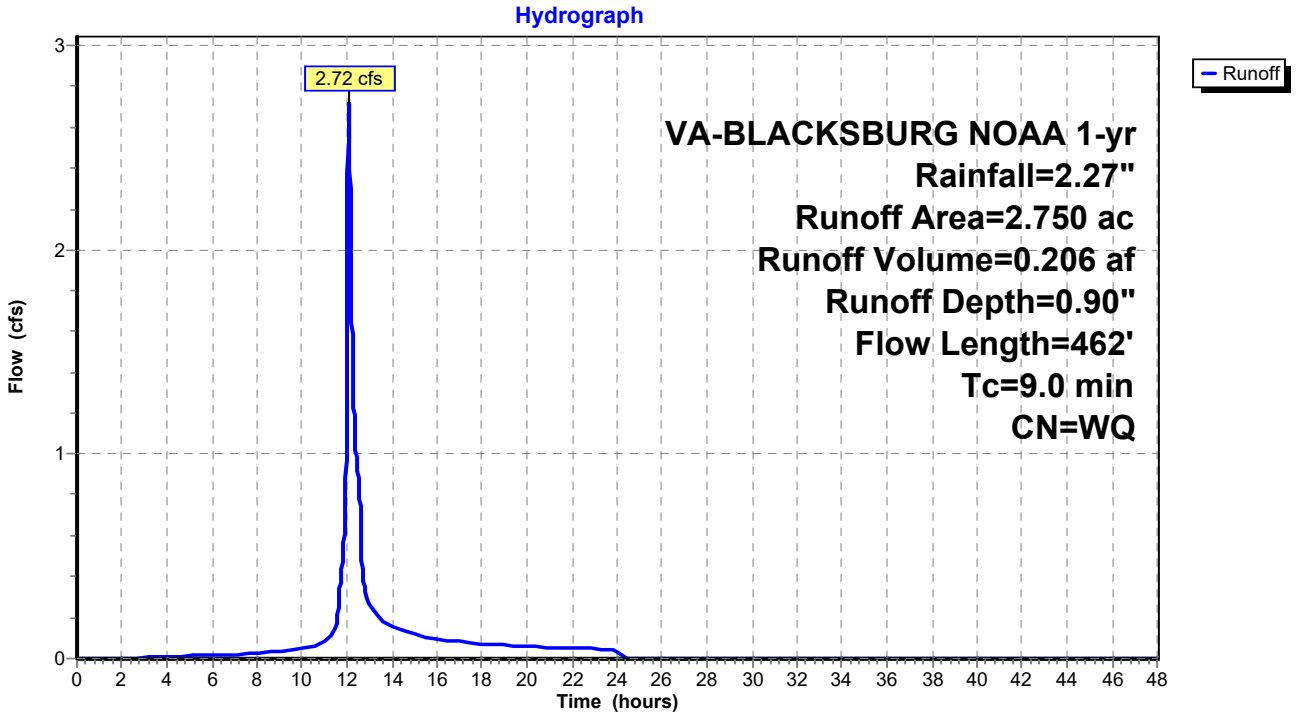
Runoff = 2.72 cfs @ 12.08 hrs, Volume= 0.206 af, Depth= 0.90"
Routed to Link 9L : POA 1

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
1.637	74	>75% Grass cover, Good, HSG C
0.170	98	Paved parking, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.336	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
2.750		Weighted Average
1.966		71.50% Pervious Area
0.784		28.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

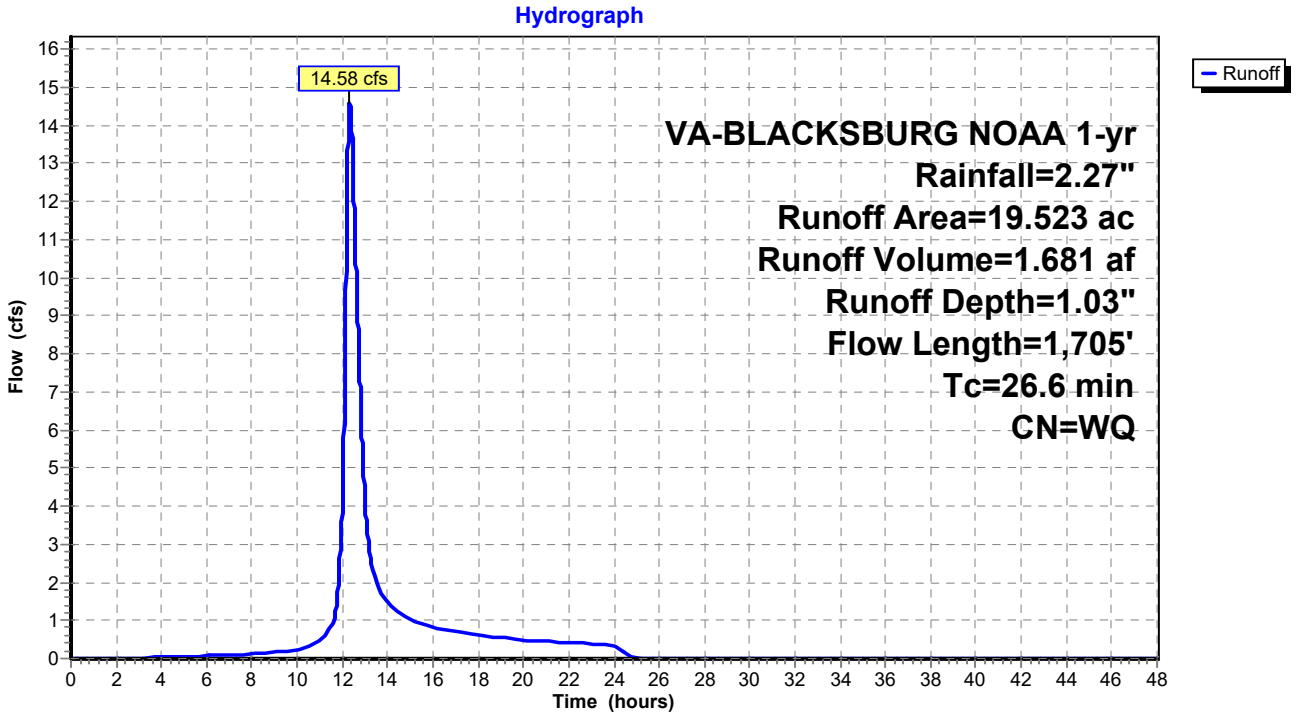
Runoff = 14.58 cfs @ 12.33 hrs, Volume= 1.681 af, Depth= 1.03"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
2.128	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.523		Weighted Average
11.197		57.35% Pervious Area
8.326		42.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 18141% of capacity of segment #8

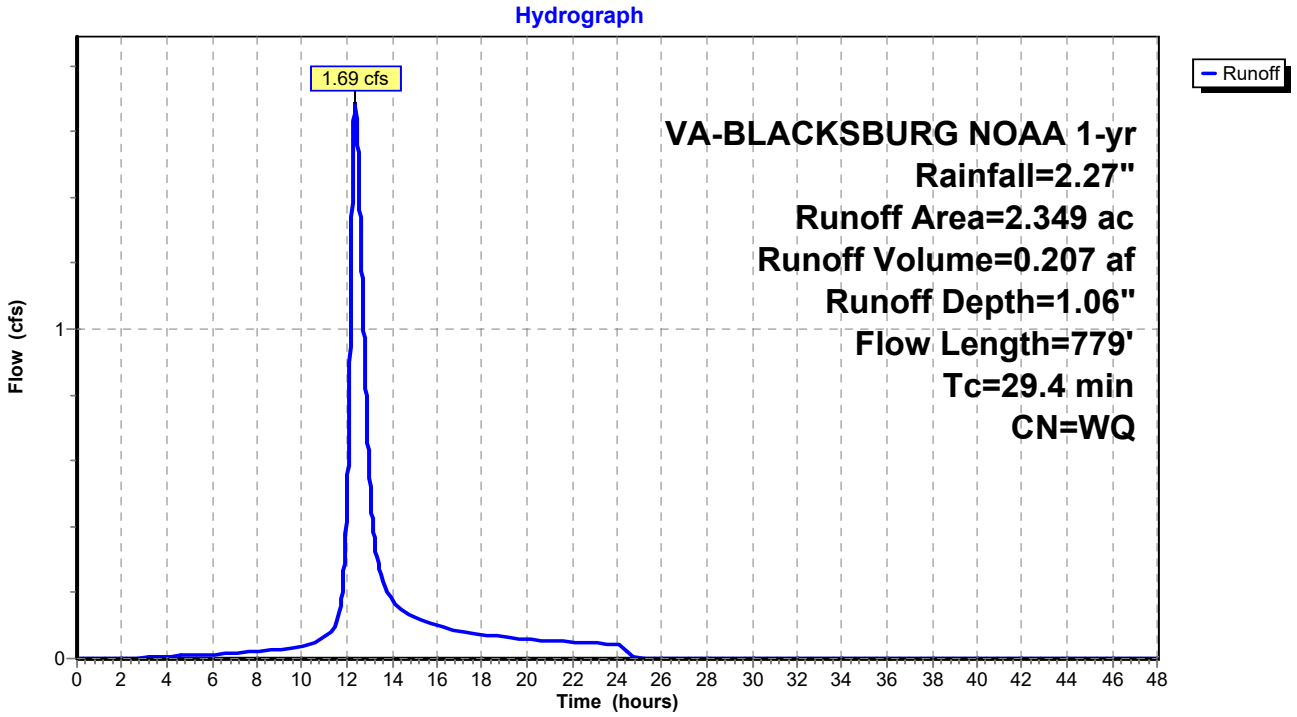
Runoff = 1.69 cfs @ 12.38 hrs, Volume= 0.207 af, Depth= 1.06"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.096	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.349		Weighted Average
1.325		56.41% Pervious Area
1.024		43.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.03' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

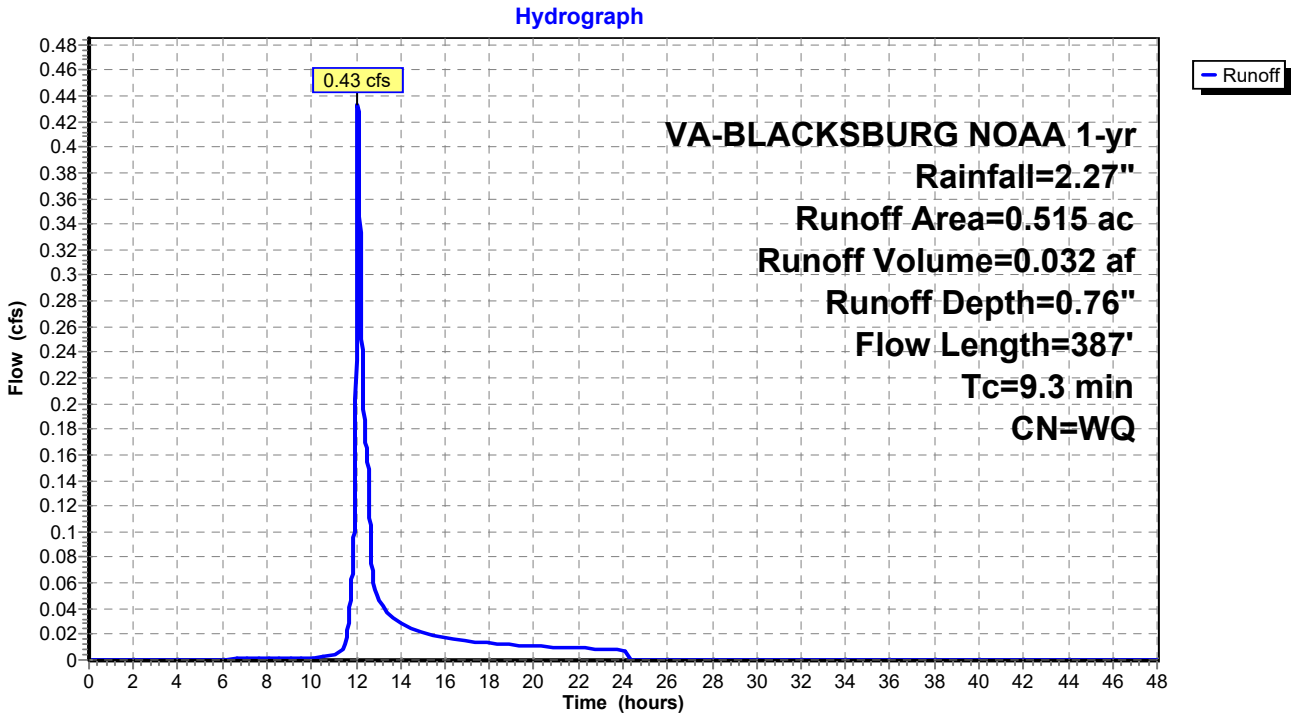
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 0.76"
Routed to Reach 7R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Reach 7R: EXISTING PIPE

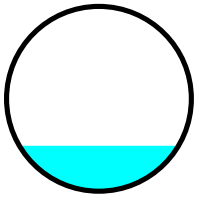
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 11R : OVERLAND FLOW TO POA1

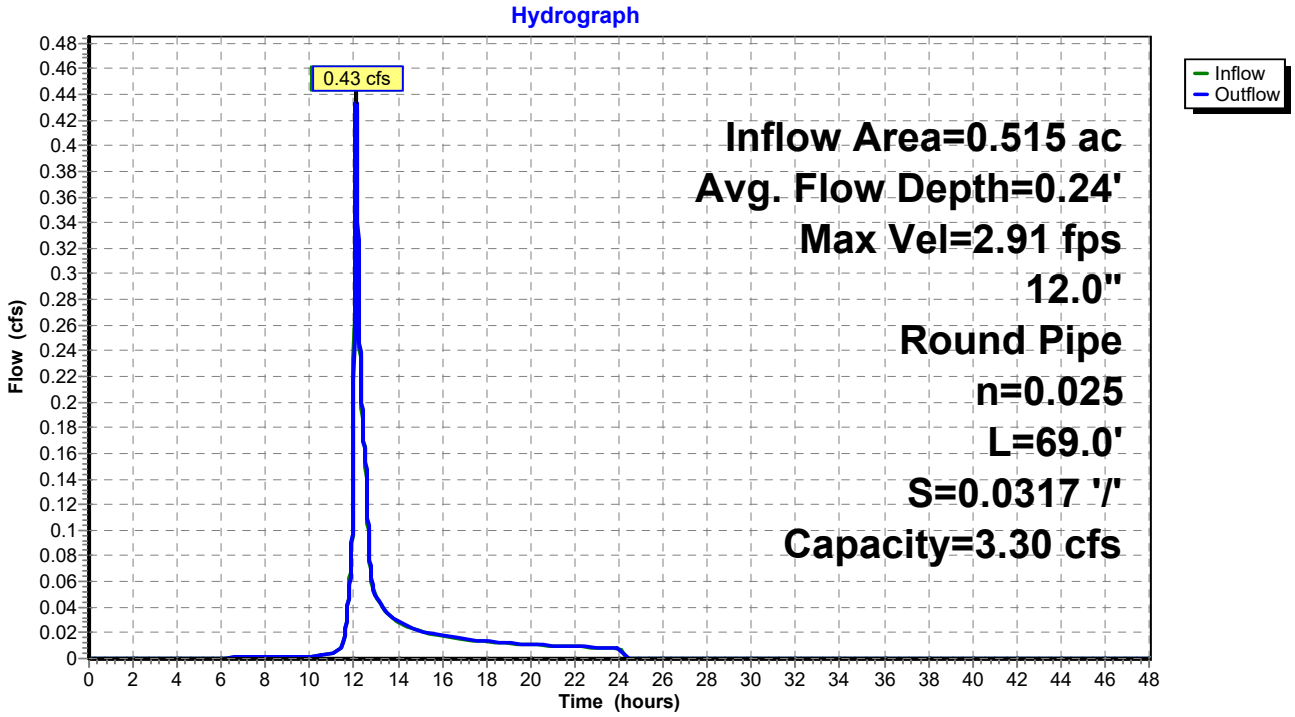
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 1.3 min

Peak Storage= 10 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.24' , Surface Width= 0.86'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 7R: EXISTING PIPE

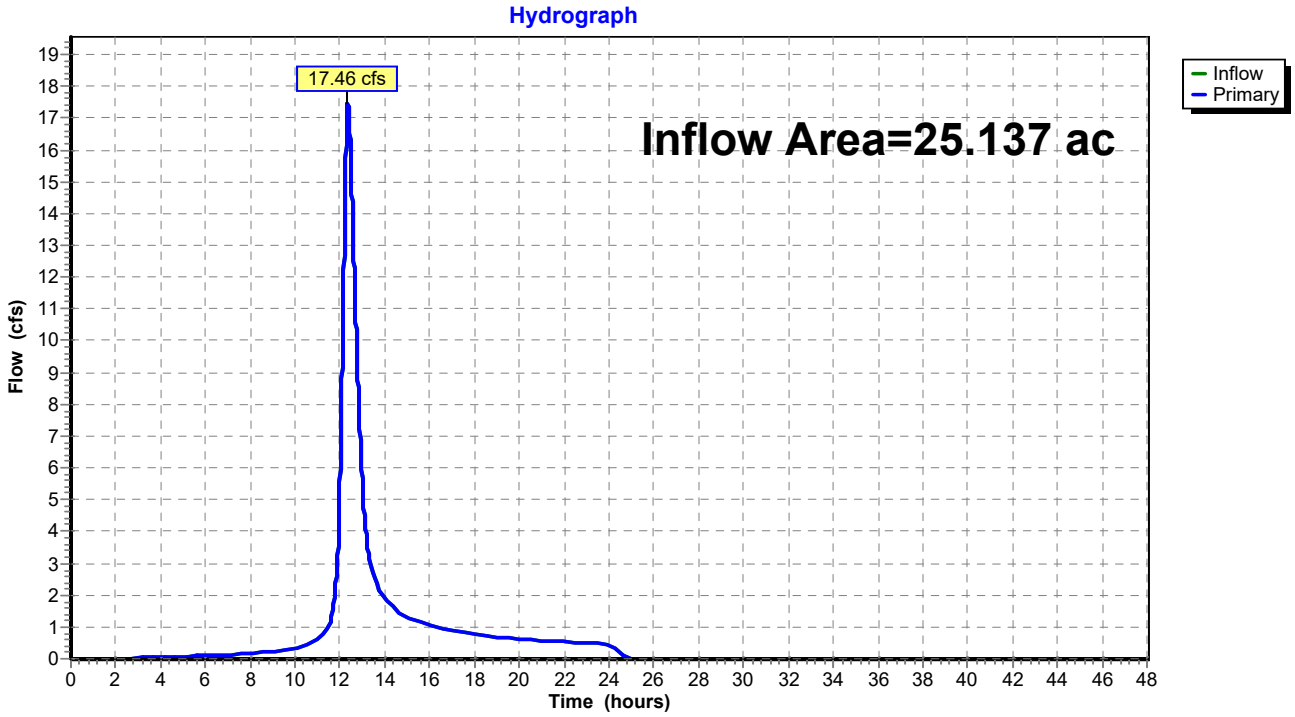


Summary for Link 9L: POA 1

Inflow Area = 25.137 ac, 40.81% Impervious, Inflow Depth = 1.02" for 1-yr event
Inflow = 17.46 cfs @ 12.35 hrs, Volume= 2.127 af
Primary = 17.46 cfs @ 12.35 hrs, Volume= 2.127 af, Atten= 0%, Lag= 0.0 min

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

Link 9L: POA 1



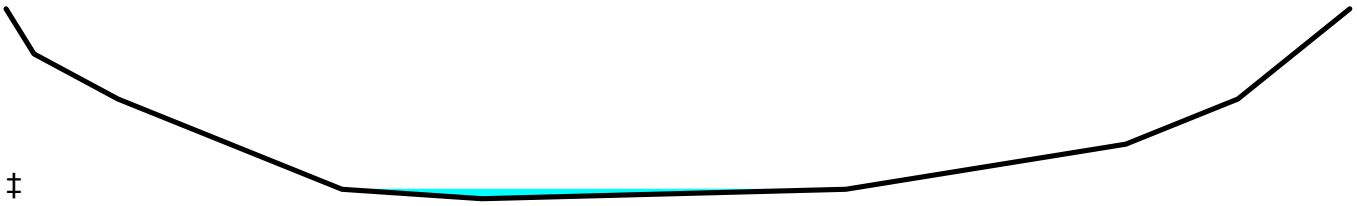
Summary for Reach 10R: OVERLAND FLOW TO POA1

Inflow Area = 21.872 ac, 42.75% Impervious, Inflow Depth = 1.04" for 1-yr event
Inflow = 16.23 cfs @ 12.33 hrs, Volume= 1.889 af
Outflow = 16.11 cfs @ 12.36 hrs, Volume= 1.889 af, Atten= 1%, Lag= 1.9 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.58 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 5.8 min

Peak Storage= 2,422 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.22' , Surface Width= 90.59'
Bank-Full Depth= 4.21' Flow Area= 759.5 sf, Capacity= 10,937.20 cfs

Custom cross-section, Length= 237.0' Slope= 0.0127 '/' (103 Elevation Intervals)
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,112.00', Outlet Invert= 2,109.00'

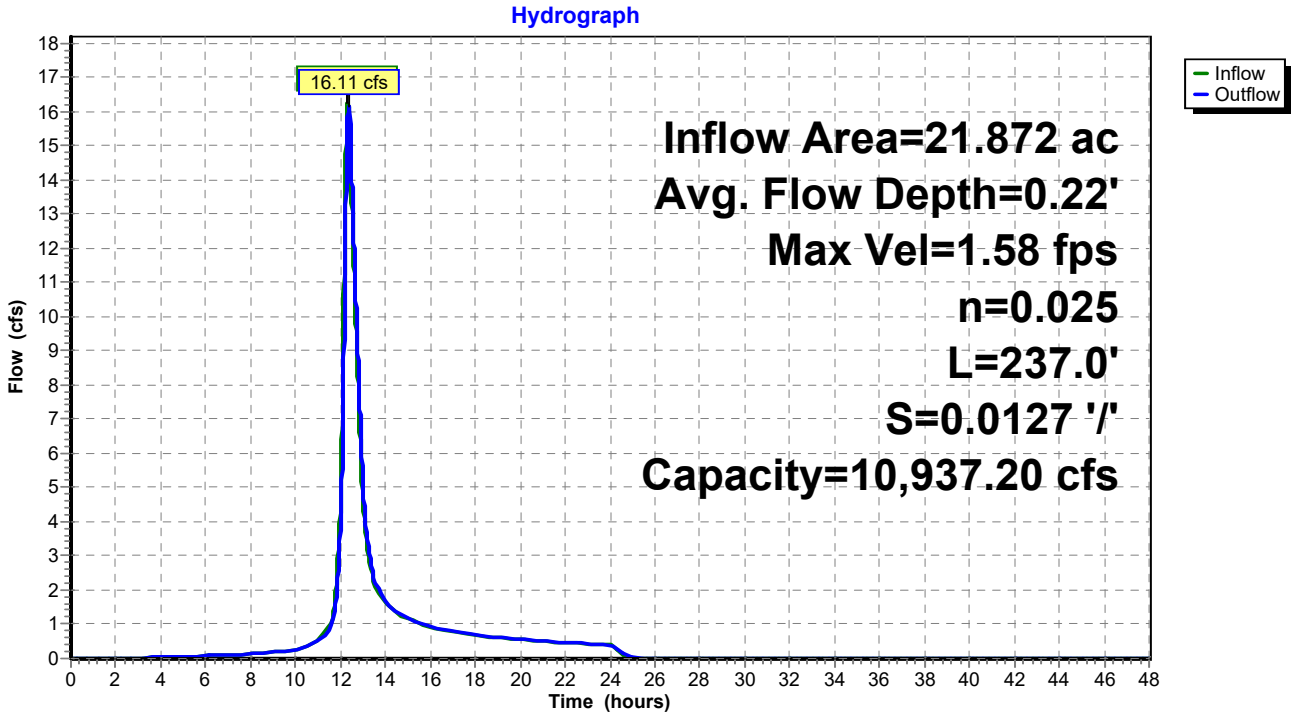


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
5.00	2,114.00	1.00
20.00	2,113.00	2.00
40.00	2,112.00	3.00
60.00	2,111.00	4.00
85.00	2,110.79	4.21
150.00	2,111.00	4.00
200.00	2,112.00	3.00
220.00	2,113.00	2.00
230.00	2,114.00	1.00
240.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.21	9.5	90.0	89.8	2,241	14.10
1.21	134.5	160.0	160.0	31,865	800.55
2.21	314.5	200.1	200.0	74,525	2,842.54
3.21	527.0	225.2	225.0	124,887	6,211.67
4.21	759.5	240.3	240.0	179,990	10,937.20

Reach 10R: OVERLAND FLOW TO POA1



Summary for Reach 11R: OVERLAND FLOW TO POA1

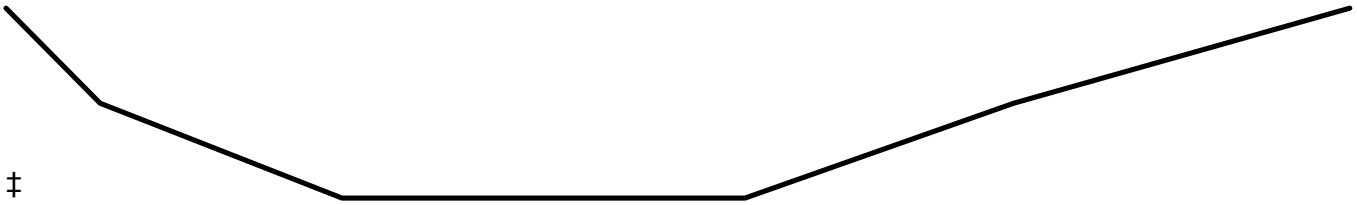
[61] Hint: Exceeded Reach 7R outlet invert by 0.02' @ 12.18 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.34 cfs @ 12.18 hrs, Volume= 0.032 af, Atten= 22%, Lag= 5.4 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 5.9 min

Peak Storage= 120 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.02' , Surface Width= 30.59'
Bank-Full Depth= 2.00' Flow Area= 133.0 sf, Capacity= 1,579.47 cfs

Custom cross-section, Length= 256.0' Slope= 0.0273 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,116.00', Outlet Invert= 2,109.00'



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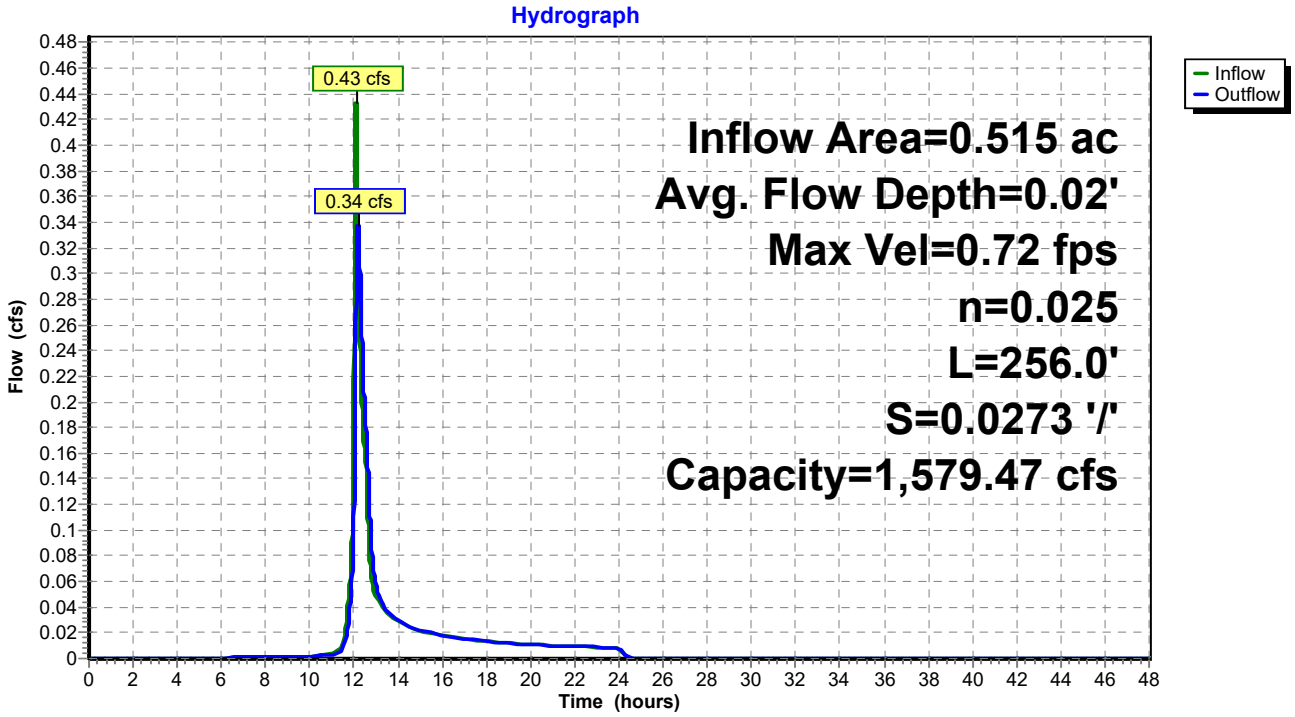
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
7.00	2,114.00	1.00
25.00	2,113.00	2.00
55.00	2,113.00	2.00
75.00	2,114.00	1.00
100.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	30.0	0.0	0	0.00
1.00	49.0	68.1	68.0	12,544	386.90
2.00	133.0	100.1	100.0	34,048	1,579.47

Reach 11R: OVERLAND FLOW TO POA1



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

Subcatchment 1S: DA 1 Runoff Area=2.750 ac 28.50% Impervious Runoff Depth=1.23"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=3.84 cfs 0.282 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.523 ac 42.65% Impervious Runoff Depth=1.41"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=20.20 cfs 2.286 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.349 ac 43.59% Impervious Runoff Depth=1.43"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=2.32 cfs 0.279 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=1.09"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=0.65 cfs 0.047 af

Reach 7R: EXISTING PIPE Avg. Flow Depth=0.30' Max Vel=3.26 fps Inflow=0.65 cfs 0.047 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=0.65 cfs 0.047 af

Link 9L: POA 1 Inflow=24.22 cfs 2.894 af
Primary=24.22 cfs 2.894 af

Reach 10R: OVERLAND FLOW TO Avg. Flow Depth=0.24' Max Vel=1.78 fps Inflow=22.48 cfs 2.566 af
n=0.025 L=237.0' S=0.0127 '/' Capacity=10,937.20 cfs Outflow=22.32 cfs 2.566 af

Reach 11R: OVERLAND FLOW TO POA1 Avg. Flow Depth=0.02' Max Vel=0.80 fps Inflow=0.65 cfs 0.047 af
n=0.025 L=256.0' S=0.0273 '/' Capacity=1,579.47 cfs Outflow=0.54 cfs 0.047 af

Total Runoff Area = 25.137 ac Runoff Volume = 2.894 af Average Runoff Depth = 1.38"
59.19% Pervious = 14.878 ac 40.81% Impervious = 10.259 ac

Summary for Subcatchment 1S: DA 1

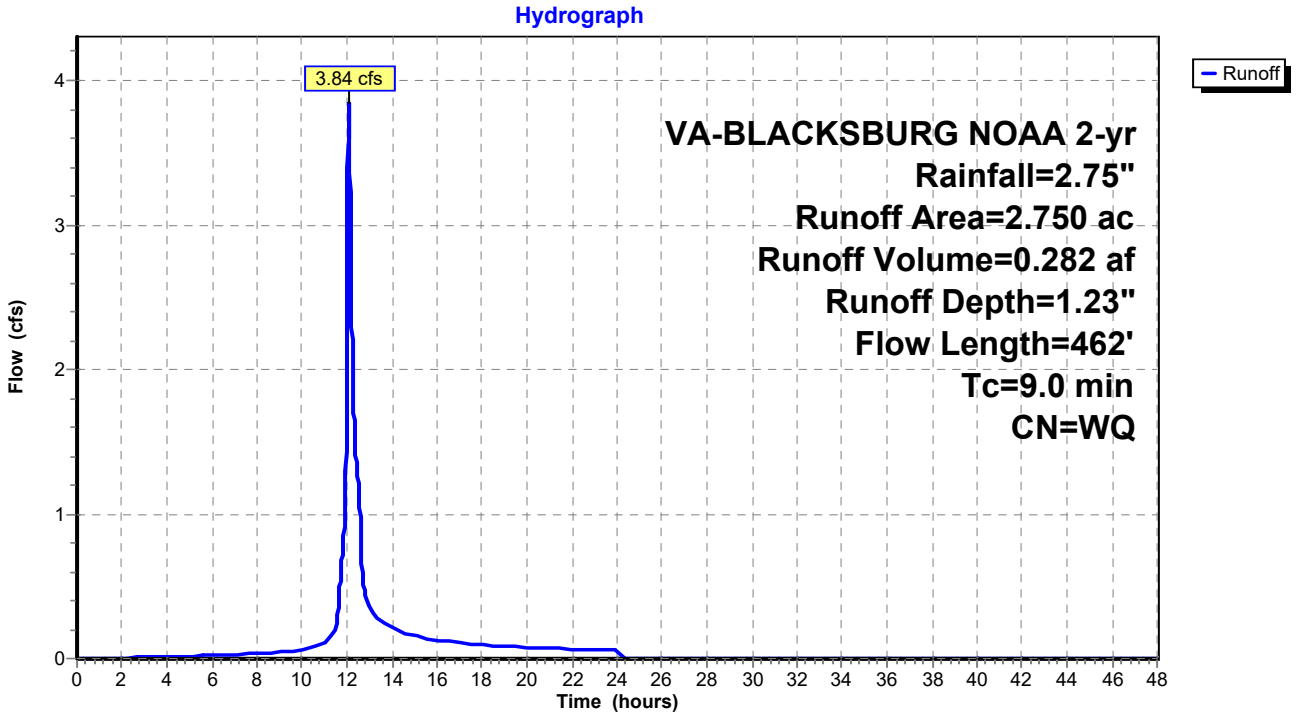
Runoff = 3.84 cfs @ 12.08 hrs, Volume= 0.282 af, Depth= 1.23"
Routed to Link 9L : POA 1

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
1.637	74	>75% Grass cover, Good, HSG C
0.170	98	Paved parking, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.336	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
2.750		Weighted Average
1.966		71.50% Pervious Area
0.784		28.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

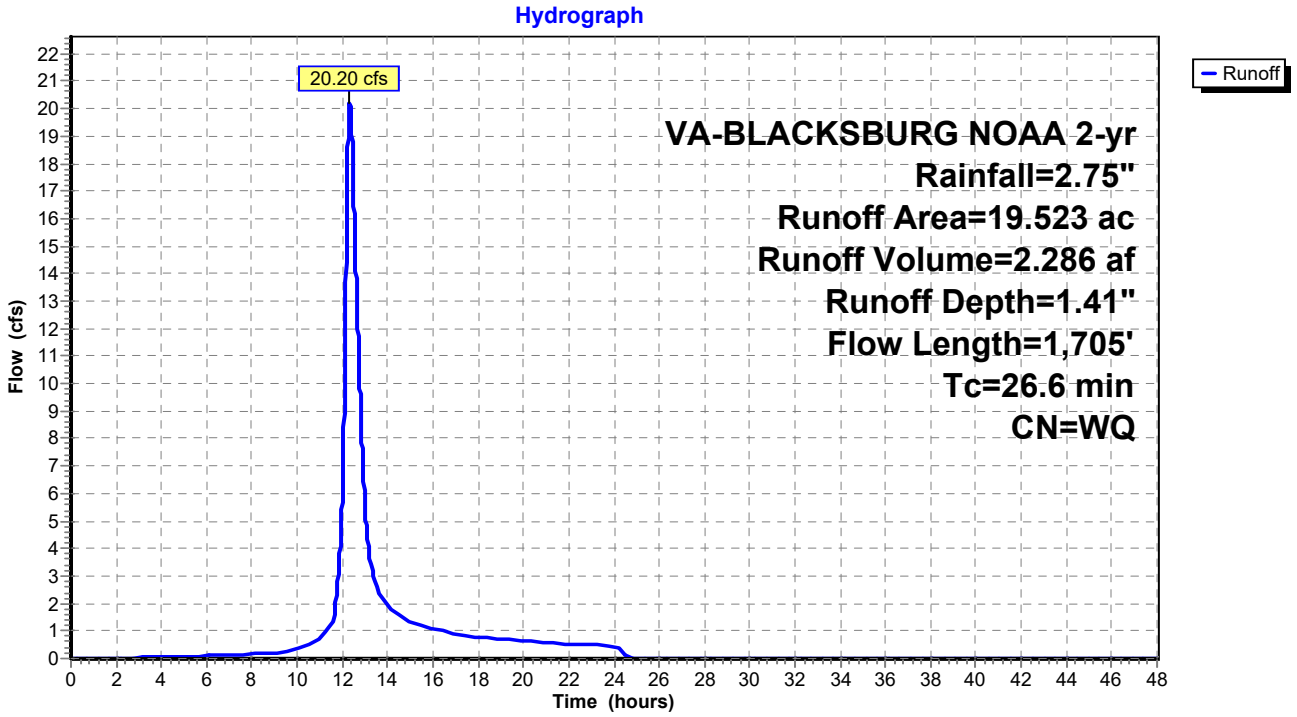
Runoff = 20.20 cfs @ 12.33 hrs, Volume= 2.286 af, Depth= 1.41"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
2.128	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.523		Weighted Average
11.197		57.35% Pervious Area
8.326		42.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 24948% of capacity of segment #8

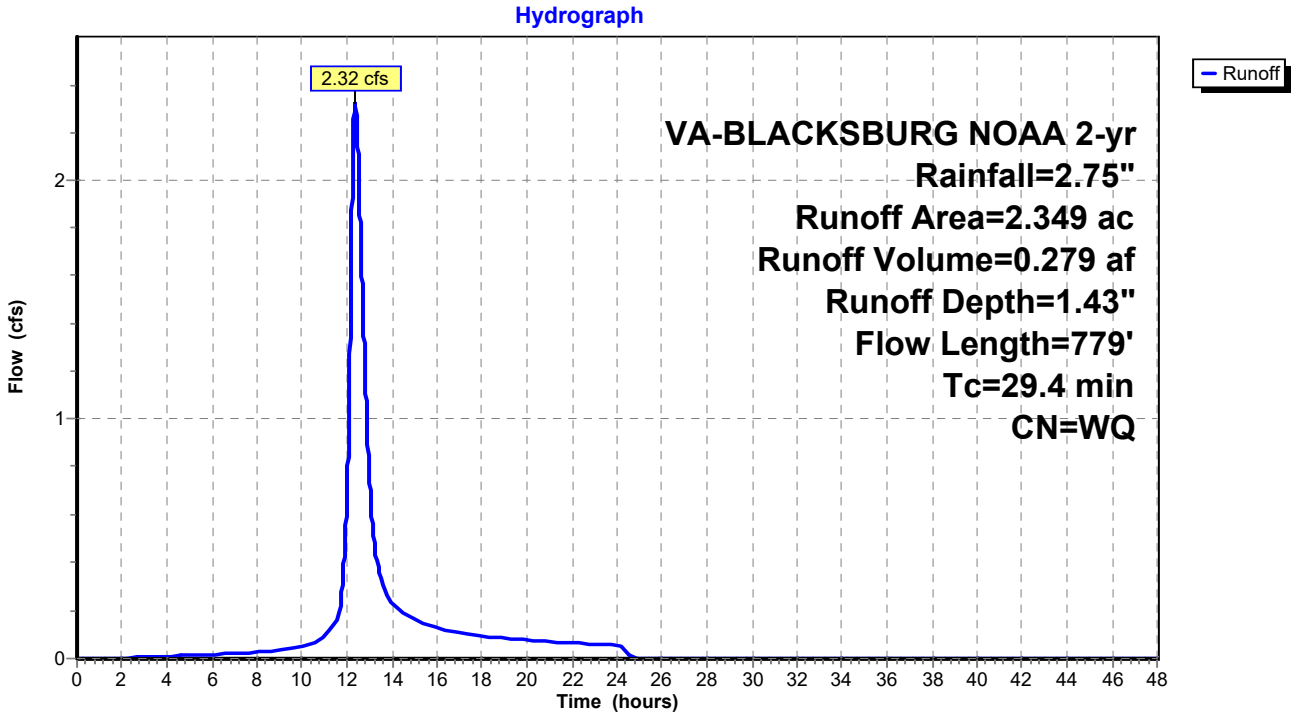
Runoff = 2.32 cfs @ 12.38 hrs, Volume= 0.279 af, Depth= 1.43"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.096	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.349		Weighted Average
1.325		56.41% Pervious Area
1.024		43.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.03' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

