STORMWATER MANAGEMENT CALCULATIONS

FOR

CLAY STREET APARTMENTS
REZONING APPLICATION

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VIRGINIA

October 1, 2024

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SECTION I: PROJECT NARRATIVE

Project Description

The purpose of this project is the rezoning of 1.56 acres of land for Kaler Communications, LLC. The subject parcel is adjacent to the Midtown Development currently under construction and previously held a fraternity house with associated parking. The applicant proposes to rezone this property from R-5 (Transitional Residential) to a PRD (Planned Residential District) in order to build apartments.

Existing Site Conditions

The project site[1] is situated at the northeastern corner of Midtown on Clay Street. The site is bound by the properties of Double Bull, LLC, Gary J. Ashton and John C. Ashton III, et al, Roger M. and Vicki S. Powell, and CMEJME, LLC to the east, the Midtown Development to the south and west, and Clay Street to the north. Surrounding properties consist of single-family residential lots (both rental properties and owner-occupied), multi-unit residential developments, commercial properties, and open space.

Existing soil conditions on site include the types listed below with slopes ranging from 2%-15%.

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

[1] For the purposes of the Project Narrative, "site" shall be defined as the area within the subject property boundary, 1.59 acres, Tax Map #257-A 188.

Development Plans

The proposed development will consist of two new three-story apartment buildings with a mix of 1-bedroom and 2-bedroom units. One 18-unit building and one 24-unit building are proposed, for a total of 42 units with 72 beds. Parking will be provided in a surface lot. Sanitary sewer and water extensions into the site are proposed. Stormwater quantity management will be handled by an underground detention system. Water quality will be handled by purchasing nutrient credits.

During Construction

Neighboring areas are developed urban land consisting of single-family and multi-unit residential, commercial developments, and open space. Any runoff from the site shall be controlled with temporary measures such as a construction entrance, silt fence, sediment traps or basins, 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 is primarily grassed, with a few trees and some asphalt. The majority of the site drains towards Clay Street and into an existing roadside ditch. A portion of the property draining to Clay Street (approximately 0.42 acres) flows across the street and bypasses the ditch. A small portion of the site (approximately 0.29 acres) drains towards the Midtown Development and eventually reaches an existing underground detention system. There are no existing BMP's upstream of the site. The point of analysis has been set where runoff from the site enters the roadside ditch along Clay Street.

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
1.281	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
0.425	98	Paved parking, HSG C (1S, 2S, 3S)
1.706	**80**	**TOTAL AREA**

Point of Analysis

Total Drainage Area= 0.989 acres

	Peak Flow	Runoff Volume
1-year	0.87 cfs	0.076 af
2-year	1.23 cfs	0.103 af
10-year	2.18 cfs	0.187 af
100-year	3.65 cfs	0.357 af

Direct Runoff #1 (drains to Midtown Underground System)

Total Drainage Area= 0.294 acres

	Runoff Volume
1-year	0.027 af
2-year	0.036 af
10-year	0.062 af
100-year	0.114 af

Direct Runoff #2 (drains to Clay Street)

Total Drainage Area= 0.423 acres

	Runoff Volume
1-year	0.021 af
2-year	0.032 af
10-year	0.065 af
100-year	0.134 af

POST-DEVELOPMENT SUMMARY

Please see Sheet SW4 for drainage area map.

In the post-development condition, the proposed site will be graded to capture runoff via sheet flow, roof drains, curb inlets, and stormwater piping. From there, runoff will be conveyed to an underground detention basin underneath the parking lot. Outflow from this system will be managed by multiple flow control orifices located in an outlet structure. As shown in the enclosed HydroCAD calculations, the underground system has been designed to manage peak flows and meet water quantity requirements and has been sized to hold the 100-year storm.

Outflow from the system will be discharged directly into the existing ditch along Clay Street. This ditch conveys runoff from the site to a 24" culvert under Clay Street and eventually into a large box culvert under Wharton Street and to Stroubles Creek.

Portions of the direct runoff areas will continue to flow either to Clay Street or towards Midtown as in the pre-development condition. As shown in the following pages, the volume conveyed to these areas will be reduced below the pre-development volume.

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
0.756	74	>75% Grass cover, HSG C (1S-A, 1S-B, 2S, 3S)
1.041	98	Paved parking, HSG C (1S-A, 1S-B)
1.797	**88**	**TOTAL AREA**

Point of Analysis

Total Drainage Area= 1.499 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	Reduction
1-year	0.87 cfs	0.23 cfs	-73.6%
2-year	1.23 cfs	0.75 cfs	-39.0%
10-year	2.18 cfs	1.74 cfs	-20.2%

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.

Direct Runoff Area #1 (to Midtown SWM Facility)

Total Drainage Area= 0.132 acres

The following table summarizes the pre- and post-development runoff volumes for Direct Runoff Area #1 and the percent change for each storm (See HydroCAD report).

	Pre-Dev Runoff Volume	Post-Dev Runoff Volume	Reduction
1-year	0.027 af	0.005 af	-81.5%
2-year	0.036 af	0.008 af	-77.8%
10-year	0.062 af	0.018 af	-71.0%
100-year	0.114 af	0.040 af	-64.9%

Direct Runoff Area #2 (to Clay Street)

Total Drainage Area= 0.149 acres

The following table summarizes the pre- and post-development runoff volumes for Direct Runoff Area #2 and the percent change for each storm (See HydroCAD report).

	Pre-Dev Runoff Volume	Post-Dev Runoff Volume	Reduction
1-year	0.021 af	0.006 af	-71.4%
2-year	0.032 af	0.009 af	-71.9%
10-year	0.065 af	0.021 af	-67.7%
100-year	0.134 af	0.045 af	-66.4%

As shown above, the post-development runoff volumes for the direct runoff areas are less than the pre-development runoff volumes for the 1-year, 2-year, and 10-year, thus meeting the requirements of 9VAC25-875-600 subsection D.

Channel Protection

In accordance with 9VAC25-875-600 (B), concentrated stormwater flows will be discharged directly to a stormwater conveyance system. Runoff from this system will be discharged through a pipe into a channel. From this point, runoff will flow through a series of manmade and natural conveyance systems to the 1% analysis point of the site[2]. No erosion of either the natural or the manmade system should be expected from stormwater flows. Per subdivision (3)(a), the maximum post-development peak flow rate from the 1-year 24-hour storm shall be calculated per the equations below to prevent erosion of the natural conveyance systems. Additionally, all analyzed storms will produce a post-development flow rate lower than the pre-development flow rate, therefore no erosion of the manmade system should be expected.

R_v Calculation – POA

Pre-developed = 0.072 acre*ft – See HydroCAD "RV Calculation" Report

Developed = 0.185 acre*ft – See HydroCAD "RV Calculation" Report

$$Q_{Developed} \leq I.F. \times \left(Q_{Pre-developed} \times RV_{Pre-Developed}\right)/RV_{Developed}$$
$$Q_{Developed} \leq 0.8 \times \left(Q_{Pre-developed} \times 0.072\right)/0.185$$
$$Q_{Developed} \leq 0.31 \times Q_{Pre-developed}$$

The resulting maximum allowable peak flow rate for the one-year 24-hour storm at the Point of Analysis is 0.30 cfs. The actual post-development peak flow rate achieved is 0.23 cfs.

The direct runoff areas are sheet flow. Per 9VAC25-875-600 (D), increased volumes of sheet flow shall be evaluated for potential impacts downstream. Because both direct runoff areas show a significant reduction in volume when compared to the predevelopment 1-year 24-hour storm, no impacts are expected downstream and no further water quantity analysis or controls are needed.

[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 1.67 acres). See Sheets SW3-SW4.

Flood Protection

In accordance with 9VAC25-875-600 (C), concentrated stormwater flows have been discharged to a stormwater conveyance system. The downstream conveyance systems are made up of a series of natural and manmade conveyance systems. As shown on the attached HydroCAD calculations, the point of discharge releases a post-development peak flow rate for the 10-year 24-hour storm event that is less than the pre-development peak flow rate from the 10-year 24-hour storm event, satisfying subdivision 2(b). Per subdivision (3) of these regulations, no further analysis of the downstream stormwater conveyance system is required.

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 1.67 acres and a reduction requirement of 0.52 pounds per year.

The existing site[3] has an impervious land cover of 0.42 acres (25%). The post-development site will have an impervious land cover of 1.00 acres (60%) resulting in a runoff coefficient (R_v) of 0.66. The required pollutant removal rate is 0.52 lb/year, all of which will be handled by purchasing 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 1.67 acres). See Sheets SW3-SW4.

SECTION IV: DOWNSTREAM ANALYSIS

Runoff from the proposed development is discharged directly into to a series of natural and manmade conveyance systems. These conveyance systems carry flows from the site downstream to the 1% analysis point (167 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 9VAC25-875-600 subsection A, compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations has been satisfied by meeting the requirements of the for channel protection and flood protection as shown in the Post Development Summary. No adverse impacts to downstream properties are expected as a result of this development.

SECTION 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.

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

January 28, 2022

Preface

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

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

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

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

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

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

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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 Scale: 1:959 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 45 90 180 270

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

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

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	0.6	28.4%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	1.4	71.6%
Totals for Area of Interest		**2.0**	**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
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: Stream terraces, depressions
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
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: Stream terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

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

Soil Erosion Factors

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

K Factor, Whole Soil

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

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

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

Map—K Factor, Whole Soil

Map Scale: 1:959 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

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

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

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

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

Table—K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	.32	0.6	28.4%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	.32	1.4	71.6%
Totals for Area of Interest			**2.0**	**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 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.

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.

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

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

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

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

Table—Surface Texture

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	Loam	0.6	28.4%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	Loam	1.4	71.6%
Totals for Area of Interest			**2.0**	**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 LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

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

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

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

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

Table—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	0.6	28.4%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	C	1.4	71.6%
Totals for Area of Interest			**2.0**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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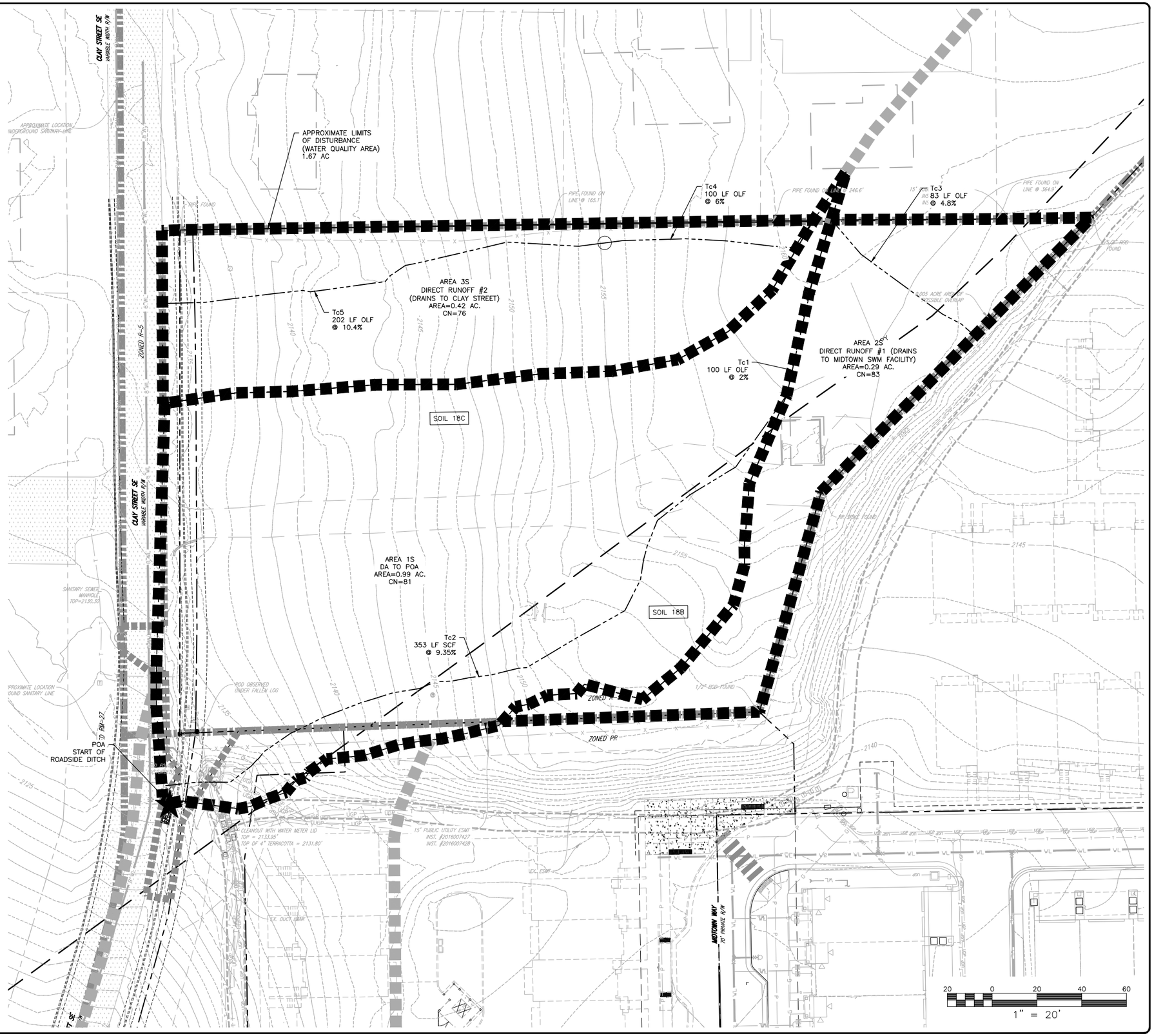
APPENDIX B:
DRAINAGE MAPS



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COMMONWEALTH OF VIRGINIA
GRETCHEN LEE MERIX
Lic. No. 63588
10/1/24
PROFESSIONAL ENGINEER

CLAY STREET APARTMENTS

PLANNED RESIDENTIAL DEVELOPMENT

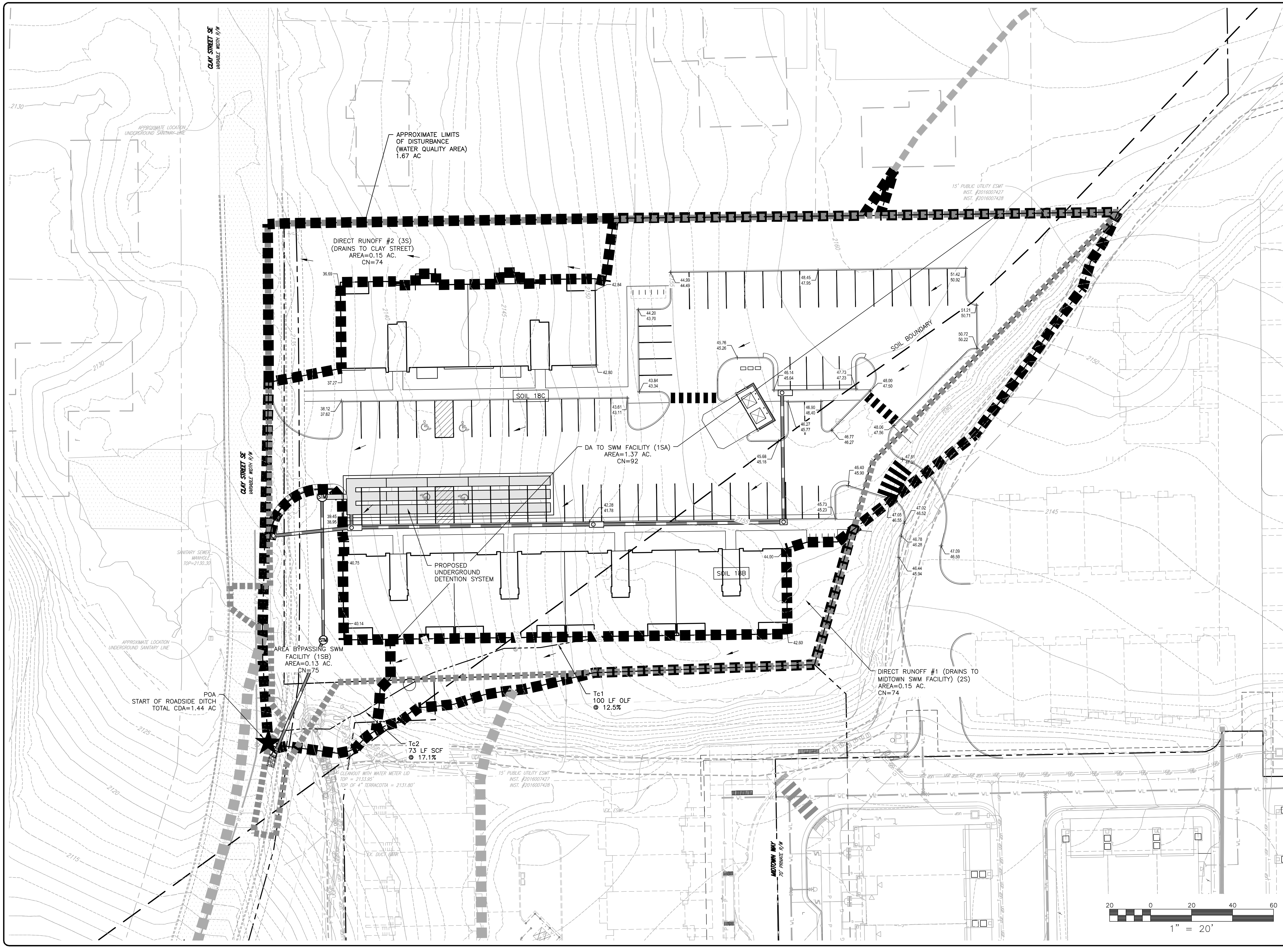
PRE-DEVELOPMENT DRAINAGE MAP

MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, MONTGOMERY COUNTY, VIRGINIA

DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	JRT
DATE	10/1/24
SCALE	1" = 20'
REVISIONS	

SW3

PROJECT NO. 24240392.00


CLAY STREET SE
VARIABLE WIDTH R/W
APPROXIMATE LIMITS OF DISTURBANCE (WATER QUALITY AREA) 1.67 AC
DIRECT RUNOFF #2 (3S) (DRAINS TO CLAY STREET) AREA=0.15 AC. CN=74
SOIL 18C
SOIL BOUNDARY
DA TO SWM FACILITY (1SA) AREA=1.37 AC. CN=92
PROPOSED UNDERGROUND DETENTION SYSTEM
SOIL 18B
AREA BYPASSING SWM FACILITY (1SB) AREA=0.13 AC. CN=75
POA
START OF ROADSIDE DITCH
TOTAL CDA=1.44 AC
Tc1
100 LF OLF
@ 12.5%
Tc2
73 LF SCF
@ 17.1%
DIRECT RUNOFF #1 (DRAINS TO MIDTOWN SWM FACILITY) (2S) AREA=0.15 AC. CN=74
15' PUBLIC UTILITY ESMT INST. #2016007427 INST. #2016007428
APPROXIMATE LOCATION UNDERGROUND SANITARY LINE
SANITARY SEWER MANHOLE TOP=2130.30
CLEANOUT WITH WATER METER LID TOP = 2133.95' TOP OF 4" TERRACOTTA = 2131.80'
MIDTOWN WAY
70' PRIVATE R/W
1" = 20'

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10/1/24
PROFESSIONAL ENGINEER

CLAY STREET APARTMENTS

PLANNED RESIDENTIAL DEVELOPMENT

POST-DEVELOPMENT DRAINAGE MAP

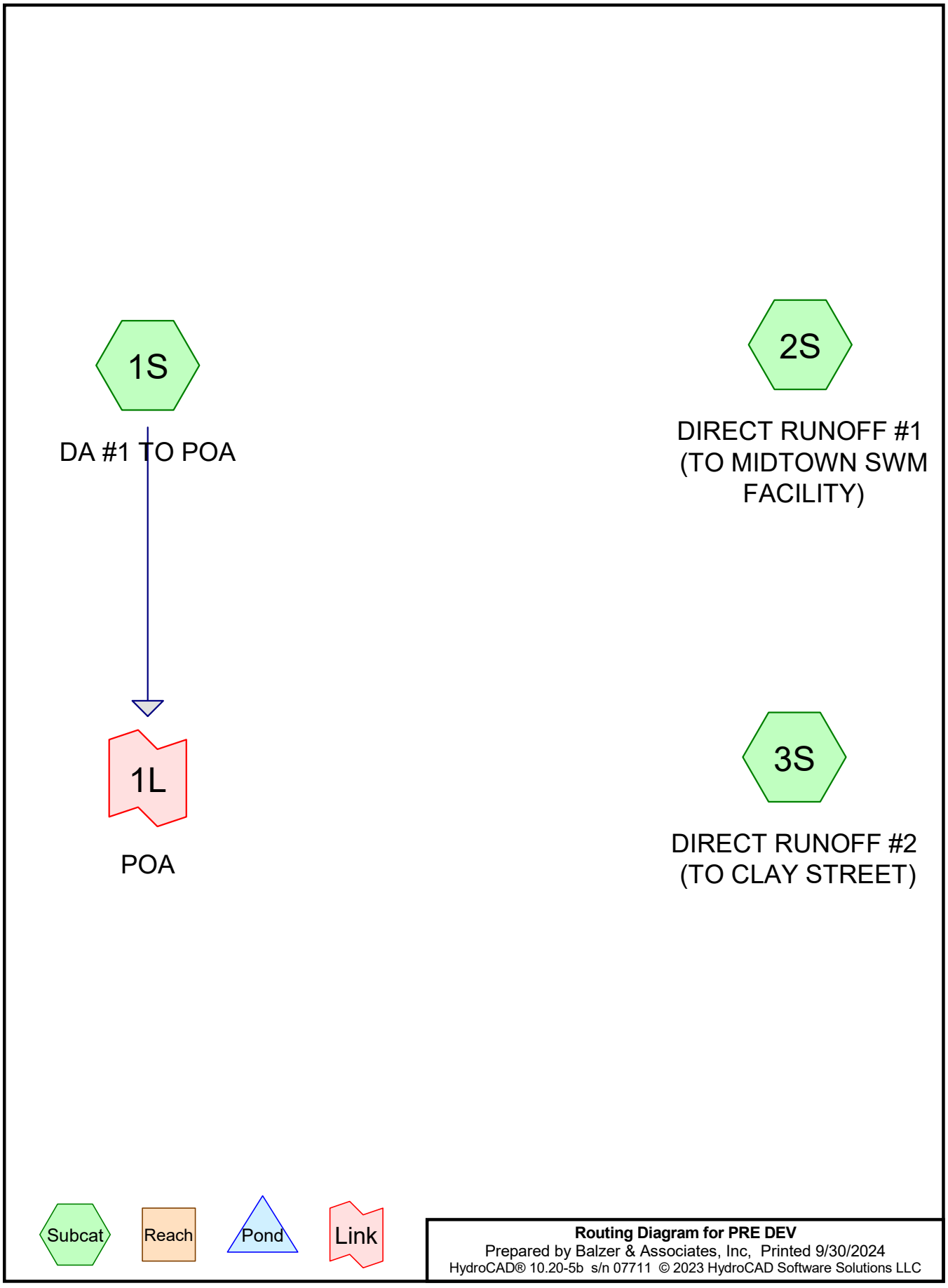
MOUNT TABOR MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, MONTGOMERY COUNTY, VIRGINIA

DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	JRT
DATE	10/1/24
SCALE	1" = 20'
REVISIONS	

SW4

PROJECT NO. 24240392.00

APPENDIX C:
STORMWATER QUANTITY CALCULATIONS



Routing Diagram for PRE DEV
Prepared by Balzer & Associates, Inc, Printed 9/30/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.281	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
0.425	98	Paved parking, HSG C (1S, 2S, 3S)
1.706	**80**	**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 TO POA Runoff Area=0.989 ac 27.81% Impervious Runoff Depth=0.92"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=0.87 cfs 0.076 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.294 ac 39.46% Impervious Runoff Depth=1.10"
Flow Length=83' Slope=0.0480 '/' Tc=6.4 min CN=WQ Runoff=0.40 cfs 0.027 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.423 ac 8.04% Impervious Runoff Depth=0.61"
Flow Length=302' Tc=7.4 min CN=WQ Runoff=0.28 cfs 0.021 af

Link 1L: POA Inflow=0.87 cfs 0.076 af
Primary=0.87 cfs 0.076 af

Total Runoff Area = 1.706 ac Runoff Volume = 0.124 af Average Runoff Depth = 0.87"
75.09% Pervious = 1.281 ac 24.91% Impervious = 0.425 ac

Summary for Subcatchment 1S: DA #1 TO POA

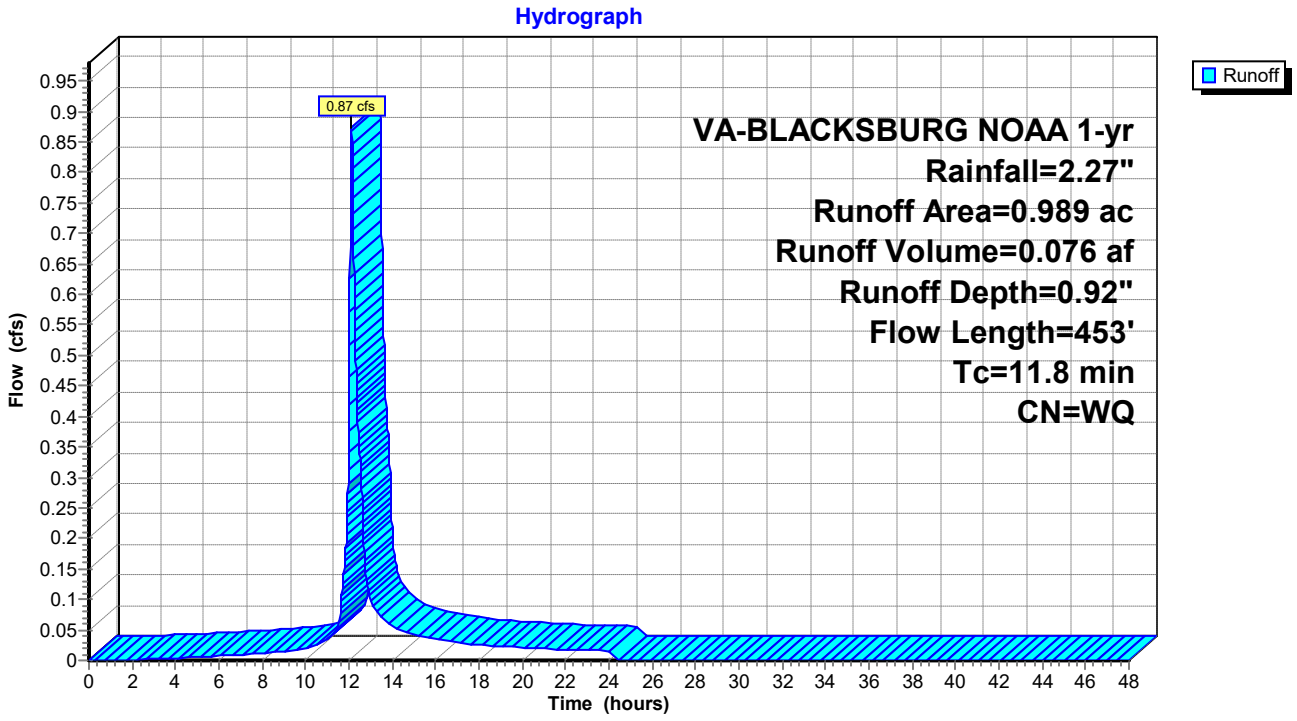
Runoff = 0.87 cfs @ 12.12 hrs, Volume= 0.076 af, Depth= 0.92"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.714	74	>75% Grass cover, Good, HSG C
0.275	98	Paved parking, HSG C
0.989		Weighted Average
0.714		72.19% Pervious Area
0.275		27.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1S: DA #1 TO POA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

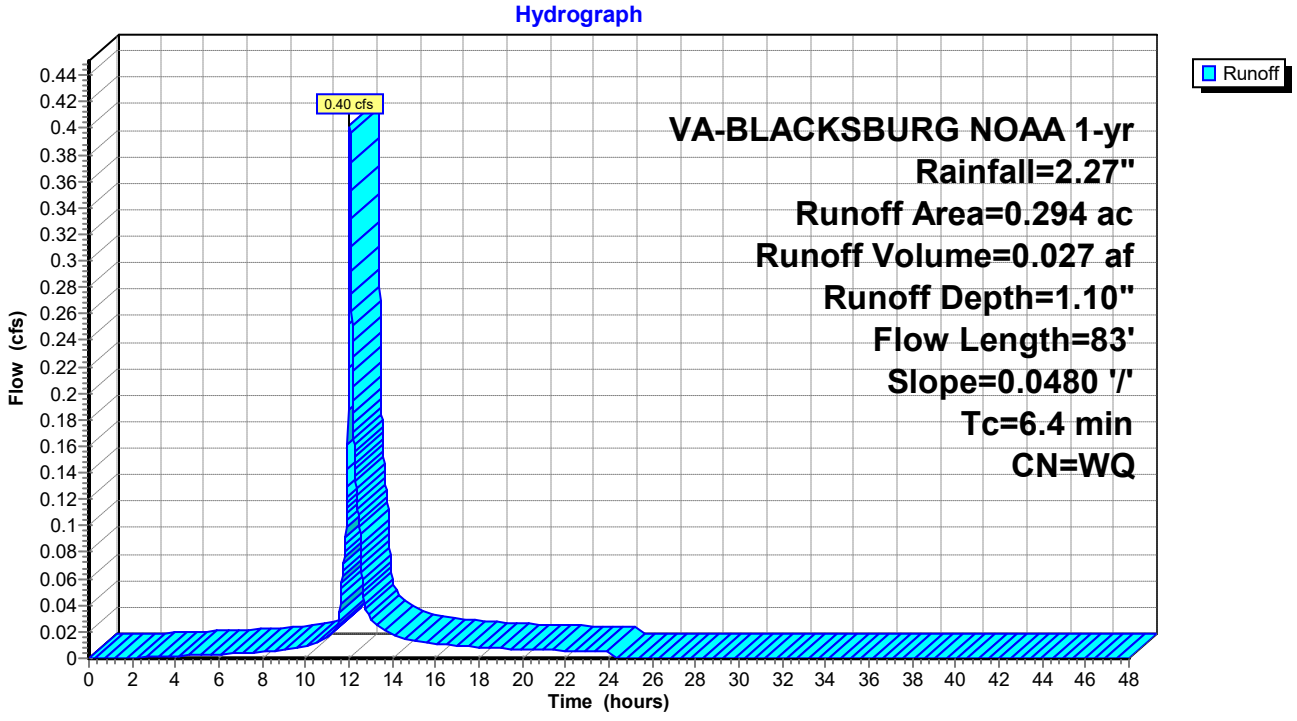
Runoff = 0.40 cfs @ 12.04 hrs, Volume= 0.027 af, Depth= 1.10"