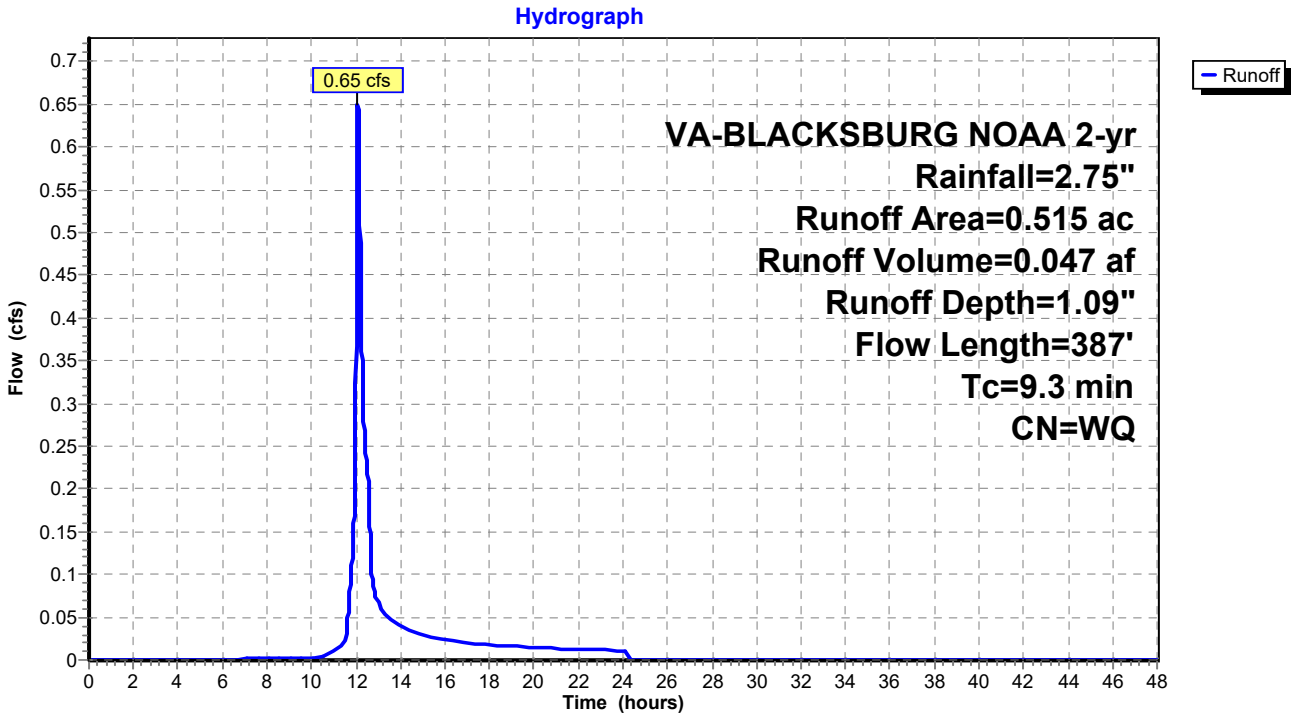
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 0.047 af, Depth= 1.09"
Routed to Reach 7R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Reach 7R: EXISTING PIPE

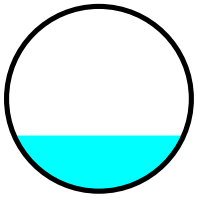
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 0.047 af
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 11R : OVERLAND FLOW TO POA1

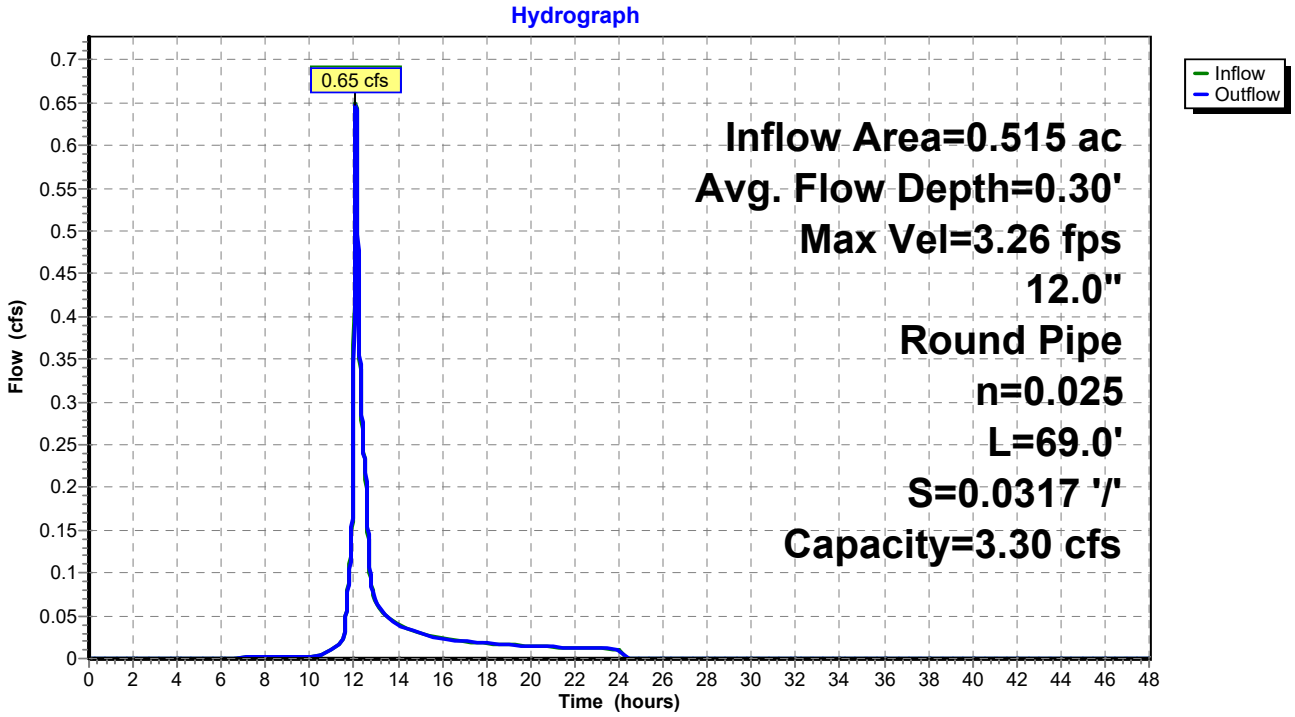
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.26 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 1.2 min

Peak Storage= 14 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.30' , Surface Width= 0.92'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 7R: EXISTING PIPE

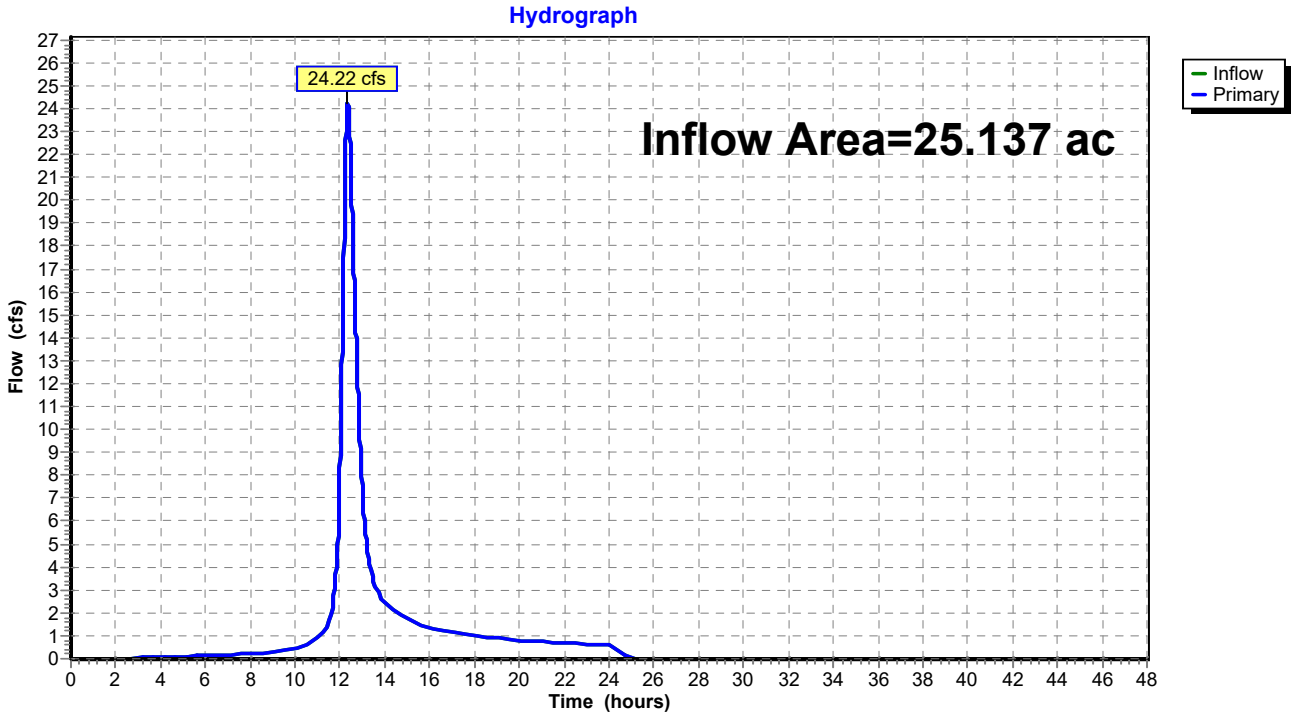


Summary for Link 9L: POA 1

Inflow Area = 25.137 ac, 40.81% Impervious, Inflow Depth = 1.38" for 2-yr event
Inflow = 24.22 cfs @ 12.35 hrs, Volume= 2.894 af
Primary = 24.22 cfs @ 12.35 hrs, Volume= 2.894 af, Atten= 0%, Lag= 0.0 min

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

Link 9L: POA 1



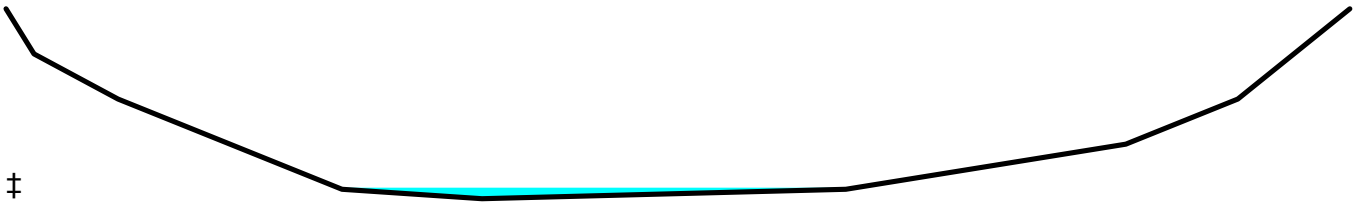
Summary for Reach 10R: OVERLAND FLOW TO POA1

Inflow Area = 21.872 ac, 42.75% Impervious, Inflow Depth = 1.41" for 2-yr event
Inflow = 22.48 cfs @ 12.33 hrs, Volume= 2.566 af
Outflow = 22.32 cfs @ 12.36 hrs, Volume= 2.566 af, Atten= 1%, Lag= 1.7 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.78 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 5.5 min

Peak Storage= 2,973 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.24' , Surface Width= 92.37'
Bank-Full Depth= 4.21' Flow Area= 759.5 sf, Capacity= 10,937.20 cfs

Custom cross-section, Length= 237.0' Slope= 0.0127 '/' (103 Elevation Intervals)
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,112.00', Outlet Invert= 2,109.00'



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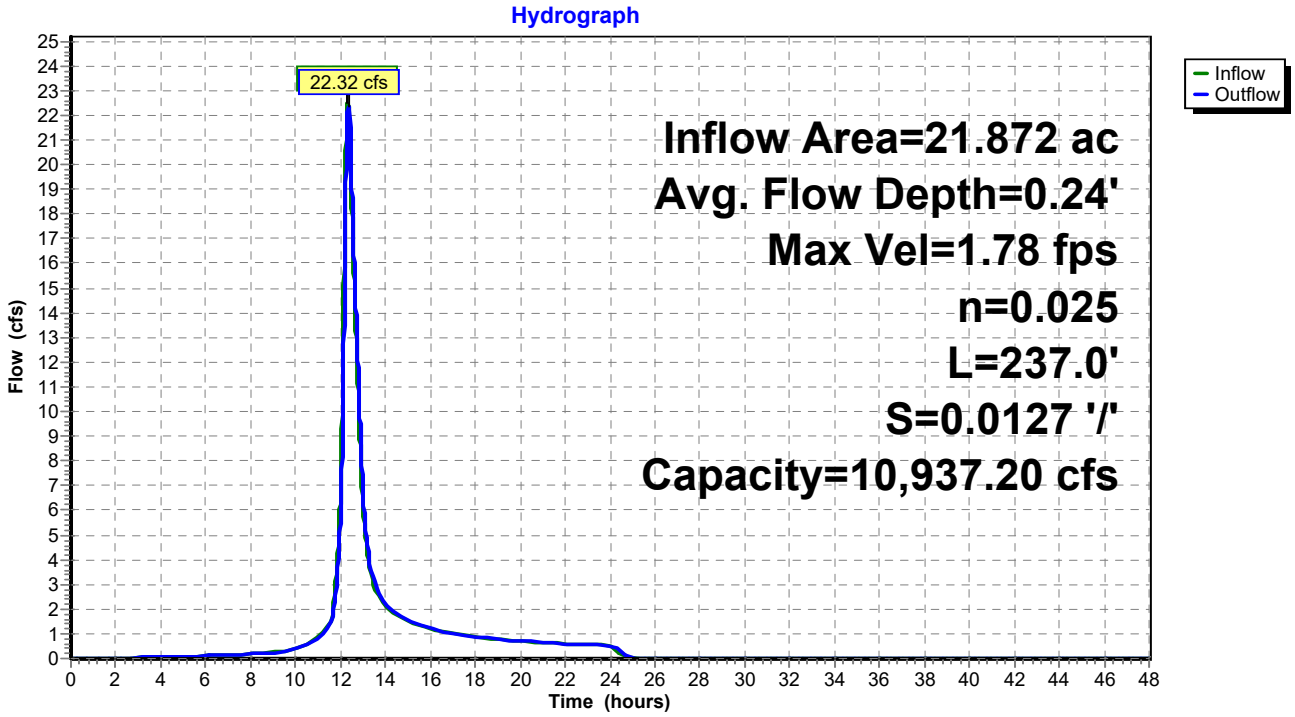
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
5.00	2,114.00	1.00
20.00	2,113.00	2.00
40.00	2,112.00	3.00
60.00	2,111.00	4.00
85.00	2,110.79	4.21
150.00	2,111.00	4.00
200.00	2,112.00	3.00
220.00	2,113.00	2.00
230.00	2,114.00	1.00
240.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.21	9.5	90.0	89.8	2,241	14.10
1.21	134.5	160.0	160.0	31,865	800.55
2.21	314.5	200.1	200.0	74,525	2,842.54
3.21	527.0	225.2	225.0	124,887	6,211.67
4.21	759.5	240.3	240.0	179,990	10,937.20

Reach 10R: OVERLAND FLOW TO POA1



Summary for Reach 11R: OVERLAND FLOW TO POA1

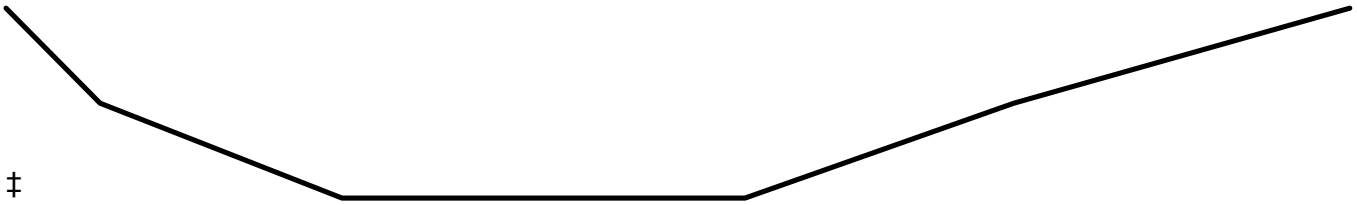
[61] Hint: Exceeded Reach 7R outlet invert by 0.02' @ 12.16 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.54 cfs @ 12.16 hrs, Volume= 0.047 af, Atten= 17%, Lag= 4.2 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.80 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 5.9 min

Peak Storage= 173 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.02' , Surface Width= 30.84'
Bank-Full Depth= 2.00' Flow Area= 133.0 sf, Capacity= 1,579.47 cfs

Custom cross-section, Length= 256.0' Slope= 0.0273 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,116.00', Outlet Invert= 2,109.00'



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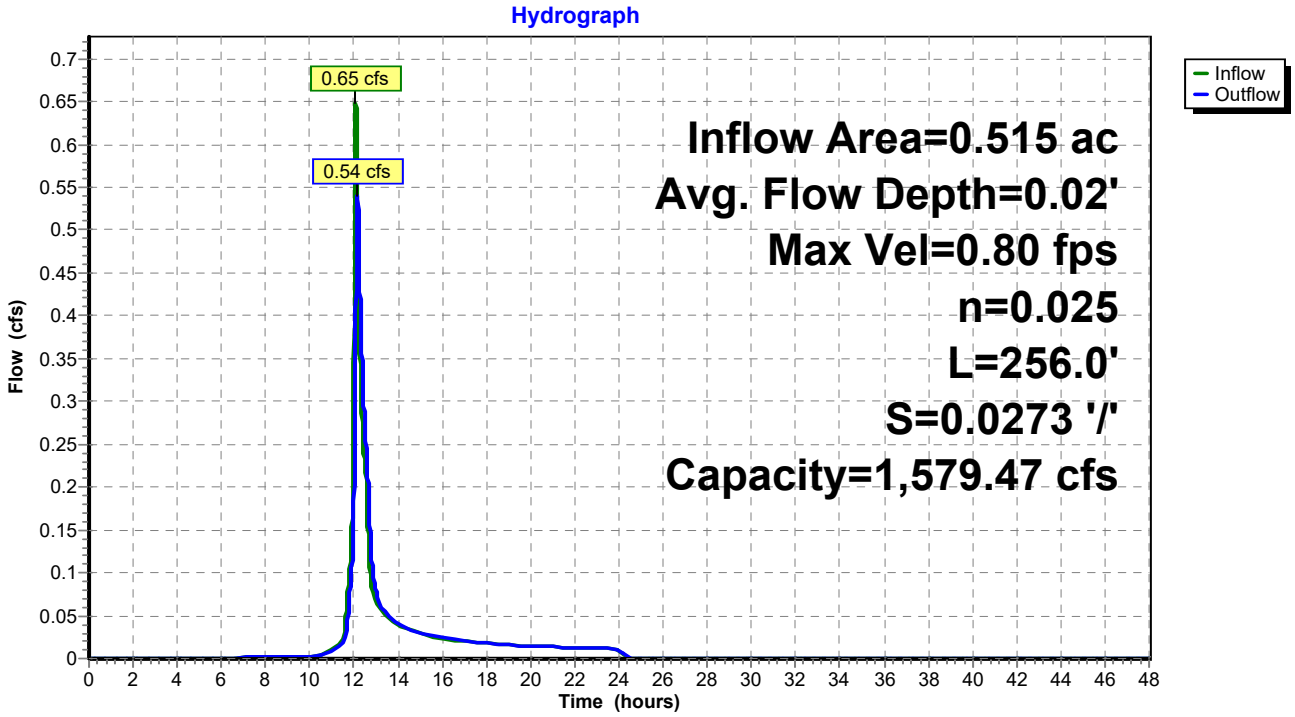
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
7.00	2,114.00	1.00
25.00	2,113.00	2.00
55.00	2,113.00	2.00
75.00	2,114.00	1.00
100.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	30.0	0.0	0	0.00
1.00	49.0	68.1	68.0	12,544	386.90
2.00	133.0	100.1	100.0	34,048	1,579.47

Reach 11R: OVERLAND FLOW TO POA1



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

Subcatchment 1S: DA 1 Runoff Area=2.750 ac 28.50% Impervious Runoff Depth=2.27"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=6.83 cfs 0.520 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.523 ac 42.65% Impervious Runoff Depth=2.54"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=35.32 cfs 4.126 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.349 ac 43.59% Impervious Runoff Depth=2.55"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=4.04 cfs 0.500 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=2.13"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=1.23 cfs 0.091 af

Reach 7R: EXISTING PIPE Avg. Flow Depth=0.42' Max Vel=3.89 fps Inflow=1.23 cfs 0.091 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=1.23 cfs 0.091 af

Link 9L: POA 1 Inflow=42.69 cfs 5.237 af
Primary=42.69 cfs 5.237 af

Reach 10R: OVERLAND FLOW TO Avg. Flow Depth=0.30' Max Vel=2.18 fps Inflow=39.31 cfs 4.625 af
n=0.025 L=237.0' S=0.0127 '/' Capacity=10,937.20 cfs Outflow=39.15 cfs 4.625 af

Reach 11R: OVERLAND FLOW TO POA1 Avg. Flow Depth=0.03' Max Vel=1.06 fps Inflow=1.23 cfs 0.091 af
n=0.025 L=256.0' S=0.0273 '/' Capacity=1,579.47 cfs Outflow=1.11 cfs 0.091 af

Total Runoff Area = 25.137 ac Runoff Volume = 5.237 af Average Runoff Depth = 2.50"
59.19% Pervious = 14.878 ac 40.81% Impervious = 10.259 ac

Summary for Subcatchment 1S: DA 1

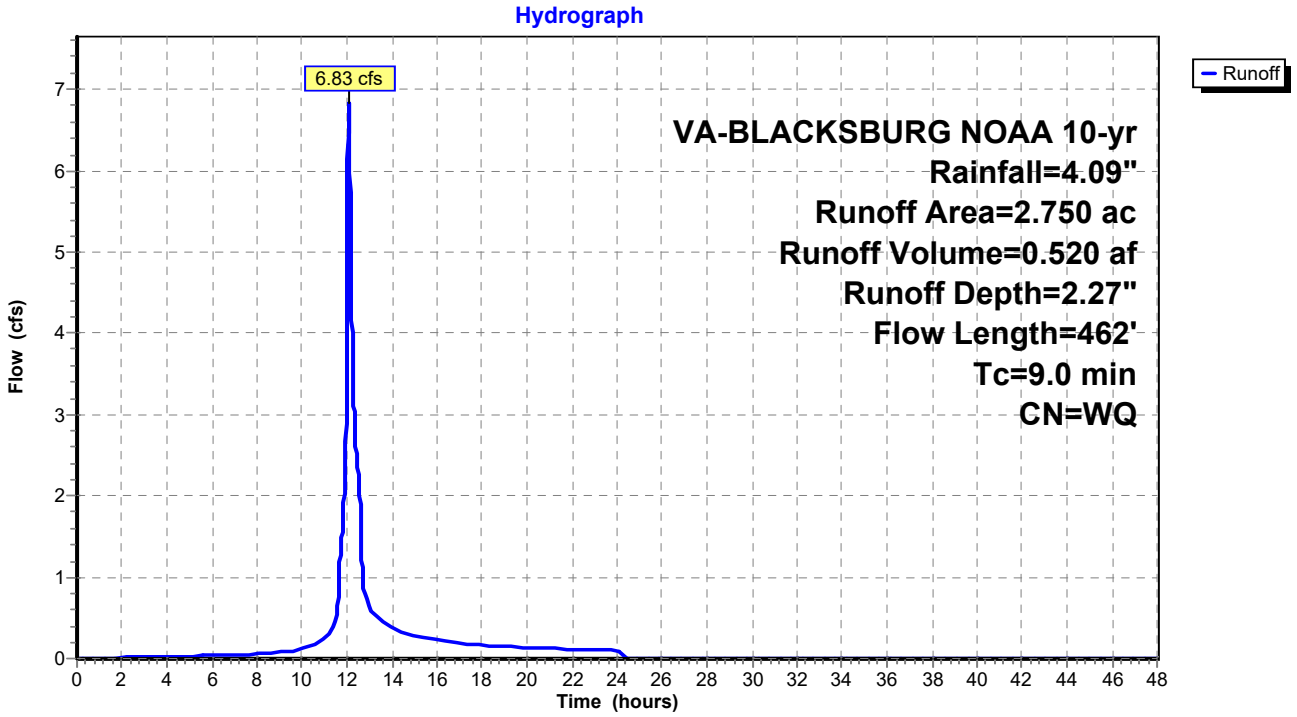
Runoff = 6.83 cfs @ 12.07 hrs, Volume= 0.520 af, Depth= 2.27"
Routed to Link 9L : POA 1

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
1.637	74	>75% Grass cover, Good, HSG C
0.170	98	Paved parking, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.336	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
2.750		Weighted Average
1.966		71.50% Pervious Area
0.784		28.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

[47] Hint: Peak is 115% of capacity of segment #8

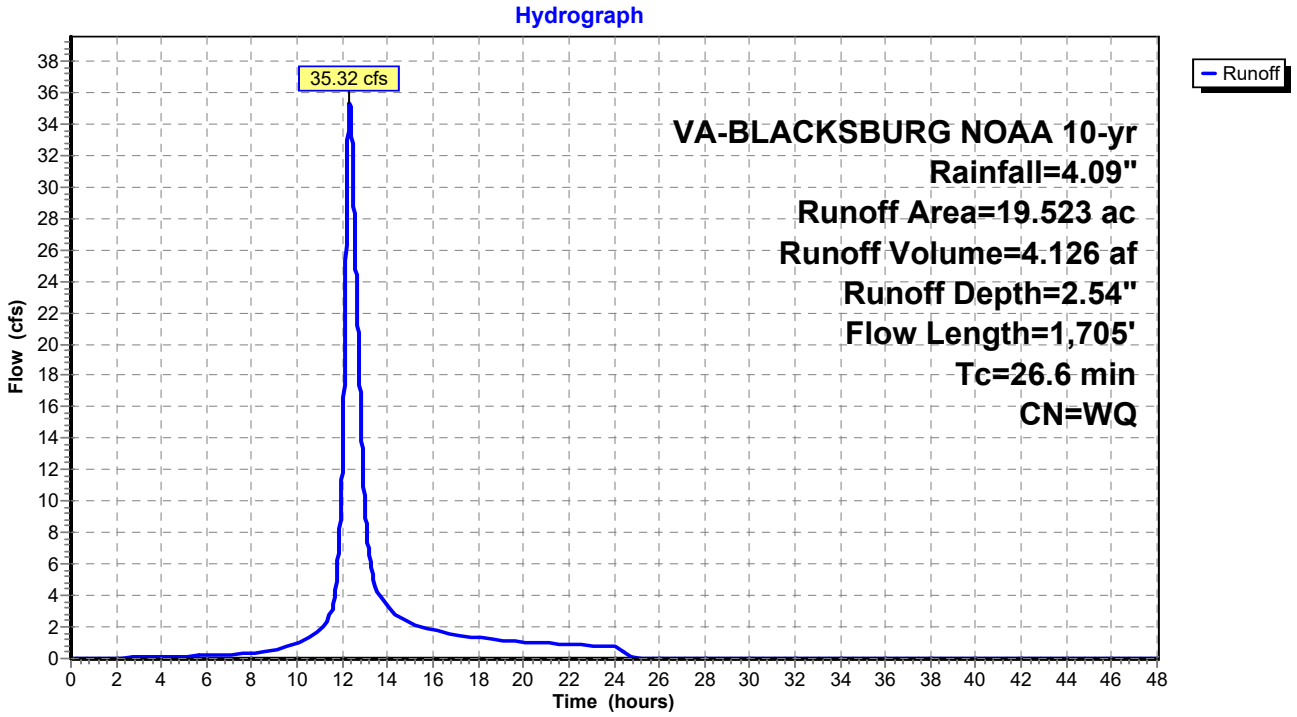
Runoff = 35.32 cfs @ 12.32 hrs, Volume= 4.126 af, Depth= 2.54"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
2.128	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.523		Weighted Average
11.197		57.35% Pervious Area
8.326		42.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 120% of capacity of segment #6
[47] Hint: Peak is 43436% of capacity of segment #8

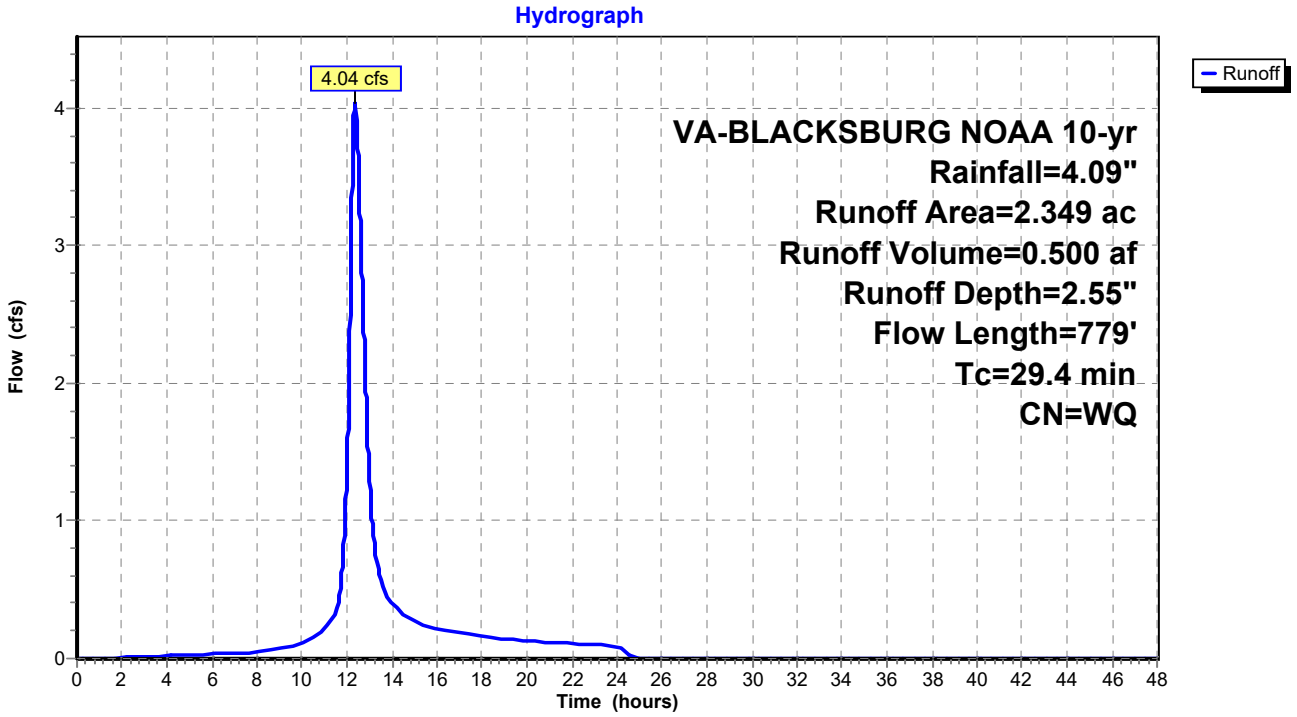
Runoff = 4.04 cfs @ 12.38 hrs, Volume= 0.500 af, Depth= 2.55"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.096	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.349		Weighted Average
1.325		56.41% Pervious Area
1.024		43.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.03' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

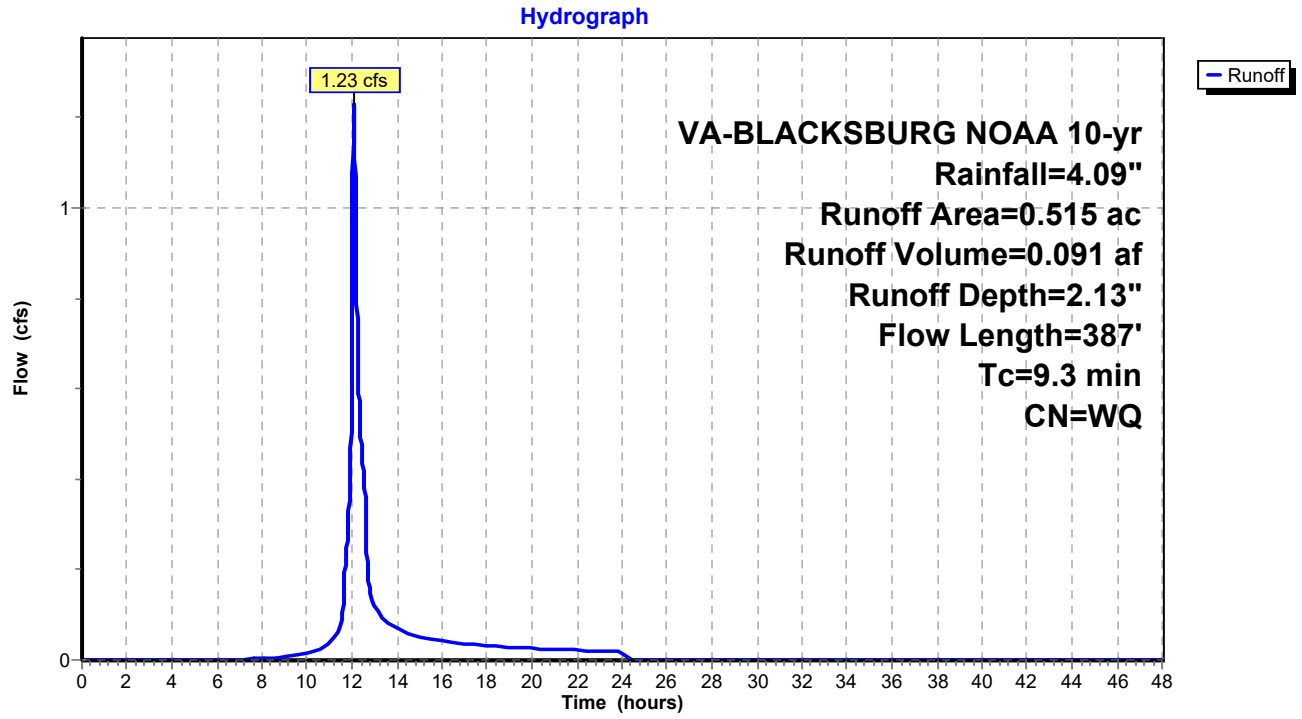
Runoff = 1.23 cfs @ 12.08 hrs, Volume= 0.091 af, Depth= 2.13"
Routed to Reach 7R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Reach 7R: EXISTING PIPE

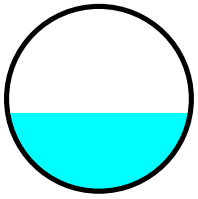
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.23 cfs @ 12.08 hrs, Volume= 0.091 af
Outflow = 1.23 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 11R : OVERLAND FLOW TO POA1

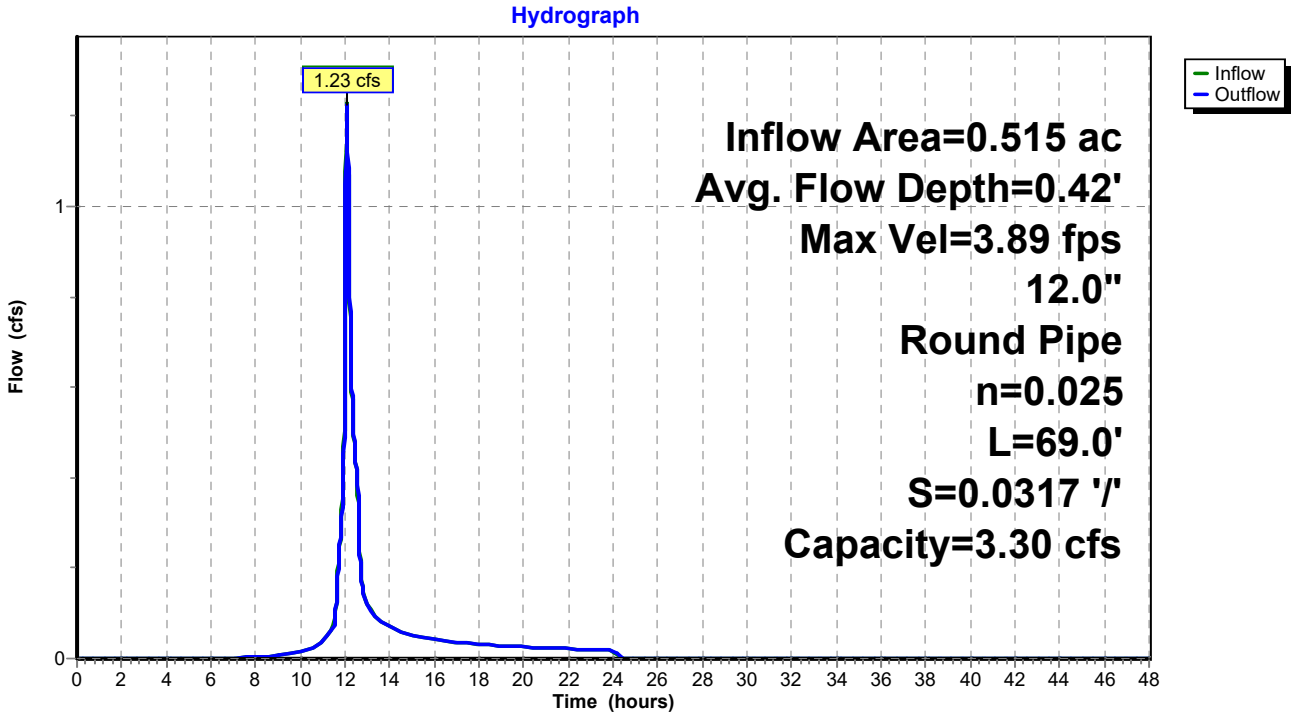
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.13 fps, Avg. Travel Time= 1.0 min

Peak Storage= 22 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 7R: EXISTING PIPE

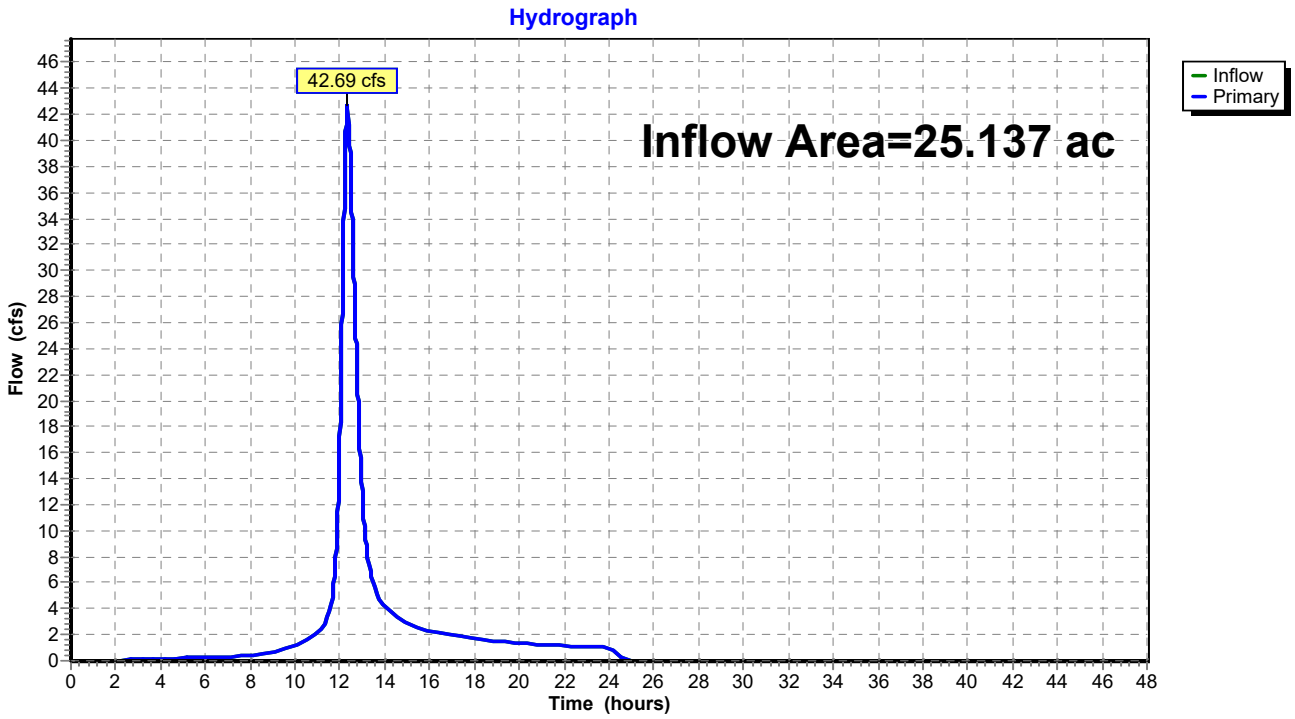


Summary for Link 9L: POA 1

Inflow Area = 25.137 ac, 40.81% Impervious, Inflow Depth = 2.50" for 10-yr event
Inflow = 42.69 cfs @ 12.33 hrs, Volume= 5.237 af
Primary = 42.69 cfs @ 12.33 hrs, Volume= 5.237 af, Atten= 0%, Lag= 0.0 min

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

Link 9L: POA 1



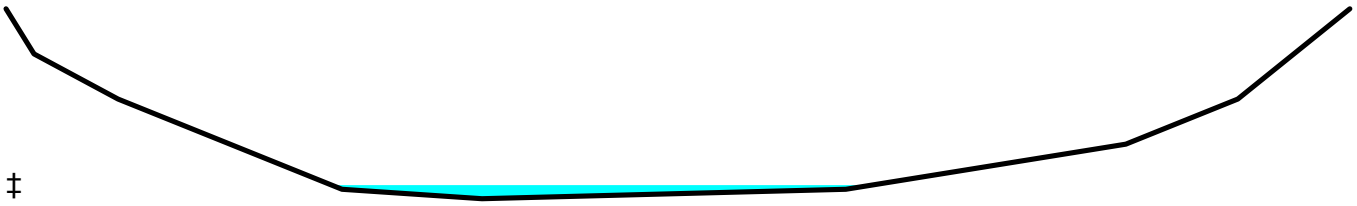
Summary for Reach 10R: OVERLAND FLOW TO POA1