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
0.178	74	>75% Grass cover, Good, HSG C
0.116	98	Paved parking, HSG C
0.294		Weighted Average
0.178		60.54% Pervious Area
0.116		39.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	83	0.0480	0.22		**Sheet Flow, Tc4** Grass: Short n= 0.150 P2= 2.76"

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

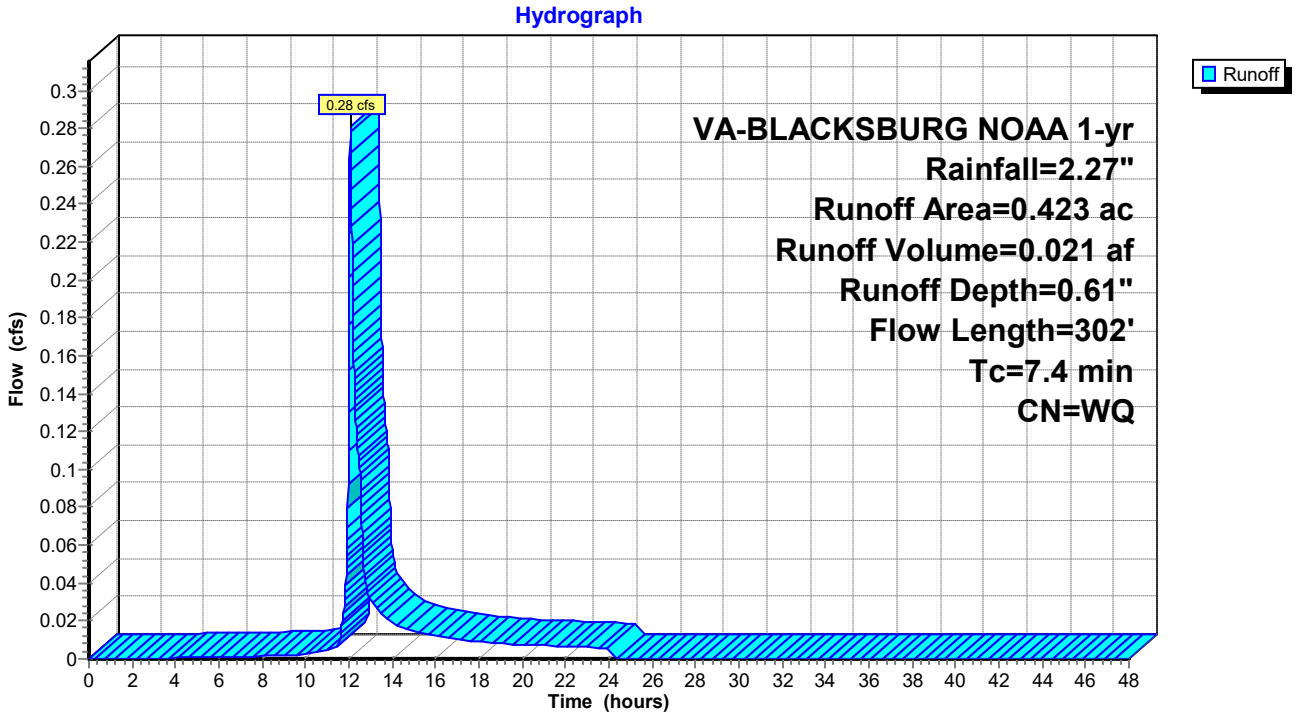
Runoff = 0.28 cfs @ 12.06 hrs, Volume= 0.021 af, Depth= 0.61"

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
0.389	74	>75% Grass cover, Good, HSG C
0.034	98	Paved parking, HSG C
0.423		Weighted Average
0.389		91.96% Pervious Area
0.034		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0600	0.25		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
0.6	202	0.1040	5.19		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
7.4	302	Total			

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

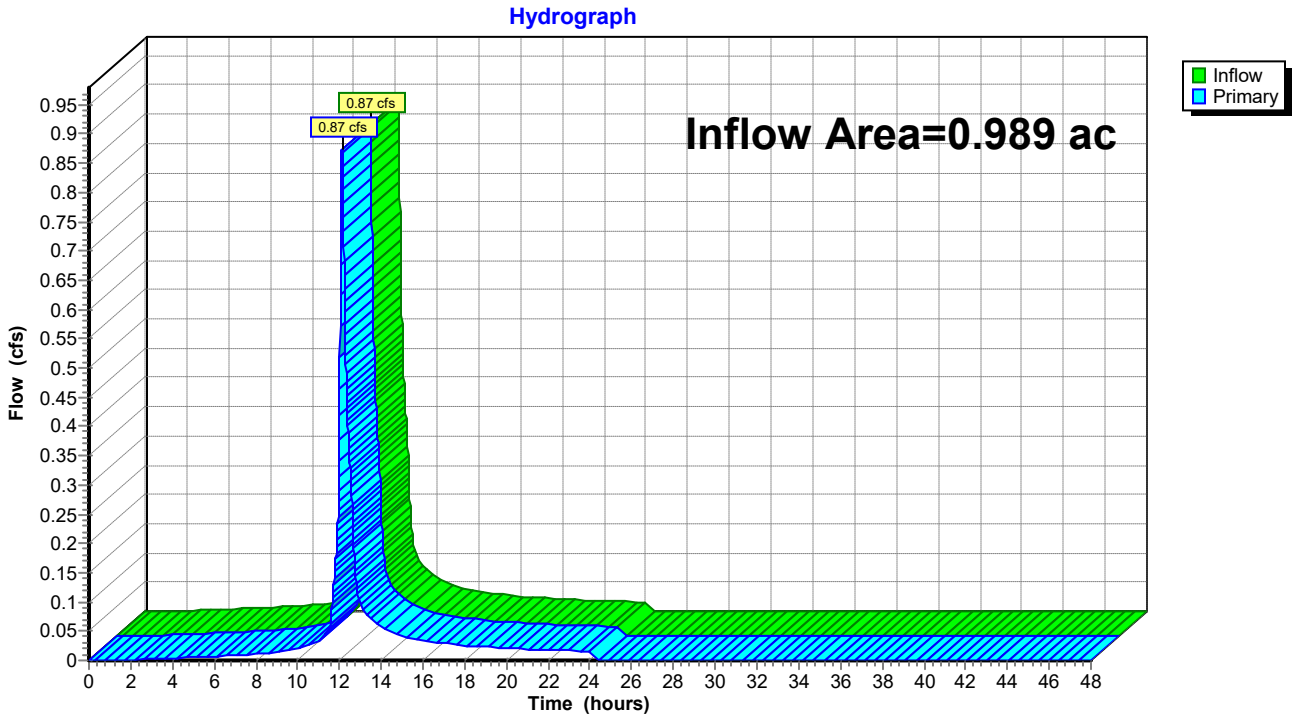


Summary for Link 1L: POA

Inflow Area = 0.989 ac, 27.81% Impervious, Inflow Depth = 0.92" for 1-yr event
Inflow = 0.87 cfs @ 12.12 hrs, Volume= 0.076 af
Primary = 0.87 cfs @ 12.12 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: POA



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

Subcatchment 1S: DA #1 TO POA Runoff Area=0.989 ac 27.81% Impervious Runoff Depth=1.24"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=1.23 cfs 0.103 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.294 ac 39.46% Impervious Runoff Depth=1.45"
Flow Length=83' Slope=0.0480 '/' Tc=6.4 min CN=WQ Runoff=0.54 cfs 0.036 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.423 ac 8.04% Impervious Runoff Depth=0.90"
Flow Length=302' Tc=7.4 min CN=WQ Runoff=0.45 cfs 0.032 af

Link 1L: POA Inflow=1.23 cfs 0.103 af
Primary=1.23 cfs 0.103 af

Total Runoff Area = 1.706 ac Runoff Volume = 0.170 af Average Runoff Depth = 1.19"
75.09% Pervious = 1.281 ac 24.91% Impervious = 0.425 ac

Summary for Subcatchment 1S: DA #1 TO POA

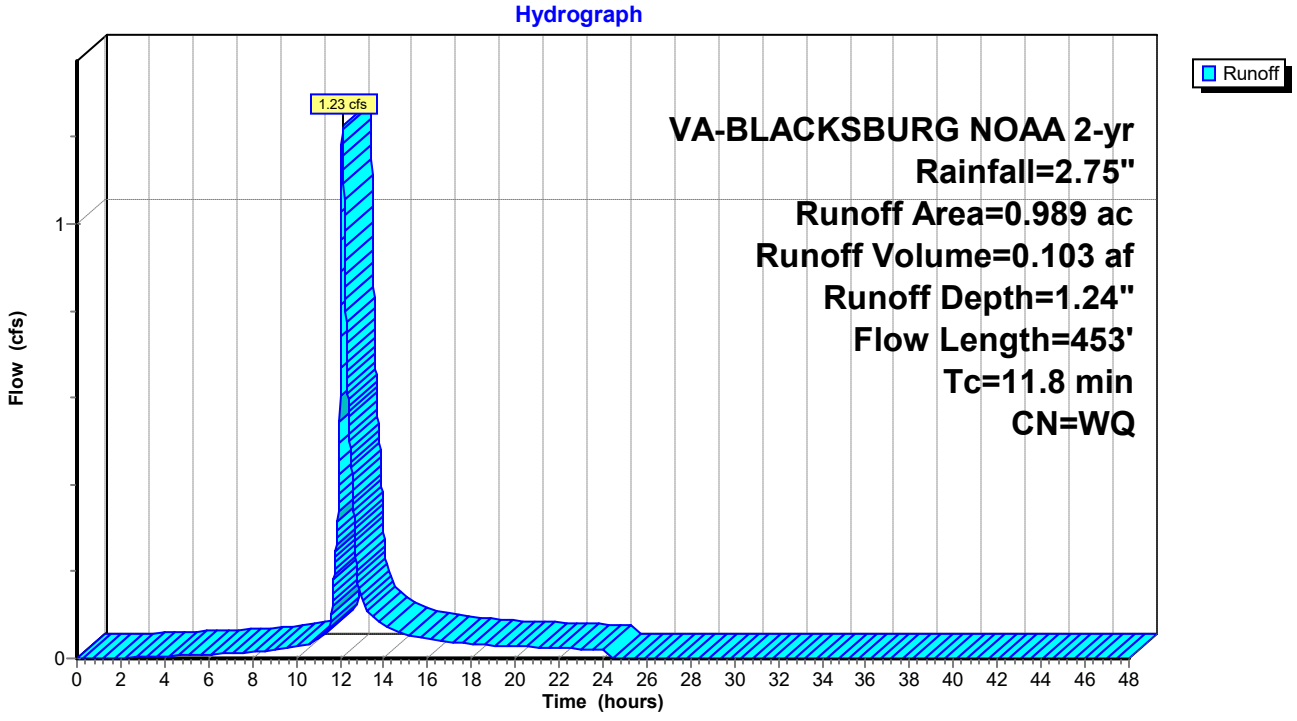
Runoff = 1.23 cfs @ 12.12 hrs, Volume= 0.103 af, Depth= 1.24"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.714	74	>75% Grass cover, Good, HSG C
0.275	98	Paved parking, HSG C
0.989		Weighted Average
0.714		72.19% Pervious Area
0.275		27.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1S: DA #1 TO POA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

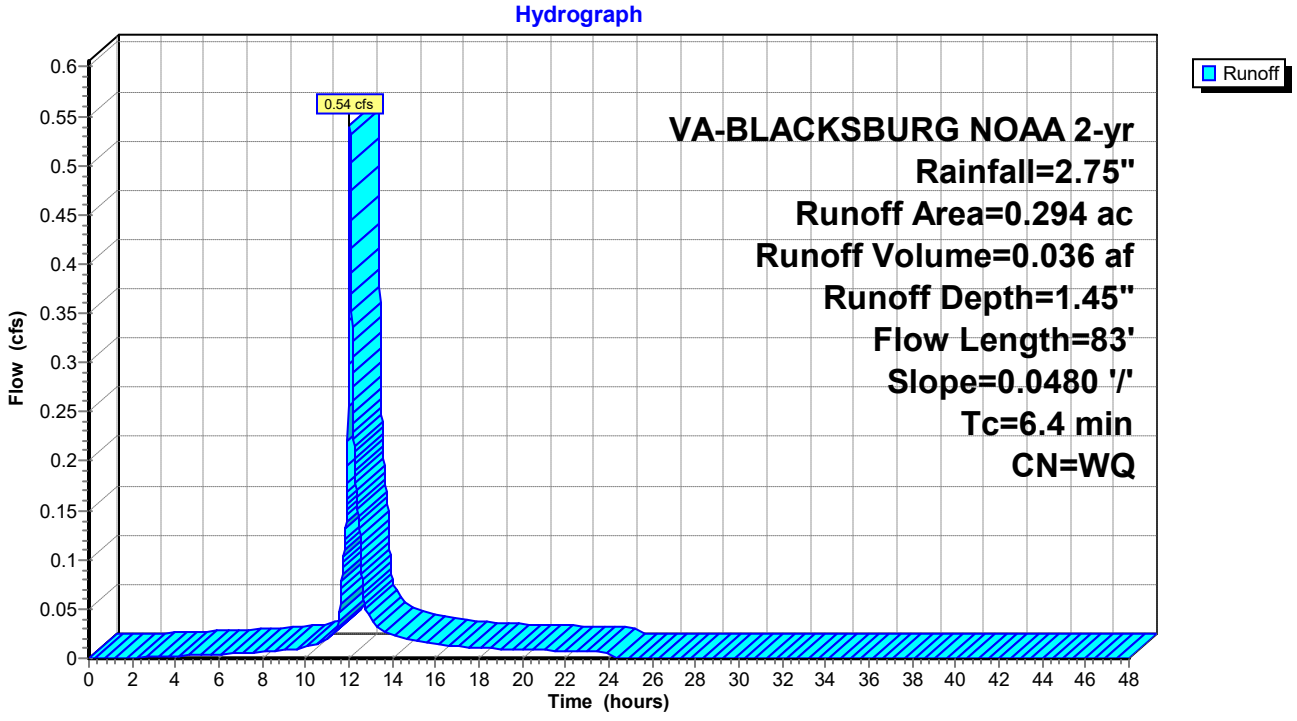
Runoff = 0.54 cfs @ 12.04 hrs, Volume= 0.036 af, Depth= 1.45"

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
0.178	74	>75% Grass cover, Good, HSG C
0.116	98	Paved parking, HSG C
0.294		Weighted Average
0.178		60.54% Pervious Area
0.116		39.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	83	0.0480	0.22		**Sheet Flow, Tc4** Grass: Short n= 0.150 P2= 2.76"

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

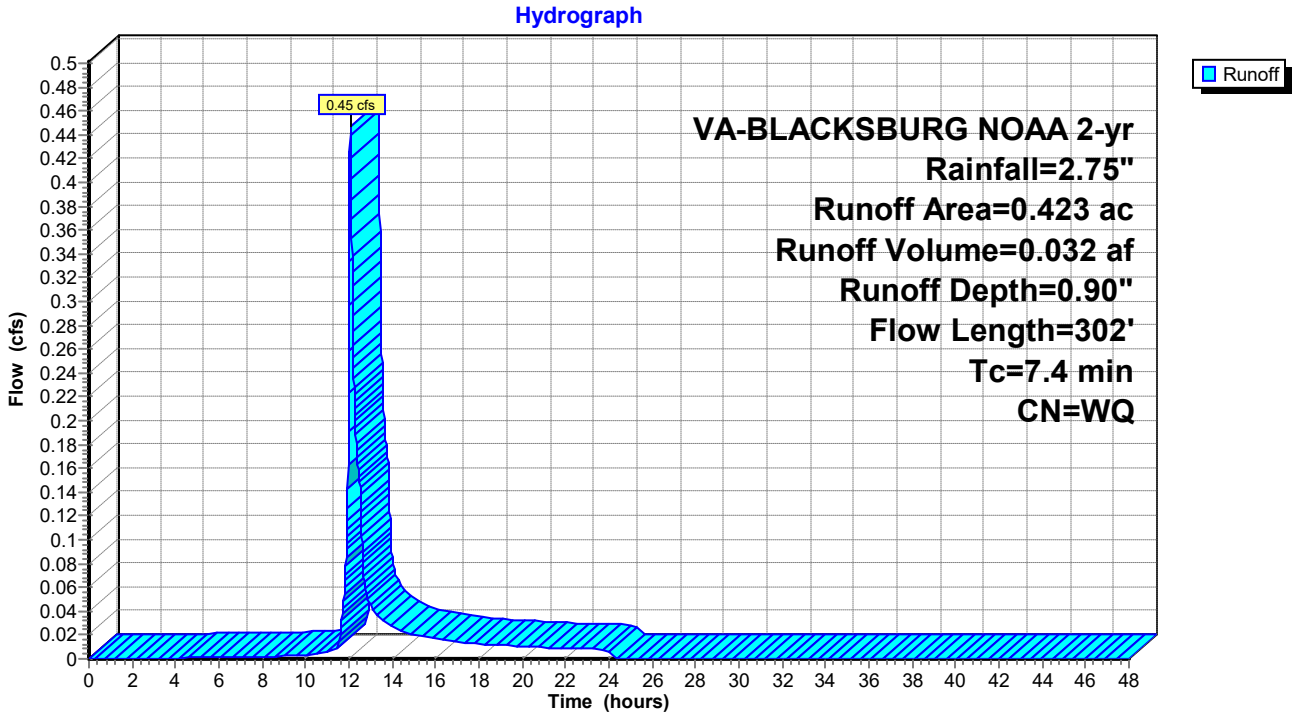
Runoff = 0.45 cfs @ 12.06 hrs, Volume= 0.032 af, Depth= 0.90"

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
0.389	74	>75% Grass cover, Good, HSG C
0.034	98	Paved parking, HSG C
0.423		Weighted Average
0.389		91.96% Pervious Area
0.034		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0600	0.25		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
0.6	202	0.1040	5.19		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
7.4	302	Total			

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

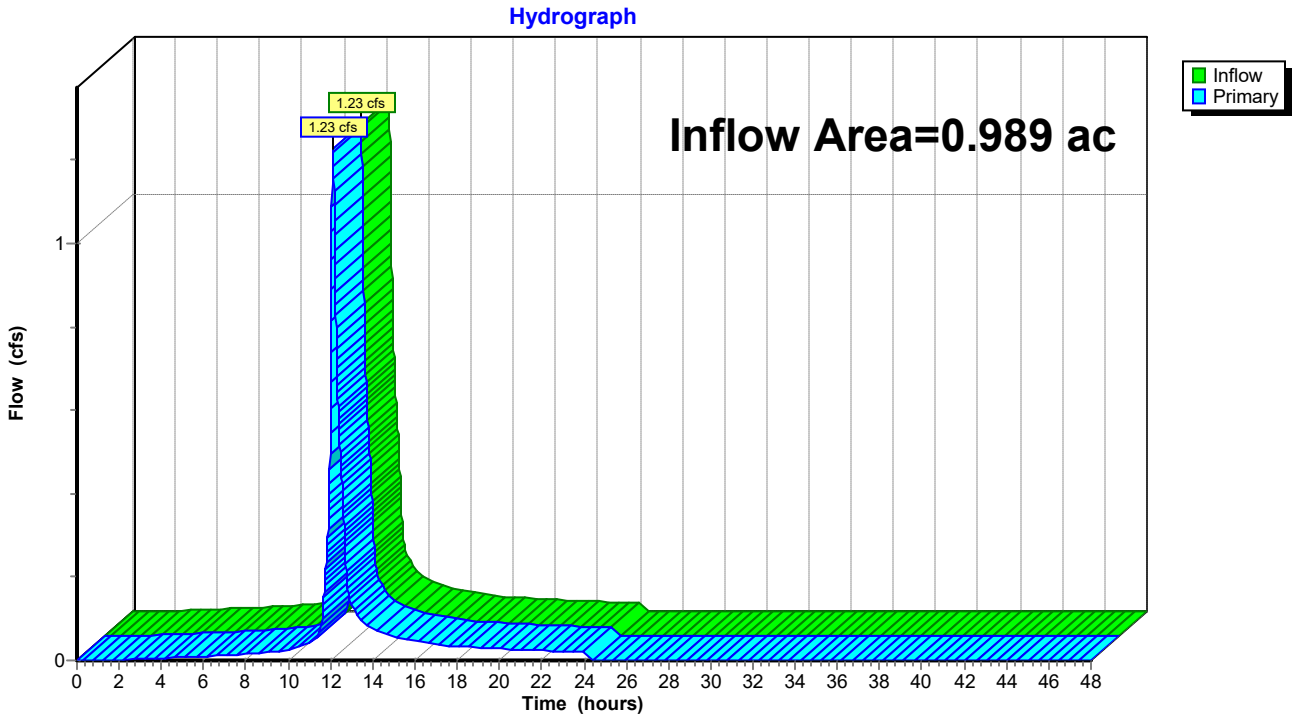


Summary for Link 1L: POA

Inflow Area = 0.989 ac, 27.81% Impervious, Inflow Depth = 1.24" for 2-yr event
Inflow = 1.23 cfs @ 12.12 hrs, Volume= 0.103 af
Primary = 1.23 cfs @ 12.12 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: POA



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

Subcatchment 1S: DA #1 TO POA Runoff Area=0.989 ac 27.81% Impervious Runoff Depth=2.27"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=2.18 cfs 0.187 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.294 ac 39.46% Impervious Runoff Depth=2.53"
Flow Length=83' Slope=0.0480 '/' Tc=6.4 min CN=WQ Runoff=0.89 cfs 0.062 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.423 ac 8.04% Impervious Runoff Depth=1.84"
Flow Length=302' Tc=7.4 min CN=WQ Runoff=0.92 cfs 0.065 af

Link 1L: POA Inflow=2.18 cfs 0.187 af
Primary=2.18 cfs 0.187 af

Total Runoff Area = 1.706 ac Runoff Volume = 0.314 af Average Runoff Depth = 2.21"
75.09% Pervious = 1.281 ac 24.91% Impervious = 0.425 ac

Summary for Subcatchment 1S: DA #1 TO POA

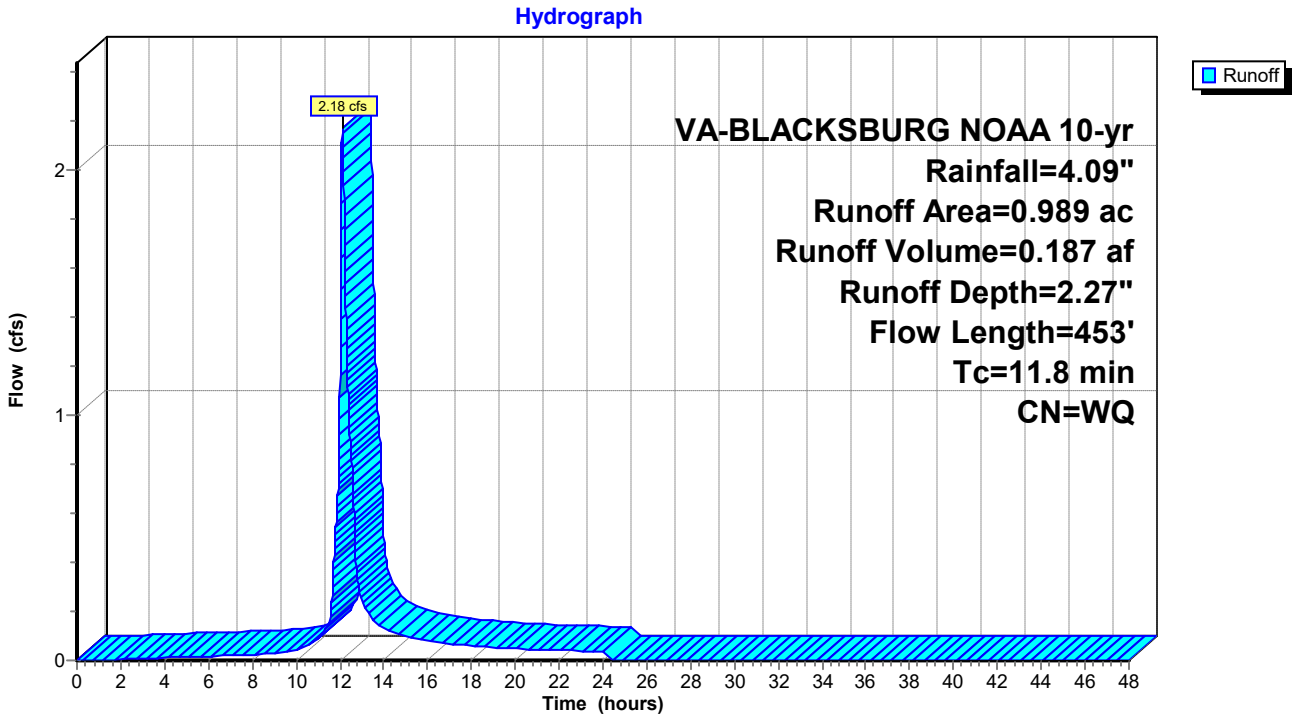
Runoff = 2.18 cfs @ 12.12 hrs, Volume= 0.187 af, Depth= 2.27"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.714	74	>75% Grass cover, Good, HSG C
0.275	98	Paved parking, HSG C
0.989		Weighted Average
0.714		72.19% Pervious Area
0.275		27.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1S: DA #1 TO POA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

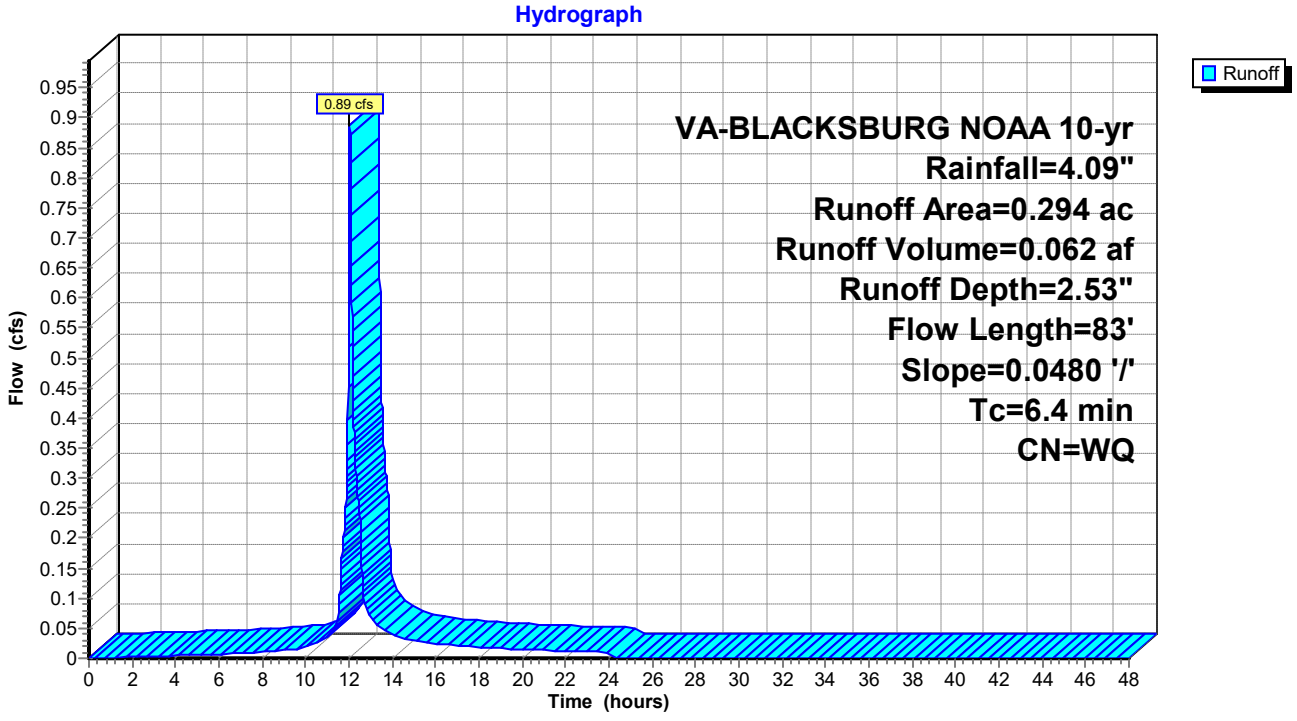
Runoff = 0.89 cfs @ 12.04 hrs, Volume= 0.062 af, Depth= 2.53"

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
0.178	74	>75% Grass cover, Good, HSG C
0.116	98	Paved parking, HSG C
0.294		Weighted Average
0.178		60.54% Pervious Area
0.116		39.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	83	0.0480	0.22		**Sheet Flow, Tc4** Grass: Short n= 0.150 P2= 2.76"

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

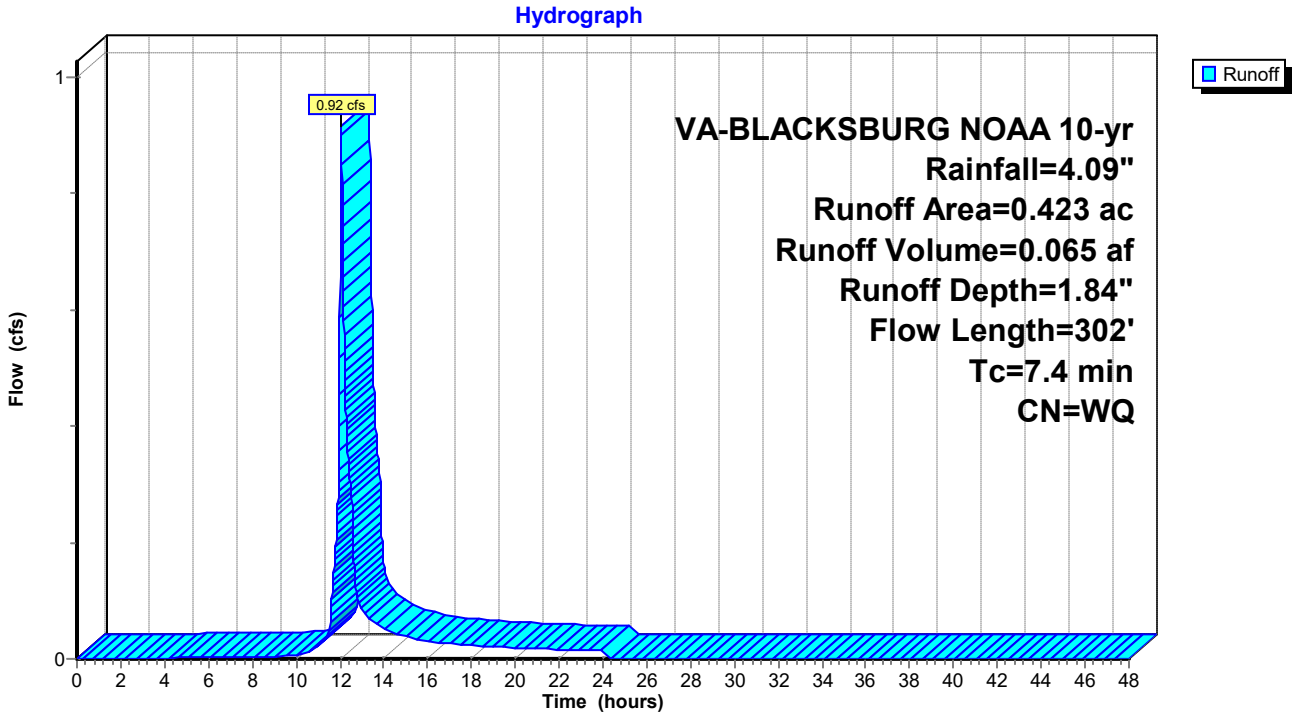
Runoff = 0.92 cfs @ 12.06 hrs, Volume= 0.065 af, Depth= 1.84"