Inflow Area = 21.872 ac, 42.75% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 39.31 cfs @ 12.33 hrs, Volume= 4.625 af
Outflow = 39.15 cfs @ 12.34 hrs, Volume= 4.625 af, Atten= 0%, Lag= 1.1 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.18 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 4.9 min

Peak Storage= 4,247 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.30' , Surface Width= 96.36'
Bank-Full Depth= 4.21' Flow Area= 759.5 sf, Capacity= 10,937.20 cfs

Custom cross-section, Length= 237.0' Slope= 0.0127 '/' (103 Elevation Intervals)
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,112.00', Outlet Invert= 2,109.00'

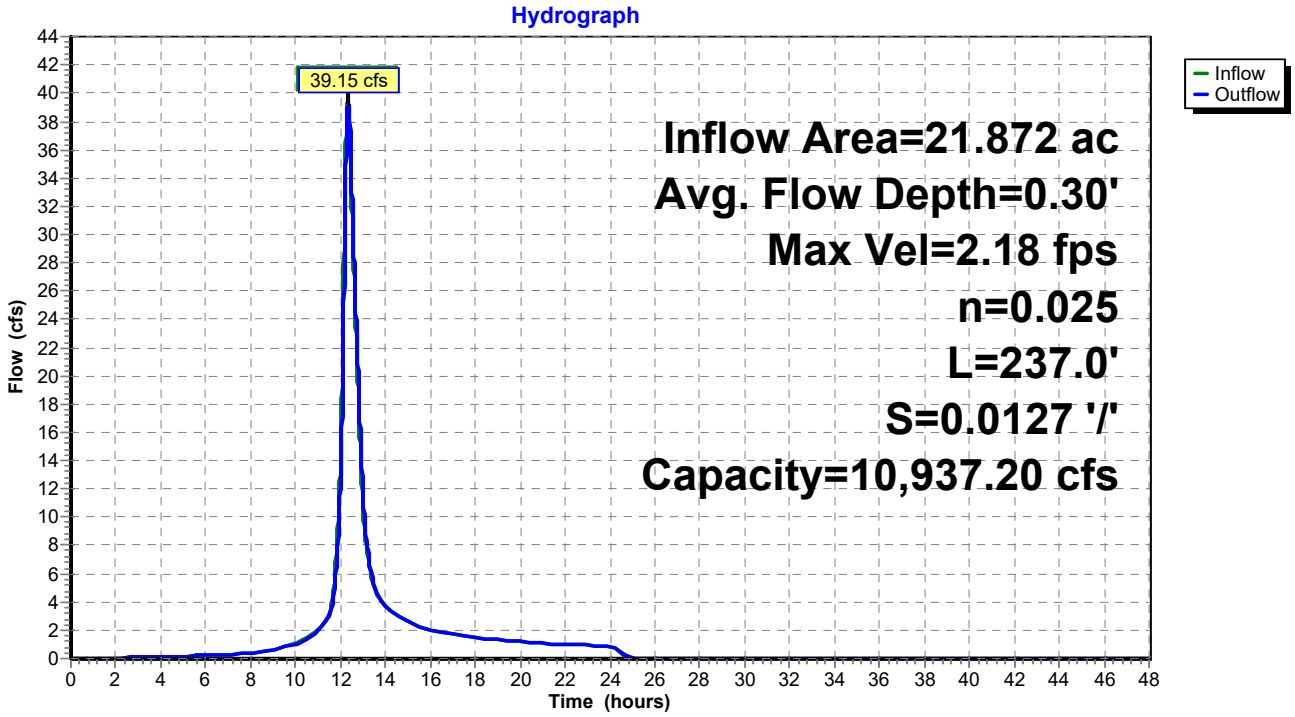


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
5.00	2,114.00	1.00
20.00	2,113.00	2.00
40.00	2,112.00	3.00
60.00	2,111.00	4.00
85.00	2,110.79	4.21
150.00	2,111.00	4.00
200.00	2,112.00	3.00
220.00	2,113.00	2.00
230.00	2,114.00	1.00
240.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.21	9.5	90.0	89.8	2,241	14.10
1.21	134.5	160.0	160.0	31,865	800.55
2.21	314.5	200.1	200.0	74,525	2,842.54
3.21	527.0	225.2	225.0	124,887	6,211.67
4.21	759.5	240.3	240.0	179,990	10,937.20

Reach 10R: OVERLAND FLOW TO POA1



Summary for Reach 11R: OVERLAND FLOW TO POA1

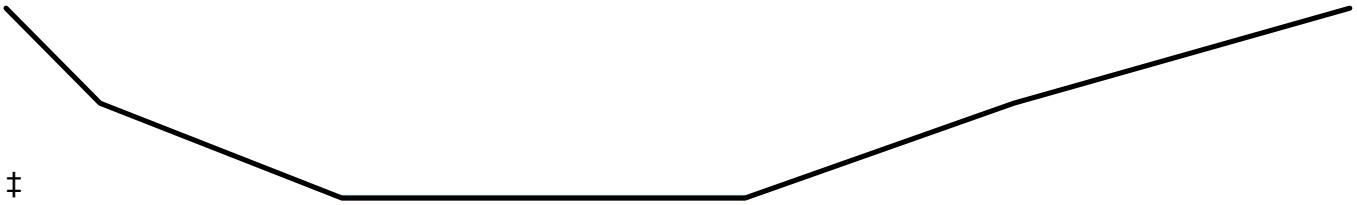
[61] Hint: Exceeded Reach 7R outlet invert by 0.03' @ 12.13 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.23 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.11 cfs @ 12.13 hrs, Volume= 0.091 af, Atten= 9%, Lag= 2.9 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.06 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 5.9 min

Peak Storage= 268 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.03' , Surface Width= 31.30'
Bank-Full Depth= 2.00' Flow Area= 133.0 sf, Capacity= 1,579.47 cfs

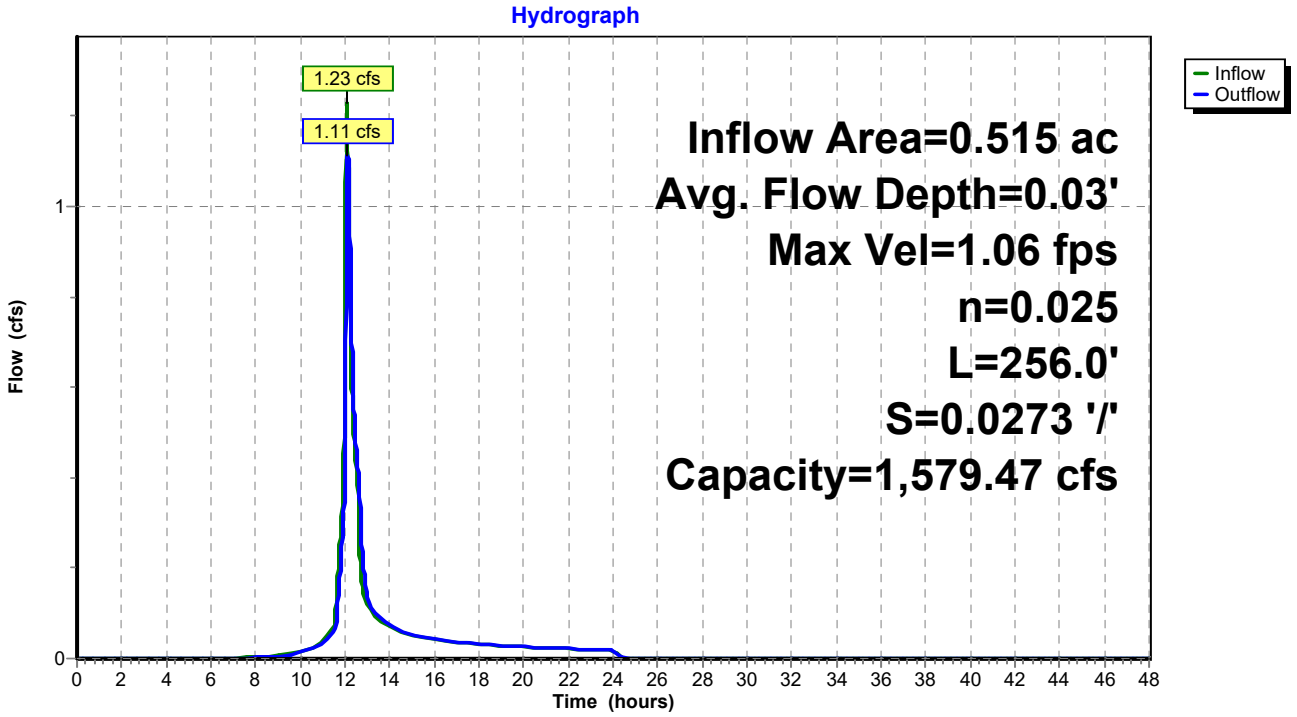
Custom cross-section, Length= 256.0' Slope= 0.0273 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,116.00', Outlet Invert= 2,109.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
7.00	2,114.00	1.00
25.00	2,113.00	2.00
55.00	2,113.00	2.00
75.00	2,114.00	1.00
100.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	30.0	0.0	0	0.00
1.00	49.0	68.1	68.0	12,544	386.90
2.00	133.0	100.1	100.0	34,048	1,579.47

Reach 11R: OVERLAND FLOW TO POA1



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

Subcatchment 1S: DA 1 Runoff Area=2.750 ac 28.50% Impervious Runoff Depth=4.34"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=11.37 cfs 0.994 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.523 ac 42.65% Impervious Runoff Depth=4.72"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=58.13 cfs 7.678 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.349 ac 43.59% Impervious Runoff Depth=4.73"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=6.65 cfs 0.925 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=4.22"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=2.10 cfs 0.181 af

Reach 7R: EXISTING PIPE Avg. Flow Depth=0.58' Max Vel=4.45 fps Inflow=2.10 cfs 0.181 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=2.10 cfs 0.181 af

Link 9L: POA 1 Inflow=70.78 cfs 9.778 af
Primary=70.78 cfs 9.778 af

Reach 10R: OVERLAND FLOW TO Avg. Flow Depth=0.37' Max Vel=2.62 fps Inflow=64.73 cfs 8.603 af
n=0.025 L=237.0' S=0.0127 '/' Capacity=10,937.20 cfs Outflow=64.53 cfs 8.603 af

Reach 11R: OVERLAND FLOW TO POA1 Avg. Flow Depth=0.05' Max Vel=1.31 fps Inflow=2.10 cfs 0.181 af
n=0.025 L=256.0' S=0.0273 '/' Capacity=1,579.47 cfs Outflow=1.98 cfs 0.181 af

Total Runoff Area = 25.137 ac Runoff Volume = 9.778 af Average Runoff Depth = 4.67"
59.19% Pervious = 14.878 ac 40.81% Impervious = 10.259 ac

Summary for Subcatchment 1S: DA 1

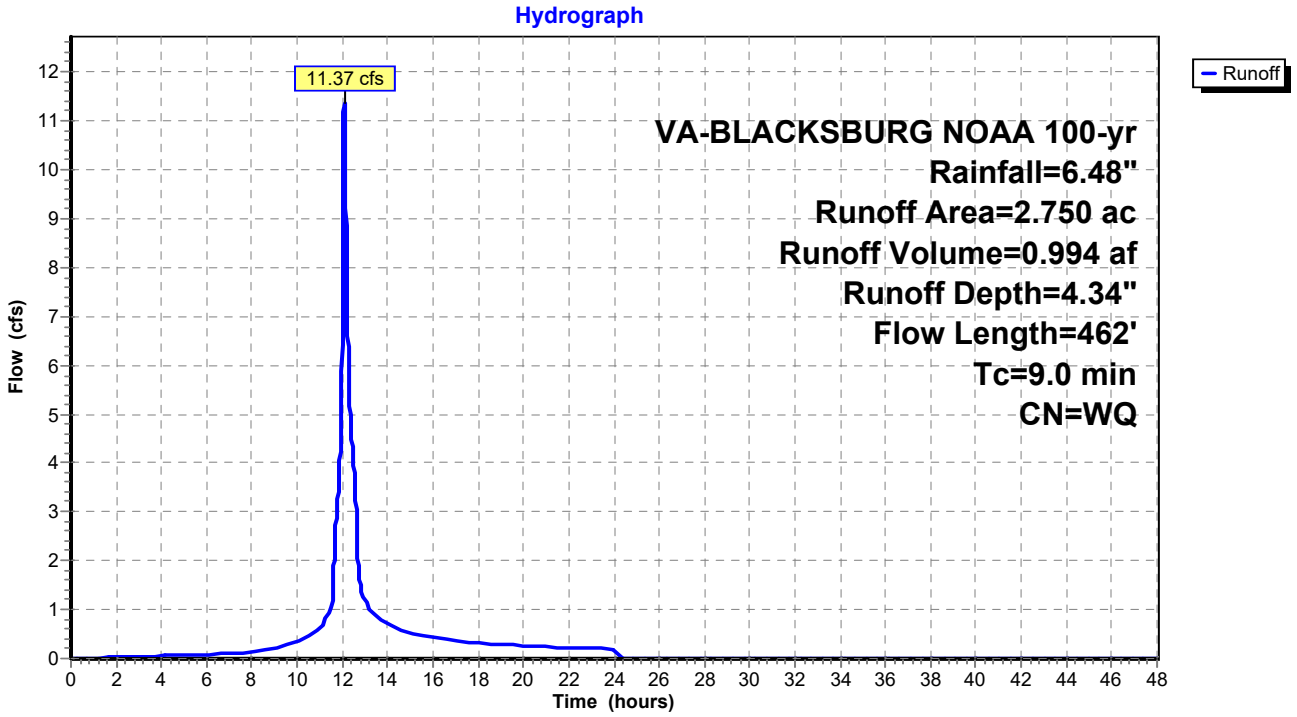
Runoff = 11.37 cfs @ 12.07 hrs, Volume= 0.994 af, Depth= 4.34"
Routed to Link 9L : POA 1

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
1.637	74	>75% Grass cover, Good, HSG C
0.170	98	Paved parking, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.336	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
2.750		Weighted Average
1.966		71.50% Pervious Area
0.784		28.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

[47] Hint: Peak is 135% of capacity of segment #7
[47] Hint: Peak is 190% of capacity of segment #8

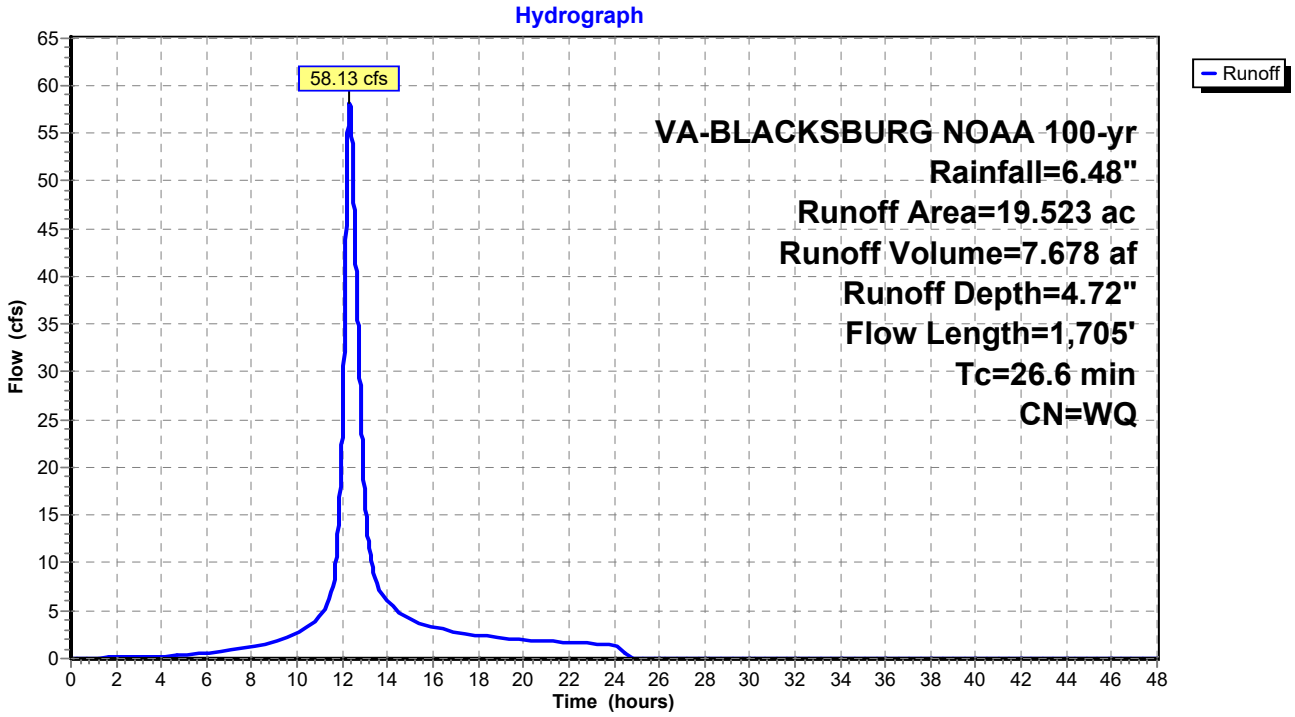
Runoff = 58.13 cfs @ 12.32 hrs, Volume= 7.678 af, Depth= 4.72"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
2.128	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.523		Weighted Average
11.197		57.35% Pervious Area
8.326		42.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 198% of capacity of segment #6
[47] Hint: Peak is 71599% of capacity of segment #8

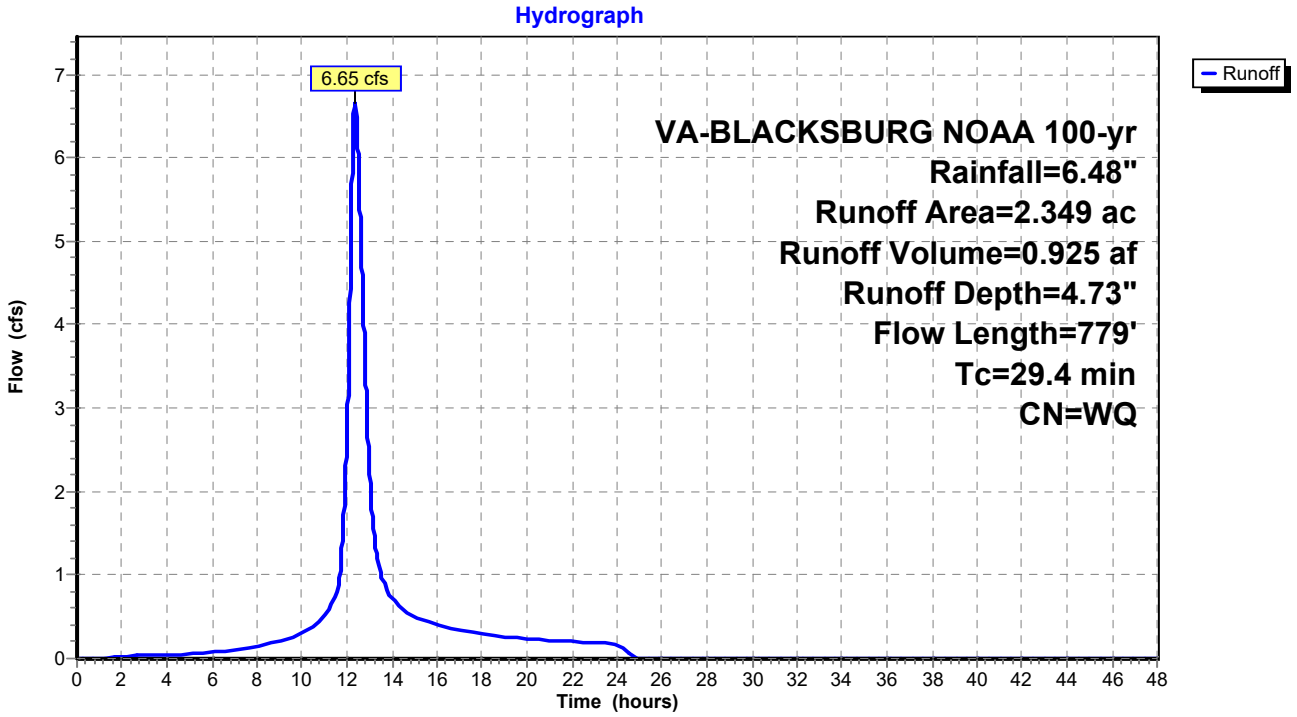
Runoff = 6.65 cfs @ 12.37 hrs, Volume= 0.925 af, Depth= 4.73"
Routed to Reach 10R : OVERLAND FLOW TO POA1

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.096	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.349		Weighted Average
1.325		56.41% Pervious Area
1.024		43.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.03' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

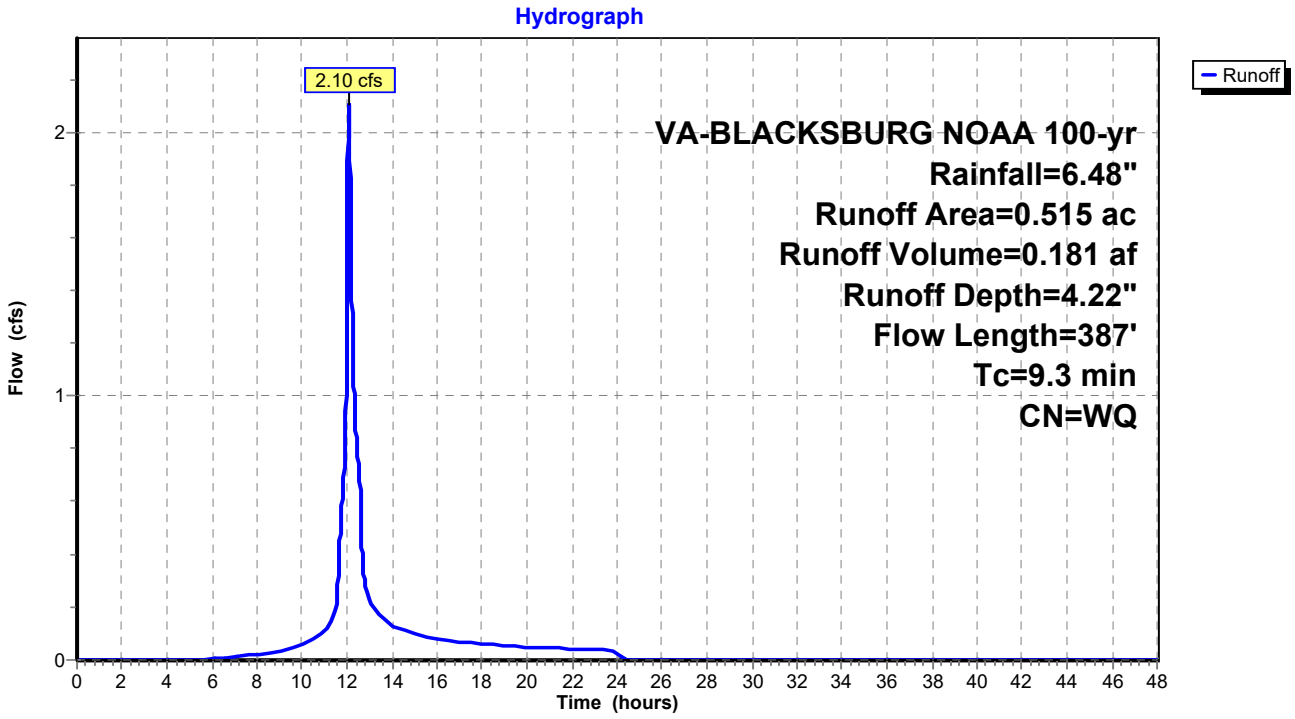
Runoff = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af, Depth= 4.22"
Routed to Reach 7R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Reach 7R: EXISTING PIPE

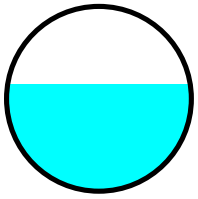
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 4.22" for 100-yr event
Inflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af
Outflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 11R : OVERLAND FLOW TO POA1

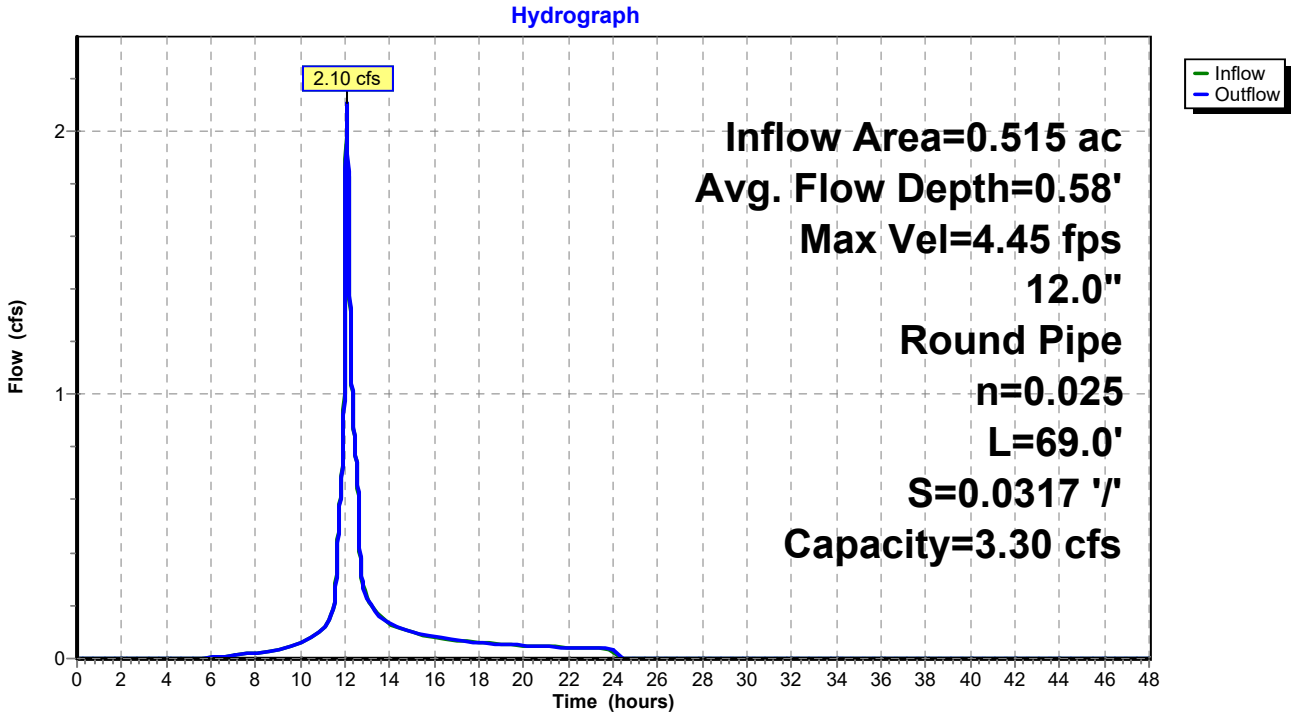
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.45 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.8 min

Peak Storage= 33 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.58' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 7R: EXISTING PIPE

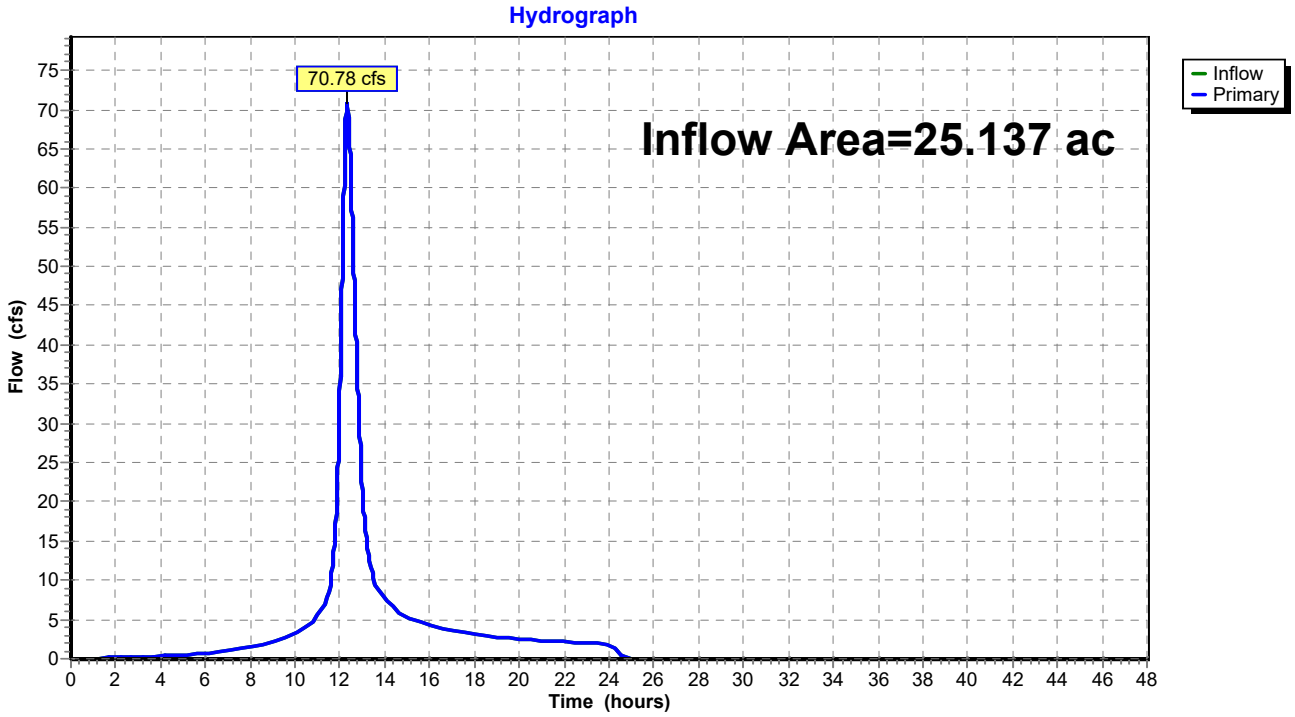


Summary for Link 9L: POA 1

Inflow Area = 25.137 ac, 40.81% Impervious, Inflow Depth = 4.67" for 100-yr event
Inflow = 70.78 cfs @ 12.33 hrs, Volume= 9.778 af
Primary = 70.78 cfs @ 12.33 hrs, Volume= 9.778 af, Atten= 0%, Lag= 0.0 min

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

Link 9L: POA 1



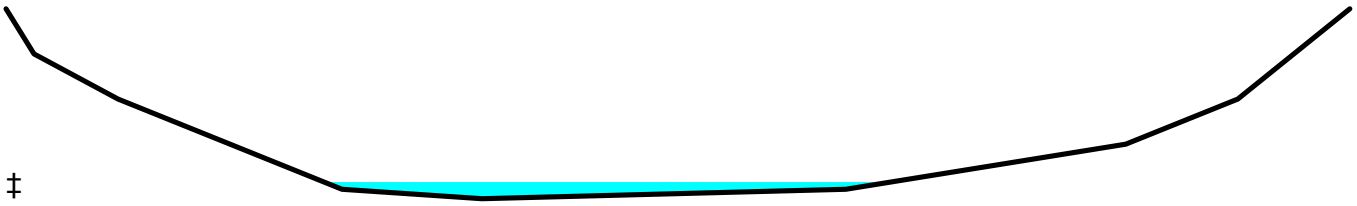
Summary for Reach 10R: OVERLAND FLOW TO POA1

Inflow Area = 21.872 ac, 42.75% Impervious, Inflow Depth = 4.72" for 100-yr event
Inflow = 64.73 cfs @ 12.32 hrs, Volume= 8.603 af
Outflow = 64.53 cfs @ 12.34 hrs, Volume= 8.603 af, Atten= 0%, Lag= 0.9 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.94 fps, Avg. Travel Time= 4.2 min

Peak Storage= 5,846 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.37' , Surface Width= 101.14'
Bank-Full Depth= 4.21' Flow Area= 759.5 sf, Capacity= 10,937.20 cfs

Custom cross-section, Length= 237.0' Slope= 0.0127 '/' (103 Elevation Intervals)
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,112.00', Outlet Invert= 2,109.00'

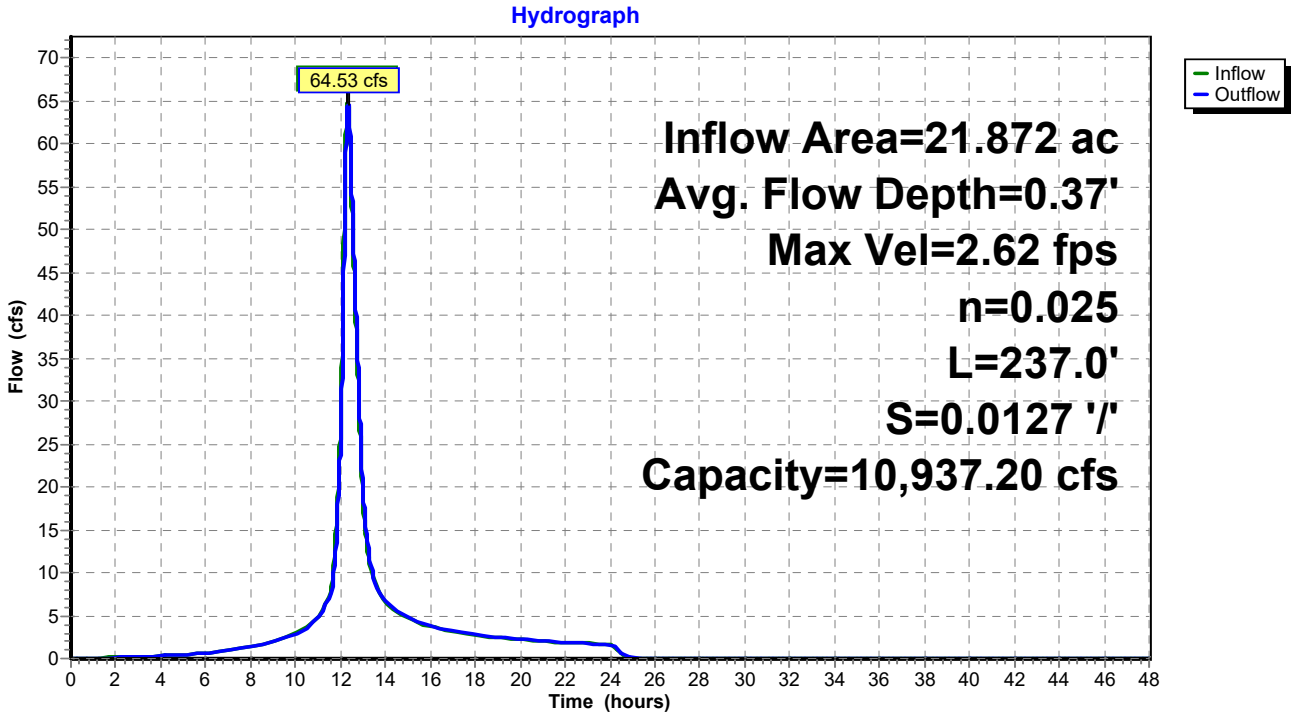


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
5.00	2,114.00	1.00
20.00	2,113.00	2.00
40.00	2,112.00	3.00
60.00	2,111.00	4.00
85.00	2,110.79	4.21
150.00	2,111.00	4.00
200.00	2,112.00	3.00
220.00	2,113.00	2.00
230.00	2,114.00	1.00
240.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.21	9.5	90.0	89.8	2,241	14.10
1.21	134.5	160.0	160.0	31,865	800.55
2.21	314.5	200.1	200.0	74,525	2,842.54
3.21	527.0	225.2	225.0	124,887	6,211.67
4.21	759.5	240.3	240.0	179,990	10,937.20

Reach 10R: OVERLAND FLOW TO POA1



Summary for Reach 11R: OVERLAND FLOW TO POA1

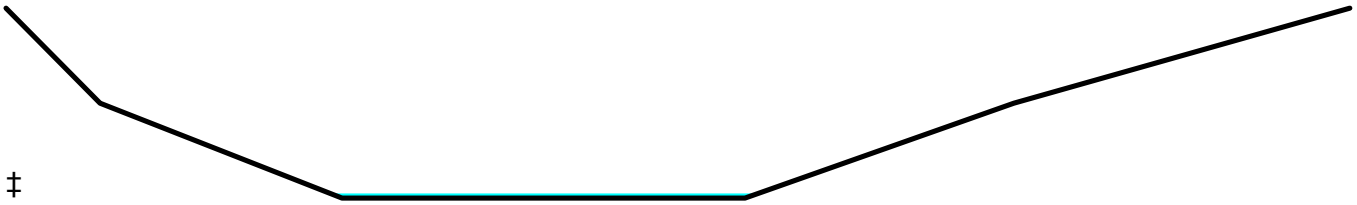
[61] Hint: Exceeded Reach 7R outlet invert by 0.05' @ 12.12 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 4.22" for 100-yr event
Inflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af
Outflow = 1.98 cfs @ 12.12 hrs, Volume= 0.181 af, Atten= 6%, Lag= 2.1 min
Routed to Link 9L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.31 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 5.8 min

Peak Storage= 386 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.05' , Surface Width= 31.85'
Bank-Full Depth= 2.00' Flow Area= 133.0 sf, Capacity= 1,579.47 cfs

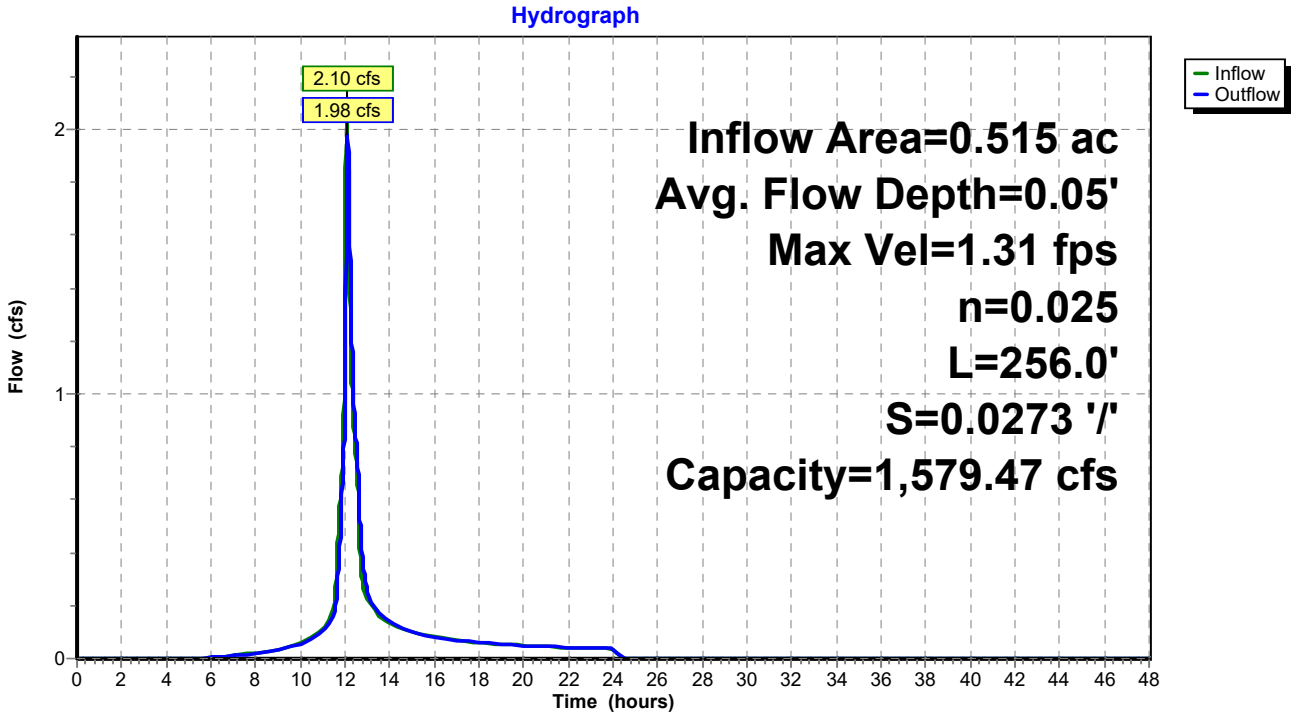
Custom cross-section, Length= 256.0' Slope= 0.0273 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,116.00', Outlet Invert= 2,109.00'