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
0.389	74	>75% Grass cover, Good, HSG C
0.034	98	Paved parking, HSG C
0.423		Weighted Average
0.389		91.96% Pervious Area
0.034		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0600	0.25		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
0.6	202	0.1040	5.19		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
7.4	302	Total			

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

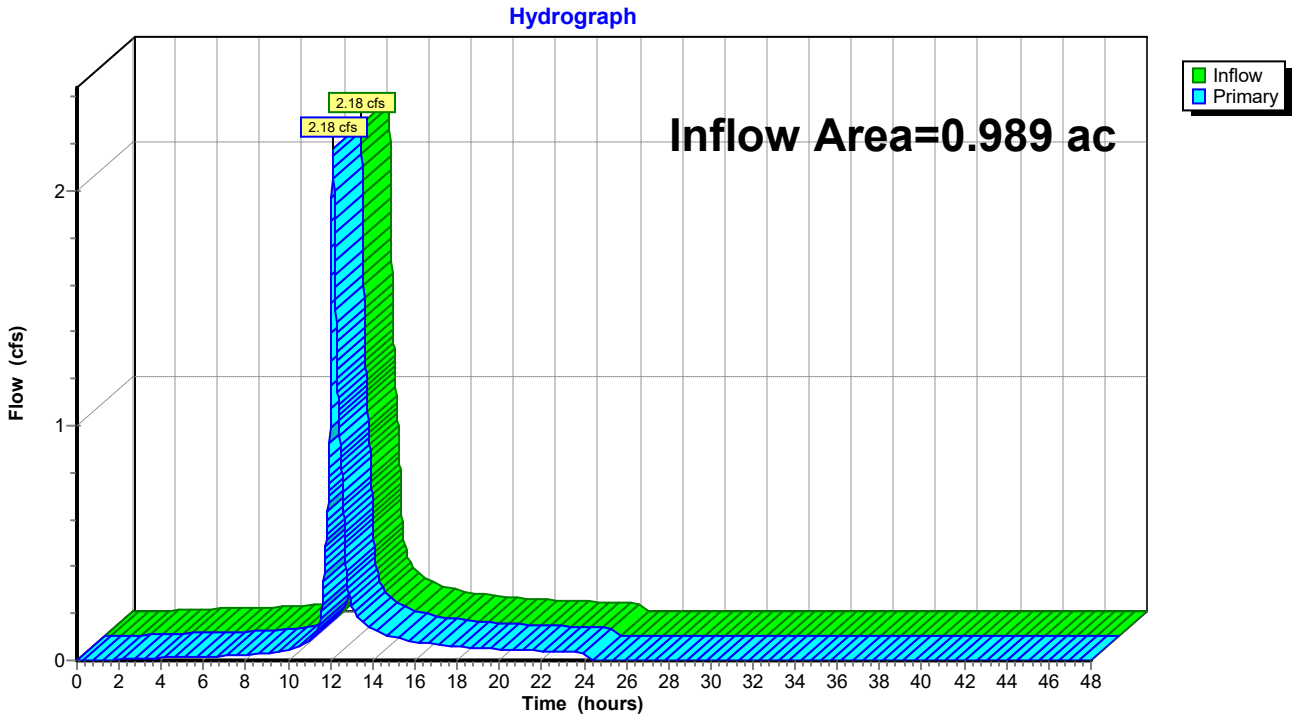


Summary for Link 1L: POA

Inflow Area = 0.989 ac, 27.81% Impervious, Inflow Depth = 2.27" for 10-yr event
Inflow = 2.18 cfs @ 12.12 hrs, Volume= 0.187 af
Primary = 2.18 cfs @ 12.12 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: POA



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

Subcatchment 1S: DA #1 TO POA Runoff Area=0.989 ac 27.81% Impervious Runoff Depth=4.33"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=3.65 cfs 0.357 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.294 ac 39.46% Impervious Runoff Depth=4.64"
Flow Length=83' Slope=0.0480 '/' Tc=6.4 min CN=WQ Runoff=1.40 cfs 0.114 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.423 ac 8.04% Impervious Runoff Depth=3.81"
Flow Length=302' Tc=7.4 min CN=WQ Runoff=1.66 cfs 0.134 af

Link 1L: POA Inflow=3.65 cfs 0.357 af
Primary=3.65 cfs 0.357 af

Total Runoff Area = 1.706 ac Runoff Volume = 0.605 af Average Runoff Depth = 4.25"
75.09% Pervious = 1.281 ac 24.91% Impervious = 0.425 ac

Summary for Subcatchment 1S: DA #1 TO POA

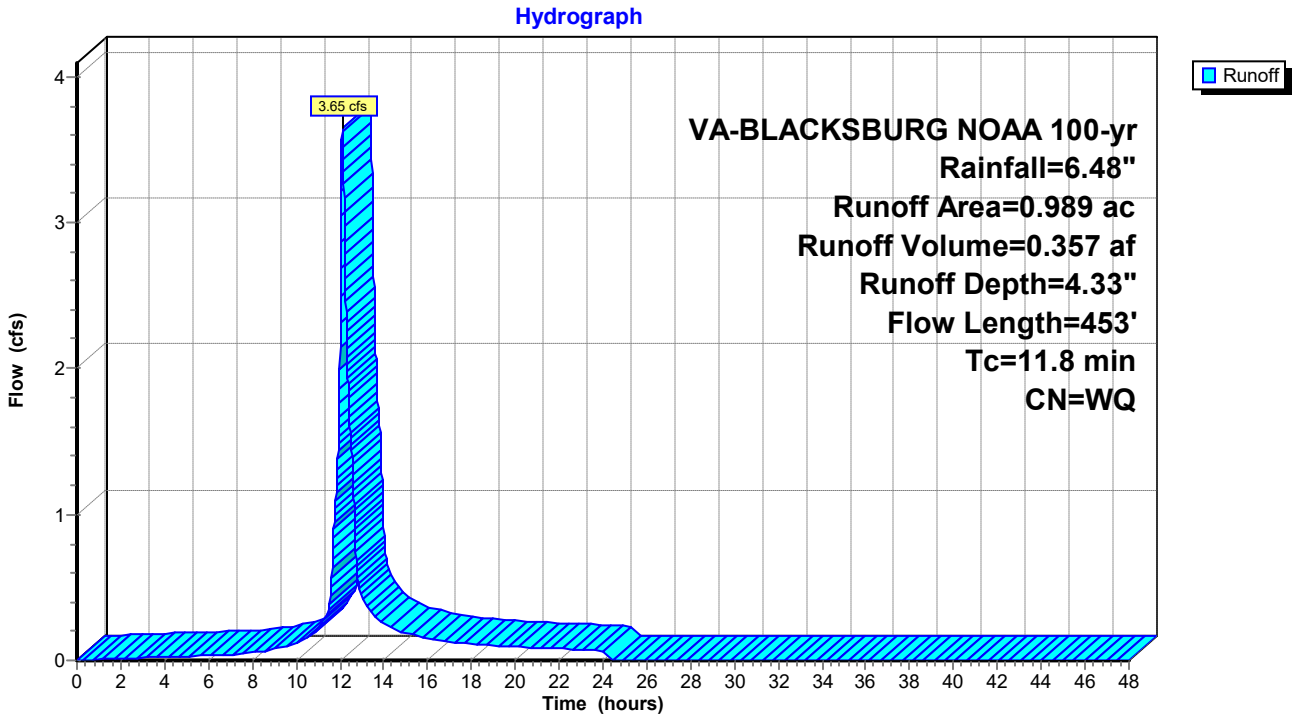
Runoff = 3.65 cfs @ 12.12 hrs, Volume= 0.357 af, Depth= 4.33"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.714	74	>75% Grass cover, Good, HSG C
0.275	98	Paved parking, HSG C
0.989		Weighted Average
0.714		72.19% Pervious Area
0.275		27.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1S: DA #1 TO POA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

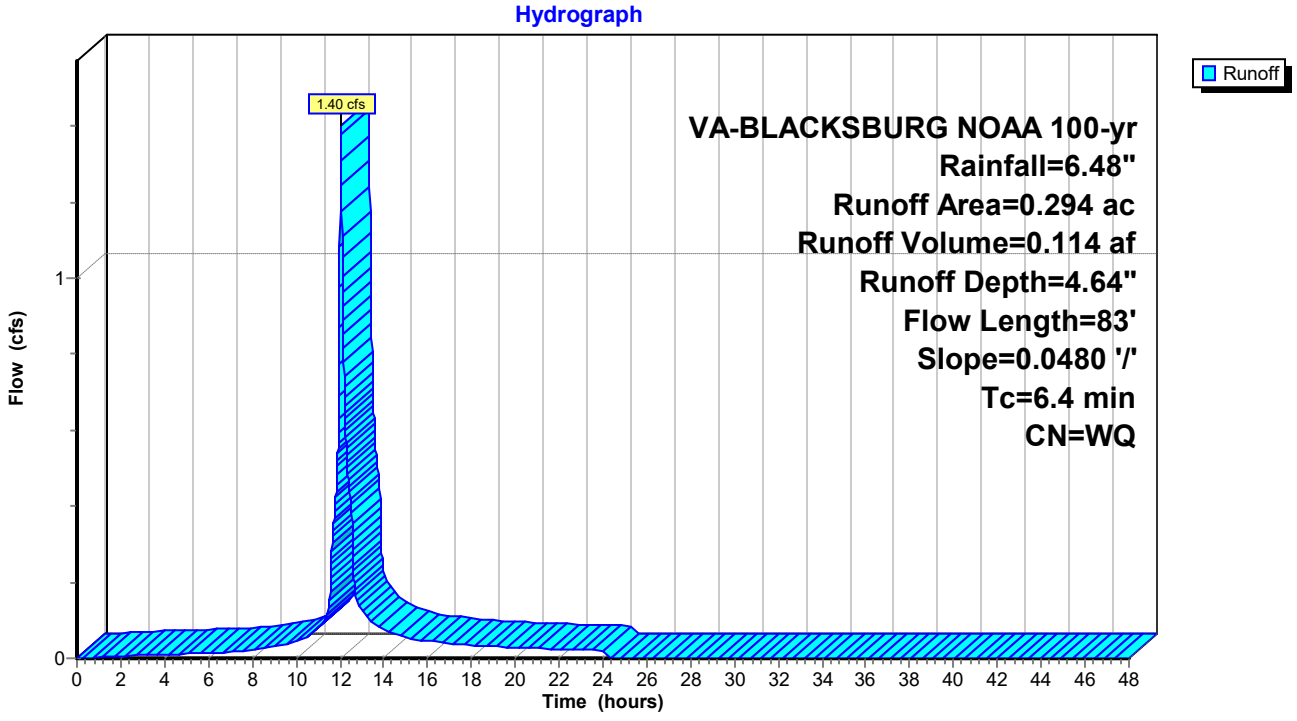
Runoff = 1.40 cfs @ 12.04 hrs, Volume= 0.114 af, Depth= 4.64"

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
0.178	74	>75% Grass cover, Good, HSG C
0.116	98	Paved parking, HSG C
0.294		Weighted Average
0.178		60.54% Pervious Area
0.116		39.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	83	0.0480	0.22		**Sheet Flow, Tc4** Grass: Short n= 0.150 P2= 2.76"

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

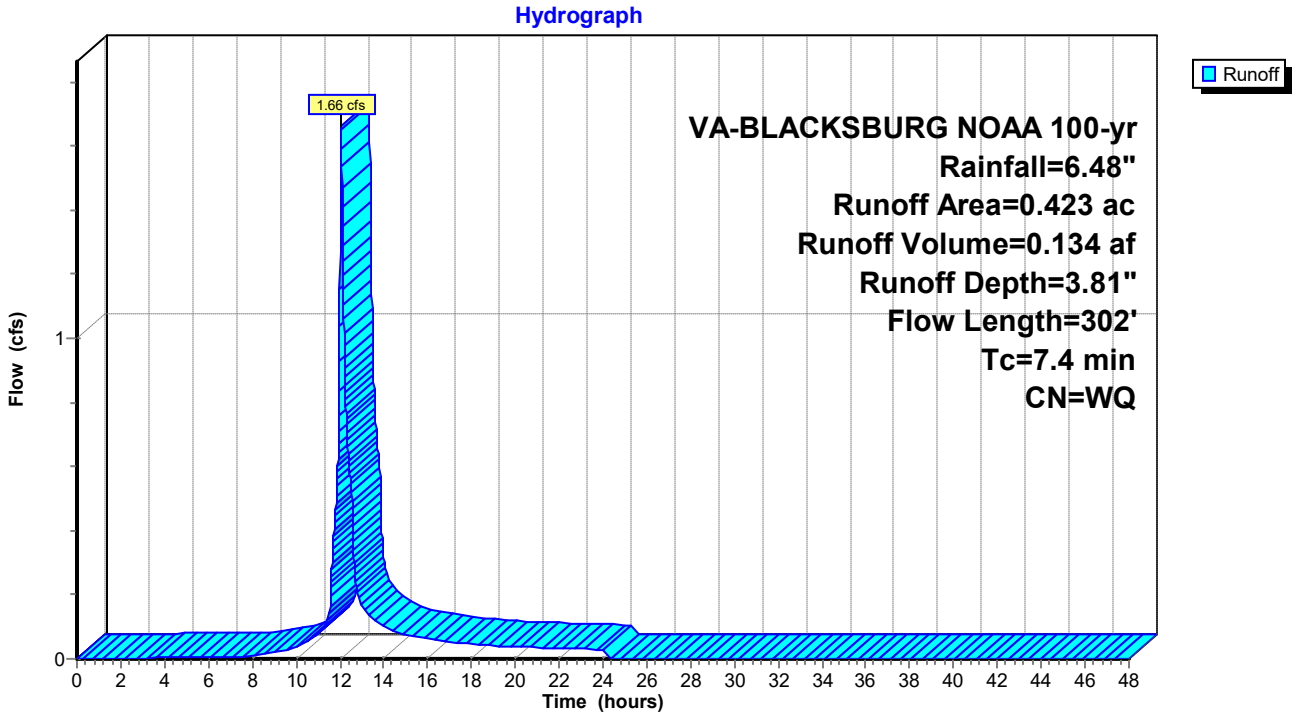
Runoff = 1.66 cfs @ 12.06 hrs, Volume= 0.134 af, Depth= 3.81"