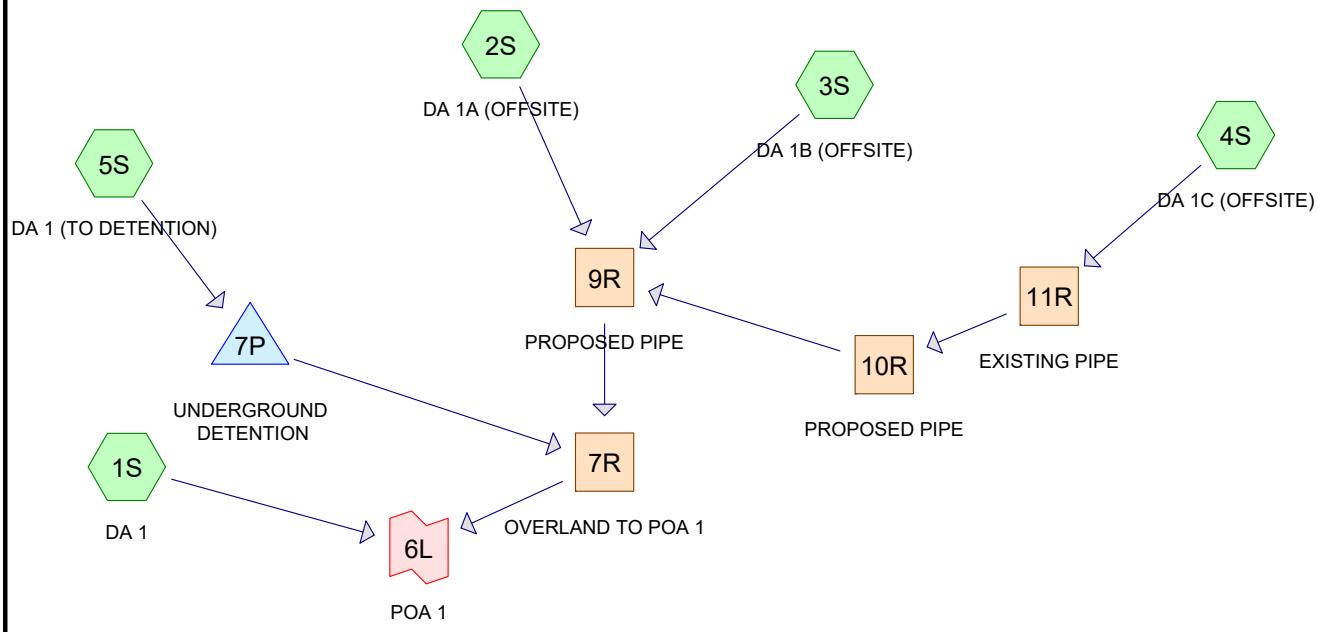


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,115.00	0.00
7.00	2,114.00	1.00
25.00	2,113.00	2.00
55.00	2,113.00	2.00
75.00	2,114.00	1.00
100.00	2,115.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	30.0	0.0	0	0.00
1.00	49.0	68.1	68.0	12,544	386.90
2.00	133.0	100.1	100.0	34,048	1,579.47

Reach 11R: OVERLAND FLOW TO POA1





Subcat Reach Pond Link

Routing Diagram for POST DEV

Prepared by Balzer & Associates, Inc, Printed 6/30/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.659	79	1 acre lots, 20% imp, HSG C (1S, 3S, 4S)
2.520	80	1/2 acre lots, 25% imp, HSG C (2S, 3S, 4S)
12.913	83	1/4 acre lots, 38% imp, HSG C (1S, 2S, 3S, 5S)
3.507	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 5S)
1.422	98	Paved parking, HSG C (2S, 5S)
2.928	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 3S, 4S)
1.188	92	Paved roads w/open ditches, 50% imp, HSG C (2S, 3S)
25.137	**84**	**TOTAL AREA**

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

Subcatchment 1S: DA 1 Runoff Area=1.709 ac 33.72% Impervious Runoff Depth=0.97"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=1.85 cfs 0.139 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.545 ac 42.60% Impervious Runoff Depth=1.03"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=14.58 cfs 1.682 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.320 ac 44.13% Impervious Runoff Depth=1.07"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=1.68 cfs 0.206 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=0.76"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=0.43 cfs 0.032 af

Subcatchment 5S: DA 1 (TO DETENTION) Runoff Area=1.048 ac 53.59% Impervious Runoff Depth=1.30"
Tc=6.0 min CN=WQ Runoff=1.78 cfs 0.114 af

Link 6L: POA 1 Inflow=17.23 cfs 2.172 af
Primary=17.23 cfs 2.172 af

Pond 7P: UNDERGROUND DETENTION Peak Elev=2,111.74' Storage=0.068 af Inflow=1.78 cfs 0.114 af
Outflow=0.06 cfs 0.113 af

Reach 7R: OVERLAND TO POA 1 Avg. Flow Depth=0.22' Max Vel=3.77 fps Inflow=16.47 cfs 2.034 af
n=0.025 L=20.0' S=0.0445 '/' Capacity=391.92 cfs Outflow=16.47 cfs 2.034 af

Reach 9R: PROPOSED PIPE Avg. Flow Depth=1.35' Max Vel=4.81 fps Inflow=16.45 cfs 1.921 af
42.0" Round Pipe n=0.020 L=261.0' S=0.0064 '/' Capacity=52.31 cfs Outflow=16.42 cfs 1.921 af

Reach 10R: PROPOSED PIPE Avg. Flow Depth=0.20' Max Vel=3.09 fps Inflow=0.43 cfs 0.032 af
18.0" Round Pipe n=0.020 L=170.0' S=0.0280 '/' Capacity=11.43 cfs Outflow=0.43 cfs 0.032 af

Reach 11R: EXISTING PIPE Avg. Flow Depth=0.24' Max Vel=2.91 fps Inflow=0.43 cfs 0.032 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=0.43 cfs 0.032 af

Total Runoff Area = 25.137 ac Runoff Volume = 2.173 af Average Runoff Depth = 1.04"
57.78% Pervious = 14.524 ac 42.22% Impervious = 10.613 ac

Summary for Subcatchment 1S: DA 1

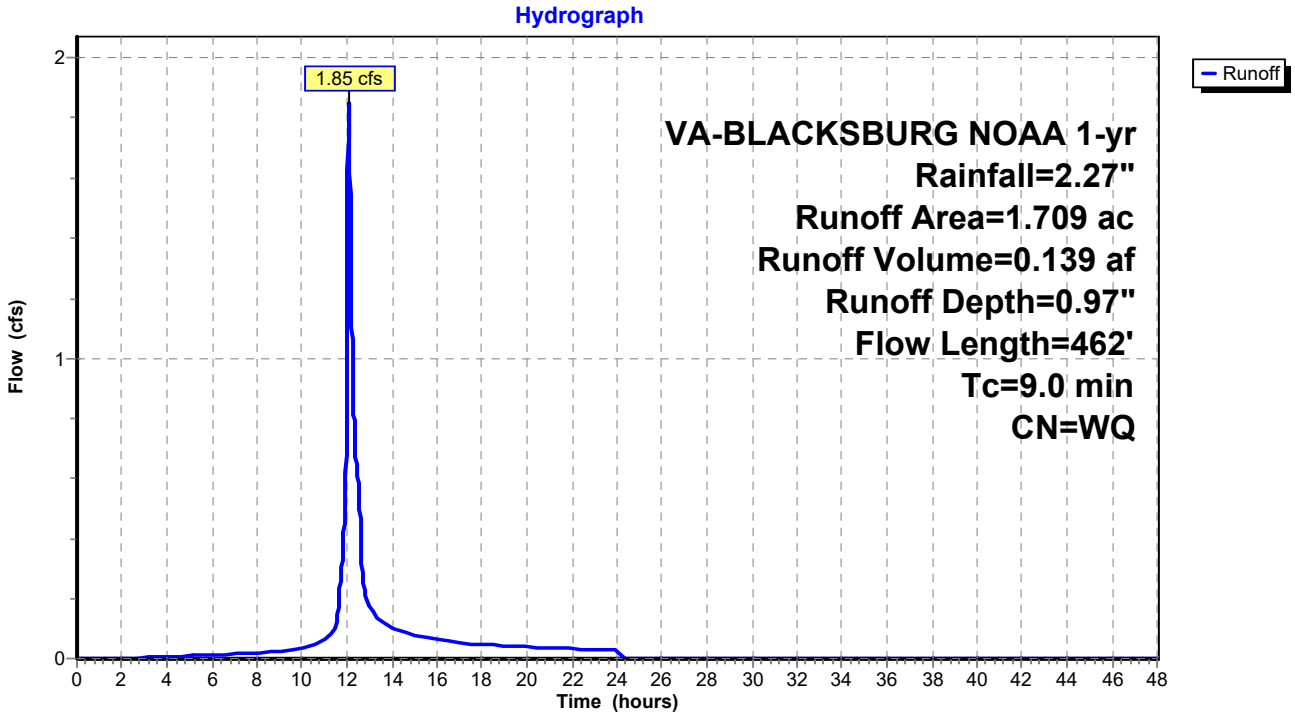
Runoff = 1.85 cfs @ 12.08 hrs, Volume= 0.139 af, Depth= 0.97"
Routed to Link 6L : POA 1

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
0.865	74	>75% Grass cover, Good, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.237	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
1.709		Weighted Average
1.133		66.28% Pervious Area
0.576		33.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

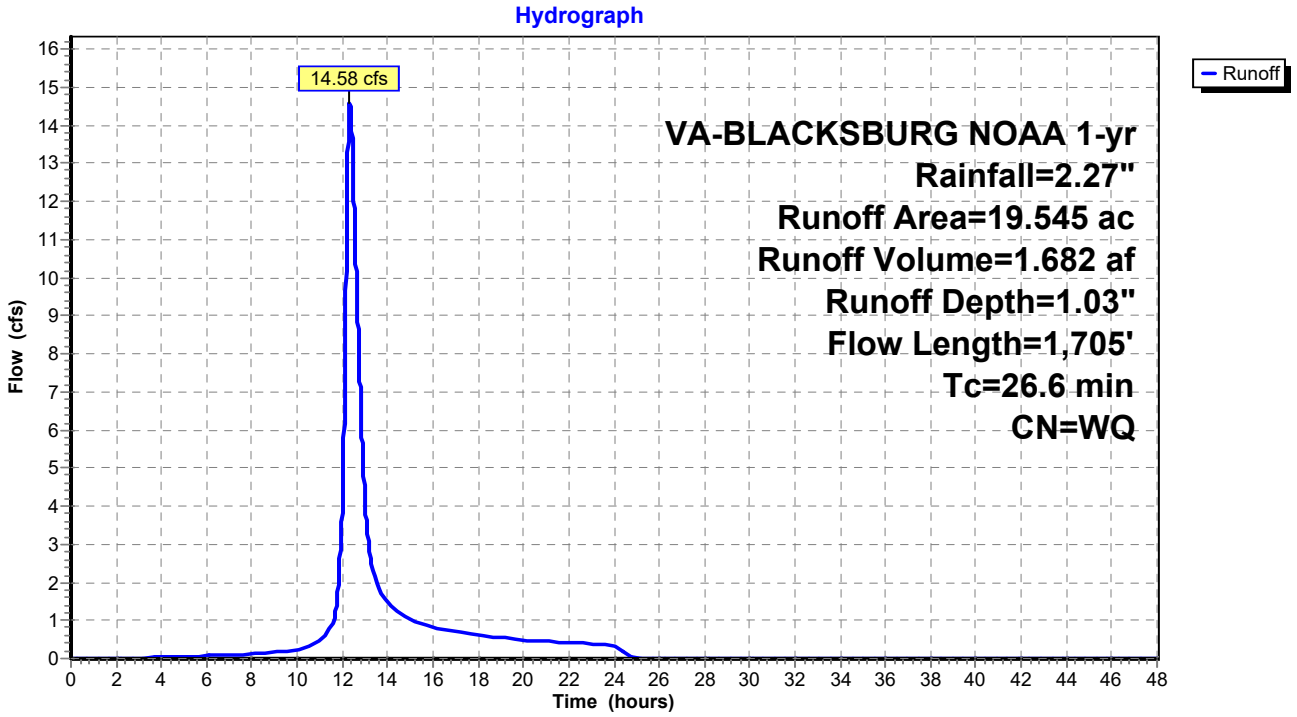
Runoff = 14.58 cfs @ 12.33 hrs, Volume= 1.682 af, Depth= 1.03"
Routed to Reach 9R : PROPOSED PIPE

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
2.150	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.545		Weighted Average
11.219		57.40% Pervious Area
8.326		42.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 18054% of capacity of segment #8

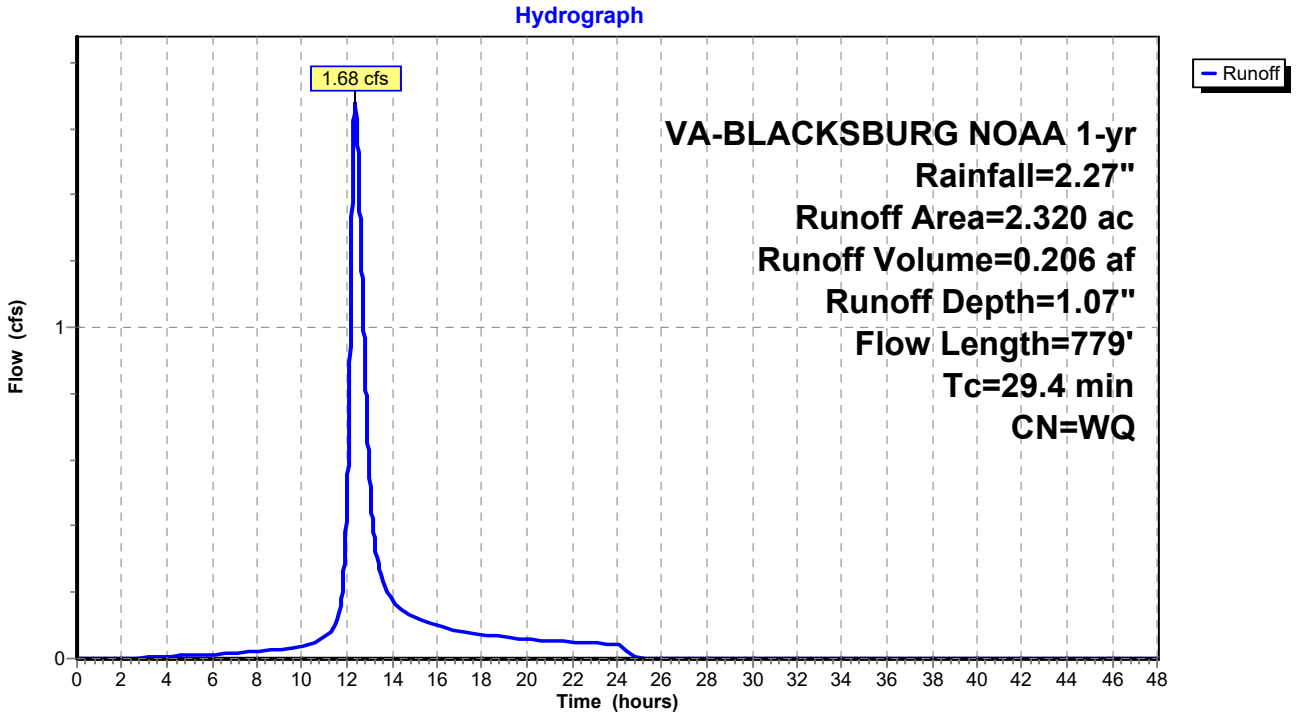
Runoff = 1.68 cfs @ 12.38 hrs, Volume= 0.206 af, Depth= 1.07"
Routed to Reach 9R : PROPOSED PIPE

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.067	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.320		Weighted Average
1.296		55.87% Pervious Area
1.024		44.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.02' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

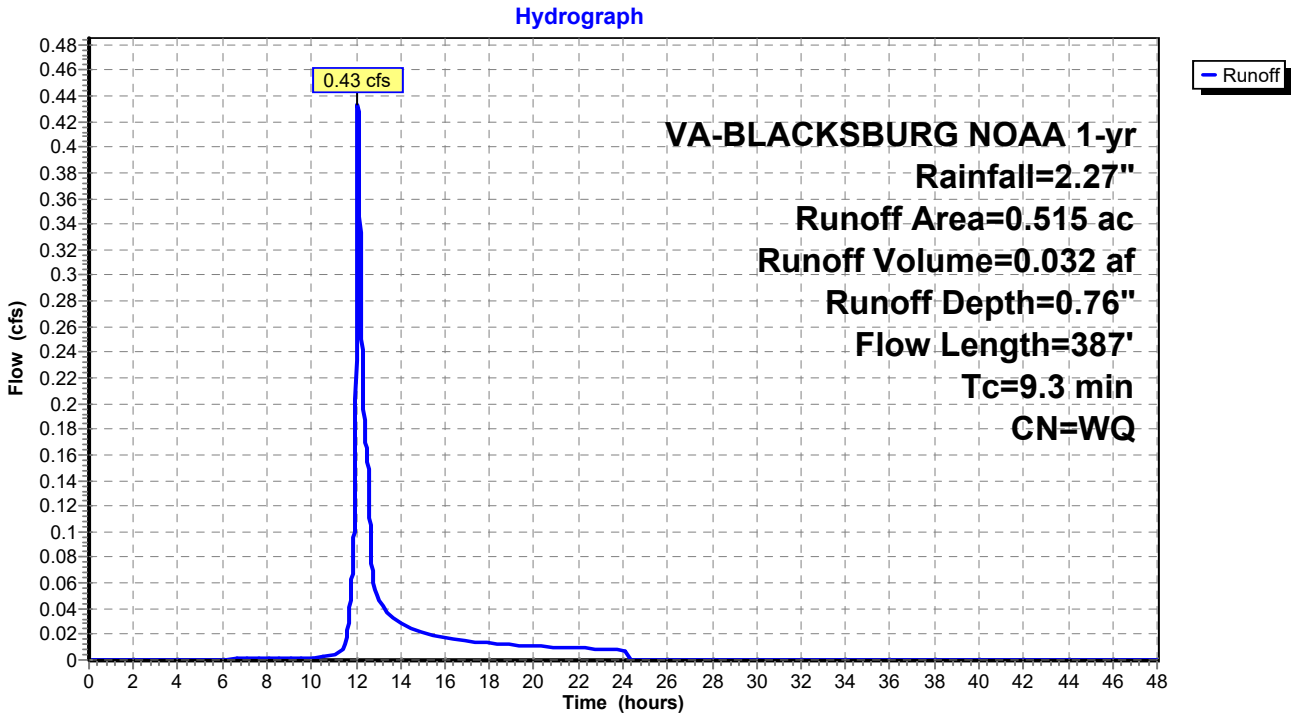
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 0.76"
Routed to Reach 11R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Subcatchment 5S: DA 1 (TO DETENTION)

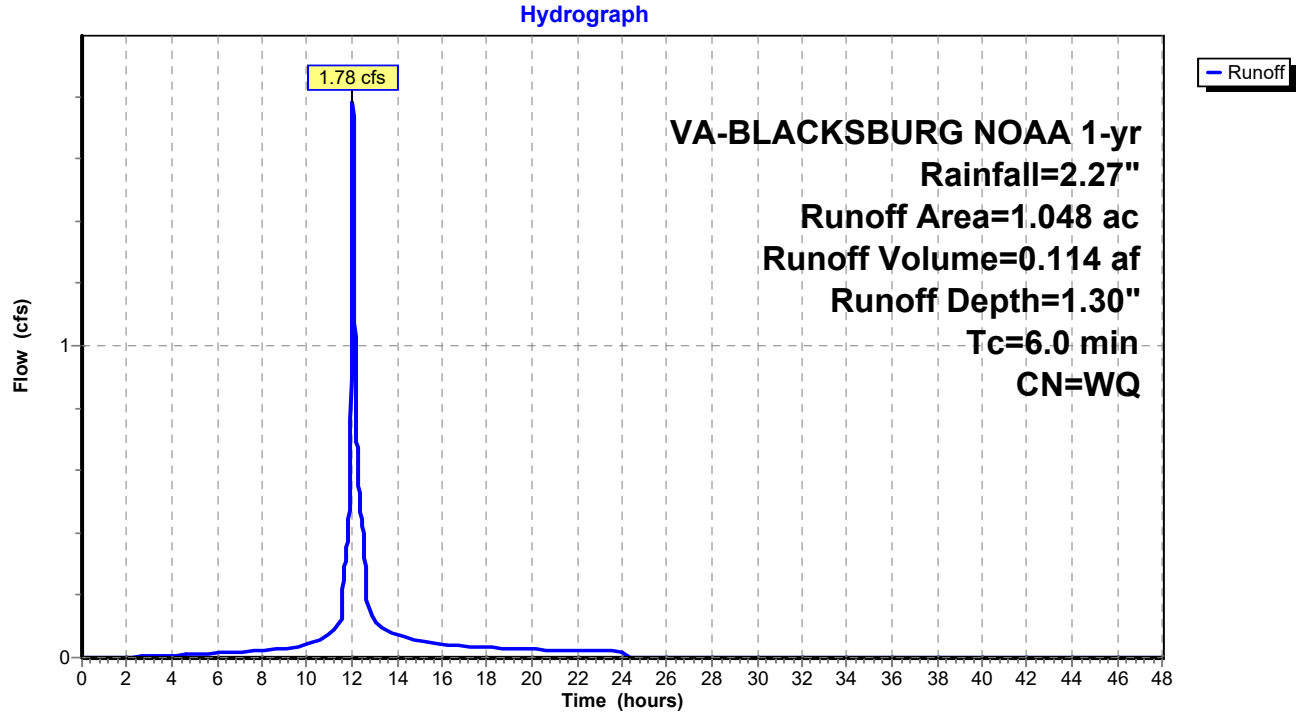
Runoff = 1.78 cfs @ 12.04 hrs, Volume= 0.114 af, Depth= 1.30"
Routed to Pond 7P : UNDERGROUND DETENTION

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
0.425	74	>75% Grass cover, Good, HSG C
0.524	98	Paved parking, HSG C
0.099	83	1/4 acre lots, 38% imp, HSG C
1.048		Weighted Average
0.486		46.41% Pervious Area
0.562		53.59% Impervious Area

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

Subcatchment 5S: DA 1 (TO DETENTION)

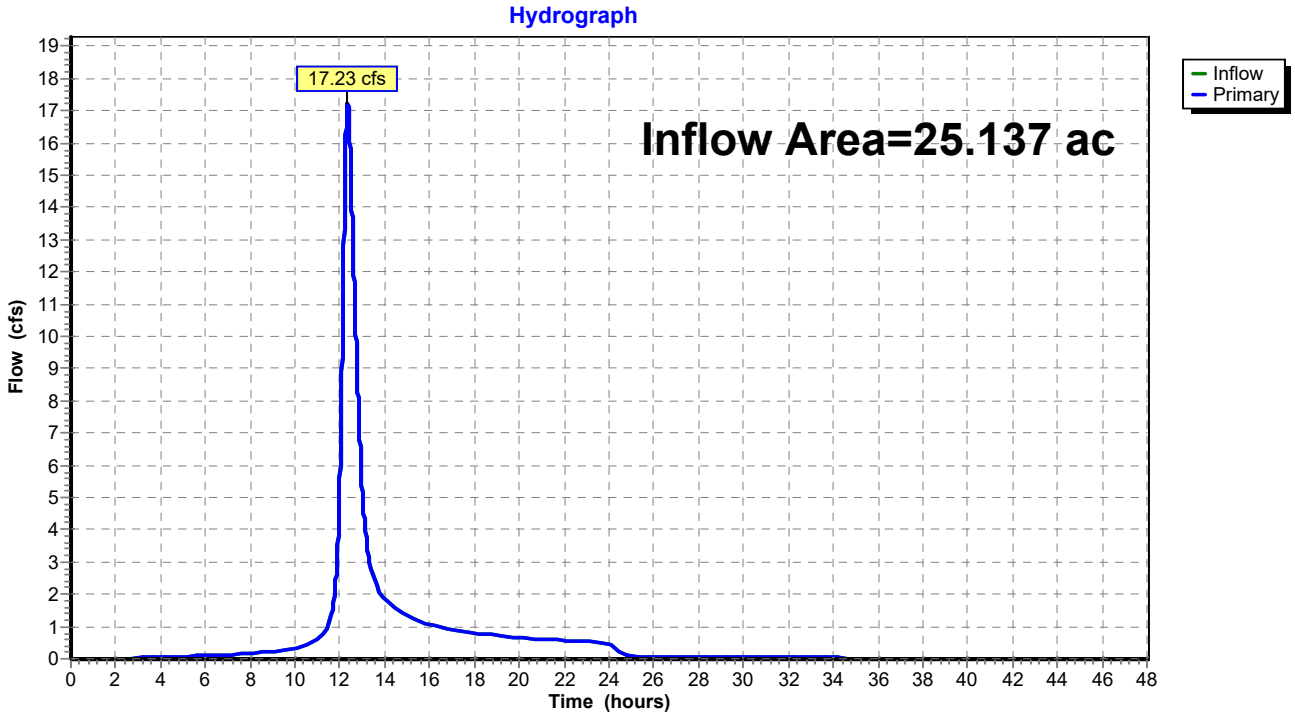


Summary for Link 6L: POA 1

Inflow Area = 25.137 ac, 42.22% Impervious, Inflow Depth = 1.04" for 1-yr event
Inflow = 17.23 cfs @ 12.34 hrs, Volume= 2.172 af
Primary = 17.23 cfs @ 12.34 hrs, Volume= 2.172 af, Atten= 0%, Lag= 0.0 min

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

Link 6L: POA 1



Summary for Pond 7P: UNDERGROUND DETENTION

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1.048 ac, 53.59% Impervious, Inflow Depth = 1.30" for 1-yr event
Inflow = 1.78 cfs @ 12.04 hrs, Volume= 0.114 af
Outflow = 0.06 cfs @ 14.49 hrs, Volume= 0.113 af, Atten= 97%, Lag= 147.0 min
Primary = 0.06 cfs @ 14.49 hrs, Volume= 0.113 af
Routed to Reach 7R : OVERLAND TO POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,111.74' @ 14.49 hrs Surf.Area= 0.069 ac Storage= 0.068 af

Plug-Flow detention time= 584.3 min calculated for 0.113 af (99% of inflow)
Center-of-Mass det. time= 580.6 min (1,369.9 - 789.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,110.65'	0.028 af	**80.00'W x 32.00'L x 3.00'H Field A** 0.176 af Overall - 0.107 af Embedded = 0.069 af x 40.0% Voids
#2A	2,110.65'	0.103 af	**StormTank 25 Series 24"** x 520 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 520 Chambers in 52 Rows
#3B	2,110.65'	0.002 af	**39.50'W x 11.00'L x 2.00'H Field B** 0.020 af Overall - 0.015 af Embedded = 0.004 af x 40.0% Voids
#4B	2,110.65'	0.015 af	**StormTank 25 Series 24"** x 75 Inside #3 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 75 Chambers in 25 Rows
		0.148 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,110.65'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,110.65' / 2,110.50' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	2,110.40'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,112.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.06 cfs @ 14.49 hrs HW=2,111.74' (Free Discharge)
└**1=Culvert** (Passes 0.06 cfs of 3.99 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 5.03 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field A

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

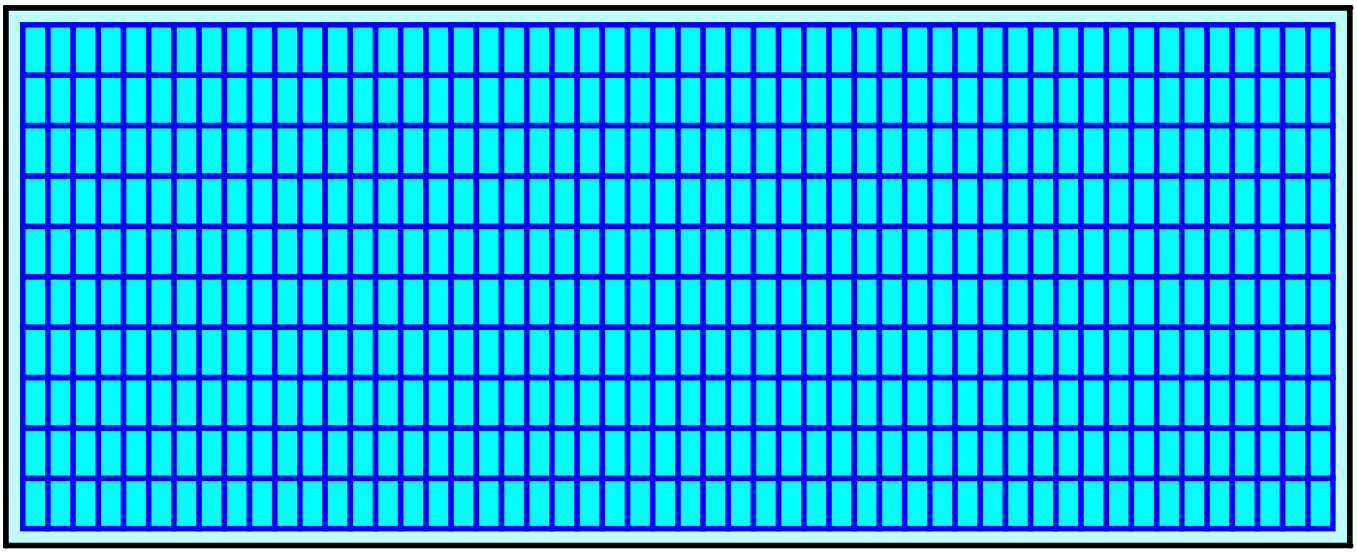
10 Chambers/Row x 3.00' Long = 30.00' Row Length +12.0" End Stone x 2 = 32.00' Base Length
52 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 80.00' Base Width
24.0" Chamber Height + 12.0" Stone Cover = 3.00' Field Height

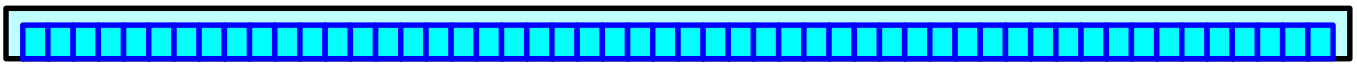
520 Chambers x 8.7 cf = 4,501.2 cf Chamber Storage
520 Chambers x 9.0 cf = 4,680.0 cf Displacement

7,680.0 cf Field - 4,680.0 cf Chambers = 3,000.0 cf Stone x 40.0% Voids = 1,200.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,701.2 cf = 0.131 af
Overall Storage Efficiency = 74.2%
Overall System Size = 32.00' x 80.00' x 3.00'

520 Chambers
284.4 cy Field
111.1 cy Stone





Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field B

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

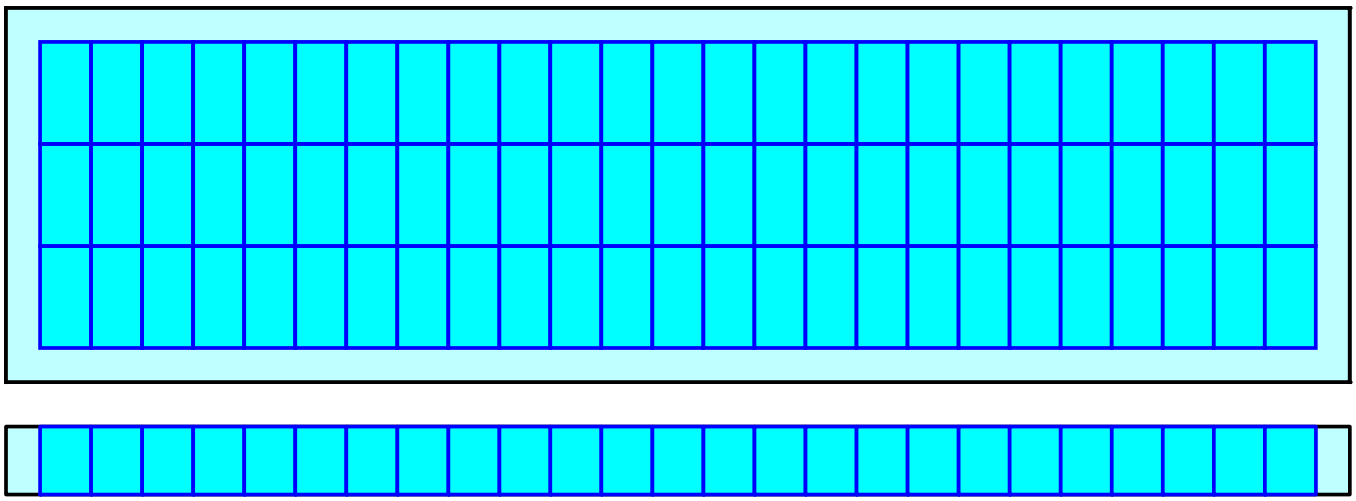
3 Chambers/Row x 3.00' Long = 9.00' Row Length +12.0" End Stone x 2 = 11.00' Base Length
25 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 39.50' Base Width
24.0" Chamber Height = 2.00' Field Height

75 Chambers x 8.7 cf = 649.2 cf Chamber Storage
75 Chambers x 9.0 cf = 675.0 cf Displacement

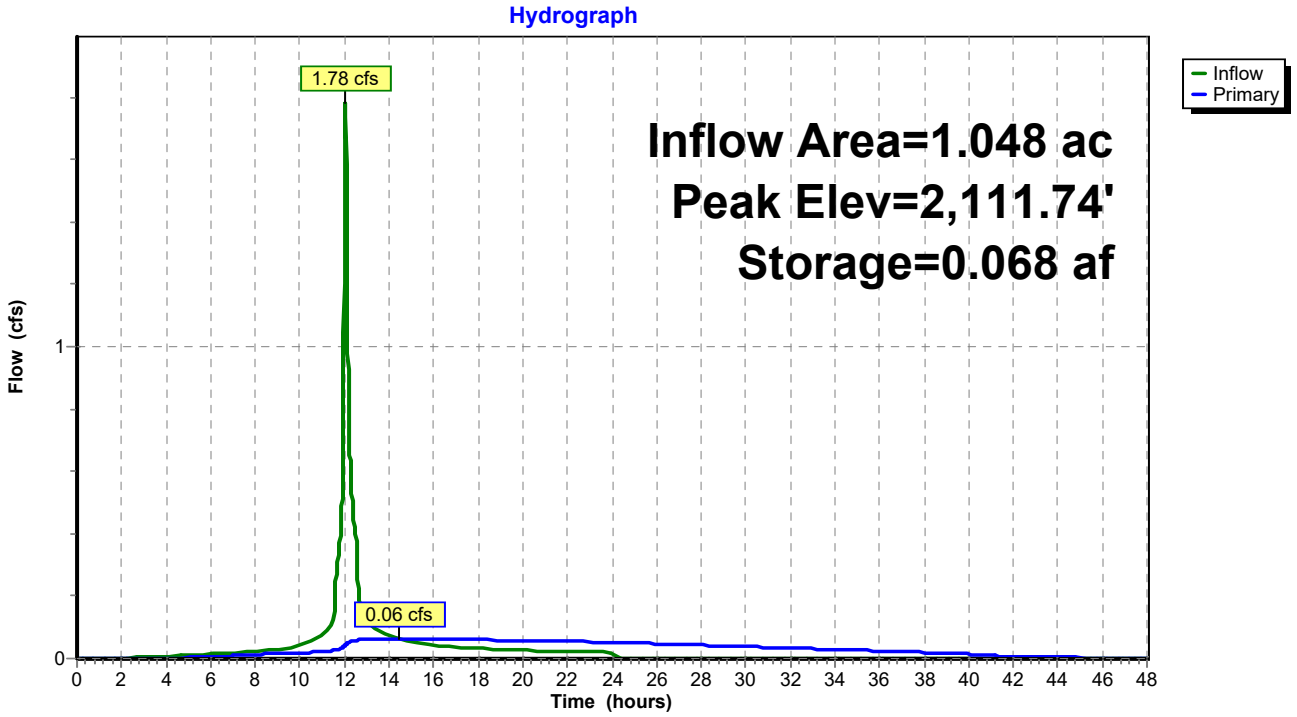
869.0 cf Field - 675.0 cf Chambers = 194.0 cf Stone x 40.0% Voids = 77.6 cf Stone Storage

Chamber Storage + Stone Storage = 726.8 cf = 0.017 af
Overall Storage Efficiency = 83.6%
Overall System Size = 11.00' x 39.50' x 2.00'

75 Chambers
32.2 cy Field
7.2 cy Stone



Pond 7P: UNDERGROUND DETENTION



Summary for Reach 7R: OVERLAND TO POA 1

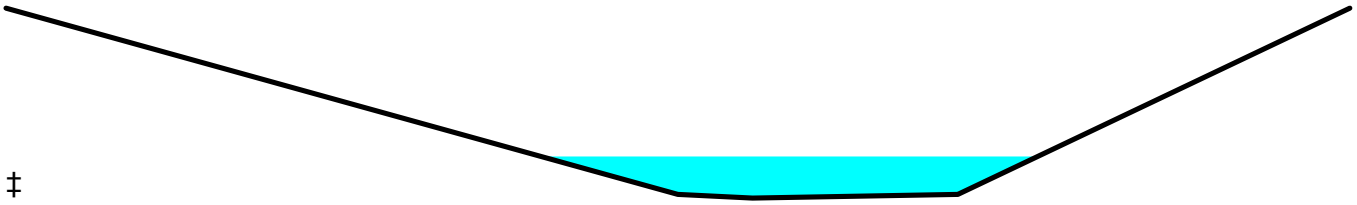
[61] Hint: Exceeded Reach 9R outlet invert by 0.18' @ 12.34 hrs

Inflow Area = 23.428 ac, 42.84% Impervious, Inflow Depth = 1.04" for 1-yr event
Inflow = 16.47 cfs @ 12.34 hrs, Volume= 2.034 af
Outflow = 16.47 cfs @ 12.34 hrs, Volume= 2.034 af, Atten= 0%, Lag= 0.0 min
Routed to Link 6L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.77 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 0.4 min

Peak Storage= 88 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.22' , Surface Width= 26.58'
Bank-Full Depth= 1.02' Flow Area= 43.6 sf, Capacity= 391.92 cfs

Custom cross-section, Length= 20.0' Slope= 0.0445 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,109.78', Outlet Invert= 2,108.89'

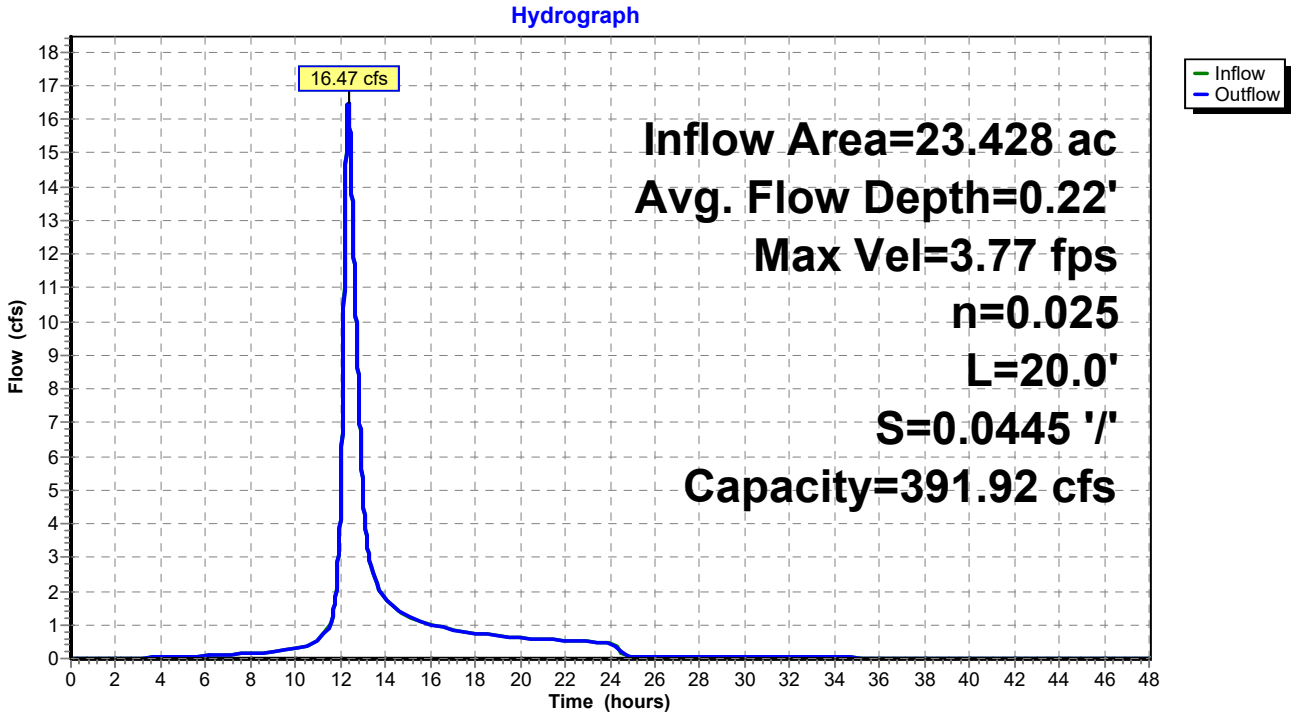


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,110.00	0.00
36.00	2,109.00	1.00
40.00	2,108.98	1.02
51.00	2,109.00	1.00
72.00	2,110.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.02	0.1	15.0	14.7	3	0.09
1.02	43.6	72.0	72.0	873	391.92

Reach 7R: OVERLAND TO POA 1



Summary for Reach 9R: PROPOSED PIPE

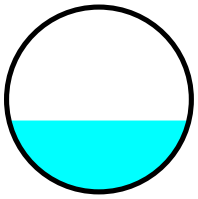
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 10R OUTLET depth by 1.57' @ 12.35 hrs

Inflow Area = 22.380 ac, 42.34% Impervious, Inflow Depth = 1.03" for 1-yr event
Inflow = 16.45 cfs @ 12.33 hrs, Volume= 1.921 af
Outflow = 16.42 cfs @ 12.34 hrs, Volume= 1.921 af, Atten= 0%, Lag= 0.8 min
Routed to Reach 7R : OVERLAND TO POA 1

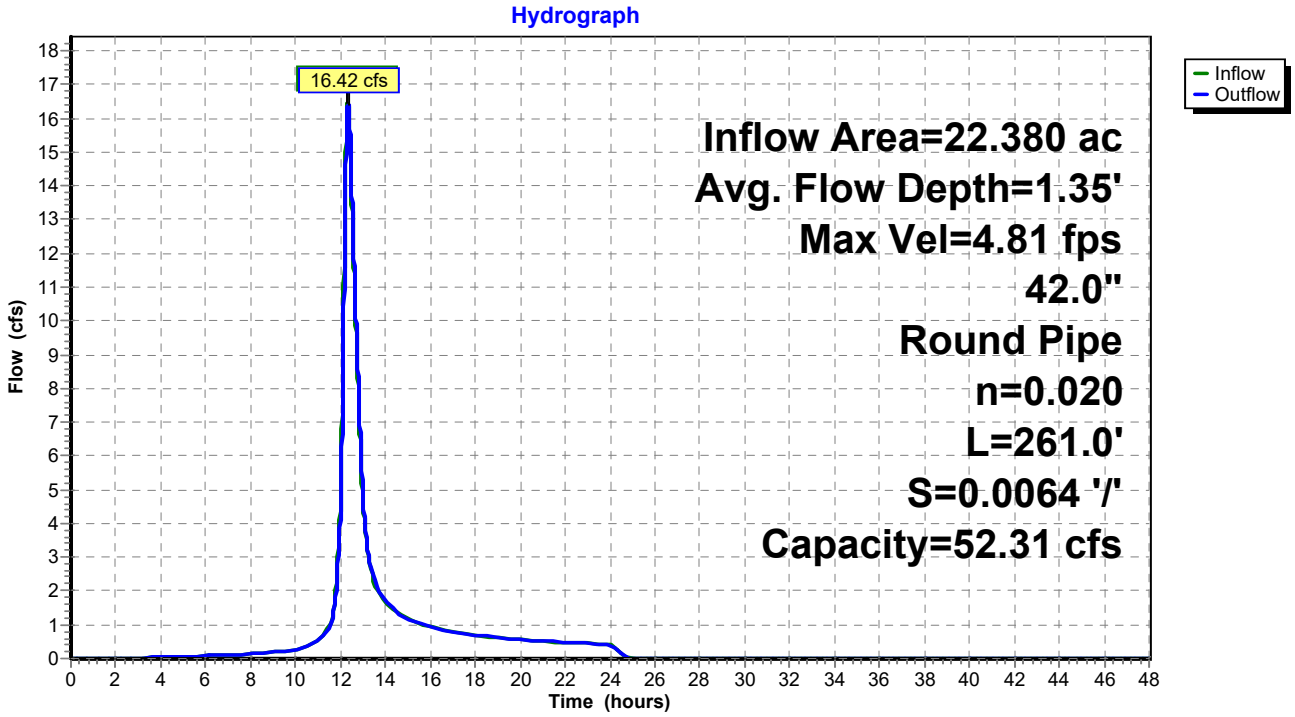
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.81 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 2.7 min

Peak Storage= 891 cf @ 12.34 hrs
Average Depth at Peak Storage= 1.35' , Surface Width= 3.41'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 52.31 cfs

42.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 261.0' Slope= 0.0064 '/'
Inlet Invert= 2,111.49', Outlet Invert= 2,109.82'



Reach 9R: PROPOSED PIPE



Summary for Reach 10R: PROPOSED PIPE

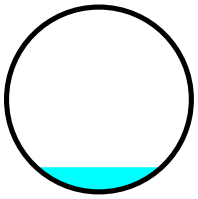
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.09' @ 12.10 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.43 cfs @ 12.10 hrs, Volume= 0.032 af, Atten= 1%, Lag= 0.7 min
Routed to Reach 9R : PROPOSED PIPE

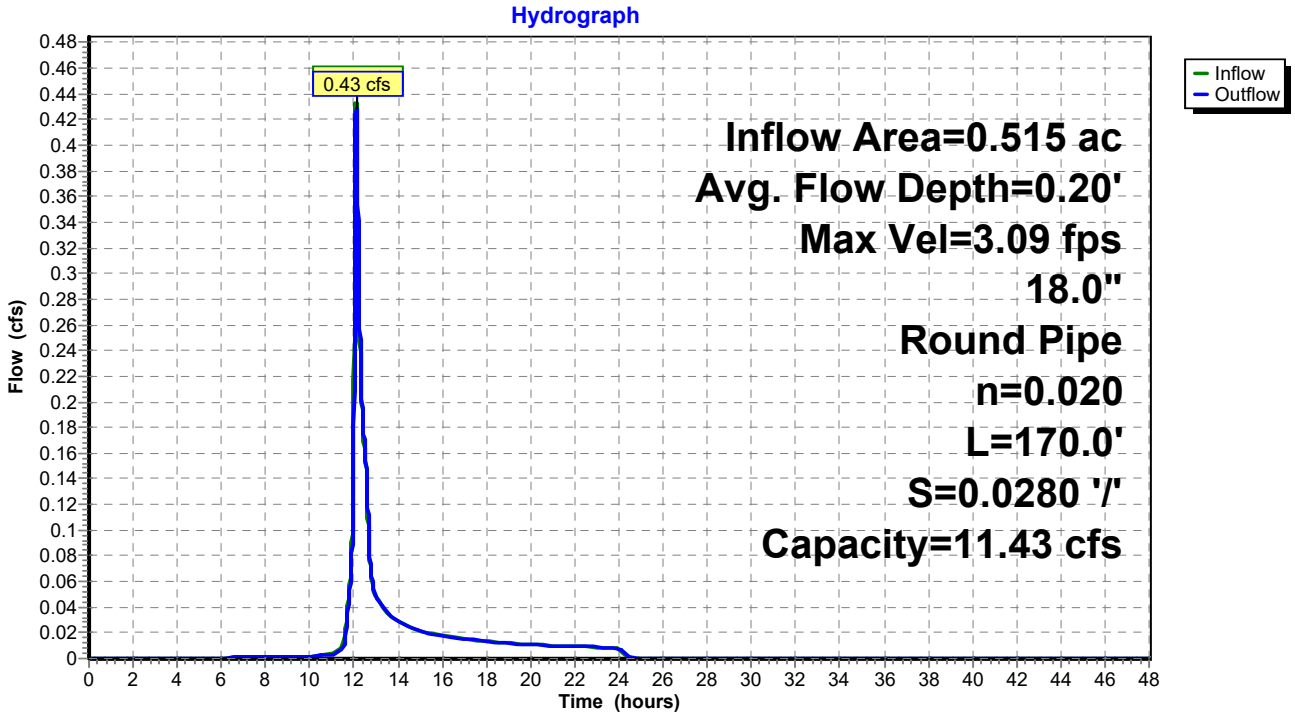
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.09 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.95 fps, Avg. Travel Time= 3.0 min

Peak Storage= 24 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.20' , Surface Width= 1.02'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.43 cfs

18.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 170.0' Slope= 0.0280 '/'
Inlet Invert= 2,115.89', Outlet Invert= 2,111.13'



Reach 10R: PROPOSED PIPE



Summary for Reach 11R: EXISTING PIPE

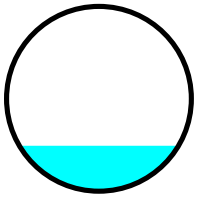
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af
Outflow = 0.43 cfs @ 12.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 10R : PROPOSED PIPE

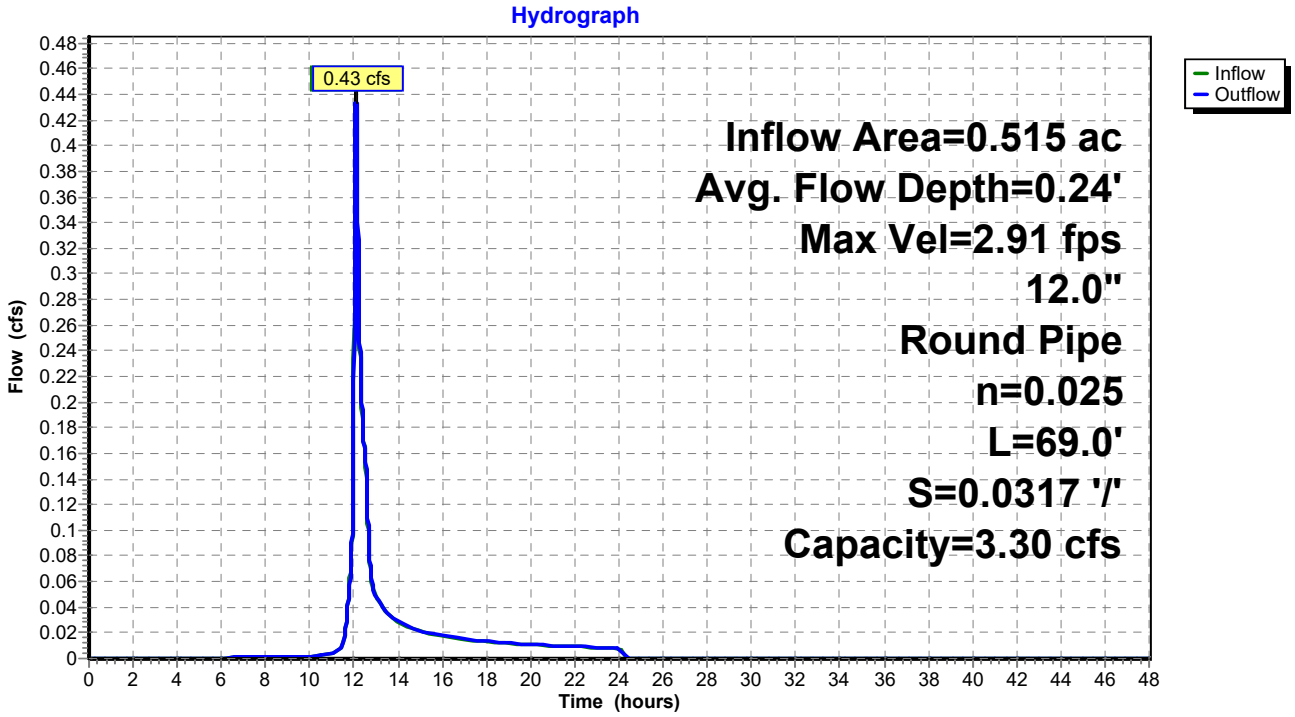
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 1.3 min

Peak Storage= 10 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.24' , Surface Width= 0.86'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 11R: EXISTING PIPE



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

Subcatchment 1S: DA 1 Runoff Area=1.709 ac 33.72% Impervious Runoff Depth=1.32"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=2.57 cfs 0.187 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.545 ac 42.60% Impervious Runoff Depth=1.40"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=20.21 cfs 2.288 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.320 ac 44.13% Impervious Runoff Depth=1.44"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=2.30 cfs 0.278 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=1.09"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=0.65 cfs 0.047 af

Subcatchment 5S: DA 1 (TO DETENTION) Runoff Area=1.048 ac 53.59% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=WQ Runoff=2.32 cfs 0.147 af

Link 6L: POA 1 Inflow=23.86 cfs 2.945 af
Primary=23.86 cfs 2.945 af

Pond 7P: UNDERGROUND DETENTION Peak Elev=2,112.11' Storage=0.091 af Inflow=2.32 cfs 0.147 af
Outflow=0.07 cfs 0.145 af

Reach 7R: OVERLAND TO POA 1 Avg. Flow Depth=0.26' Max Vel=4.15 fps Inflow=22.81 cfs 2.757 af
n=0.025 L=20.0' S=0.0445 '/' Capacity=391.92 cfs Outflow=22.82 cfs 2.757 af

Reach 9R: PROPOSED PIPE Avg. Flow Depth=1.61' Max Vel=5.25 fps Inflow=22.79 cfs 2.612 af
42.0" Round Pipe n=0.020 L=261.0' S=0.0064 '/' Capacity=52.31 cfs Outflow=22.75 cfs 2.612 af

Reach 10R: PROPOSED PIPE Avg. Flow Depth=0.24' Max Vel=3.49 fps Inflow=0.65 cfs 0.047 af
18.0" Round Pipe n=0.020 L=170.0' S=0.0280 '/' Capacity=11.43 cfs Outflow=0.64 cfs 0.047 af

Reach 11R: EXISTING PIPE Avg. Flow Depth=0.30' Max Vel=3.26 fps Inflow=0.65 cfs 0.047 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=0.65 cfs 0.047 af

Total Runoff Area = 25.137 ac Runoff Volume = 2.947 af Average Runoff Depth = 1.41"
57.78% Pervious = 14.524 ac 42.22% Impervious = 10.613 ac

Summary for Subcatchment 1S: DA 1

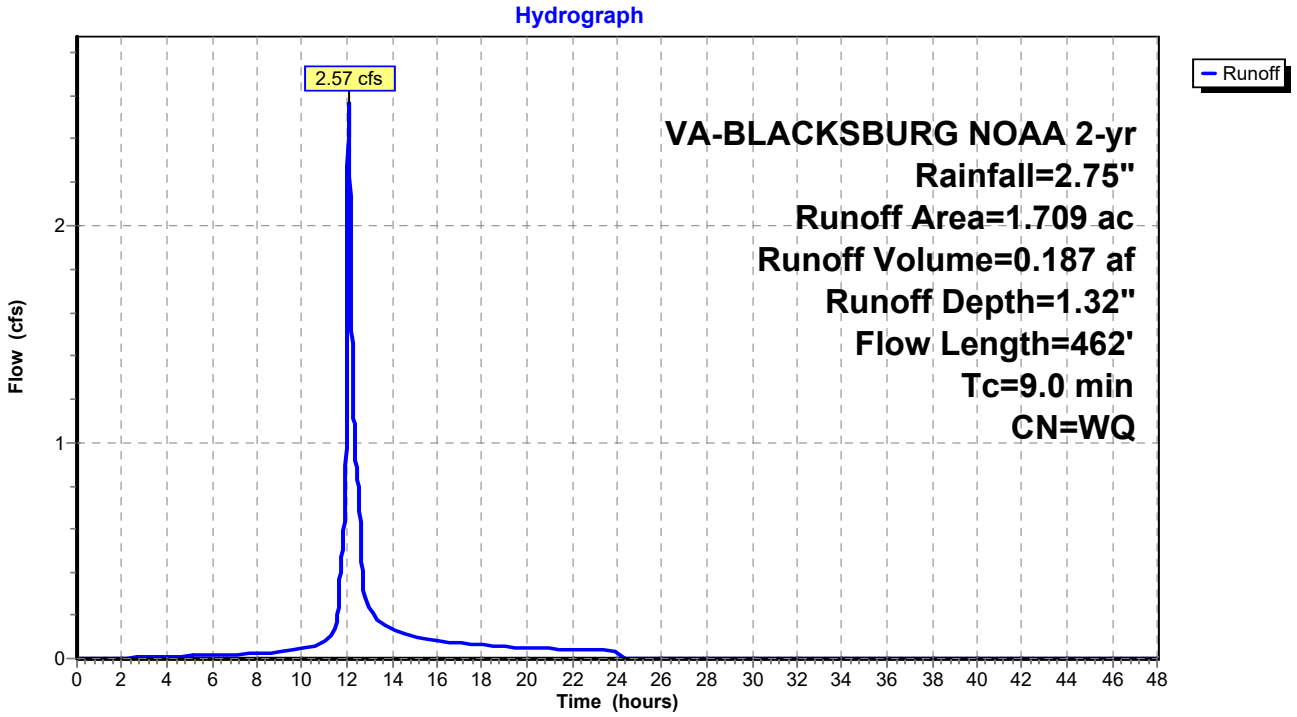
Runoff = 2.57 cfs @ 12.08 hrs, Volume= 0.187 af, Depth= 1.32"
Routed to Link 6L : POA 1

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
0.865	74	>75% Grass cover, Good, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.237	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
1.709		Weighted Average
1.133		66.28% Pervious Area
0.576		33.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

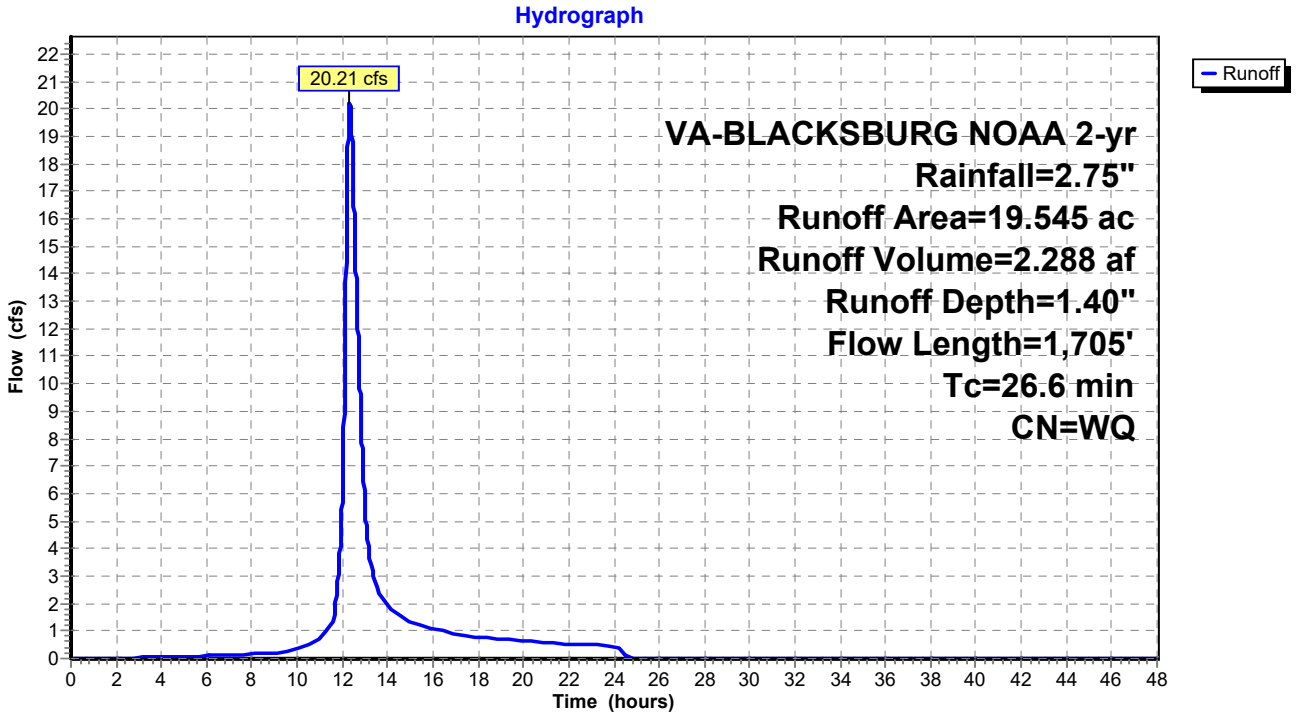
Runoff = 20.21 cfs @ 12.33 hrs, Volume= 2.288 af, Depth= 1.40"
Routed to Reach 9R : PROPOSED PIPE

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
2.150	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.545		Weighted Average
11.219		57.40% Pervious Area
8.326		42.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 24797% of capacity of segment #8

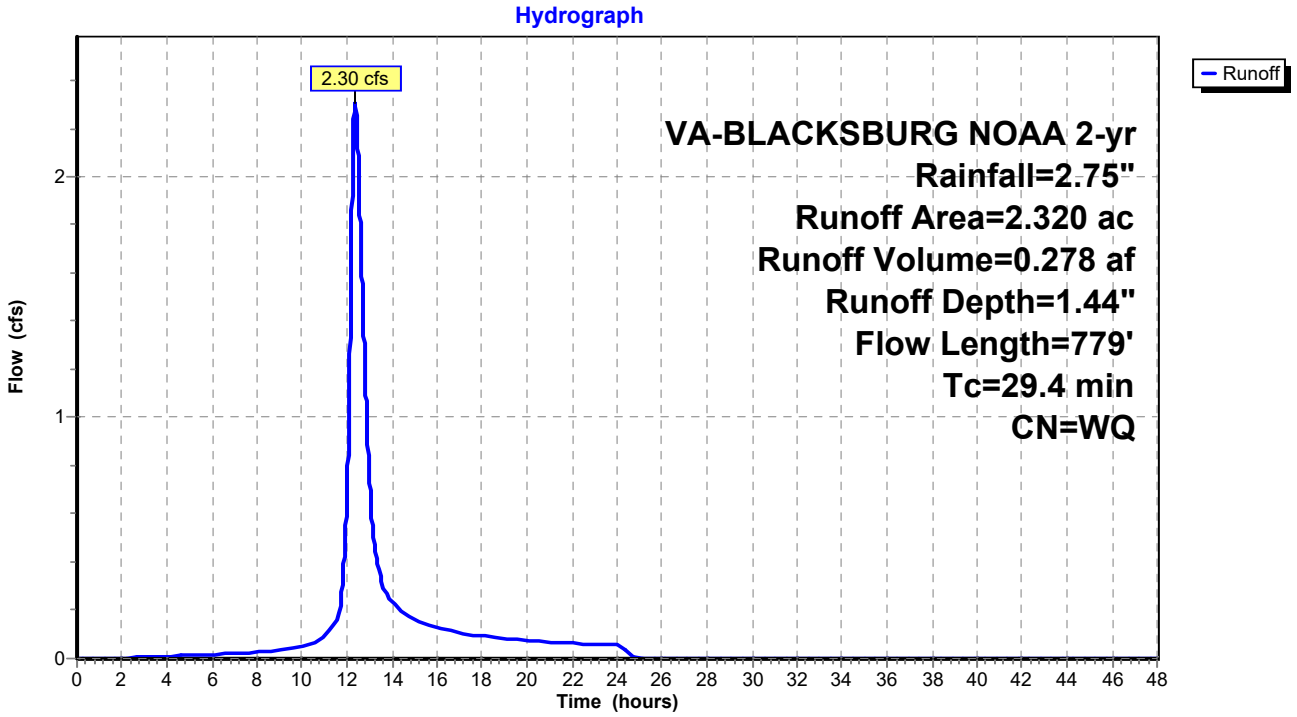
Runoff = 2.30 cfs @ 12.38 hrs, Volume= 0.278 af, Depth= 1.44"
Routed to Reach 9R : PROPOSED PIPE

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.067	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.320		Weighted Average
1.296		55.87% Pervious Area
1.024		44.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.02' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

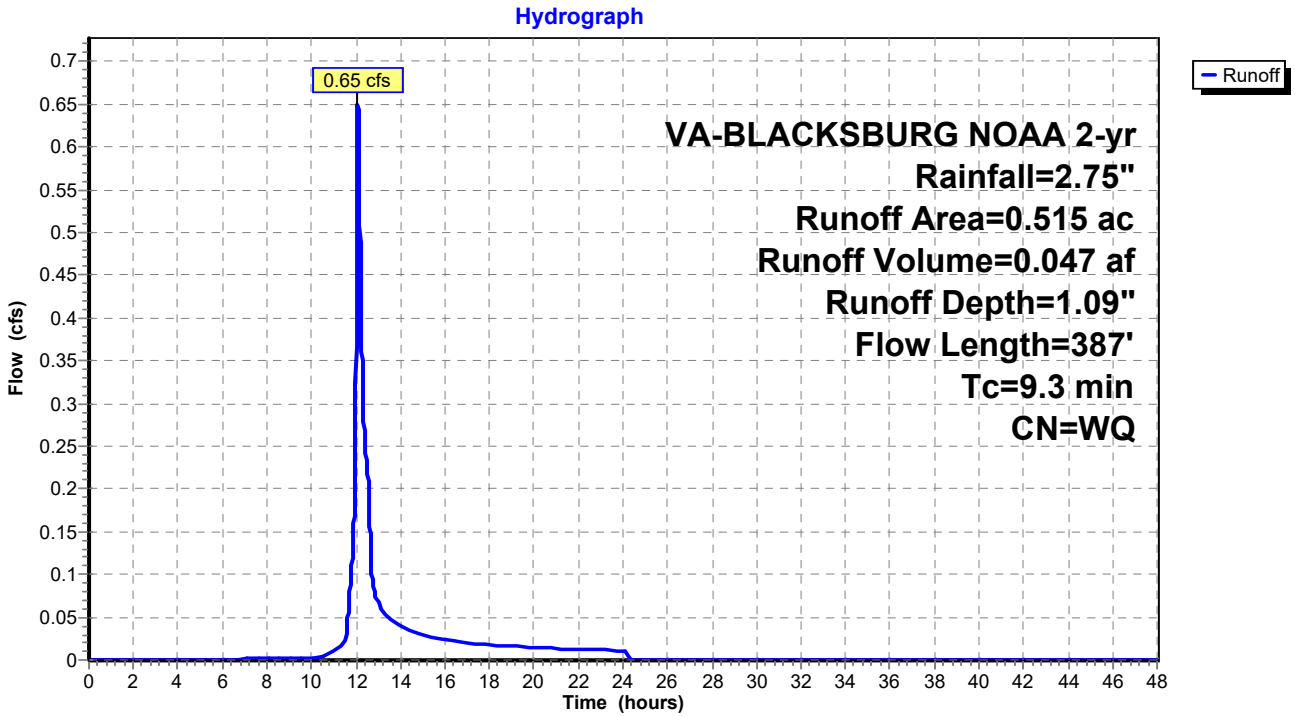
Runoff = 0.65 cfs @ 12.08 hrs, Volume= 0.047 af, Depth= 1.09"
Routed to Reach 11R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Subcatchment 5S: DA 1 (TO DETENTION)

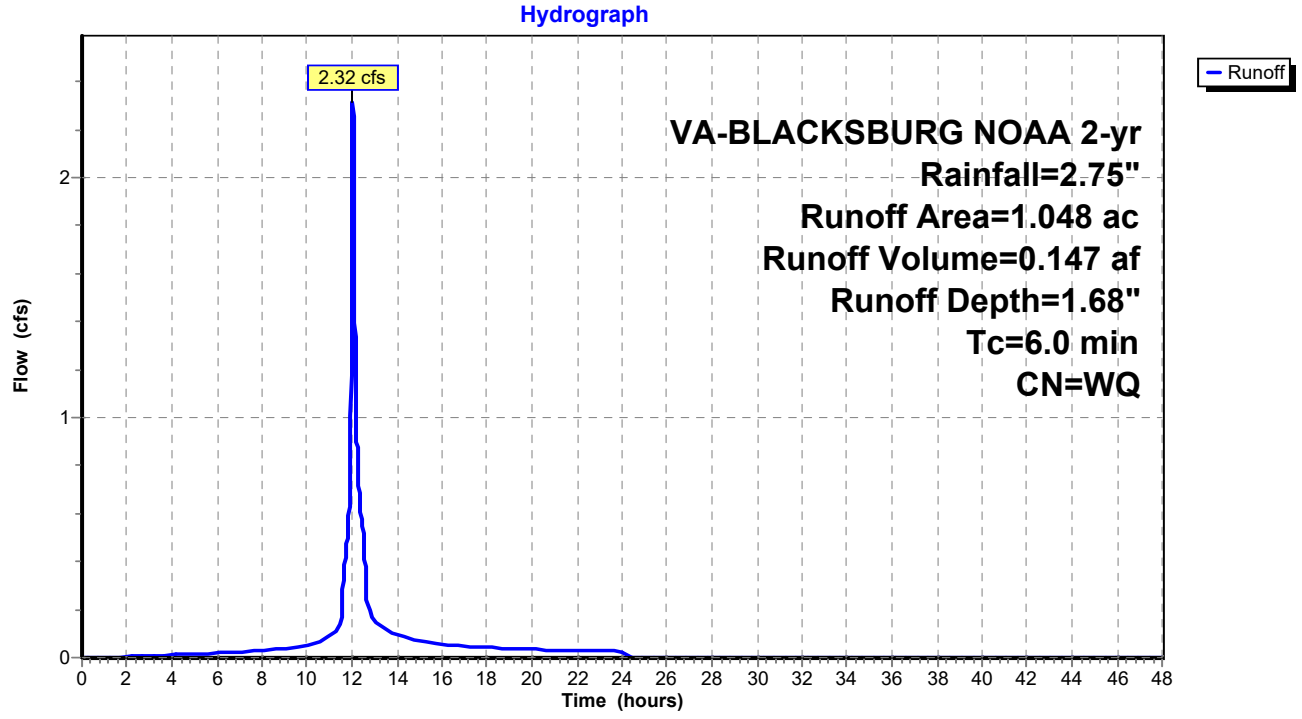
Runoff = 2.32 cfs @ 12.04 hrs, Volume= 0.147 af, Depth= 1.68"
Routed to Pond 7P : UNDERGROUND DETENTION

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
0.425	74	>75% Grass cover, Good, HSG C
0.524	98	Paved parking, HSG C
0.099	83	1/4 acre lots, 38% imp, HSG C
1.048		Weighted Average
0.486		46.41% Pervious Area
0.562		53.59% Impervious Area

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

Subcatchment 5S: DA 1 (TO DETENTION)

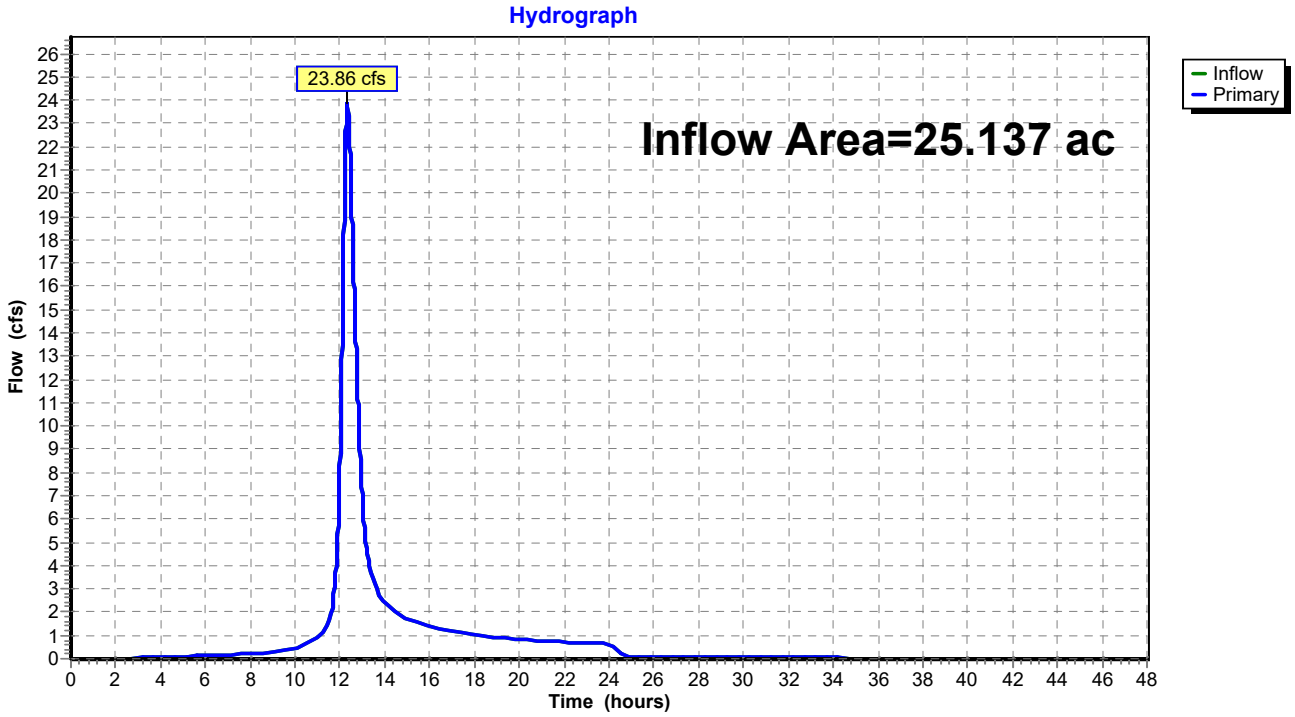


Summary for Link 6L: POA 1

Inflow Area = 25.137 ac, 42.22% Impervious, Inflow Depth > 1.41" for 2-yr event
Inflow = 23.86 cfs @ 12.33 hrs, Volume= 2.945 af
Primary = 23.86 cfs @ 12.33 hrs, Volume= 2.945 af, Atten= 0%, Lag= 0.0 min

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

Link 6L: POA 1



Summary for Pond 7P: UNDERGROUND DETENTION

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1.048 ac, 53.59% Impervious, Inflow Depth = 1.68" for 2-yr event
Inflow = 2.32 cfs @ 12.04 hrs, Volume= 0.147 af
Outflow = 0.07 cfs @ 14.85 hrs, Volume= 0.145 af, Atten= 97%, Lag= 168.8 min
Primary = 0.07 cfs @ 14.85 hrs, Volume= 0.145 af
Routed to Reach 7R : OVERLAND TO POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,112.11' @ 14.85 hrs Surf.Area= 0.069 ac Storage= 0.091 af

Plug-Flow detention time= 666.9 min calculated for 0.145 af (99% of inflow)
Center-of-Mass det. time= 660.1 min (1,446.5 - 786.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,110.65'	0.028 af	**80.00'W x 32.00'L x 3.00'H Field A** 0.176 af Overall - 0.107 af Embedded = 0.069 af x 40.0% Voids
#2A	2,110.65'	0.103 af	**StormTank 25 Series 24"** x 520 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 520 Chambers in 52 Rows
#3B	2,110.65'	0.002 af	**39.50'W x 11.00'L x 2.00'H Field B** 0.020 af Overall - 0.015 af Embedded = 0.004 af x 40.0% Voids
#4B	2,110.65'	0.015 af	**StormTank 25 Series 24"** x 75 Inside #3 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 75 Chambers in 25 Rows
		0.148 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,110.65'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,110.65' / 2,110.50' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	2,110.40'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,112.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.07 cfs @ 14.85 hrs HW=2,112.11' (Free Discharge)
└**1=Culvert** (Passes 0.07 cfs of 6.22 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.07 cfs @ 5.82 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field A

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

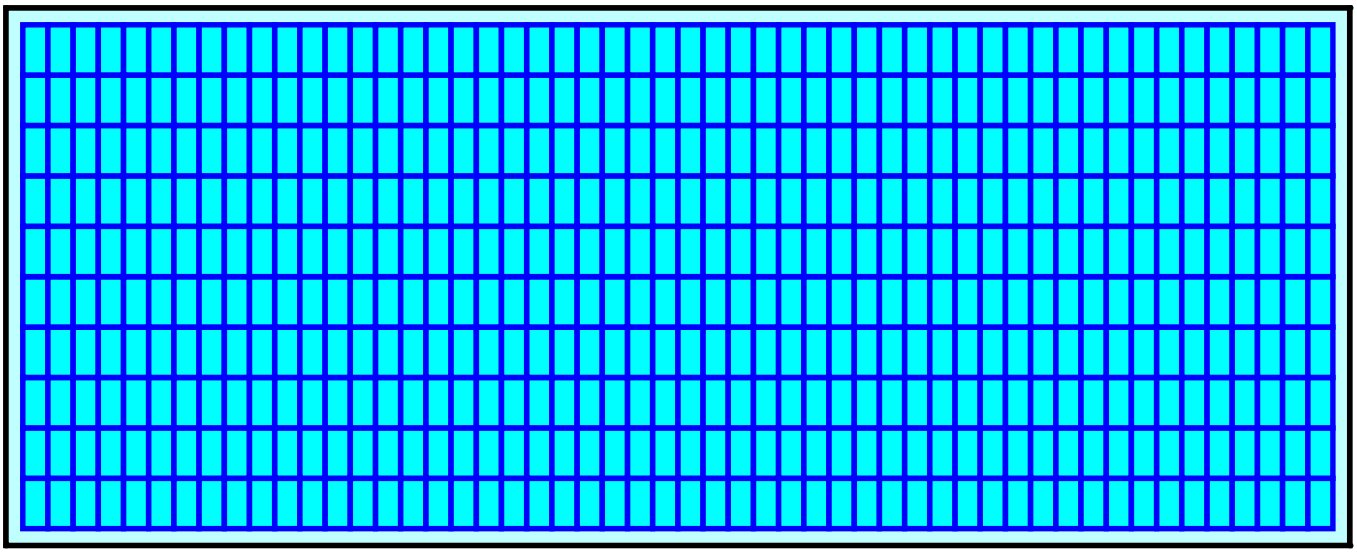
10 Chambers/Row x 3.00' Long = 30.00' Row Length +12.0" End Stone x 2 = 32.00' Base Length
52 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 80.00' Base Width
24.0" Chamber Height + 12.0" Stone Cover = 3.00' Field Height

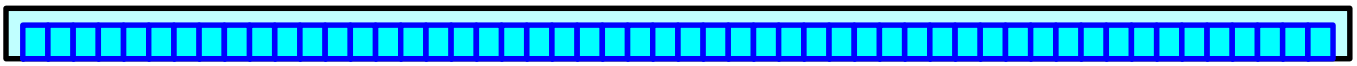
520 Chambers x 8.7 cf = 4,501.2 cf Chamber Storage
520 Chambers x 9.0 cf = 4,680.0 cf Displacement

7,680.0 cf Field - 4,680.0 cf Chambers = 3,000.0 cf Stone x 40.0% Voids = 1,200.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,701.2 cf = 0.131 af
Overall Storage Efficiency = 74.2%
Overall System Size = 32.00' x 80.00' x 3.00'

520 Chambers
284.4 cy Field
111.1 cy Stone





Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field B

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

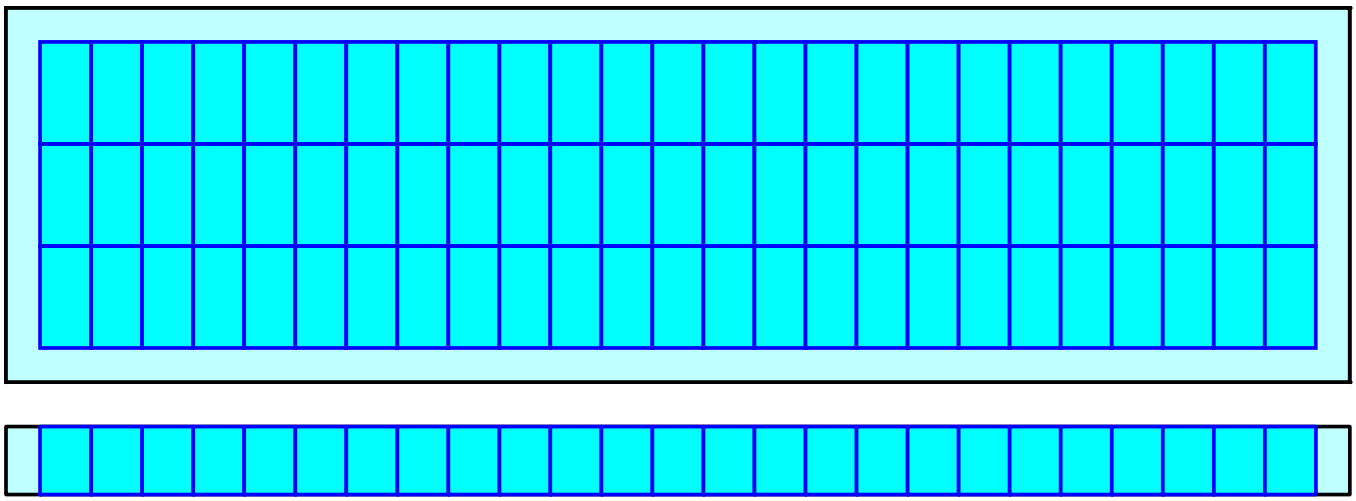
3 Chambers/Row x 3.00' Long = 9.00' Row Length +12.0" End Stone x 2 = 11.00' Base Length
25 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 39.50' Base Width
24.0" Chamber Height = 2.00' Field Height

75 Chambers x 8.7 cf = 649.2 cf Chamber Storage
75 Chambers x 9.0 cf = 675.0 cf Displacement

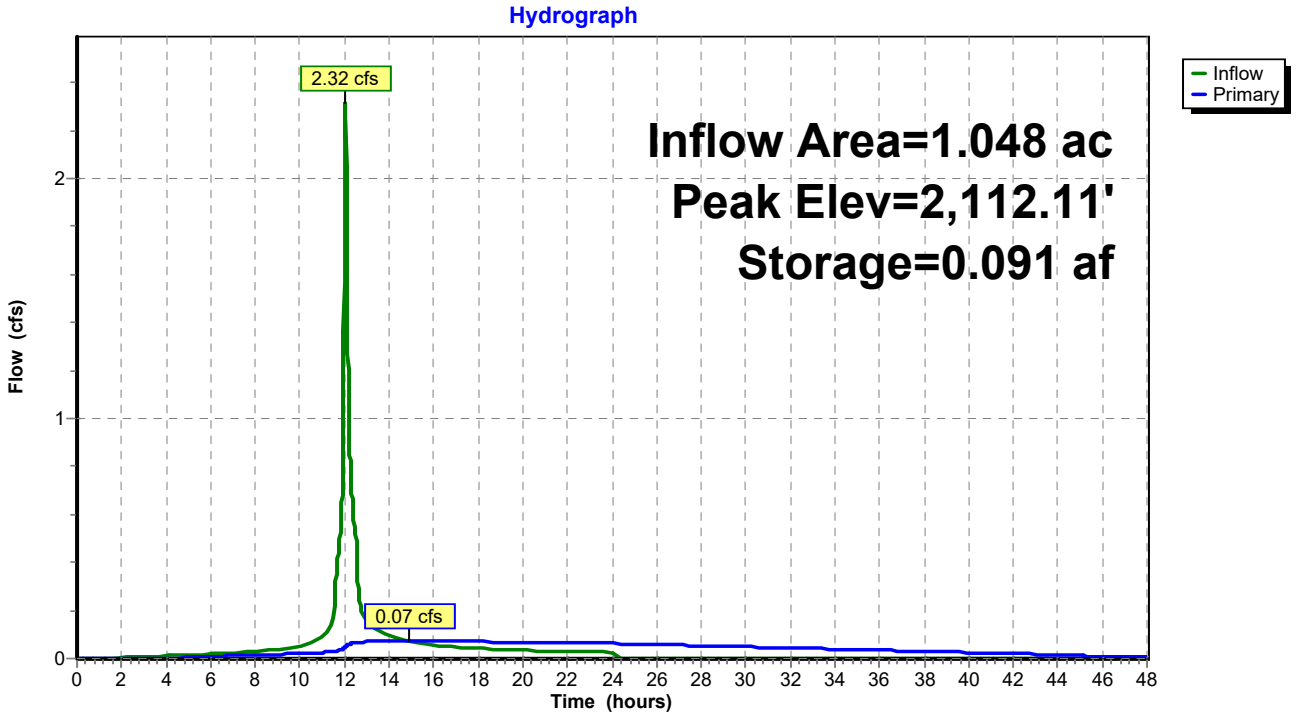
869.0 cf Field - 675.0 cf Chambers = 194.0 cf Stone x 40.0% Voids = 77.6 cf Stone Storage