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
0.389	74	>75% Grass cover, Good, HSG C
0.034	98	Paved parking, HSG C
0.423		Weighted Average
0.389		91.96% Pervious Area
0.034		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0600	0.25		**Sheet Flow, Tc5** Grass: Short n= 0.150 P2= 2.76"
0.6	202	0.1040	5.19		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
7.4	302	Total			

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

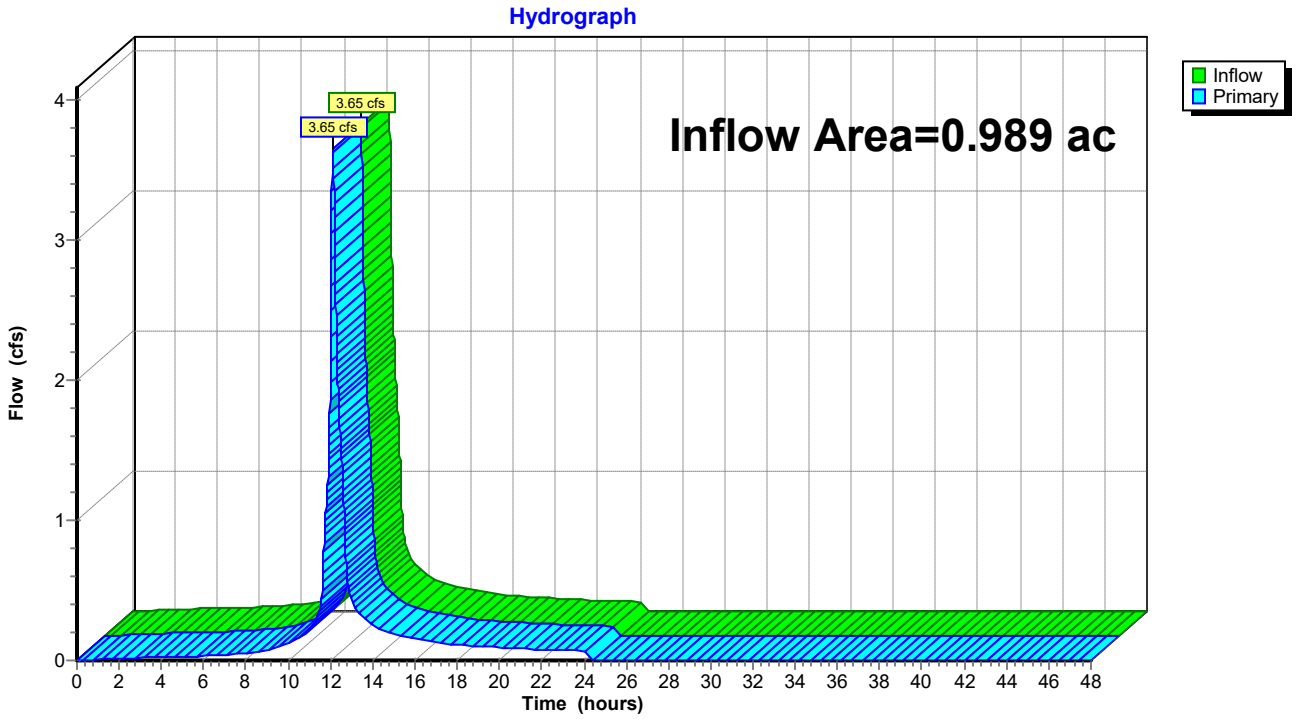


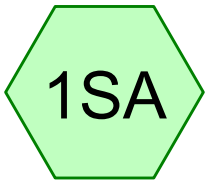
Summary for Link 1L: POA

Inflow Area = 0.989 ac, 27.81% Impervious, Inflow Depth = 4.33" for 100-yr event
Inflow = 3.65 cfs @ 12.12 hrs, Volume= 0.357 af
Primary = 3.65 cfs @ 12.12 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

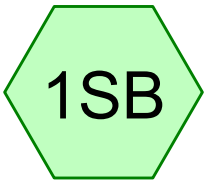
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA





DA #1 PRE



DA #1 POST

Subcat Reach Pond Link

Routing Diagram for RV CALC

Prepared by Balzer & Associates, Inc, Printed 9/30/2024

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 1SA: DA #1 PRE Runoff Area=0.935 ac 28.66% Impervious Runoff Depth=0.93"
Tc=0.0 min CN=WQ Runoff=1.39 cfs 0.072 af

Subcatchment 1SB: DA #1 POST Runoff Area=60,520 sf 71.48% Impervious Runoff Depth=1.60"
Tc=0.0 min CN=WQ Runoff=3.42 cfs 0.185 af

Summary for Subcatchment 1SA: DA #1 PRE

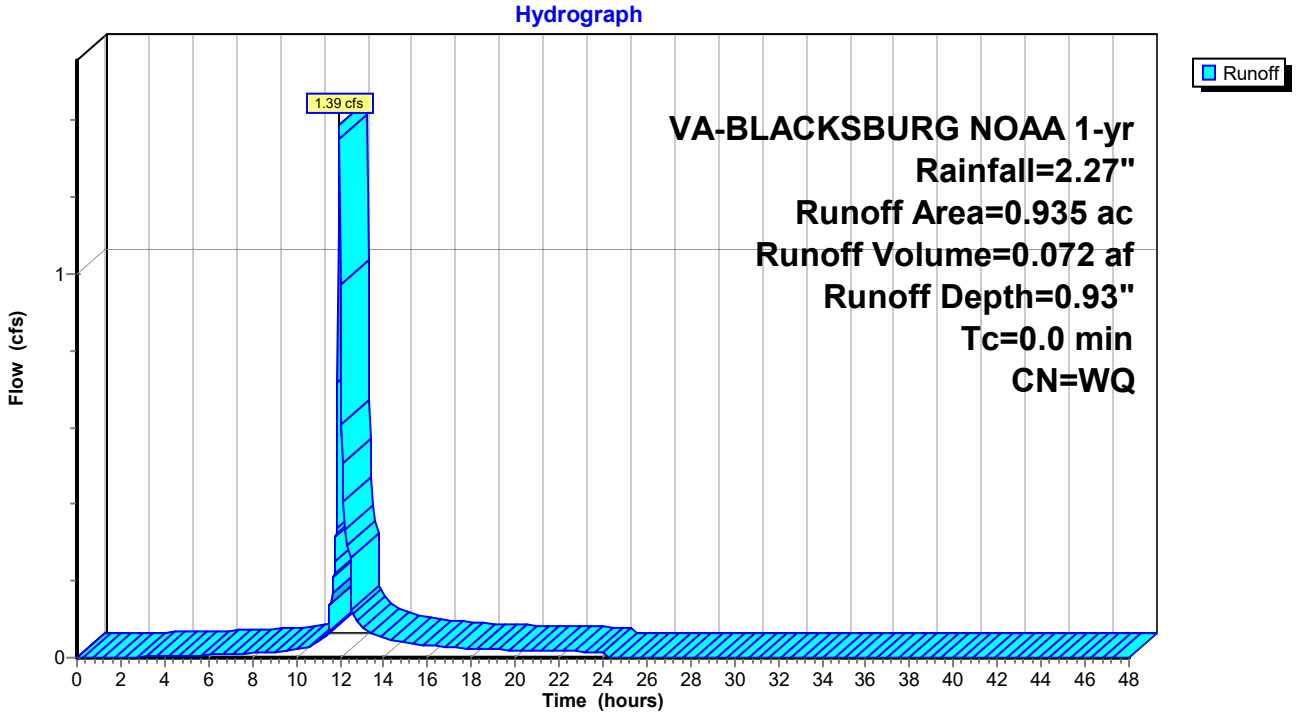
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.39 cfs @ 11.99 hrs, Volume= 0.072 af, Depth= 0.93"

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
0.667	74	>75% Grass cover, Good, HSG C
0.268	98	Paved parking, HSG C
0.935		Weighted Average
0.667		71.34% Pervious Area
0.268		28.66% Impervious Area

Subcatchment 1SA: DA #1 PRE



Summary for Subcatchment 1SB: DA #1 POST

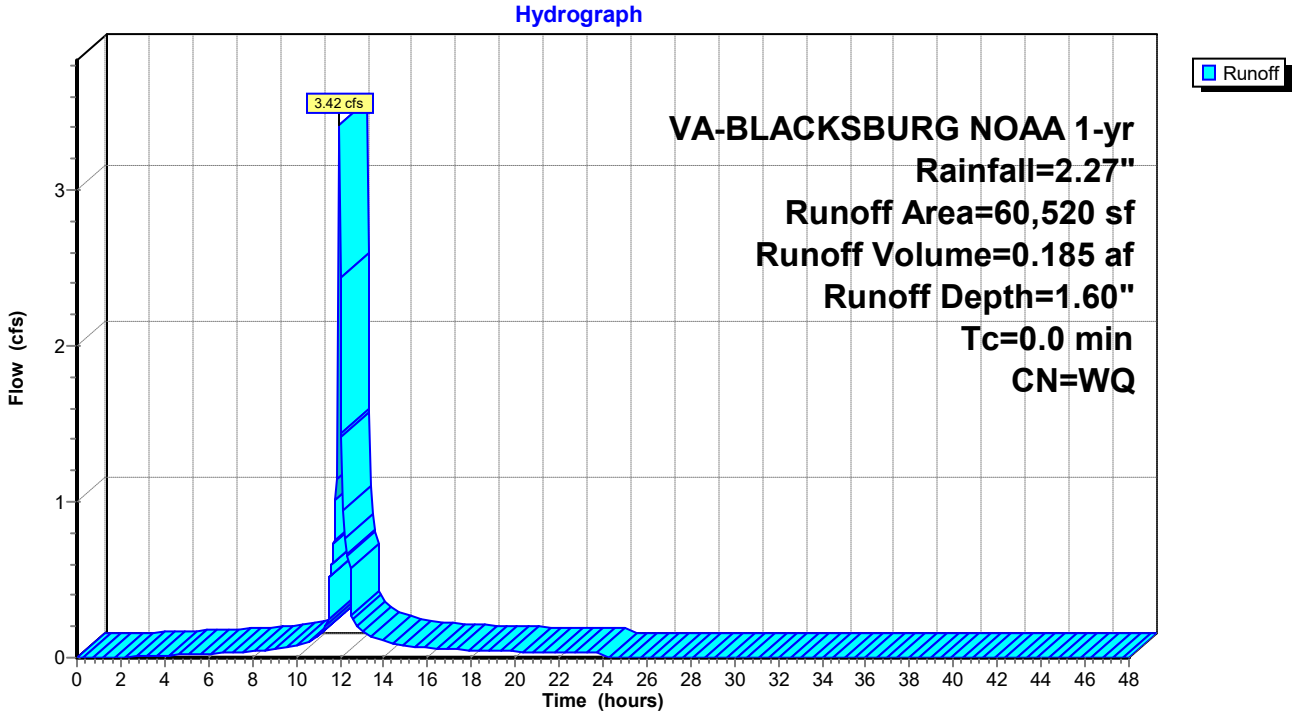
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

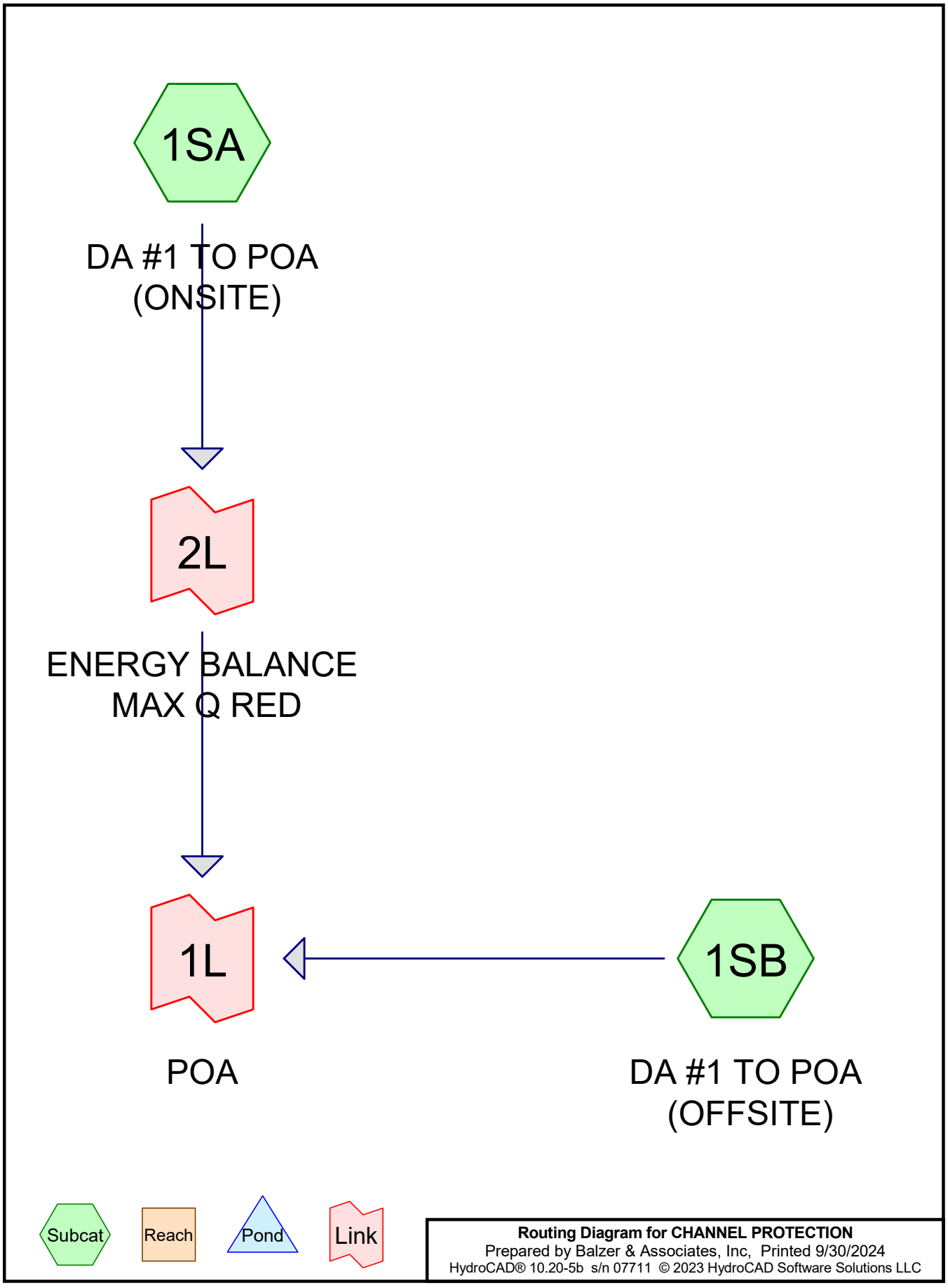
Runoff = 3.42 cfs @ 11.99 hrs, Volume= 0.185 af, Depth= 1.60"

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 (sf)	CN	Description
17,263	74	>75% Grass cover, Good, HSG C
43,257	98	Paved parking, HSG C
60,520		Weighted Average
17,263		28.52% Pervious Area
43,257		71.48% Impervious Area