Chamber Storage + Stone Storage = 726.8 cf = 0.017 af
Overall Storage Efficiency = 83.6%
Overall System Size = 11.00' x 39.50' x 2.00'

75 Chambers
32.2 cy Field
7.2 cy Stone



Pond 7P: UNDERGROUND DETENTION



Summary for Reach 7R: OVERLAND TO POA 1

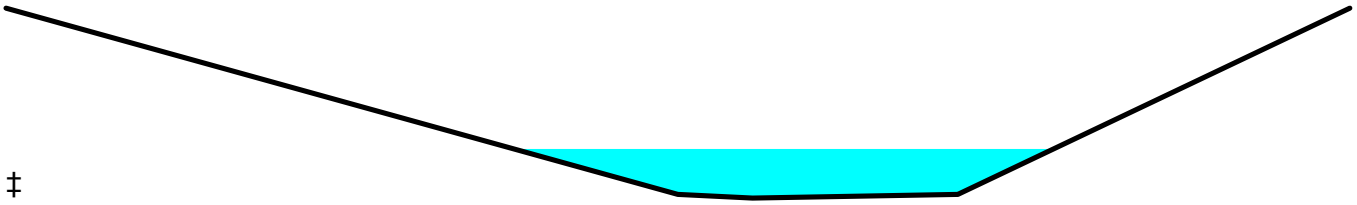
[61] Hint: Exceeded Reach 9R outlet invert by 0.22' @ 12.34 hrs

Inflow Area = 23.428 ac, 42.84% Impervious, Inflow Depth > 1.41" for 2-yr event
Inflow = 22.81 cfs @ 12.34 hrs, Volume= 2.757 af
Outflow = 22.82 cfs @ 12.34 hrs, Volume= 2.757 af, Atten= 0%, Lag= 0.1 min
Routed to Link 6L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.15 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.88 fps, Avg. Travel Time= 0.4 min

Peak Storage= 110 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 28.89'
Bank-Full Depth= 1.02' Flow Area= 43.6 sf, Capacity= 391.92 cfs

Custom cross-section, Length= 20.0' Slope= 0.0445 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,109.78', Outlet Invert= 2,108.89'

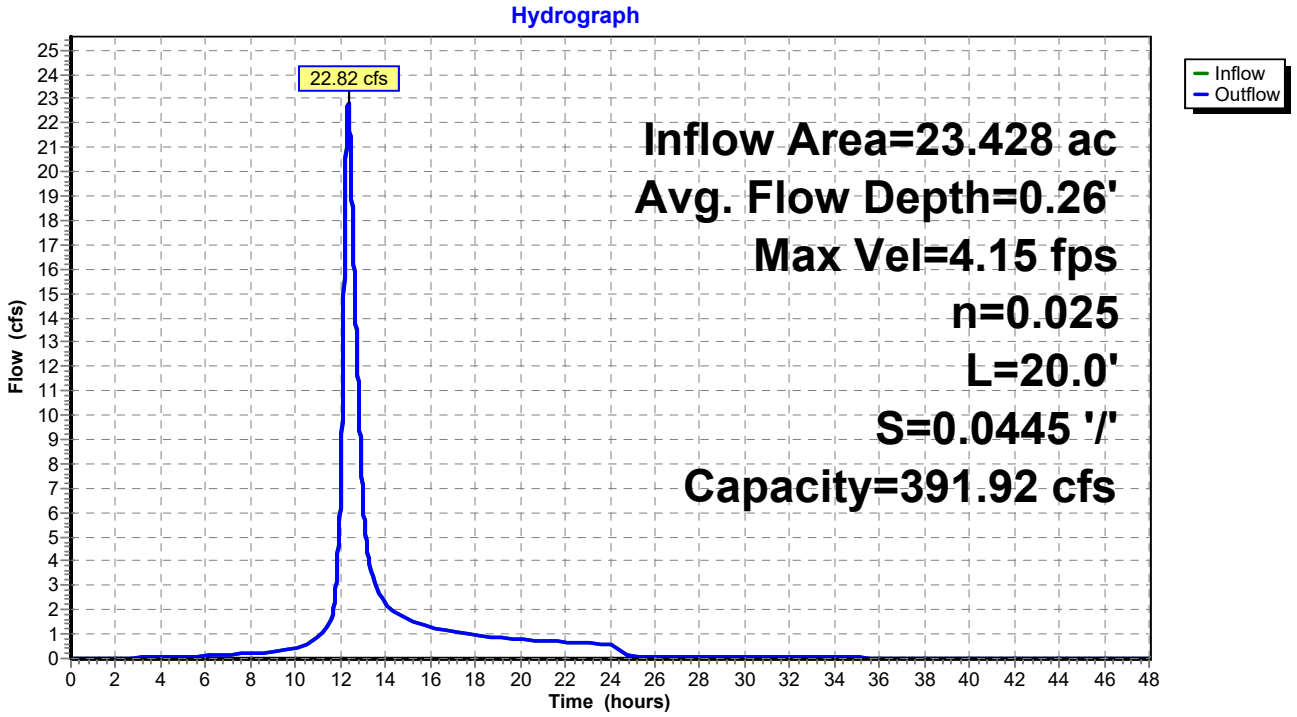


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,110.00	0.00
36.00	2,109.00	1.00
40.00	2,108.98	1.02
51.00	2,109.00	1.00
72.00	2,110.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.02	0.1	15.0	14.7	3	0.09
1.02	43.6	72.0	72.0	873	391.92

Reach 7R: OVERLAND TO POA 1



Summary for Reach 9R: PROPOSED PIPE

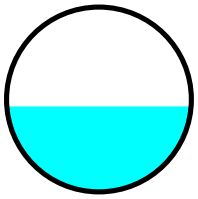
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 10R OUTLET depth by 1.81' @ 12.35 hrs

Inflow Area = 22.380 ac, 42.34% Impervious, Inflow Depth = 1.40" for 2-yr event
Inflow = 22.79 cfs @ 12.33 hrs, Volume= 2.612 af
Outflow = 22.75 cfs @ 12.34 hrs, Volume= 2.612 af, Atten= 0%, Lag= 0.7 min
Routed to Reach 7R : OVERLAND TO POA 1

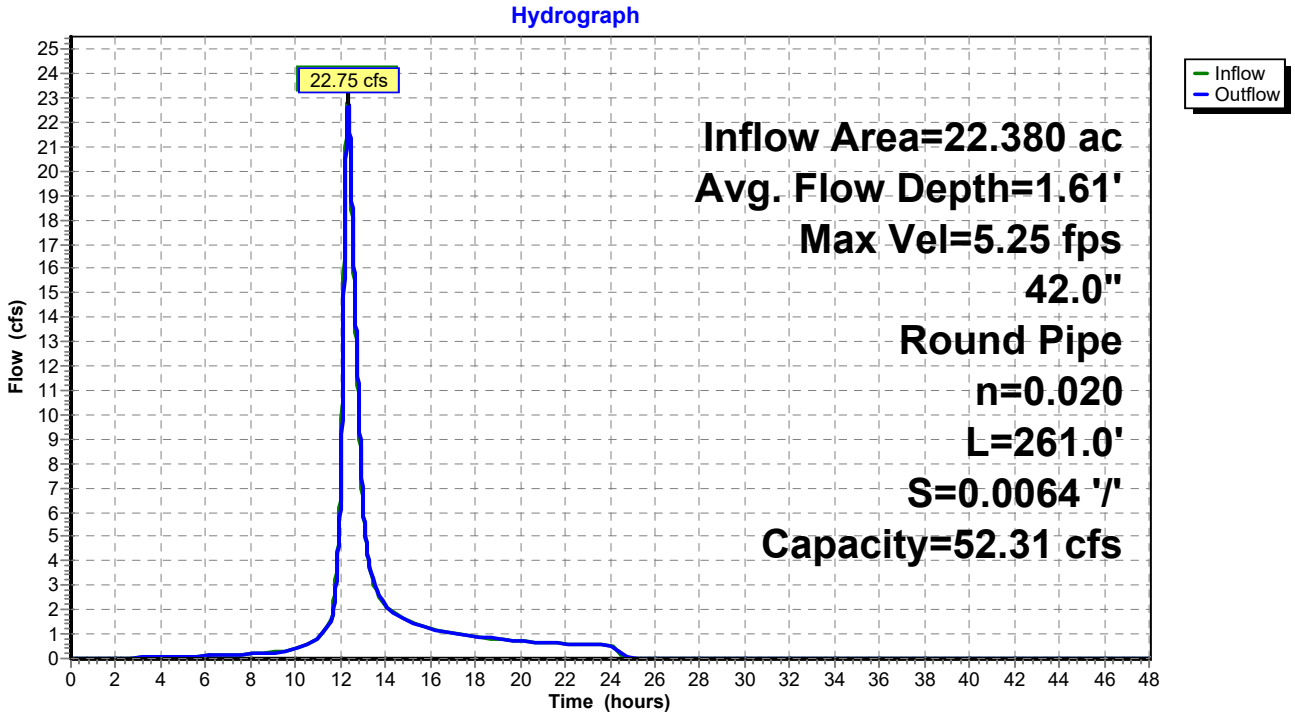
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.25 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.77 fps, Avg. Travel Time= 2.5 min

Peak Storage= 1,132 cf @ 12.34 hrs
Average Depth at Peak Storage= 1.61' , Surface Width= 3.49'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 52.31 cfs

42.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 261.0' Slope= 0.0064 '/'
Inlet Invert= 2,111.49', Outlet Invert= 2,109.82'



Reach 9R: PROPOSED PIPE



Summary for Reach 10R: PROPOSED PIPE

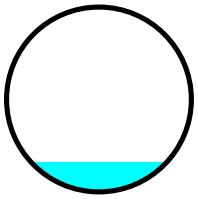
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.13' @ 12.10 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.64 cfs @ 12.10 hrs, Volume= 0.047 af, Atten= 1%, Lag= 0.6 min
Routed to Reach 9R : PROPOSED PIPE

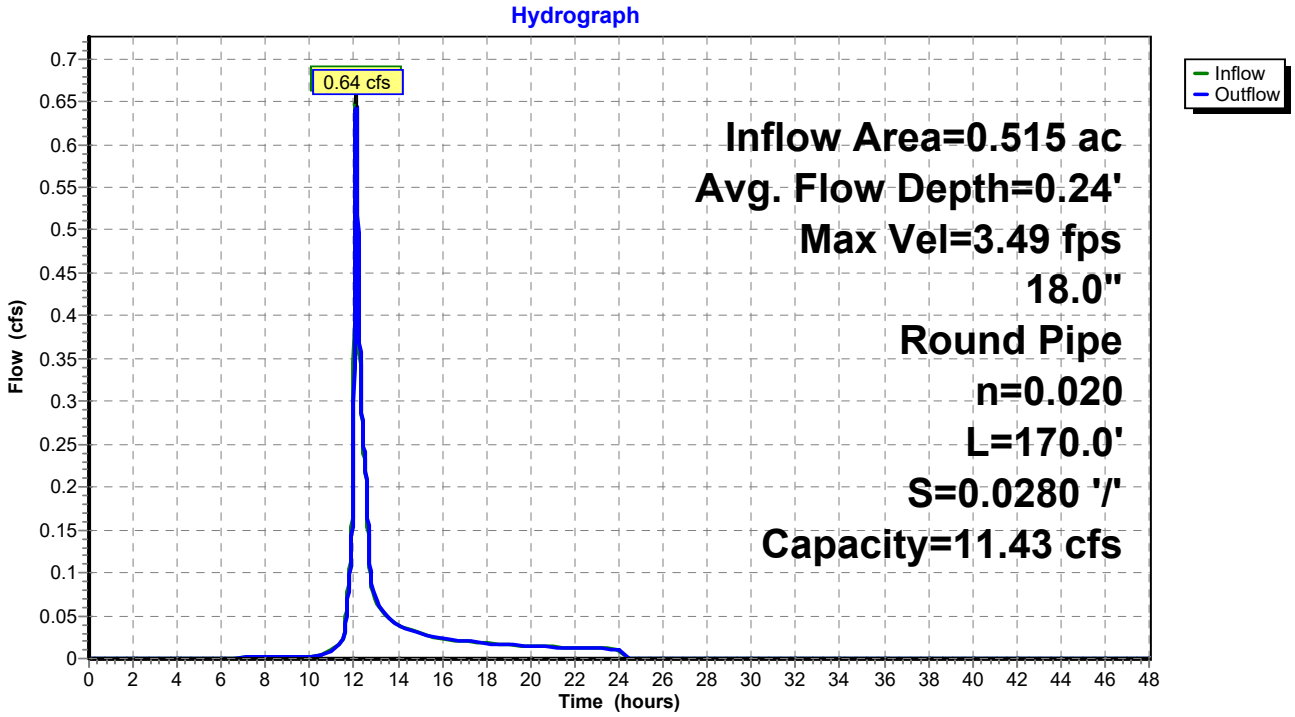
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.03 fps, Avg. Travel Time= 2.8 min

Peak Storage= 31 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.24' , Surface Width= 1.10'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.43 cfs

18.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 170.0' Slope= 0.0280 '/'
Inlet Invert= 2,115.89', Outlet Invert= 2,111.13'



Reach 10R: PROPOSED PIPE



Summary for Reach 11R: EXISTING PIPE

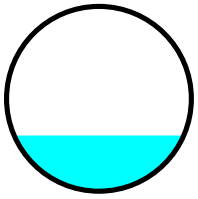
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 0.047 af
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 10R : PROPOSED PIPE

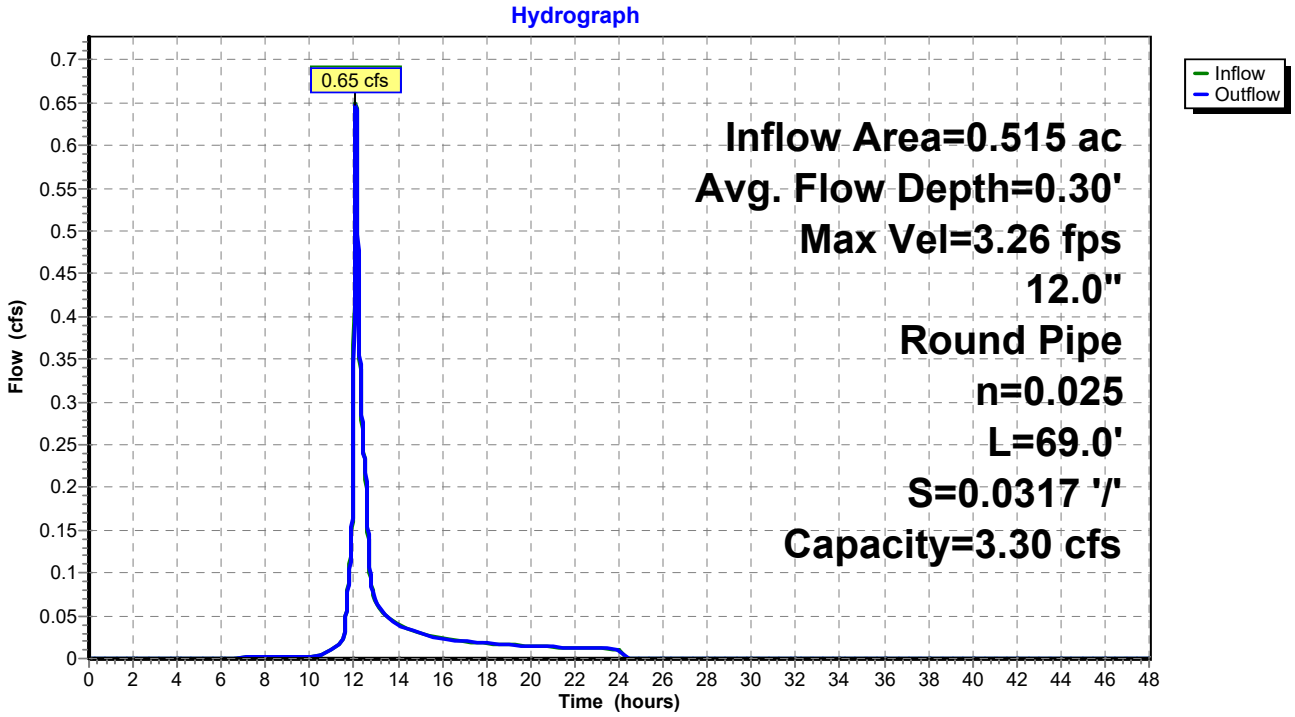
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.26 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 1.2 min

Peak Storage= 14 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.30' , Surface Width= 0.92'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 11R: EXISTING PIPE



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

Subcatchment 1S: DA 1 Runoff Area=1.709 ac 33.72% Impervious Runoff Depth=2.38"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=4.44 cfs 0.339 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.545 ac 42.60% Impervious Runoff Depth=2.54"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=35.35 cfs 4.129 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.320 ac 44.13% Impervious Runoff Depth=2.56"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=4.00 cfs 0.496 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=2.13"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=1.23 cfs 0.091 af

Subcatchment 5S: DA 1 (TO DETENTION) Runoff Area=1.048 ac 53.59% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=WQ Runoff=3.60 cfs 0.247 af

Link 6L: POA 1 Inflow=42.28 cfs 5.294 af
Primary=42.28 cfs 5.294 af

Pond 7P: UNDERGROUND DETENTION Peak Elev=2,112.66' Storage=0.124 af Inflow=3.60 cfs 0.247 af
Outflow=0.93 cfs 0.240 af

Reach 7R: OVERLAND TO POA 1 Avg. Flow Depth=0.35' Max Vel=4.89 fps Inflow=40.40 cfs 4.956 af
n=0.025 L=20.0' S=0.0445 '/' Capacity=391.92 cfs Outflow=40.40 cfs 4.956 af

Reach 9R: PROPOSED PIPE Avg. Flow Depth=2.29' Max Vel=5.98 fps Inflow=39.90 cfs 4.716 af
42.0" Round Pipe n=0.020 L=261.0' S=0.0064 '/' Capacity=52.31 cfs Outflow=39.84 cfs 4.716 af

Reach 10R: PROPOSED PIPE Avg. Flow Depth=0.33' Max Vel=4.21 fps Inflow=1.23 cfs 0.091 af
18.0" Round Pipe n=0.020 L=170.0' S=0.0280 '/' Capacity=11.43 cfs Outflow=1.22 cfs 0.091 af

Reach 11R: EXISTING PIPE Avg. Flow Depth=0.42' Max Vel=3.89 fps Inflow=1.23 cfs 0.091 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=1.23 cfs 0.091 af

Total Runoff Area = 25.137 ac Runoff Volume = 5.301 af Average Runoff Depth = 2.53"
57.78% Pervious = 14.524 ac 42.22% Impervious = 10.613 ac

Summary for Subcatchment 1S: DA 1

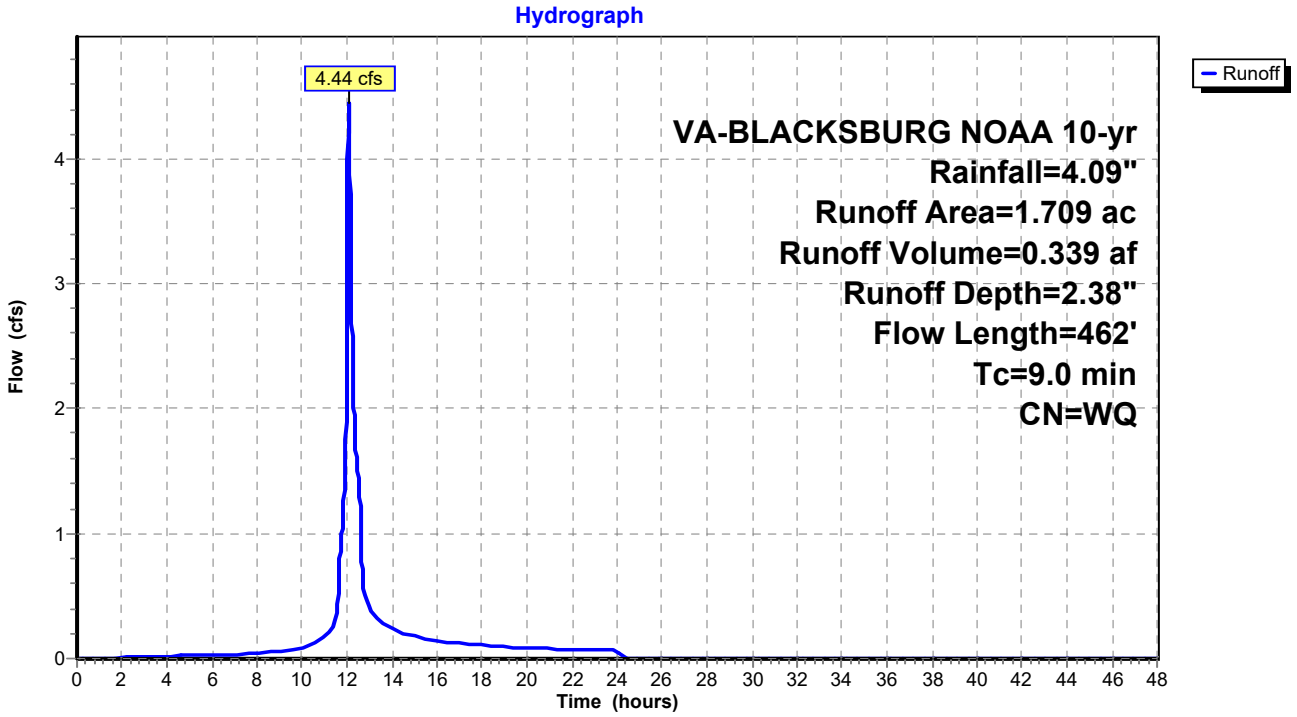
Runoff = 4.44 cfs @ 12.07 hrs, Volume= 0.339 af, Depth= 2.38"
Routed to Link 6L : POA 1

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
0.865	74	>75% Grass cover, Good, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.237	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
1.709		Weighted Average
1.133		66.28% Pervious Area
0.576		33.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

[47] Hint: Peak is 115% of capacity of segment #8

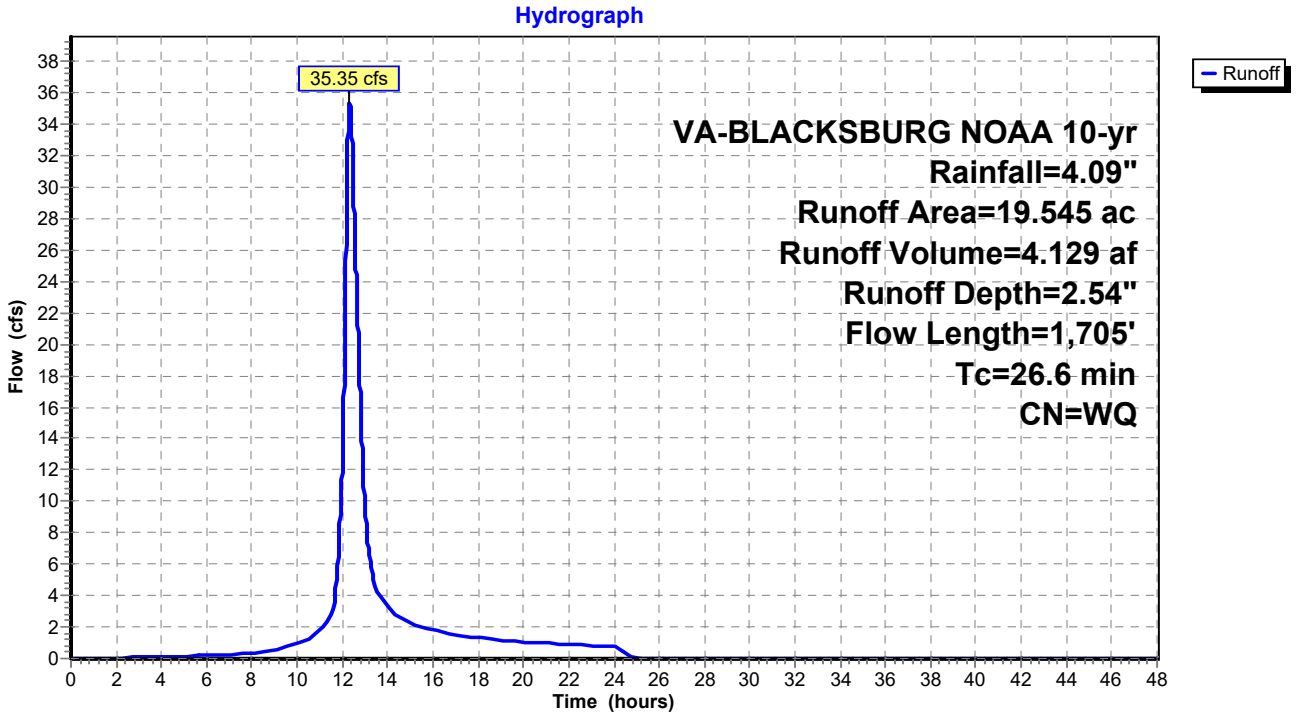
Runoff = 35.35 cfs @ 12.32 hrs, Volume= 4.129 af, Depth= 2.54"
Routed to Reach 9R : PROPOSED PIPE

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
2.150	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.545		Weighted Average
11.219		57.40% Pervious Area
8.326		42.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 119% of capacity of segment #6
[47] Hint: Peak is 43084% of capacity of segment #8

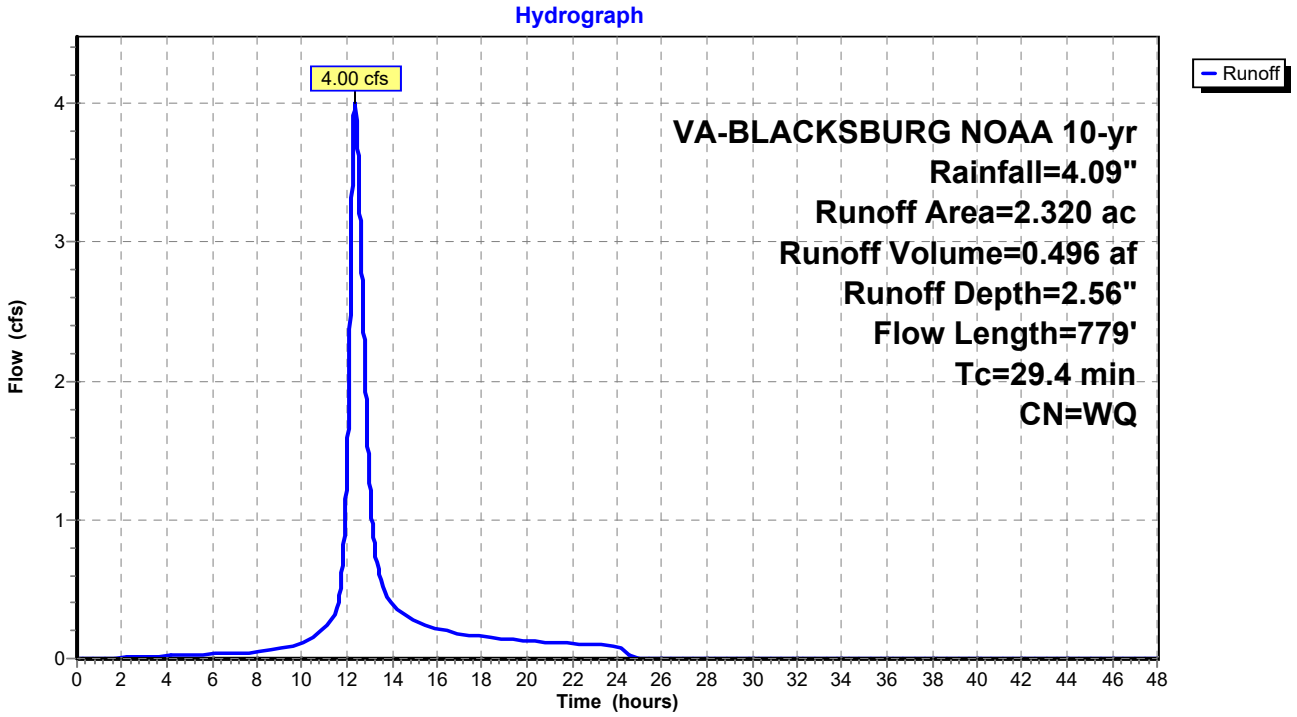
Runoff = 4.00 cfs @ 12.38 hrs, Volume= 0.496 af, Depth= 2.56"
Routed to Reach 9R : PROPOSED PIPE

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.067	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.320		Weighted Average
1.296		55.87% Pervious Area
1.024		44.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.02' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

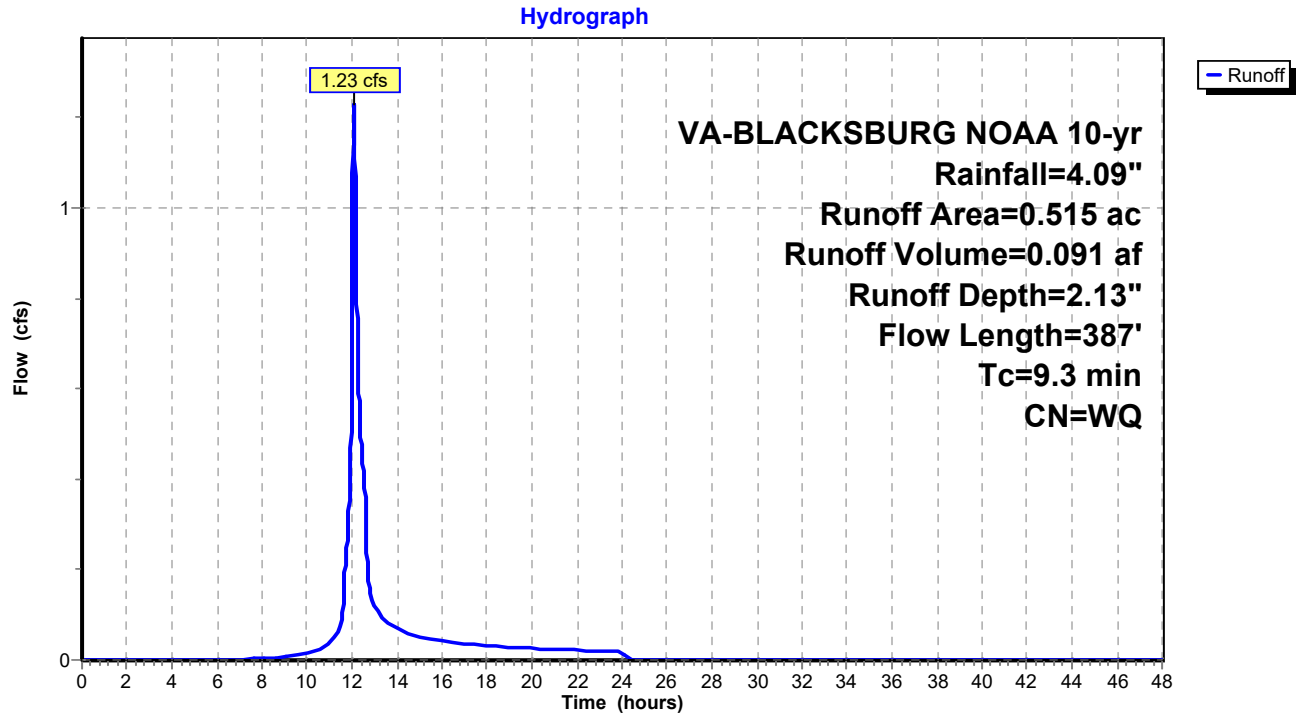
Runoff = 1.23 cfs @ 12.08 hrs, Volume= 0.091 af, Depth= 2.13"
Routed to Reach 11R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Subcatchment 5S: DA 1 (TO DETENTION)

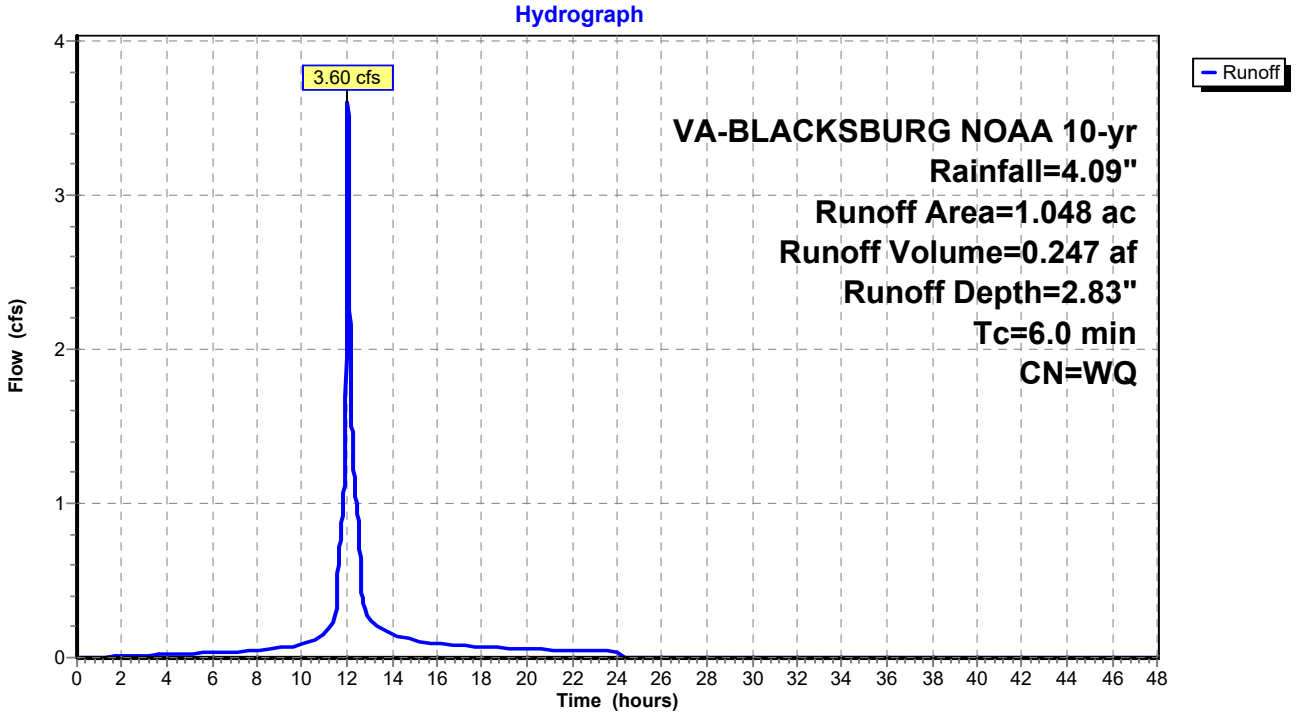
Runoff = 3.60 cfs @ 12.04 hrs, Volume= 0.247 af, Depth= 2.83"
Routed to Pond 7P : UNDERGROUND DETENTION

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
0.425	74	>75% Grass cover, Good, HSG C
0.524	98	Paved parking, HSG C
0.099	83	1/4 acre lots, 38% imp, HSG C
1.048		Weighted Average
0.486		46.41% Pervious Area
0.562		53.59% Impervious Area

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

Subcatchment 5S: DA 1 (TO DETENTION)

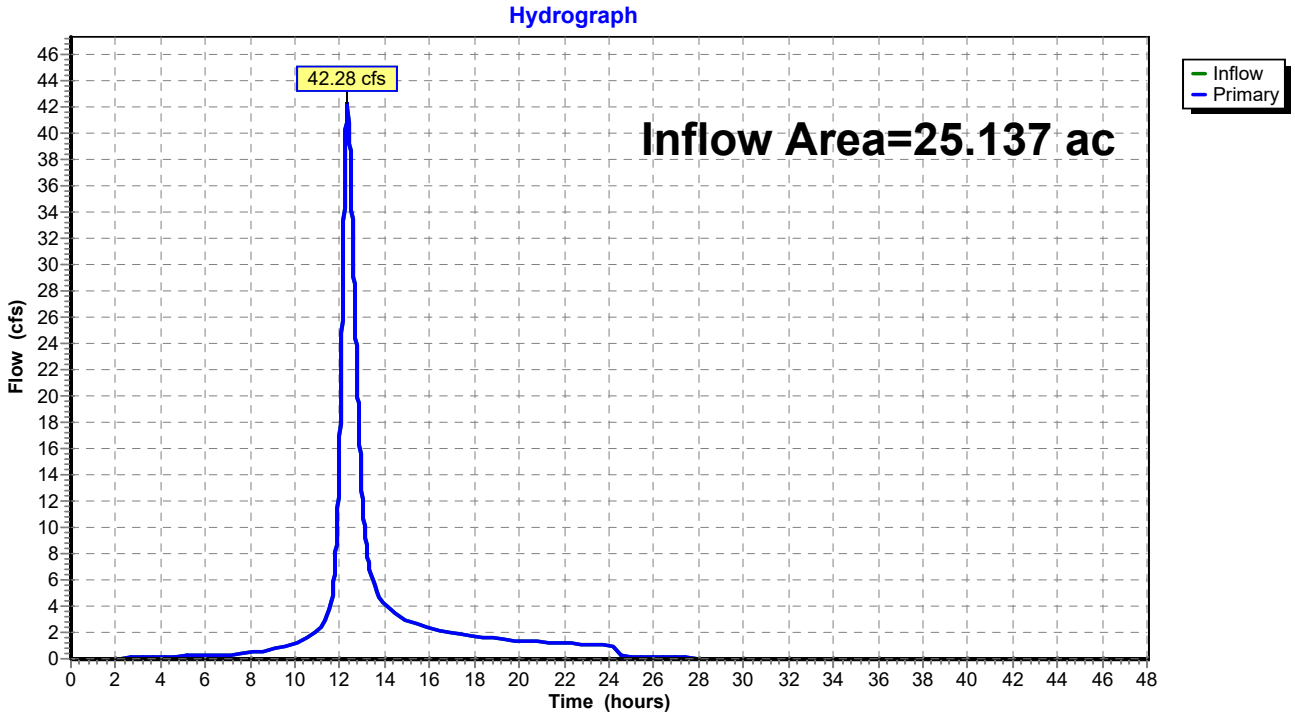


Summary for Link 6L: POA 1

Inflow Area = 25.137 ac, 42.22% Impervious, Inflow Depth > 2.53" for 10-yr event
Inflow = 42.28 cfs @ 12.33 hrs, Volume= 5.294 af
Primary = 42.28 cfs @ 12.33 hrs, Volume= 5.294 af, Atten= 0%, Lag= 0.0 min

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

Link 6L: POA 1



Summary for Pond 7P: UNDERGROUND DETENTION

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1.048 ac, 53.59% Impervious, Inflow Depth = 2.83" for 10-yr event
Inflow = 3.60 cfs @ 12.04 hrs, Volume= 0.247 af
Outflow = 0.93 cfs @ 12.48 hrs, Volume= 0.240 af, Atten= 74%, Lag= 26.6 min
Primary = 0.93 cfs @ 12.48 hrs, Volume= 0.240 af
Routed to Reach 7R : OVERLAND TO POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,112.66' @ 12.48 hrs Surf.Area= 0.069 ac Storage= 0.124 af

Plug-Flow detention time= 587.5 min calculated for 0.240 af (97% of inflow)
Center-of-Mass det. time= 570.2 min (1,351.4 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,110.65'	0.028 af	**80.00'W x 32.00'L x 3.00'H Field A** 0.176 af Overall - 0.107 af Embedded = 0.069 af x 40.0% Voids
#2A	2,110.65'	0.103 af	**StormTank 25 Series 24"** x 520 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 520 Chambers in 52 Rows
#3B	2,110.65'	0.002 af	**39.50'W x 11.00'L x 2.00'H Field B** 0.020 af Overall - 0.015 af Embedded = 0.004 af x 40.0% Voids
#4B	2,110.65'	0.015 af	**StormTank 25 Series 24"** x 75 Inside #3 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 75 Chambers in 25 Rows
		0.148 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,110.65'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,110.65' / 2,110.50' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	2,110.40'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,112.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.92 cfs @ 12.48 hrs HW=2,112.66' (Free Discharge)
└**1=Culvert** (Passes 0.92 cfs of 8.89 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 6.83 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.84 cfs @ 1.31 fps)

Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field A

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

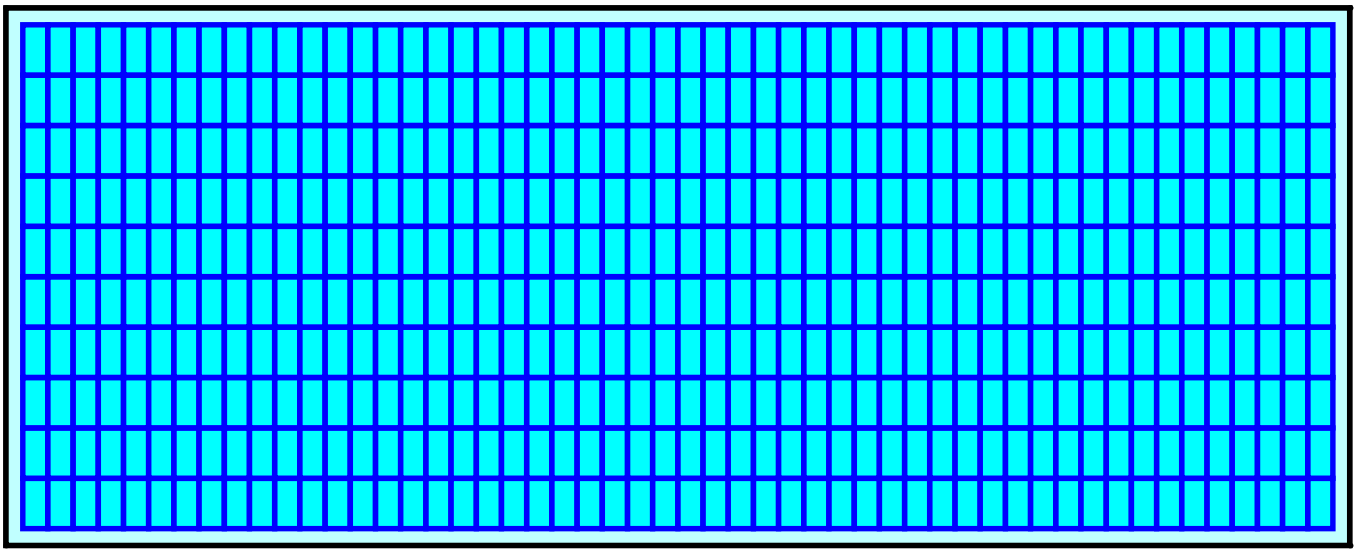
10 Chambers/Row x 3.00' Long = 30.00' Row Length +12.0" End Stone x 2 = 32.00' Base Length
52 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 80.00' Base Width
24.0" Chamber Height + 12.0" Stone Cover = 3.00' Field Height

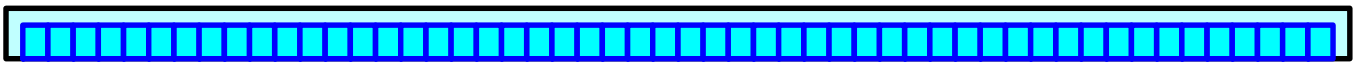
520 Chambers x 8.7 cf = 4,501.2 cf Chamber Storage
520 Chambers x 9.0 cf = 4,680.0 cf Displacement

7,680.0 cf Field - 4,680.0 cf Chambers = 3,000.0 cf Stone x 40.0% Voids = 1,200.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,701.2 cf = 0.131 af
Overall Storage Efficiency = 74.2%
Overall System Size = 32.00' x 80.00' x 3.00'

520 Chambers
284.4 cy Field
111.1 cy Stone





Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field B

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

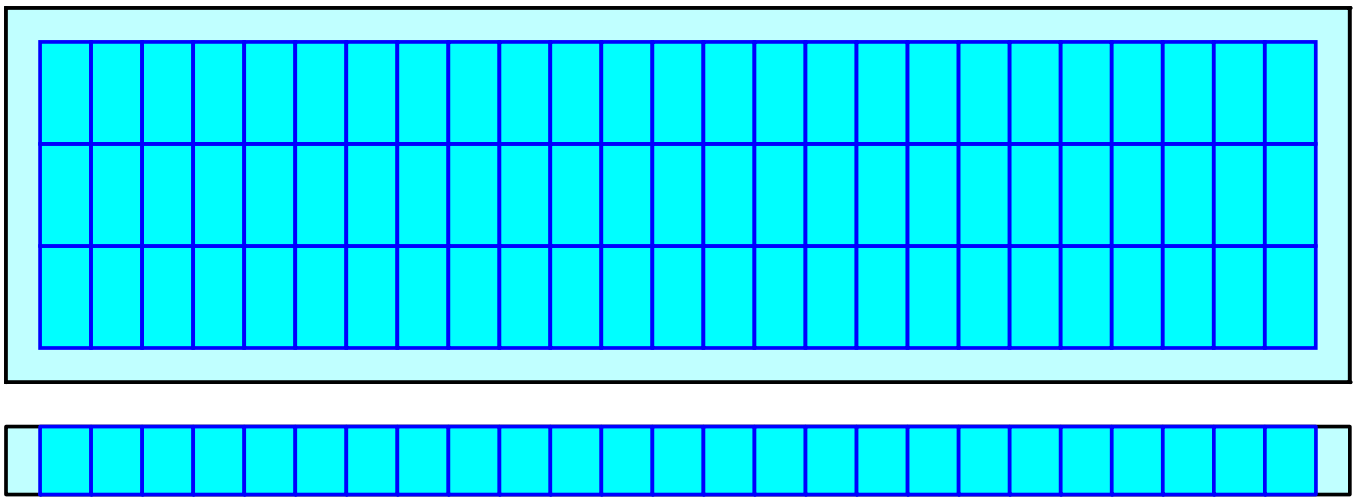
3 Chambers/Row x 3.00' Long = 9.00' Row Length +12.0" End Stone x 2 = 11.00' Base Length
25 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 39.50' Base Width
24.0" Chamber Height = 2.00' Field Height

75 Chambers x 8.7 cf = 649.2 cf Chamber Storage
75 Chambers x 9.0 cf = 675.0 cf Displacement

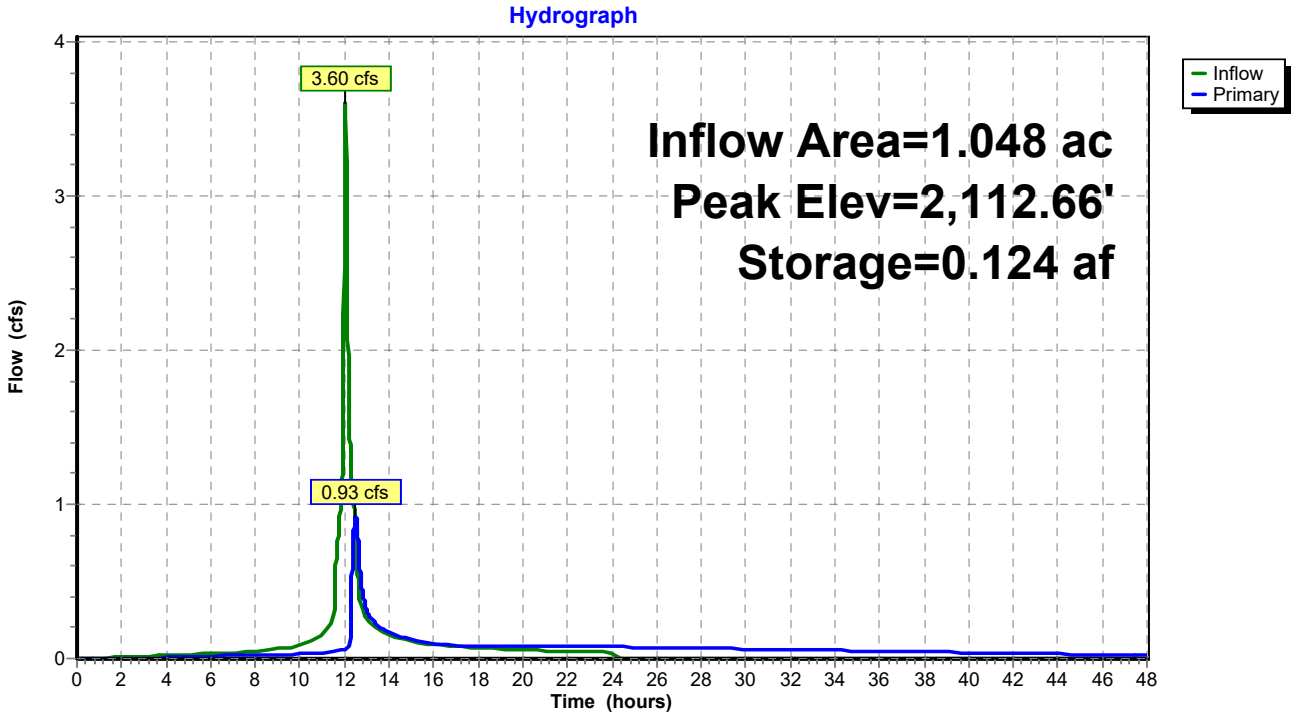
869.0 cf Field - 675.0 cf Chambers = 194.0 cf Stone x 40.0% Voids = 77.6 cf Stone Storage

Chamber Storage + Stone Storage = 726.8 cf = 0.017 af
Overall Storage Efficiency = 83.6%
Overall System Size = 11.00' x 39.50' x 2.00'

75 Chambers
32.2 cy Field
7.2 cy Stone



Pond 7P: UNDERGROUND DETENTION



Summary for Reach 7R: OVERLAND TO POA 1

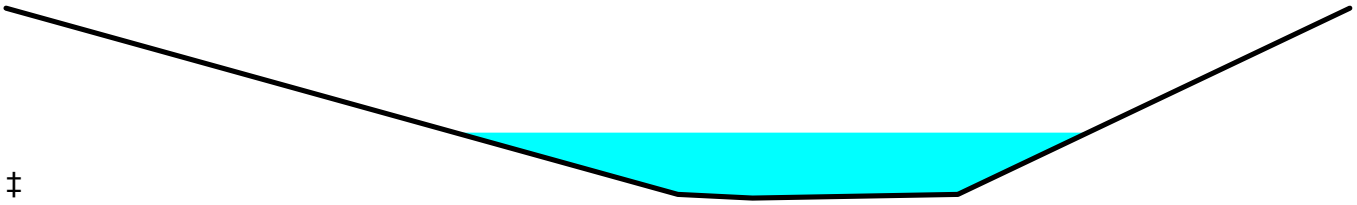
[61] Hint: Exceeded Reach 9R outlet invert by 0.31' @ 12.34 hrs

Inflow Area = 23.428 ac, 42.84% Impervious, Inflow Depth > 2.54" for 10-yr event
Inflow = 40.40 cfs @ 12.34 hrs, Volume= 4.956 af
Outflow = 40.40 cfs @ 12.34 hrs, Volume= 4.956 af, Atten= 0%, Lag= 0.1 min
Routed to Link 6L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.89 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 0.3 min

Peak Storage= 165 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 33.91'
Bank-Full Depth= 1.02' Flow Area= 43.6 sf, Capacity= 391.92 cfs

Custom cross-section, Length= 20.0' Slope= 0.0445 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,109.78', Outlet Invert= 2,108.89'



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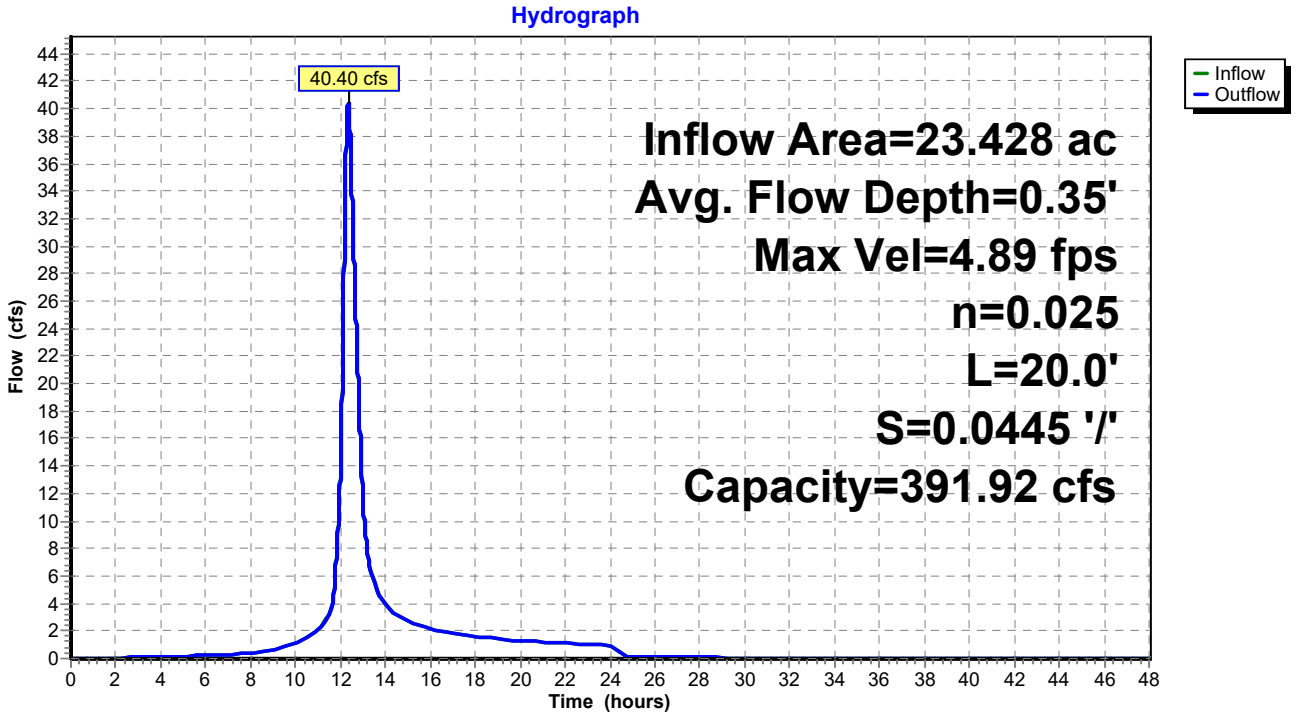
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,110.00	0.00
36.00	2,109.00	1.00
40.00	2,108.98	1.02
51.00	2,109.00	1.00
72.00	2,110.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.02	0.1	15.0	14.7	3	0.09
1.02	43.6	72.0	72.0	873	391.92

Reach 7R: OVERLAND TO POA 1



Summary for Reach 9R: PROPOSED PIPE

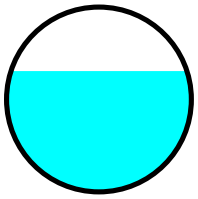
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 10R OUTLET depth by 2.42' @ 12.34 hrs

Inflow Area = 22.380 ac, 42.34% Impervious, Inflow Depth = 2.53" for 10-yr event
Inflow = 39.90 cfs @ 12.32 hrs, Volume= 4.716 af
Outflow = 39.84 cfs @ 12.33 hrs, Volume= 4.716 af, Atten= 0%, Lag= 0.6 min
Routed to Reach 7R : OVERLAND TO POA 1

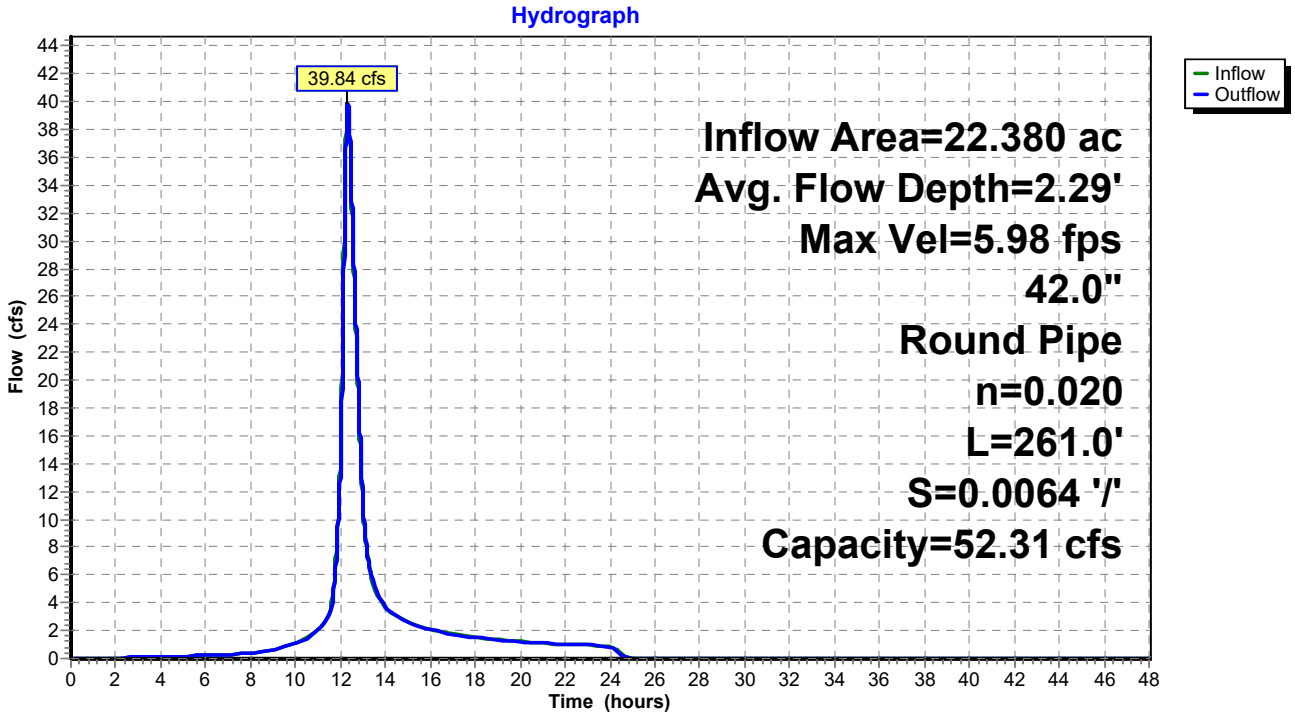
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.98 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,737 cf @ 12.33 hrs
Average Depth at Peak Storage= 2.29' , Surface Width= 3.33'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 52.31 cfs

42.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 261.0' Slope= 0.0064 '/'
Inlet Invert= 2,111.49', Outlet Invert= 2,109.82'



Reach 9R: PROPOSED PIPE



Summary for Reach 10R: PROPOSED PIPE

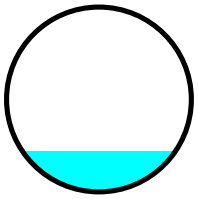
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.22' @ 12.09 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.23 cfs @ 12.09 hrs, Volume= 0.091 af
Outflow = 1.22 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.5 min
Routed to Reach 9R : PROPOSED PIPE

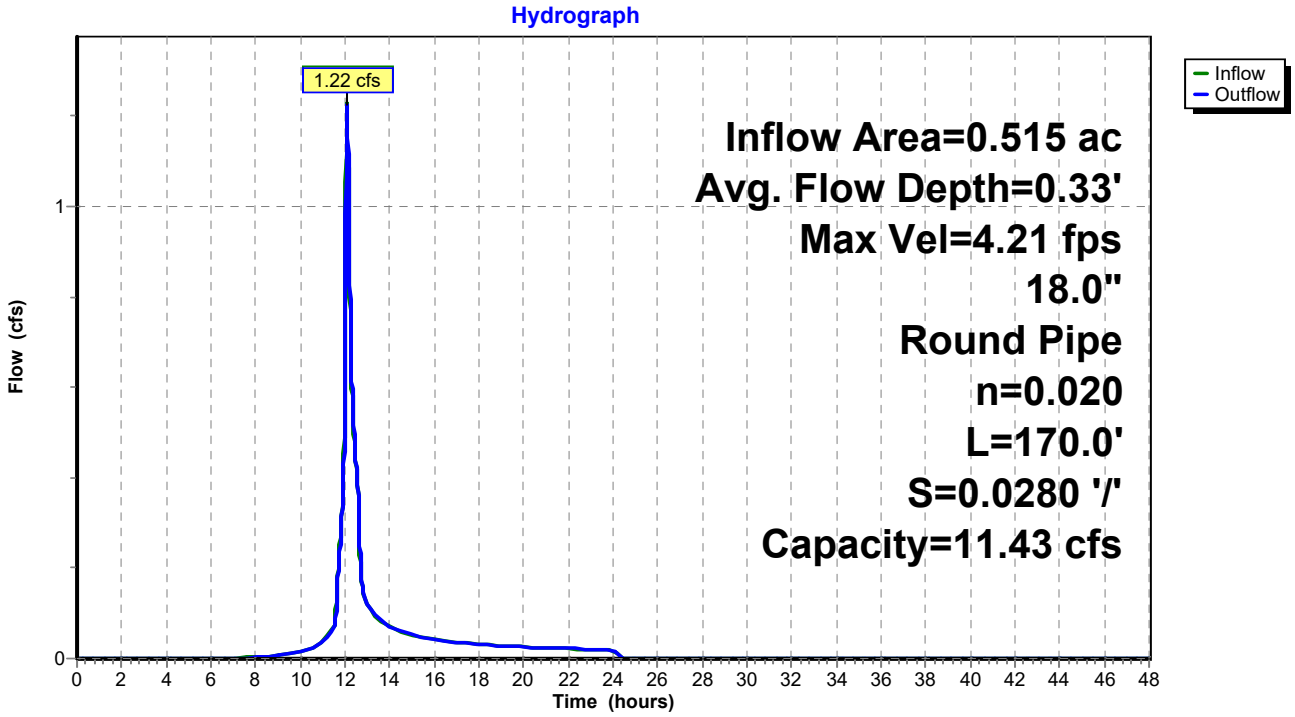
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.21 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 2.3 min

Peak Storage= 49 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 1.24'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.43 cfs

18.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 170.0' Slope= 0.0280 '/'
Inlet Invert= 2,115.89', Outlet Invert= 2,111.13'



Reach 10R: PROPOSED PIPE



Summary for Reach 11R: EXISTING PIPE

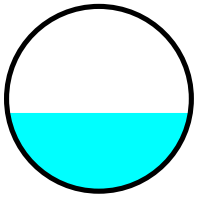
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.23 cfs @ 12.08 hrs, Volume= 0.091 af
Outflow = 1.23 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 10R : PROPOSED PIPE

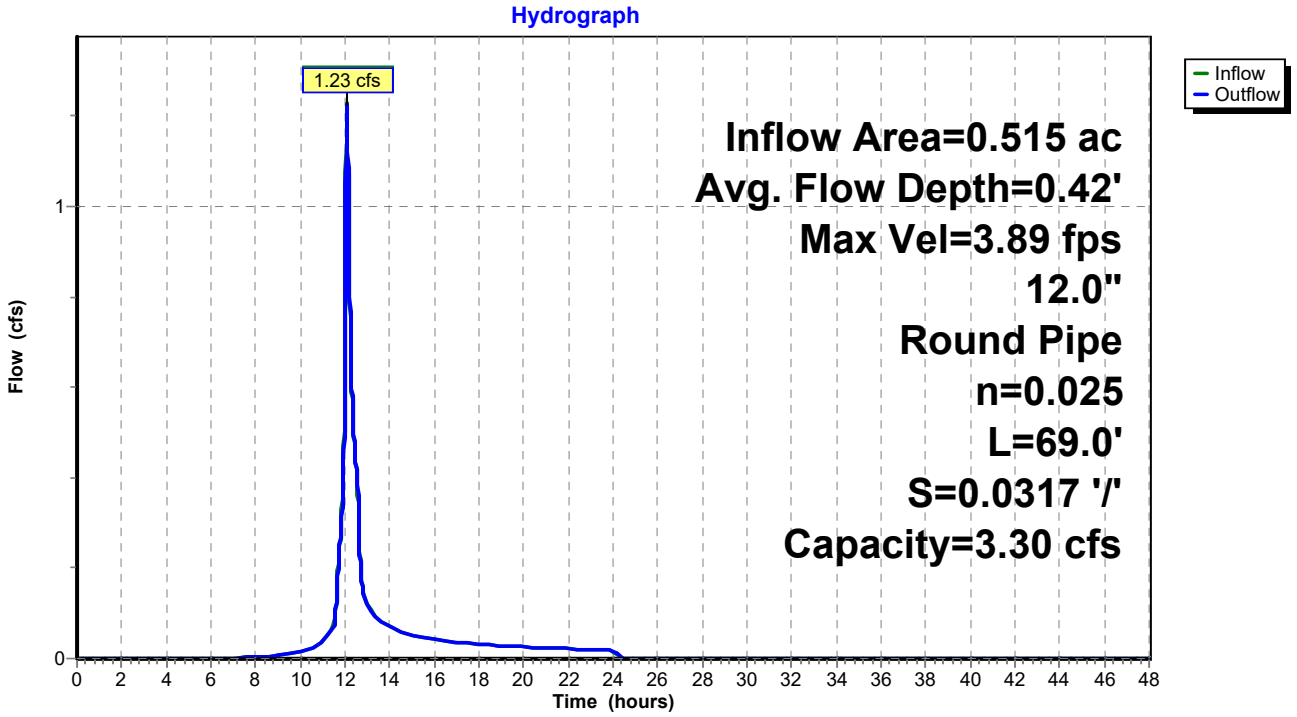
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.13 fps, Avg. Travel Time= 1.0 min

Peak Storage= 22 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 11R: EXISTING PIPE



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

Subcatchment 1S: DA 1 Runoff Area=1.709 ac 33.72% Impervious Runoff Depth=4.48"
Flow Length=462' Tc=9.0 min CN=WQ Runoff=7.25 cfs 0.638 af

Subcatchment 2S: DA 1A (OFFSITE) Runoff Area=19.545 ac 42.60% Impervious Runoff Depth=4.72"
Flow Length=1,705' Tc=26.6 min CN=WQ Runoff=58.18 cfs 7.684 af

Subcatchment 3S: DA 1B (OFFSITE) Runoff Area=2.320 ac 44.13% Impervious Runoff Depth=4.74"
Flow Length=779' Tc=29.4 min CN=WQ Runoff=6.59 cfs 0.917 af

Subcatchment 4S: DA 1C (OFFSITE) Runoff Area=0.515 ac 24.23% Impervious Runoff Depth=4.22"
Flow Length=387' Tc=9.3 min CN=WQ Runoff=2.10 cfs 0.181 af

Subcatchment 5S: DA 1 (TO DETENTION) Runoff Area=1.048 ac 53.59% Impervious Runoff Depth=5.01"
Tc=6.0 min CN=WQ Runoff=5.42 cfs 0.437 af

Link 6L: POA 1 Inflow=63.95 cfs 9.846 af
Primary=63.95 cfs 9.846 af

Pond 7P: UNDERGROUND DETENTION Peak Elev=2,113.04' Storage=0.133 af Inflow=5.42 cfs 0.437 af
Outflow=5.10 cfs 0.426 af

Reach 7R: OVERLAND TO POA 1 Avg. Flow Depth=0.42' Max Vel=5.43 fps Inflow=59.27 cfs 9.208 af
n=0.025 L=20.0' S=0.0445 '/' Capacity=391.92 cfs Outflow=59.21 cfs 9.208 af

Reach 9R: PROPOSED PIPE Avg. Flow Depth=3.50' Max Vel=6.20 fps Inflow=65.75 cfs 8.782 af
42.0" Round Pipe n=0.020 L=261.0' S=0.0064 '/' Capacity=52.31 cfs Outflow=56.44 cfs 8.782 af

Reach 10R: PROPOSED PIPE Avg. Flow Depth=0.43' Max Vel=4.92 fps Inflow=2.10 cfs 0.181 af
18.0" Round Pipe n=0.020 L=170.0' S=0.0280 '/' Capacity=11.43 cfs Outflow=2.09 cfs 0.181 af

Reach 11R: EXISTING PIPE Avg. Flow Depth=0.58' Max Vel=4.45 fps Inflow=2.10 cfs 0.181 af
12.0" Round Pipe n=0.025 L=69.0' S=0.0317 '/' Capacity=3.30 cfs Outflow=2.10 cfs 0.181 af

Total Runoff Area = 25.137 ac Runoff Volume = 9.857 af Average Runoff Depth = 4.71"
57.78% Pervious = 14.524 ac 42.22% Impervious = 10.613 ac

Summary for Subcatchment 1S: DA 1

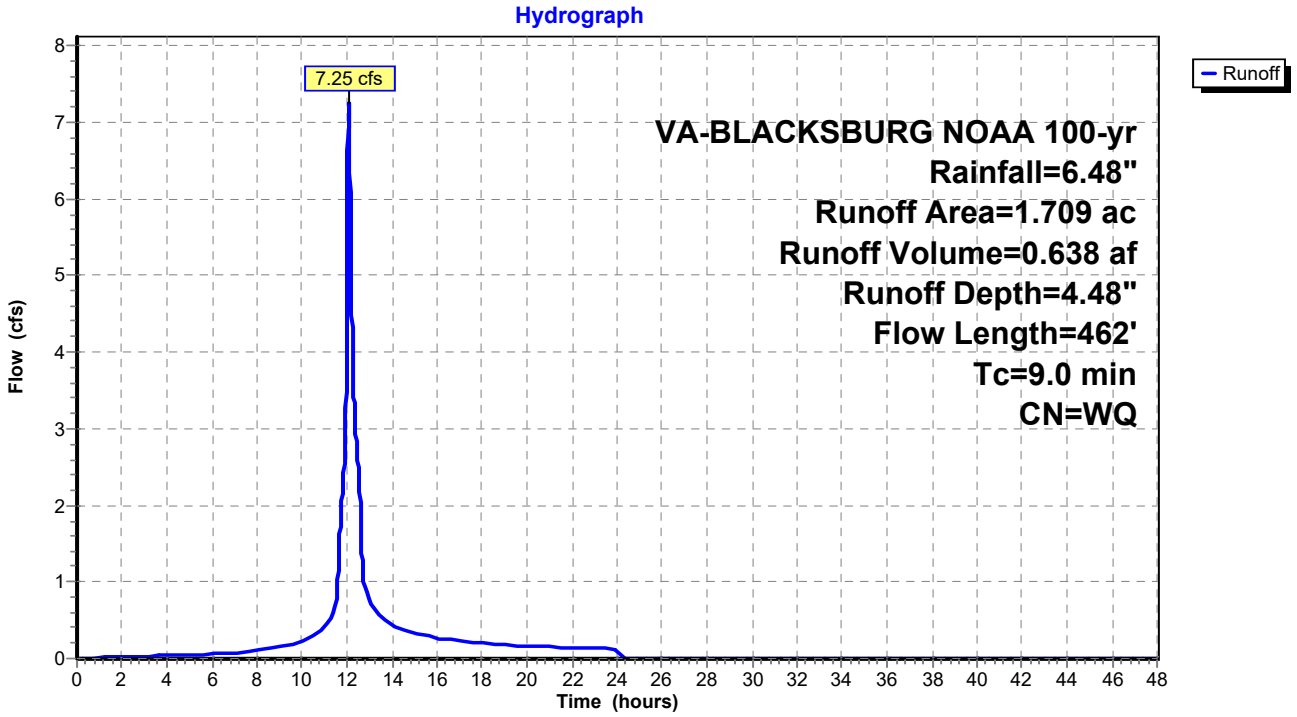
Runoff = 7.25 cfs @ 12.07 hrs, Volume= 0.638 af, Depth= 4.48"
Routed to Link 6L : POA 1

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
0.865	74	>75% Grass cover, Good, HSG C
0.456	98	Paved roads w/curbs & sewers, HSG C
0.237	83	1/4 acre lots, 38% imp, HSG C
0.151	79	1 acre lots, 20% imp, HSG C
1.709		Weighted Average
1.133		66.28% Pervious Area
0.576		33.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.1019	0.30		**Sheet Flow, TC1** Grass: Short n= 0.150 P2= 2.76"
1.1	58	0.0164	0.90		**Shallow Concentrated Flow, Tc2** Short Grass Pasture Kv= 7.0 fps
1.0	171	0.0201	2.88		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
1.4	133	0.0480	1.53		**Shallow Concentrated Flow, Tc4** Short Grass Pasture Kv= 7.0 fps
9.0	462	Total			

Subcatchment 1S: DA 1



Summary for Subcatchment 2S: DA 1A (OFFSITE)

[47] Hint: Peak is 135% of capacity of segment #7
[47] Hint: Peak is 190% of capacity of segment #8

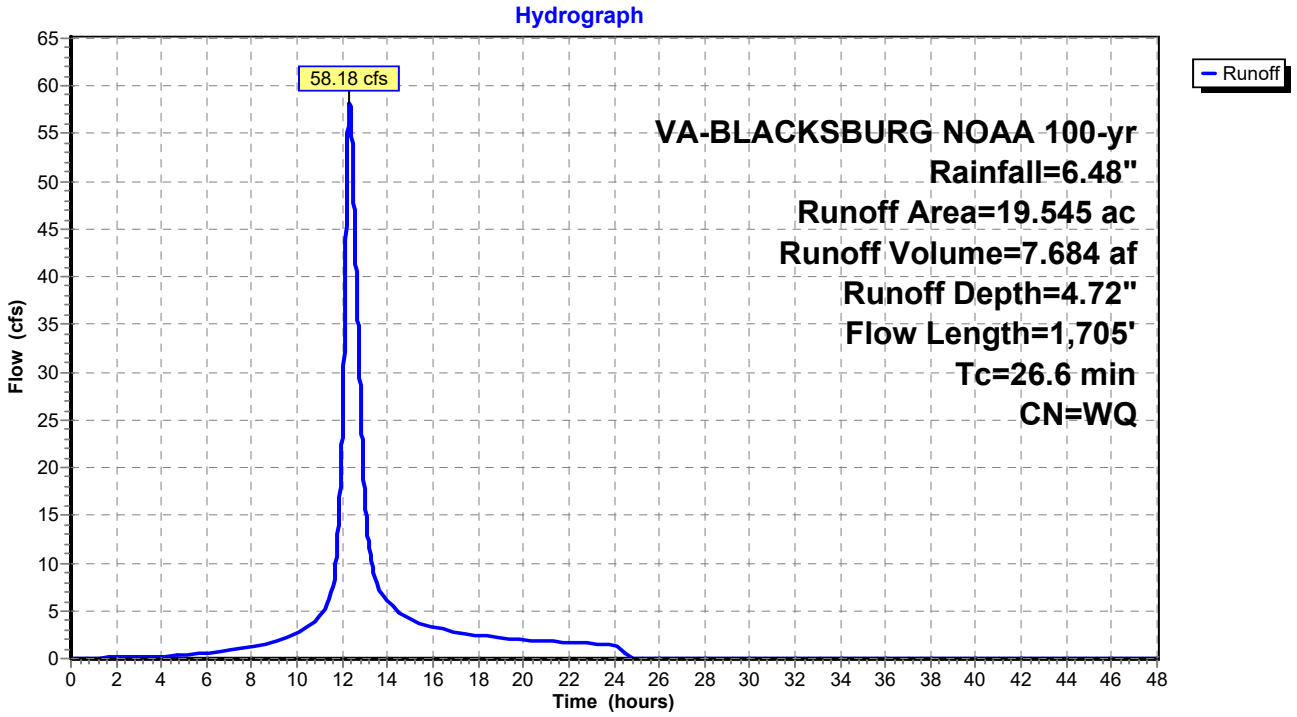
Runoff = 58.18 cfs @ 12.32 hrs, Volume= 7.684 af, Depth= 4.72"
Routed to Reach 9R : PROPOSED PIPE

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
2.150	74	>75% Grass cover, Good, HSG C
12.159	83	1/4 acre lots, 38% imp, HSG C
1.273	80	1/2 acre lots, 25% imp, HSG C
1.151	92	Paved roads w/open ditches, 50% imp, HSG C
1.914	98	Paved roads w/curbs & sewers, HSG C
0.898	98	Paved parking, HSG C
19.545		Weighted Average
11.219		57.40% Pervious Area
8.326		42.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0090	0.11		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
3.8	123	0.0058	0.53		**Shallow Concentrated Flow, Tc6** Short Grass Pasture Kv= 7.0 fps
0.5	100	0.0246	3.18		**Shallow Concentrated Flow, Tc7** Paved Kv= 20.3 fps
1.9	130	0.0269	1.15		**Shallow Concentrated Flow, Tc8** Short Grass Pasture Kv= 7.0 fps
1.2	259	0.0290	3.46		**Shallow Concentrated Flow, Tc9** Paved Kv= 20.3 fps
0.8	65	0.0403	1.41		**Shallow Concentrated Flow, Tc10** Short Grass Pasture Kv= 7.0 fps
0.7	590	0.0258	13.67	42.94	**Pipe Channel, Tc11** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	160	0.0040	6.25	30.66	**Pipe Channel, Tc12** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
2.8	178	0.0237	1.08		**Shallow Concentrated Flow, Tc13** Short Grass Pasture Kv= 7.0 fps
26.6	1,705	Total			

Subcatchment 2S: DA 1A (OFFSITE)



Summary for Subcatchment 3S: DA 1B (OFFSITE)

[47] Hint: Peak is 196% of capacity of segment #6
[47] Hint: Peak is 70901% of capacity of segment #8

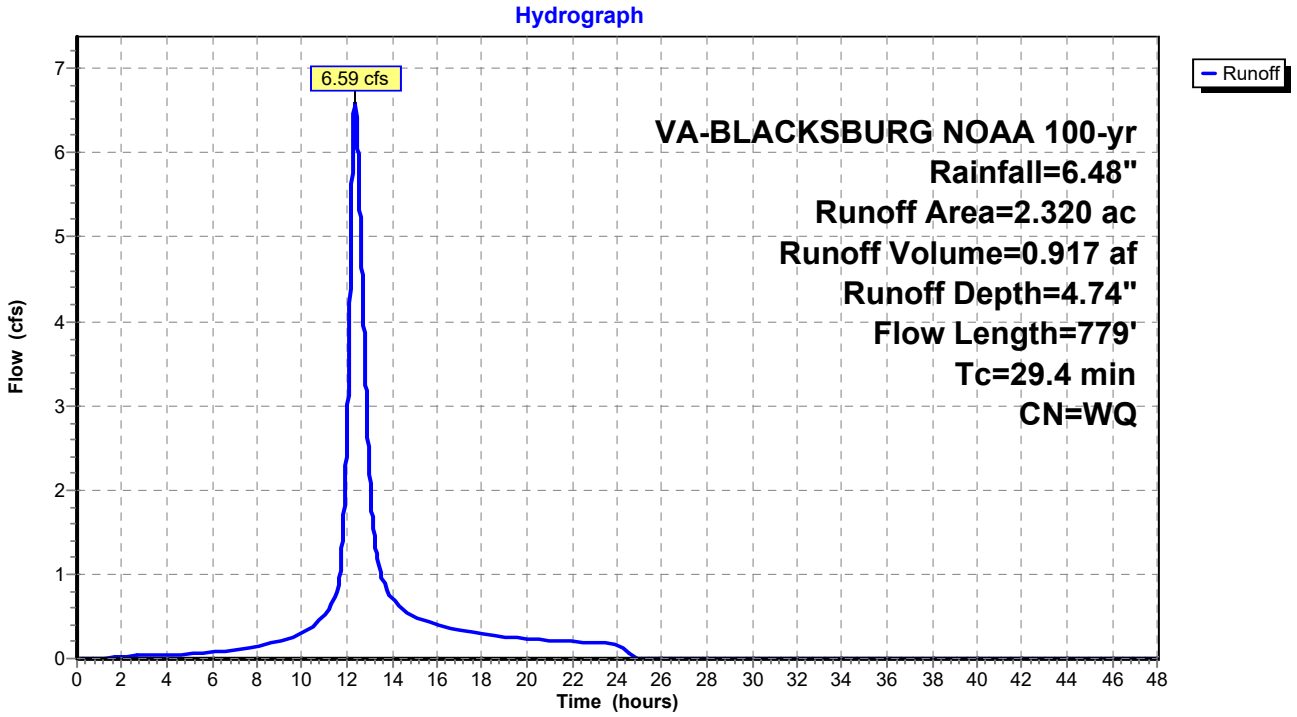
Runoff = 6.59 cfs @ 12.37 hrs, Volume= 0.917 af, Depth= 4.74"
Routed to Reach 9R : PROPOSED PIPE

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
1.195	80	1/2 acre lots, 25% imp, HSG C
0.418	83	1/4 acre lots, 38% imp, HSG C
0.534	98	Paved roads w/curbs & sewers, HSG C
0.067	74	>75% Grass cover, Good, HSG C
0.069	79	1 acre lots, 20% imp, HSG C
0.037	92	Paved roads w/open ditches, 50% imp, HSG C
2.320		Weighted Average
1.296		55.87% Pervious Area
1.024		44.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	100	0.0030	0.07		**Sheet Flow, Tc14** Grass: Short n= 0.150 P2= 2.76"
2.3	140	0.0214	1.02		**Shallow Concentrated Flow, Tc15** Short Grass Pasture Kv= 7.0 fps
0.2	60	0.1167	5.50		**Shallow Concentrated Flow, Tc16** Unpaved Kv= 16.1 fps
0.1	34	0.0882	6.03		**Shallow Concentrated Flow, Tc17** Paved Kv= 20.3 fps
0.2	20	0.0550	1.64		**Shallow Concentrated Flow, Tc18** Short Grass Pasture Kv= 7.0 fps
0.2	47	0.0328	4.27	3.36	**Pipe Channel, Tc19** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.2	131	0.0708	1.86		**Shallow Concentrated Flow, Tc20** Short Grass Pasture Kv= 7.0 fps
0.8	60	0.0542	1.18	0.01	**Pipe Channel, Tc21** 1.2" Round Area= 0.0 sf Perim= 0.3' r= 0.02' n= 0.025 Corrugated metal
1.9	187	0.0567	1.67		**Shallow Concentrated Flow, Tc22** Short Grass Pasture Kv= 7.0 fps
29.4	779	Total			