Subcatchment 1SB: DA #1 POST





Routing Diagram for CHANNEL PROTECTION
Prepared by Balzer & Associates, Inc, Printed 9/30/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.714	74	>75% Grass cover, Good, HSG C (1SA, 1SB)
0.275	98	Paved parking, HSG C (1SA, 1SB)
0.989	**81**	**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 1SA: DA #1 TO POA Runoff Area=0.935 ac 28.66% Impervious Runoff Depth=0.93"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=0.84 cfs 0.072 af

Subcatchment 1SB: DA #1 TO POA Runoff Area=2,373 sf 13.36% Impervious Runoff Depth=0.69"
Flow Length=453' Tc=11.8 min CN=WQ Runoff=0.03 cfs 0.003 af

Link 1L: POA Inflow=0.30 cfs 0.026 af
Primary=0.30 cfs 0.026 af

Link 2L: ENERGY BALANCE MAX Q RED x 0.31 Inflow=0.84 cfs 0.072 af
Primary=0.26 cfs 0.022 af Secondary=0.58 cfs 0.050 af

Total Runoff Area = 0.989 ac Runoff Volume = 0.076 af Average Runoff Depth = 0.92"
72.18% Pervious = 0.714 ac 27.82% Impervious = 0.275 ac

Summary for Subcatchment 1SA: DA #1 TO POA (ONSITE)

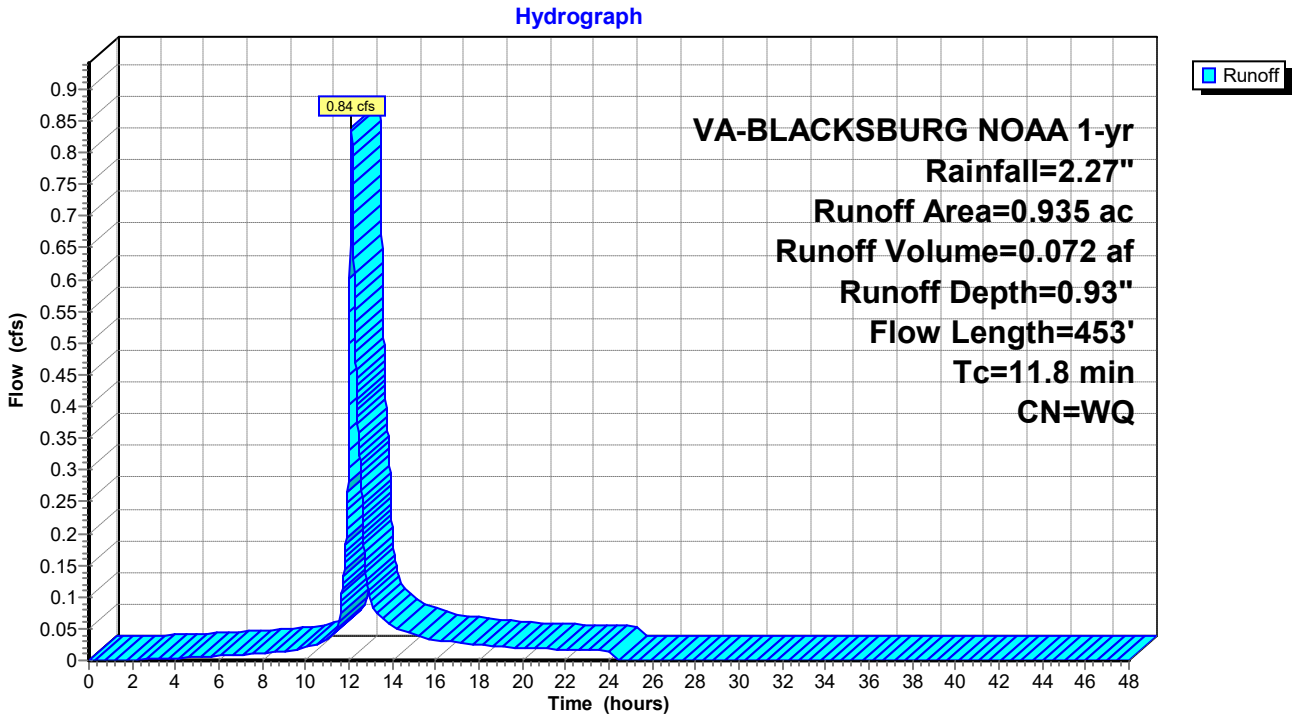
Runoff = 0.84 cfs @ 12.12 hrs, Volume= 0.072 af, Depth= 0.93"
Routed to Link 2L : ENERGY BALANCE MAX Q RED

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
0.667	74	>75% Grass cover, Good, HSG C
0.268	98	Paved parking, HSG C
0.935		Weighted Average
0.667		71.34% Pervious Area
0.268		28.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1SA: DA #1 TO POA (ONSITE)



Summary for Subcatchment 1SB: DA #1 TO POA (OFFSITE)

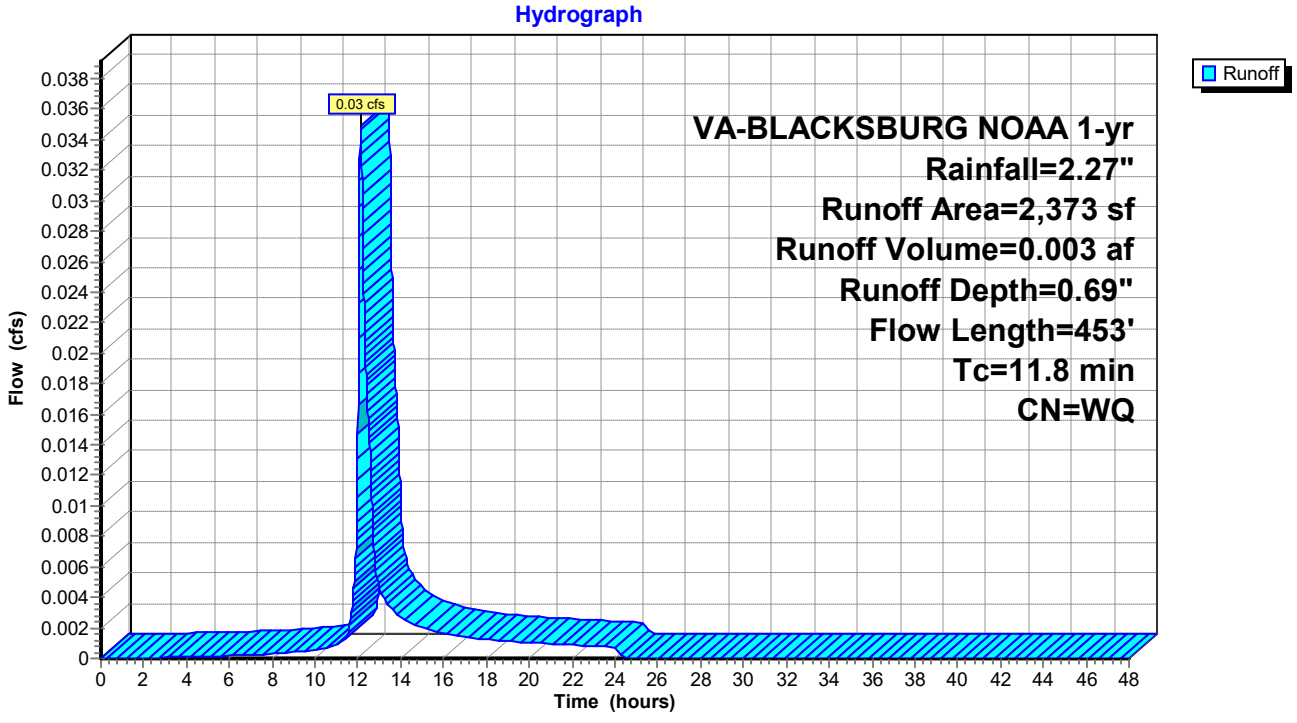
Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 0.69"
Routed to Link 1L : POA

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

Area (sf)	CN	Description
2,056	74	>75% Grass cover, Good, HSG C
317	98	Paved parking, HSG C
2,373		Weighted Average
2,056		86.64% Pervious Area
317		13.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
1.2	353	0.0935	4.92		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
11.8	453	Total			

Subcatchment 1SB: DA #1 TO POA (OFFSITE)

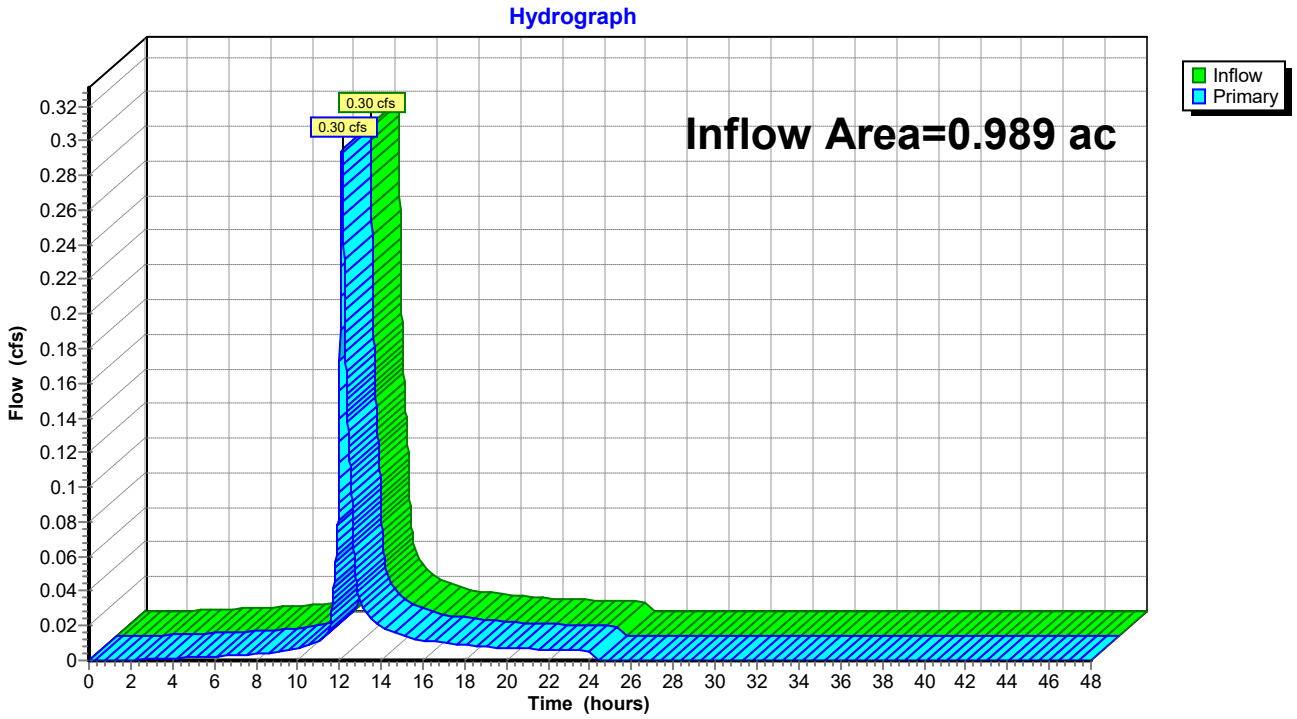


Summary for Link 1L: POA

Inflow Area = 0.989 ac, 27.82% Impervious, Inflow Depth = 0.31" for 1-yr event
Inflow = 0.30 cfs @ 12.12 hrs, Volume= 0.026 af
Primary = 0.30 cfs @ 12.12 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: POA