Subcatchment 3S: DA 1B (OFFSITE)



Summary for Subcatchment 4S: DA 1C (OFFSITE)

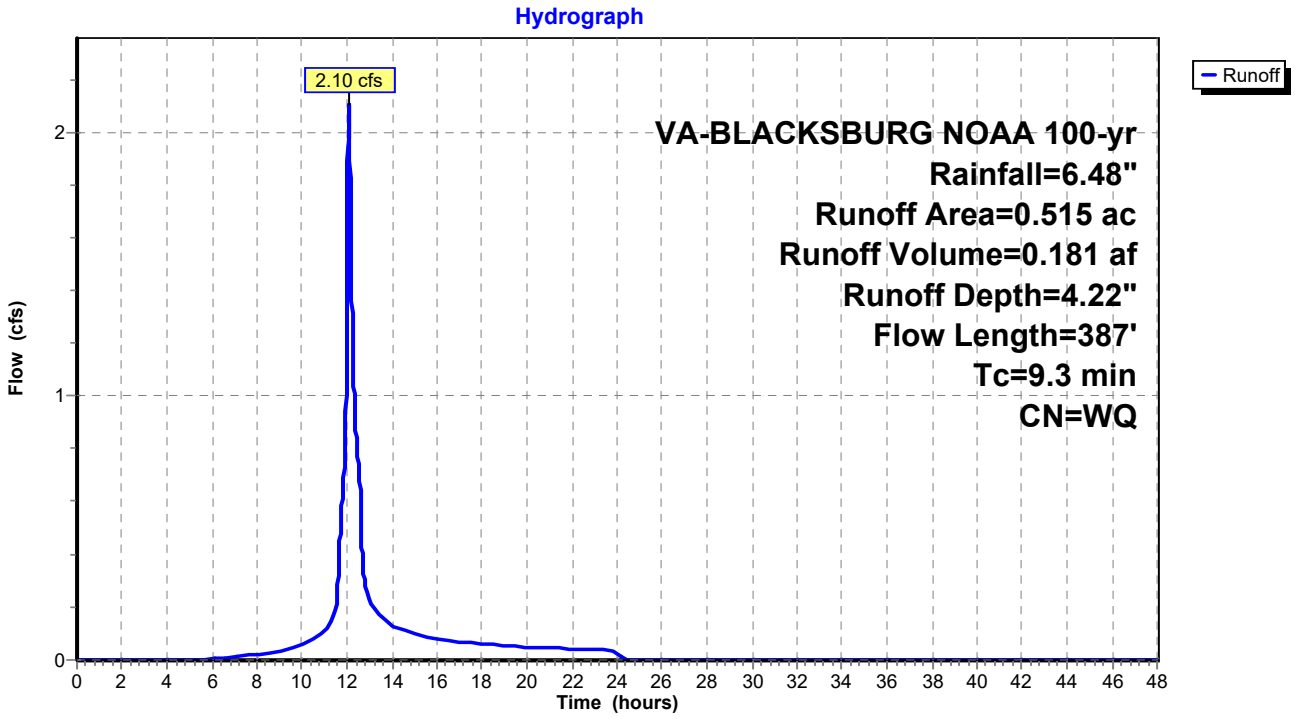
Runoff = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af, Depth= 4.22"
Routed to Reach 11R : EXISTING PIPE

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
0.439	79	1 acre lots, 20% imp, HSG C
0.052	80	1/2 acre lots, 25% imp, HSG C
0.024	98	Paved roads w/curbs & sewers, HSG C
0.515		Weighted Average
0.390		75.77% Pervious Area
0.125		24.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0634	0.25		**Sheet Flow, Tc23** Grass: Short n= 0.150 P2= 2.76"
2.6	287	0.0668	1.81		**Shallow Concentrated Flow, Tc24** Short Grass Pasture Kv= 7.0 fps
9.3	387	Total			

Subcatchment 4S: DA 1C (OFFSITE)



Summary for Subcatchment 5S: DA 1 (TO DETENTION)

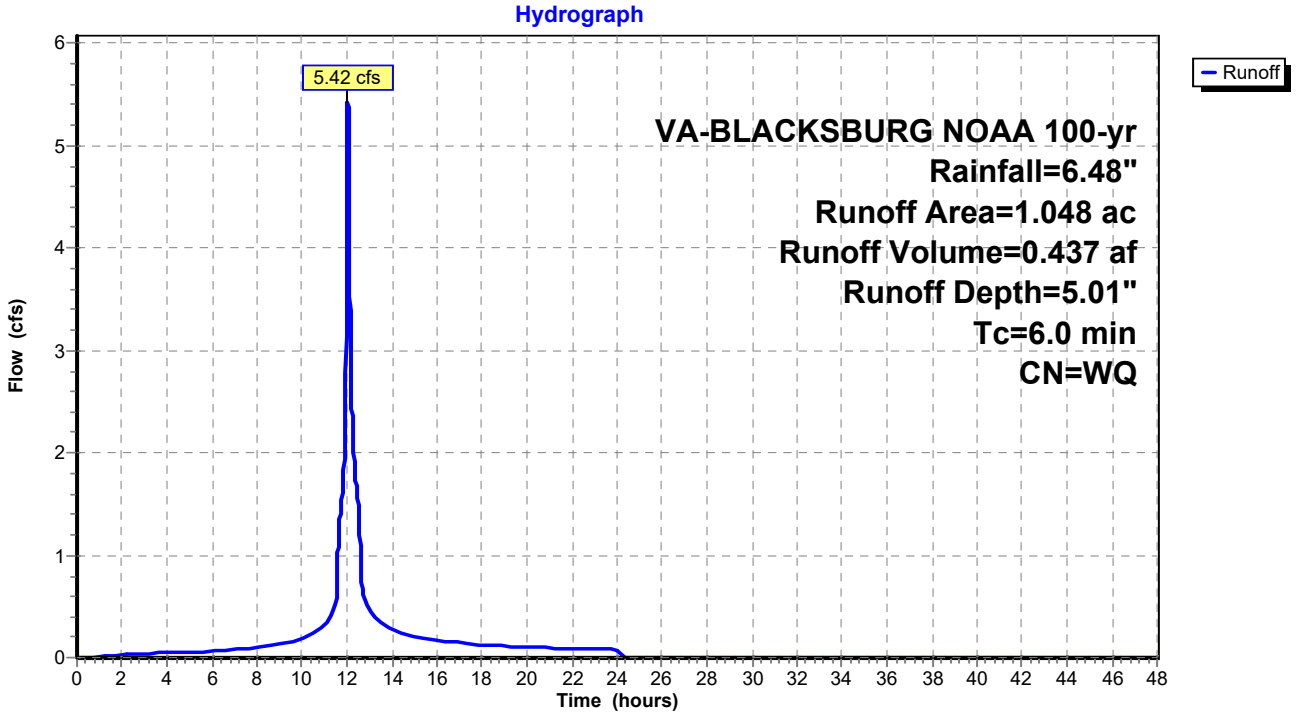
Runoff = 5.42 cfs @ 12.04 hrs, Volume= 0.437 af, Depth= 5.01"
Routed to Pond 7P : UNDERGROUND DETENTION

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
0.425	74	>75% Grass cover, Good, HSG C
0.524	98	Paved parking, HSG C
0.099	83	1/4 acre lots, 38% imp, HSG C
1.048		Weighted Average
0.486		46.41% Pervious Area
0.562		53.59% Impervious Area

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

Subcatchment 5S: DA 1 (TO DETENTION)

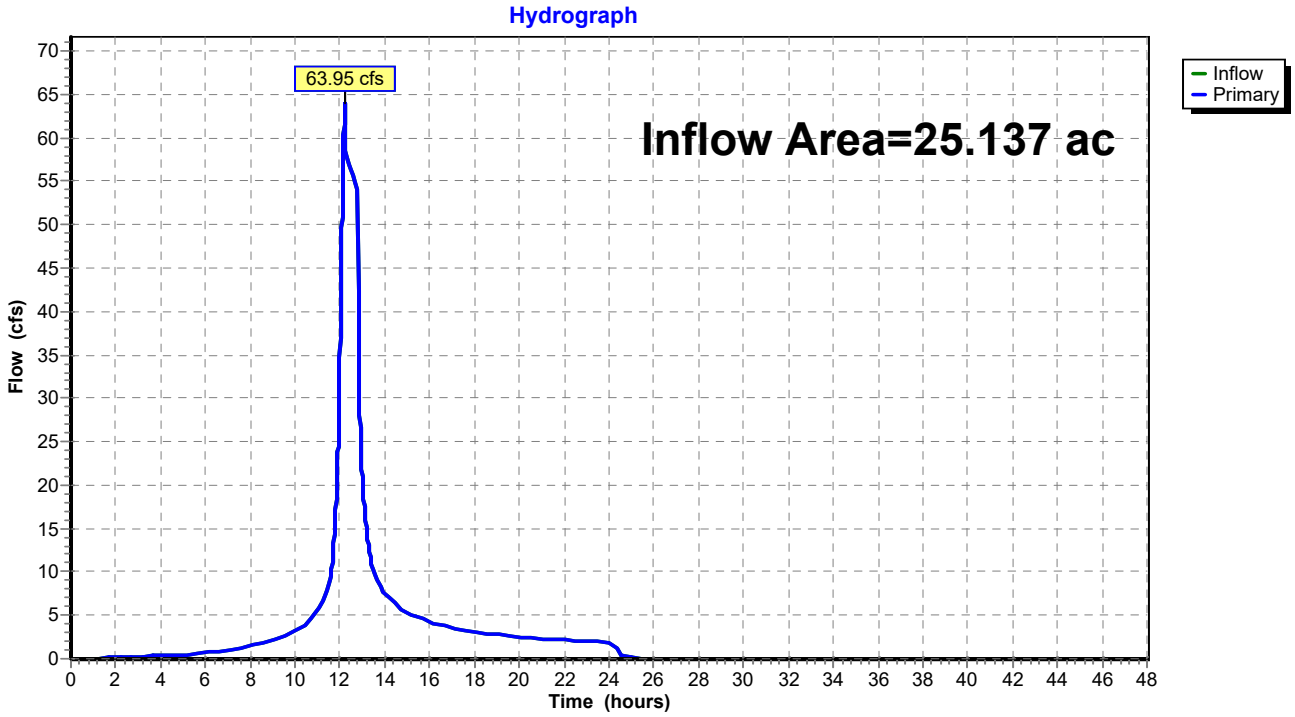


Summary for Link 6L: POA 1

Inflow Area = 25.137 ac, 42.22% Impervious, Inflow Depth > 4.70" for 100-yr event
Inflow = 63.95 cfs @ 12.21 hrs, Volume= 9.846 af
Primary = 63.95 cfs @ 12.21 hrs, Volume= 9.846 af, Atten= 0%, Lag= 0.0 min

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

Link 6L: POA 1



Summary for Pond 7P: UNDERGROUND DETENTION

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1.048 ac, 53.59% Impervious, Inflow Depth = 5.01" for 100-yr event
Inflow = 5.42 cfs @ 12.04 hrs, Volume= 0.437 af
Outflow = 5.10 cfs @ 12.06 hrs, Volume= 0.426 af, Atten= 6%, Lag= 1.5 min
Primary = 5.10 cfs @ 12.06 hrs, Volume= 0.426 af
Routed to Reach 7R : OVERLAND TO POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,113.04' @ 12.06 hrs Surf.Area= 0.069 ac Storage= 0.133 af

Plug-Flow detention time= 372.8 min calculated for 0.426 af (97% of inflow)
Center-of-Mass det. time= 357.2 min (1,133.8 - 776.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,110.65'	0.028 af	**80.00'W x 32.00'L x 3.00'H Field A** 0.176 af Overall - 0.107 af Embedded = 0.069 af x 40.0% Voids
#2A	2,110.65'	0.103 af	**StormTank 25 Series 24"** x 520 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 520 Chambers in 52 Rows
#3B	2,110.65'	0.002 af	**39.50'W x 11.00'L x 2.00'H Field B** 0.020 af Overall - 0.015 af Embedded = 0.004 af x 40.0% Voids
#4B	2,110.65'	0.015 af	**StormTank 25 Series 24"** x 75 Inside #3 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 75 Chambers in 25 Rows
		0.148 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,110.65'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,110.65' / 2,110.50' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	2,110.40'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,112.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=5.09 cfs @ 12.06 hrs HW=2,113.04' (Free Discharge)
└**1=Culvert** (Passes 5.09 cfs of 10.88 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 7.44 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 5.00 cfs @ 2.39 fps)

Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field A

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

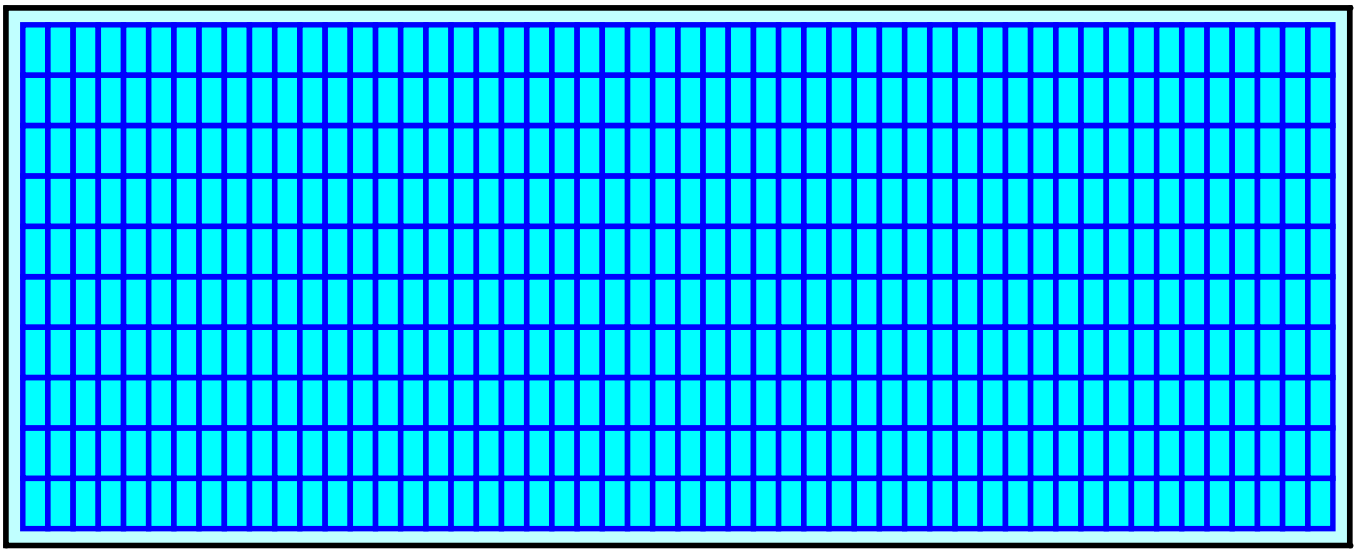
10 Chambers/Row x 3.00' Long = 30.00' Row Length +12.0" End Stone x 2 = 32.00' Base Length
52 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 80.00' Base Width
24.0" Chamber Height + 12.0" Stone Cover = 3.00' Field Height

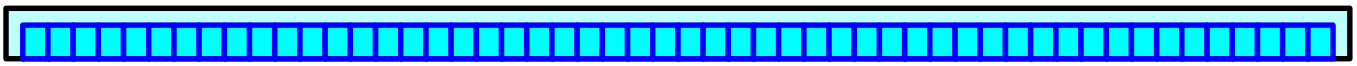
520 Chambers x 8.7 cf = 4,501.2 cf Chamber Storage
520 Chambers x 9.0 cf = 4,680.0 cf Displacement

7,680.0 cf Field - 4,680.0 cf Chambers = 3,000.0 cf Stone x 40.0% Voids = 1,200.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,701.2 cf = 0.131 af
Overall Storage Efficiency = 74.2%
Overall System Size = 32.00' x 80.00' x 3.00'

520 Chambers
284.4 cy Field
111.1 cy Stone





Pond 7P: UNDERGROUND DETENTION - Chamber Wizard Field B

Chamber Model = StormTank 25 Series 24" (StormTank Module 25 Series)
Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf
Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf

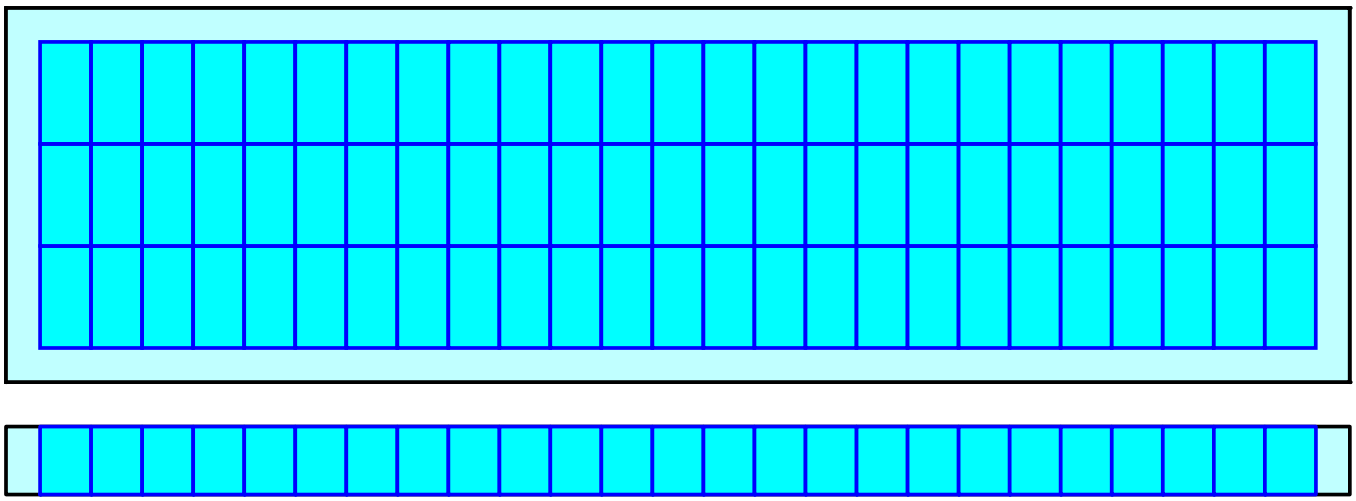
3 Chambers/Row x 3.00' Long = 9.00' Row Length +12.0" End Stone x 2 = 11.00' Base Length
25 Rows x 18.0" Wide + 12.0" Side Stone x 2 = 39.50' Base Width
24.0" Chamber Height = 2.00' Field Height

75 Chambers x 8.7 cf = 649.2 cf Chamber Storage
75 Chambers x 9.0 cf = 675.0 cf Displacement

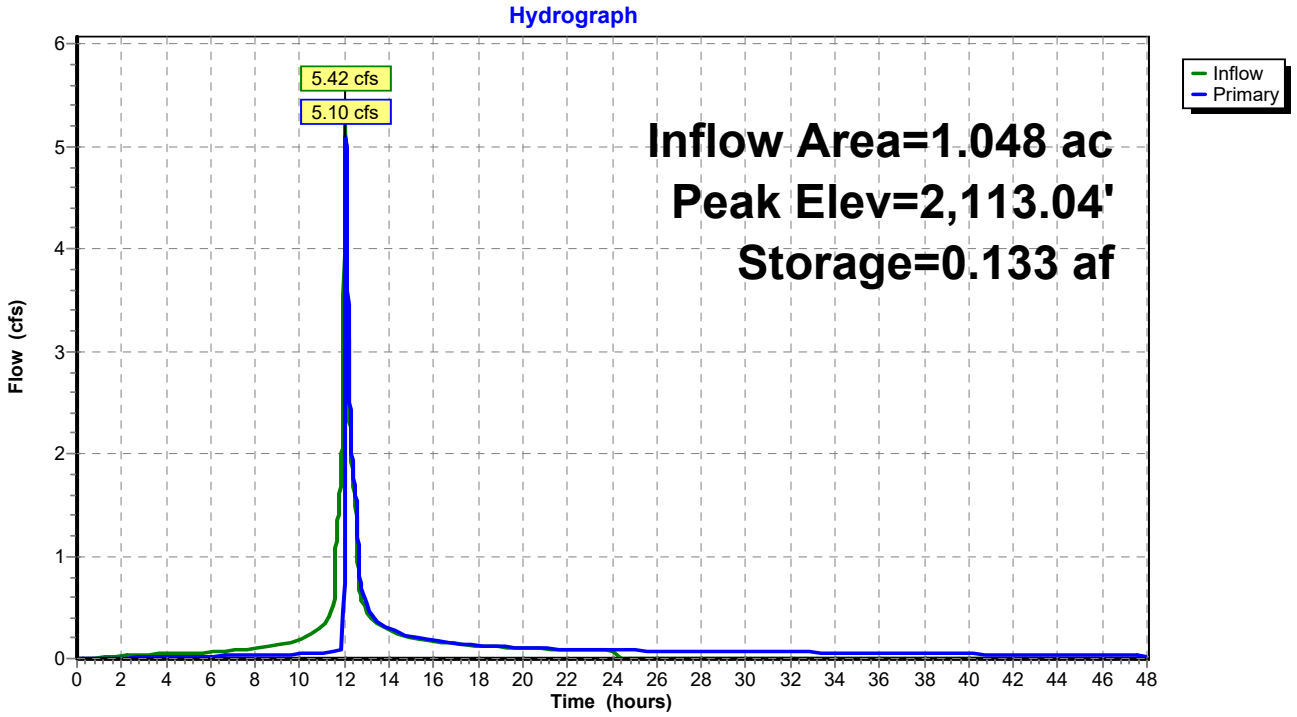
869.0 cf Field - 675.0 cf Chambers = 194.0 cf Stone x 40.0% Voids = 77.6 cf Stone Storage

Chamber Storage + Stone Storage = 726.8 cf = 0.017 af
Overall Storage Efficiency = 83.6%
Overall System Size = 11.00' x 39.50' x 2.00'

75 Chambers
32.2 cy Field
7.2 cy Stone



Pond 7P: UNDERGROUND DETENTION



Summary for Reach 7R: OVERLAND TO POA 1

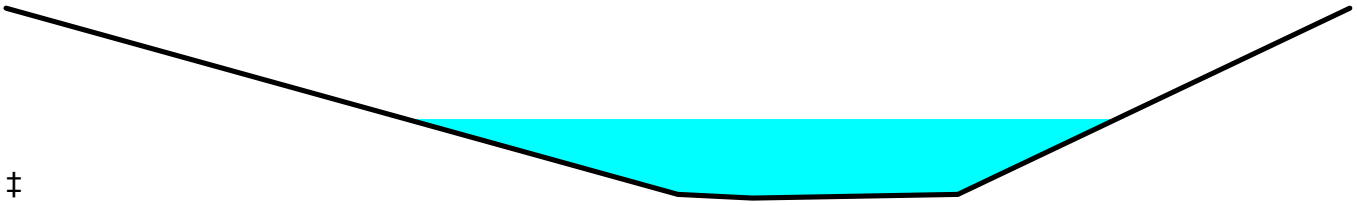
[61] Hint: Exceeded Reach 9R outlet invert by 0.38' @ 12.21 hrs

Inflow Area = 23.428 ac, 42.84% Impervious, Inflow Depth > 4.72" for 100-yr event
Inflow = 59.27 cfs @ 12.21 hrs, Volume= 9.208 af
Outflow = 59.21 cfs @ 12.21 hrs, Volume= 9.208 af, Atten= 0%, Lag= 0.0 min
Routed to Link 6L : POA 1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.43 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 0.3 min

Peak Storage= 218 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 38.06'
Bank-Full Depth= 1.02' Flow Area= 43.6 sf, Capacity= 391.92 cfs

Custom cross-section, Length= 20.0' Slope= 0.0445 '/'
Constant n= 0.025 Earth, grassed & winding
Inlet Invert= 2,109.78', Outlet Invert= 2,108.89'



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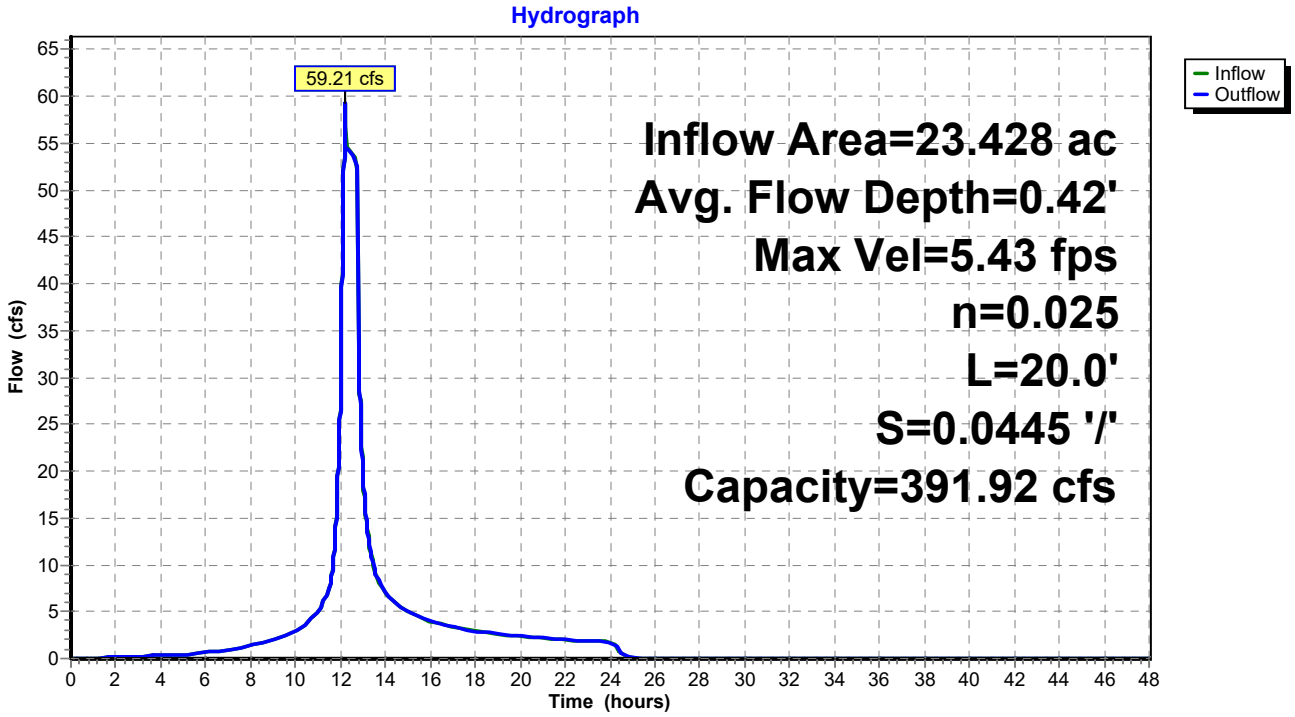
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2,110.00	0.00
36.00	2,109.00	1.00
40.00	2,108.98	1.02
51.00	2,109.00	1.00
72.00	2,110.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.02	0.1	15.0	14.7	3	0.09
1.02	43.6	72.0	72.0	873	391.92

Reach 7R: OVERLAND TO POA 1



Summary for Reach 9R: PROPOSED PIPE

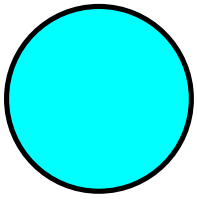
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 126% of Manning's capacity
[76] Warning: Detained 0.236 af (Pond w/culvert advised)
[62] Hint: Exceeded Reach 10R OUTLET depth by 3.69' @ 12.79 hrs

Inflow Area = 22.380 ac, 42.34% Impervious, Inflow Depth = 4.71" for 100-yr event
Inflow = 65.75 cfs @ 12.32 hrs, Volume= 8.782 af
Outflow = 56.44 cfs @ 12.21 hrs, Volume= 8.782 af, Atten= 14%, Lag= 0.0 min
Routed to Reach 7R : OVERLAND TO POA 1

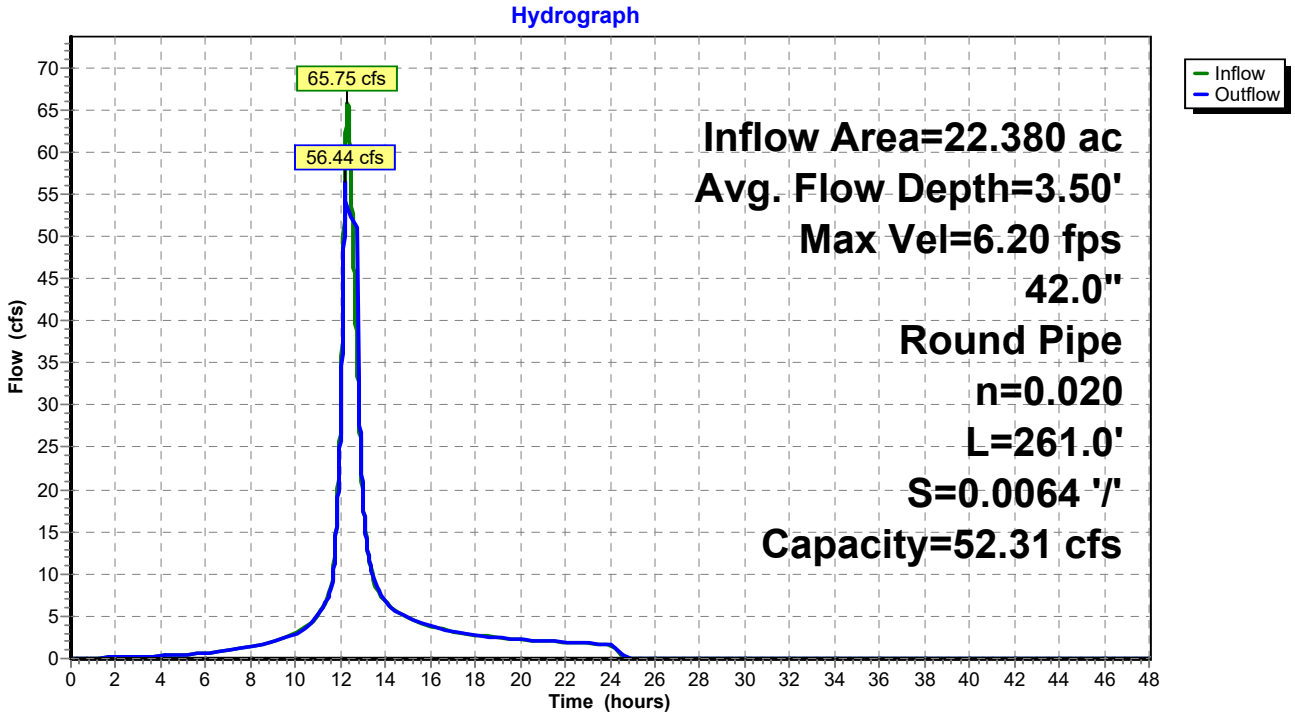
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.20 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.54 fps, Avg. Travel Time= 1.7 min

Peak Storage= 2,511 cf @ 12.22 hrs
Average Depth at Peak Storage= 3.50'
Bank-Full Depth= 3.50' Flow Area= 9.6 sf, Capacity= 52.31 cfs

42.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 261.0' Slope= 0.0064 '/'
Inlet Invert= 2,111.49', Outlet Invert= 2,109.82'



Reach 9R: PROPOSED PIPE



Summary for Reach 10R: PROPOSED PIPE

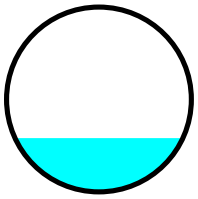
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.32' @ 12.09 hrs

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 4.22" for 100-yr event
Inflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af
Outflow = 2.09 cfs @ 12.09 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.4 min
Routed to Reach 9R : PROPOSED PIPE

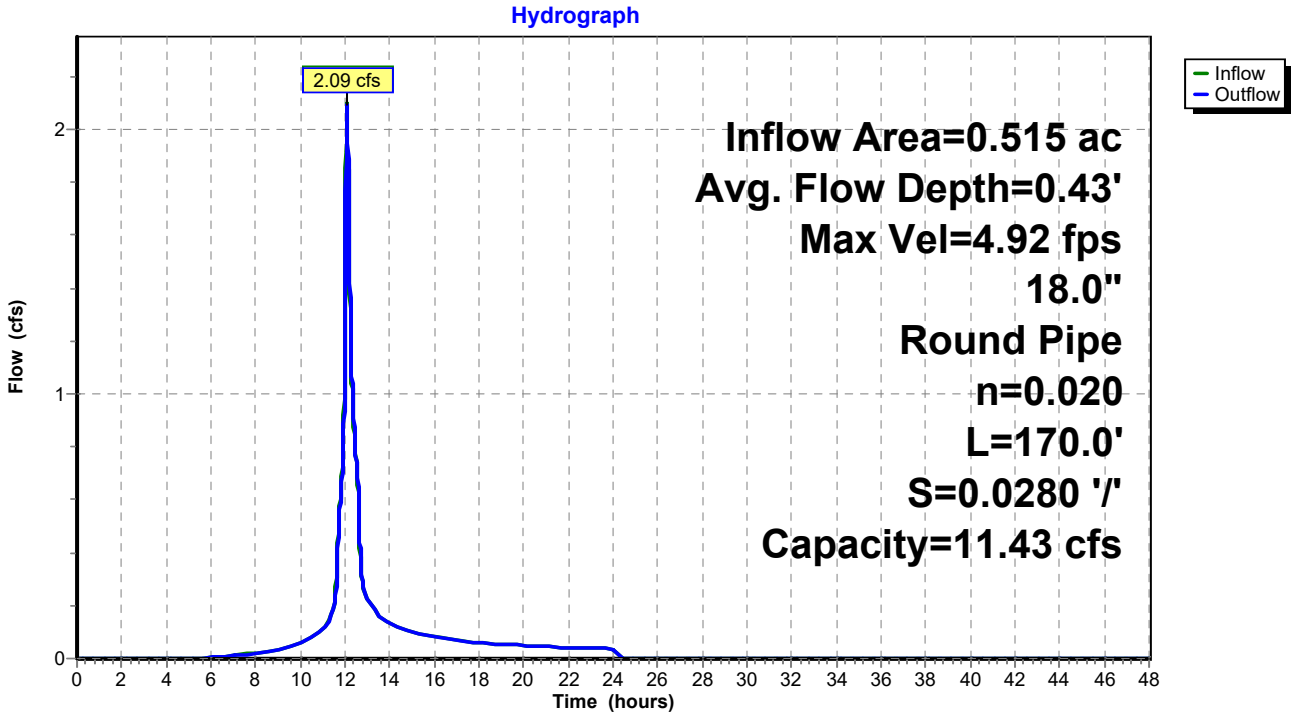
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.92 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 1.9 min

Peak Storage= 72 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.43' , Surface Width= 1.36'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.43 cfs

18.0" Round Pipe
n= 0.020 Corrugated PE, corrugated interior
Length= 170.0' Slope= 0.0280 '/'
Inlet Invert= 2,115.89', Outlet Invert= 2,111.13'



Reach 10R: PROPOSED PIPE



Summary for Reach 11R: EXISTING PIPE

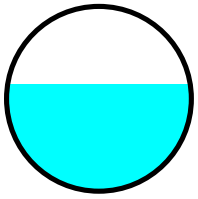
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.515 ac, 24.23% Impervious, Inflow Depth = 4.22" for 100-yr event
Inflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af
Outflow = 2.10 cfs @ 12.08 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.2 min
Routed to Reach 10R : PROPOSED PIPE

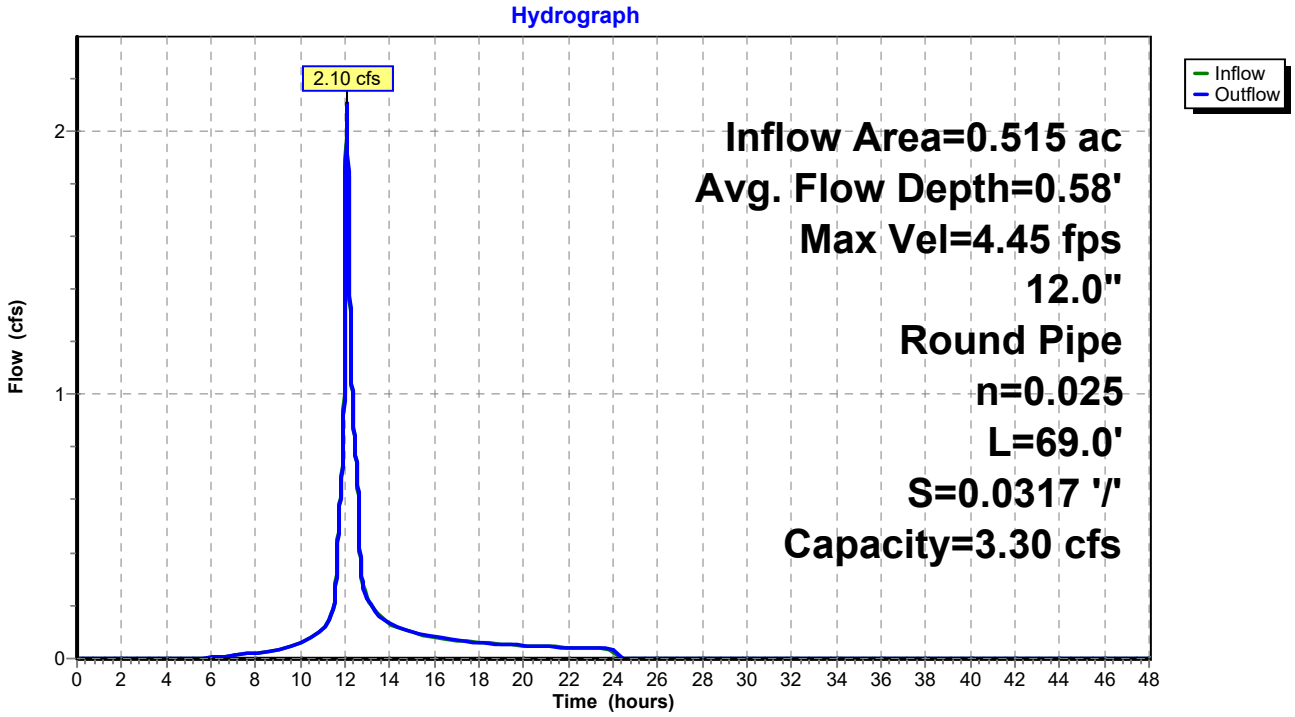
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.45 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.8 min

Peak Storage= 33 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.58' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.30 cfs

12.0" Round Pipe
n= 0.025 Corrugated metal
Length= 69.0' Slope= 0.0317 '/'
Inlet Invert= 2,118.19', Outlet Invert= 2,116.00'



Reach 11R: EXISTING PIPE



APPENDIX D:
STORMWATER QUALITY CALCULATIONS

DEQ Virginia Runoff Reduction Method Re-Development Compliance Spreadsheet - Version 3.0

BMP Design Specifications List: **2013 Draft Stds & Specs**

Site Summary

Project Title: Habitat for Humanity Airport Road Townhomes
Date: NA

Total Rainfall (in):	**43**
Total Disturbed Acreage:	**1.20**

Site Land Cover Summary

Pre-ReDevelopment Land Cover (acres)

	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)	0.00	0.00	0.93	0.00	0.93	78
Impervious Cover (acres)	0.00	0.00	0.27	0.00	0.27	23
					1.20	100

Post-ReDevelopment Land Cover (acres)

	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)	0.00	0.00	0.49	0.00	0.49	41
Impervious Cover (acres)	0.00	0.00	0.71	0.00	0.71	59
					1.20	100

Site Tv and Land Cover Nutrient Loads

	Final Post-Development (Post-ReDevelopment & New Impervious)	Post-ReDevelopment	Post-Development (New Impervious)	Adjusted Pre-ReDevelopment
Site Rv	0.65	0.48	0.95	0.48
Treatment Volume (ft^3)	2,840	1,322	1,517	1,322
TP Load (lb/yr)	1.78	0.83	0.95	0.83

Pre-ReDevelopment TP Load per acre (lb/acre/yr)	Final Post-Development TP Load per acre (lb/acre/yr)	Post-ReDevelopment TP Load per acre (lb/acre/yr)
1.09	**1.49**	**1.09**

Total TP Load Reduction Required (lb/yr)	**0.94**	0.17	0.77

	Final Post-Development Load (Post-ReDevelopment & New Impervious)	Pre-ReDevelopment
TN Load (lb/yr)	12.76	7.52

Site Compliance Summary

Maximum % Reduction Required Below Pre-ReDevelopment Load	20%

Total Runoff Volume Reduction (ft^3)	0
Total TP Load Reduction Achieved (lb/yr)	0.00
Total TN Load Reduction Achieved (lb/yr)	0.00
Remaining Post Development TP Load (lb/yr)	1.78
Remaining TP Load Reduction (lb/yr) Required	**0.94**

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)	0.00	0.00	0.00	0.00	0.00	0.00
Impervious Cover (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Total Area (acres)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

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)	0.00	0.00	0.00	0.00	0.00	0.00
TN Load Reduced (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Runoff Volume and CN Calculations

	1-year storm	2-year storm	10-year storm
Target Rainfall Event (in)	0.00	0.00	0.00

Drainage Areas	RV & CN	Drainage Area A	Drainage Area B	Drainage Area C	Drainage Area D	Drainage Area E
CN		0	0	0	0	0
RR (ft^3)		0	0	0	0	0
1-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	0	0	0	0	0
2-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	0	0	0	0	0
10-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	0	0	0	0	0