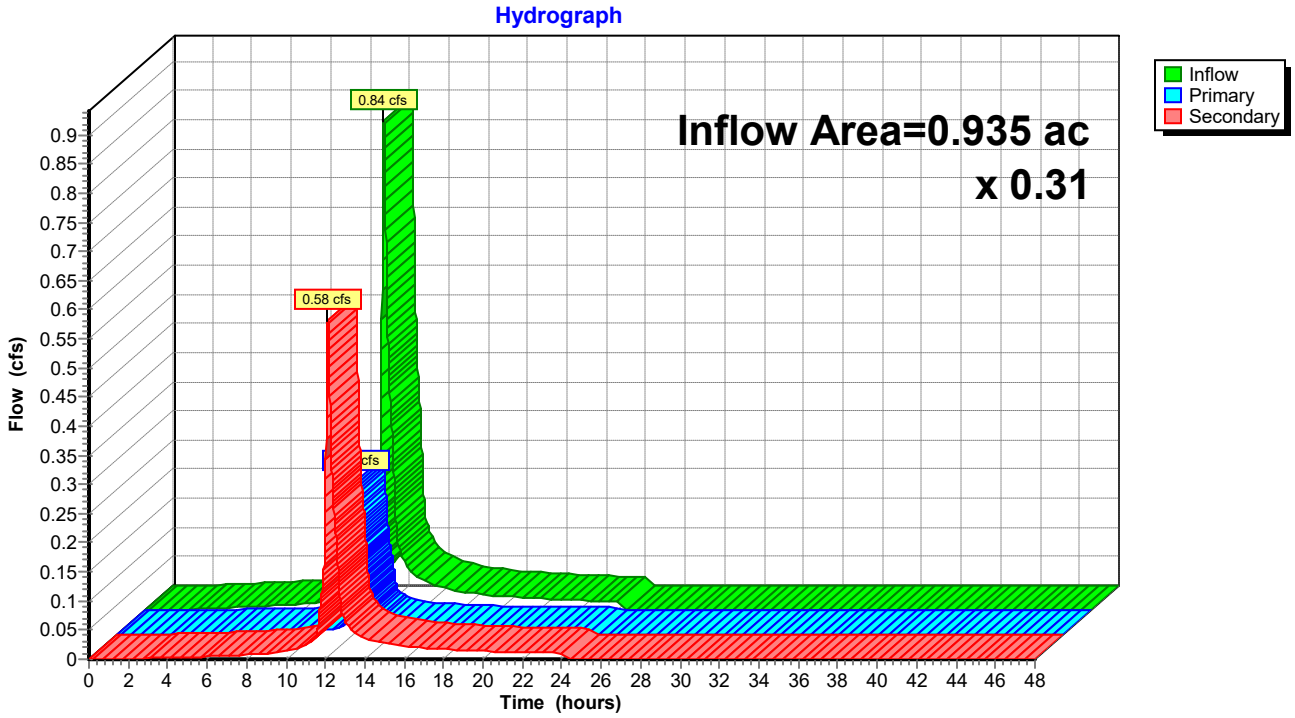


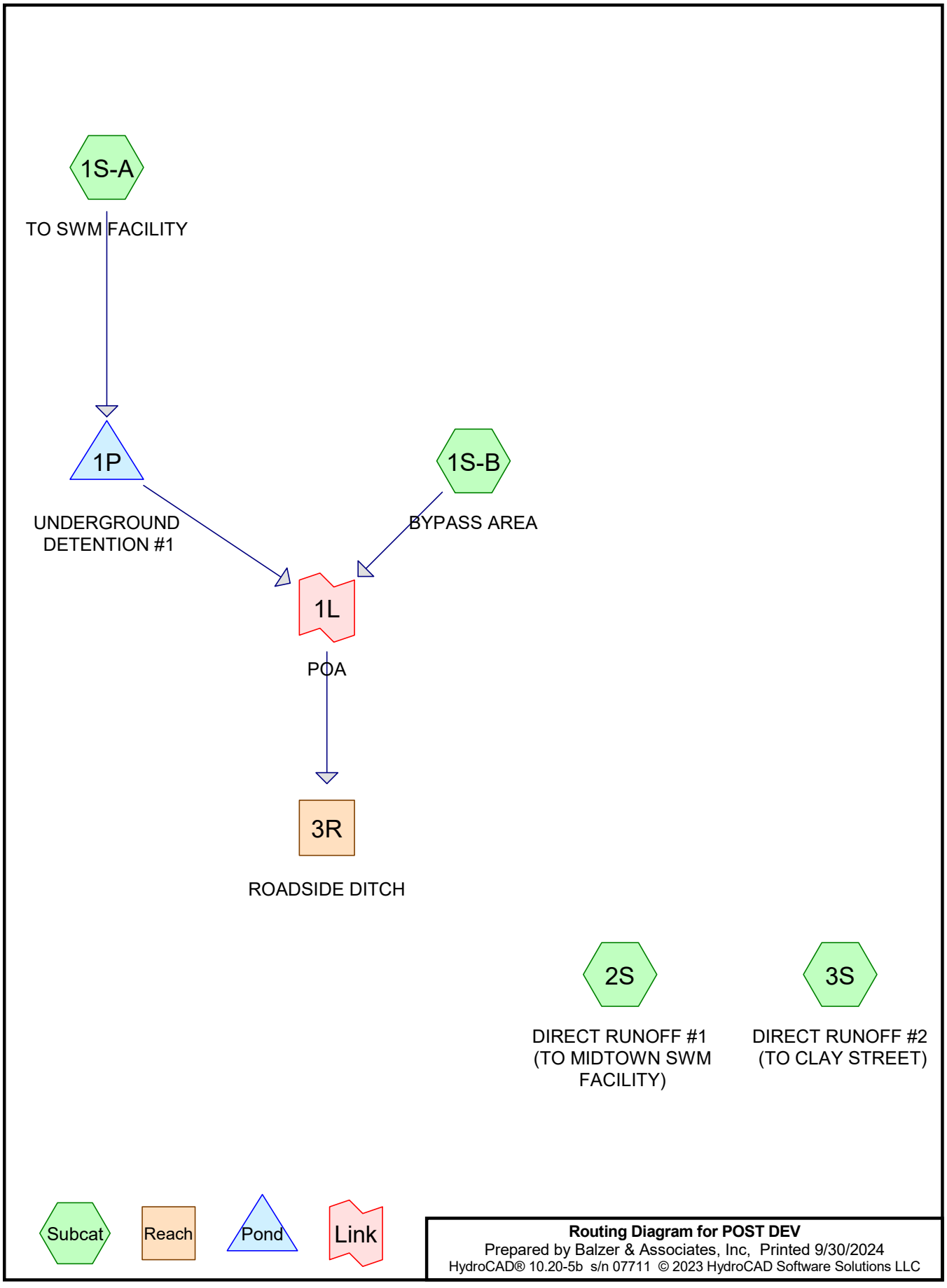
Summary for Link 2L: ENERGY BALANCE MAX Q RED

Inflow Area = 0.935 ac, 28.66% Impervious, Inflow Depth = 0.93" for 1-yr event
Inflow = 0.84 cfs @ 12.12 hrs, Volume= 0.072 af
Primary = 0.26 cfs @ 12.12 hrs, Volume= 0.022 af, Atten= 69%, Lag= 0.0 min
Routed to Link 1L : POA
Secondary = 0.58 cfs @ 12.12 hrs, Volume= 0.050 af

Primary outflow = Inflow x 0.31, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: ENERGY BALANCE MAX Q RED





Routing Diagram for POST DEV
Prepared by Balzer & Associates, Inc, Printed 9/30/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.739	74	>75% Grass cover, Good, HSG C (1S-A, 1S-B, 2S, 3S)
1.041	98	Paved parking, HSG C (1S-A, 1S-B)
1.780	**88**	**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-A: TO SWM FACILITY Runoff Area=1.370 ac 75.77% Impervious Runoff Depth=1.66"
Tc=6.0 min CN=WQ Runoff=3.01 cfs 0.190 af

Subcatchment 1S-B: BYPASS AREA Runoff Area=0.129 ac 2.33% Impervious Runoff Depth=0.52"
Flow Length=173' Tc=6.0 min CN=WQ Runoff=0.08 cfs 0.006 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.132 ac 0.00% Impervious Runoff Depth=0.48"
Tc=0.0 min CN=74 Runoff=0.10 cfs 0.005 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.149 ac 0.00% Impervious Runoff Depth=0.48"
Tc=0.0 min CN=74 Runoff=0.12 cfs 0.006 af

Reach 3R: ROADSIDE DITCH Avg. Flow Depth=0.19' Max Vel=3.03 fps Inflow=0.23 cfs 0.196 af
n=0.030 L=42.5' S=0.1007 '/' Capacity=9.74 cfs Outflow=0.23 cfs 0.196 af

Pond 1P: UNDERGROUND DETENTION #1 Peak Elev=2,130.47' Storage=0.083 af Inflow=3.01 cfs 0.190 af
Outflow=0.18 cfs 0.190 af

Link 1L: POA Inflow=0.23 cfs 0.196 af
Primary=0.23 cfs 0.196 af

Total Runoff Area = 1.780 ac Runoff Volume = 0.207 af Average Runoff Depth = 1.40"
41.52% Pervious = 0.739 ac 58.48% Impervious = 1.041 ac

Summary for Subcatchment 1S-A: TO SWM FACILITY

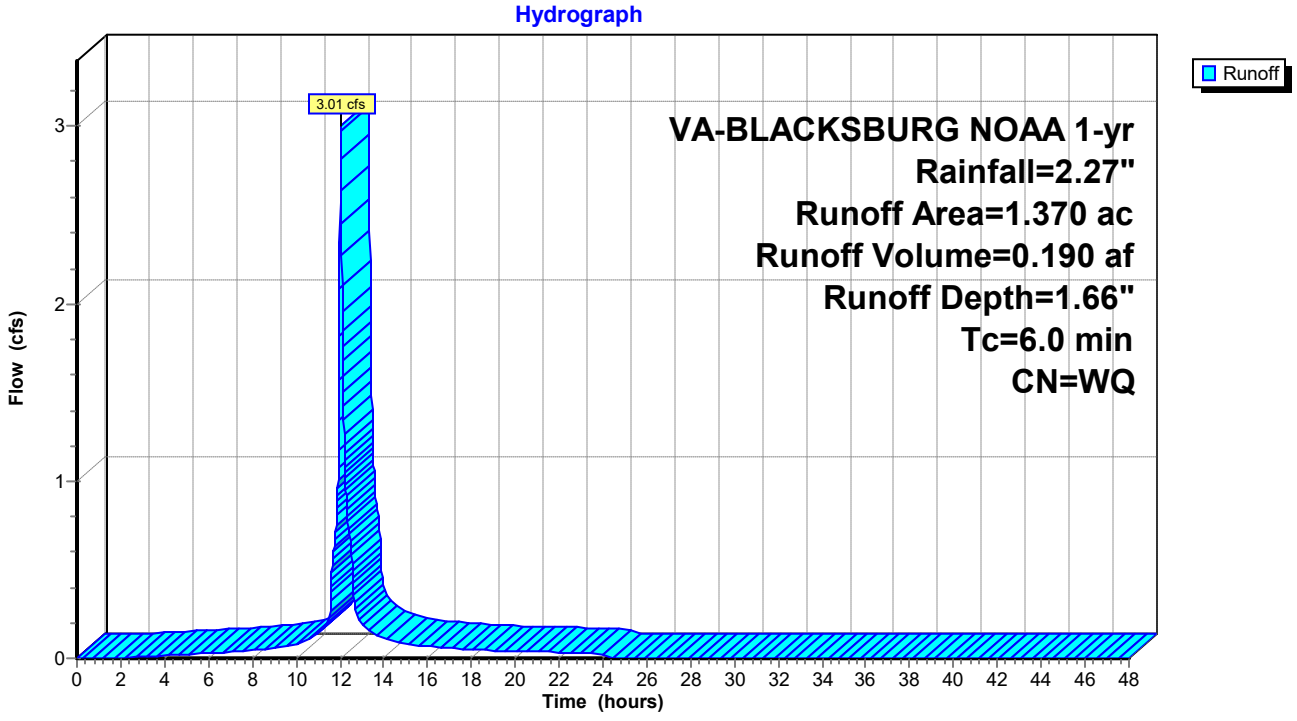
Runoff = 3.01 cfs @ 12.04 hrs, Volume= 0.190 af, Depth= 1.66"
Routed to Pond 1P : UNDERGROUND DETENTION #1

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
0.332	74	>75% Grass cover, Good, HSG C
1.038	98	Paved parking, HSG C
1.370		Weighted Average
0.332		24.23% Pervious Area
1.038		75.77% Impervious Area

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

Subcatchment 1S-A: TO SWM FACILITY



Summary for Subcatchment 1S-B: BYPASS AREA

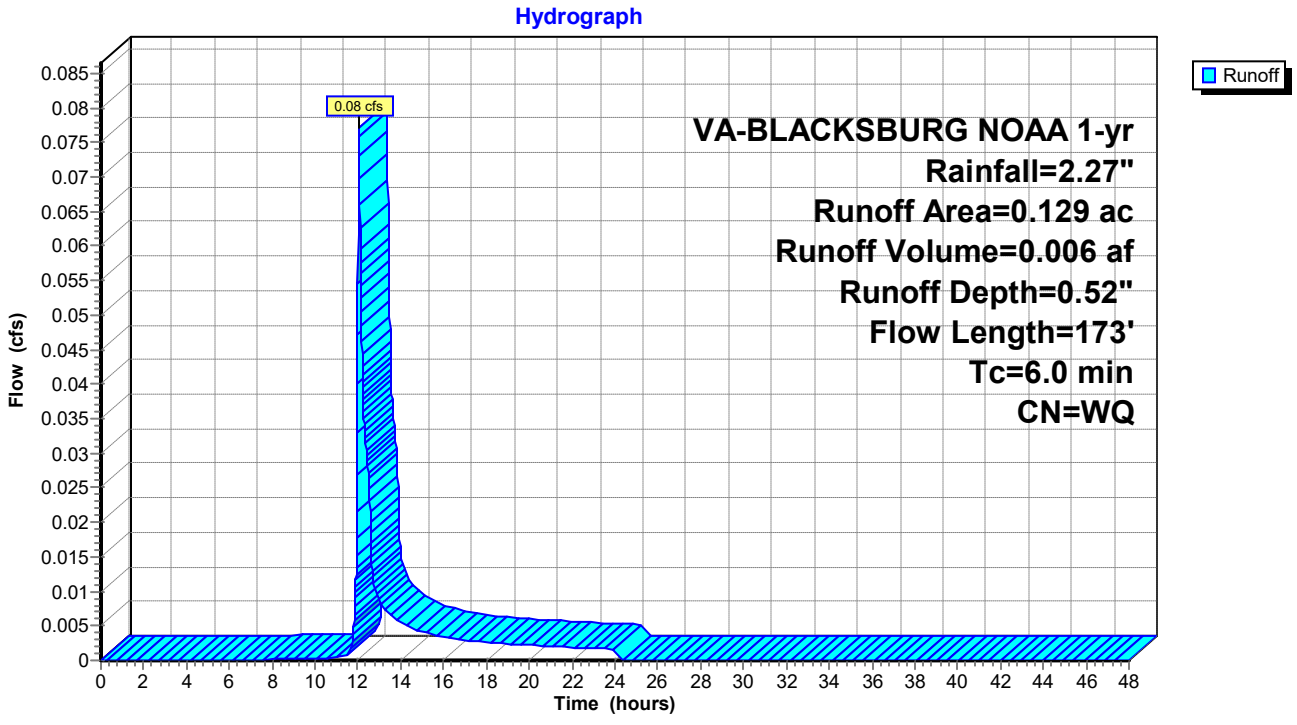
Runoff = 0.08 cfs @ 12.05 hrs, Volume= 0.006 af, Depth= 0.52"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.126	74	>75% Grass cover, Good, HSG C
0.003	98	Paved parking, HSG C
0.129		Weighted Average
0.126		97.67% Pervious Area
0.003		2.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1250	0.33		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
0.2	73	0.1710	6.66		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
5.3	173	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S-B: BYPASS AREA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

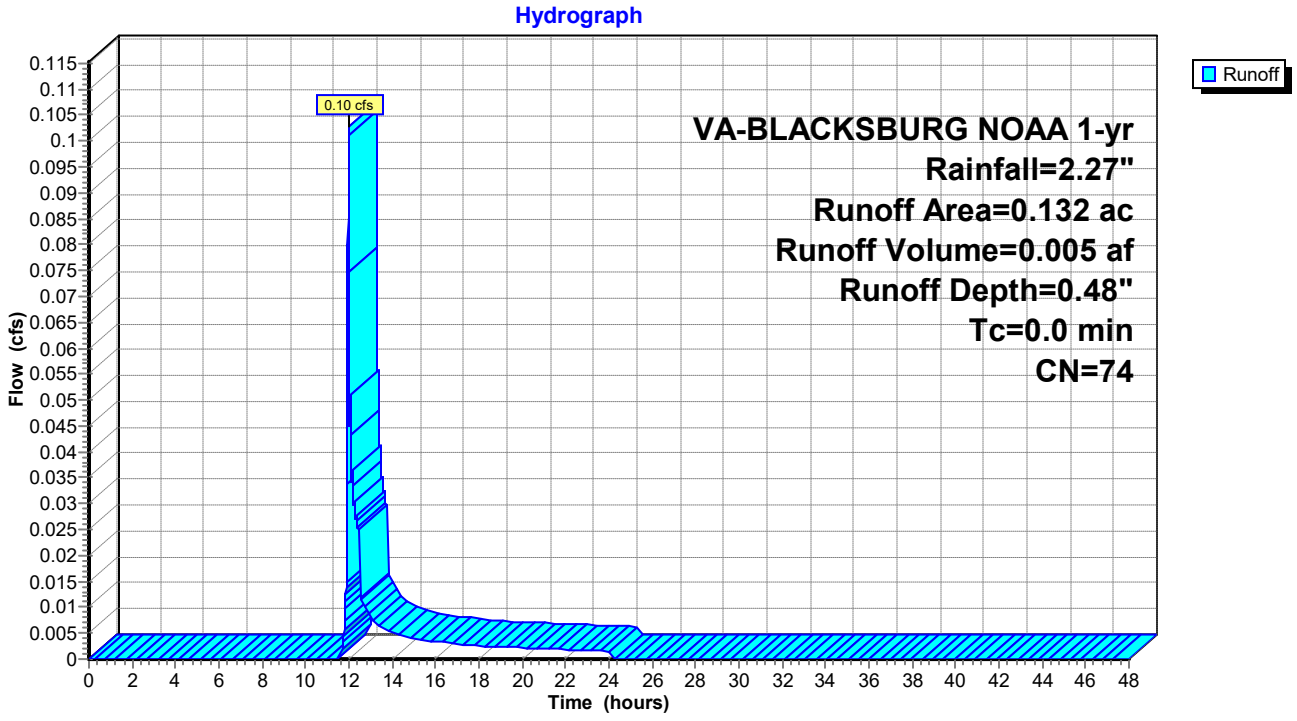
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.10 cfs @ 11.99 hrs, Volume= 0.005 af, Depth= 0.48"

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
0.132	74	>75% Grass cover, Good, HSG C
0.132		100.00% Pervious Area

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

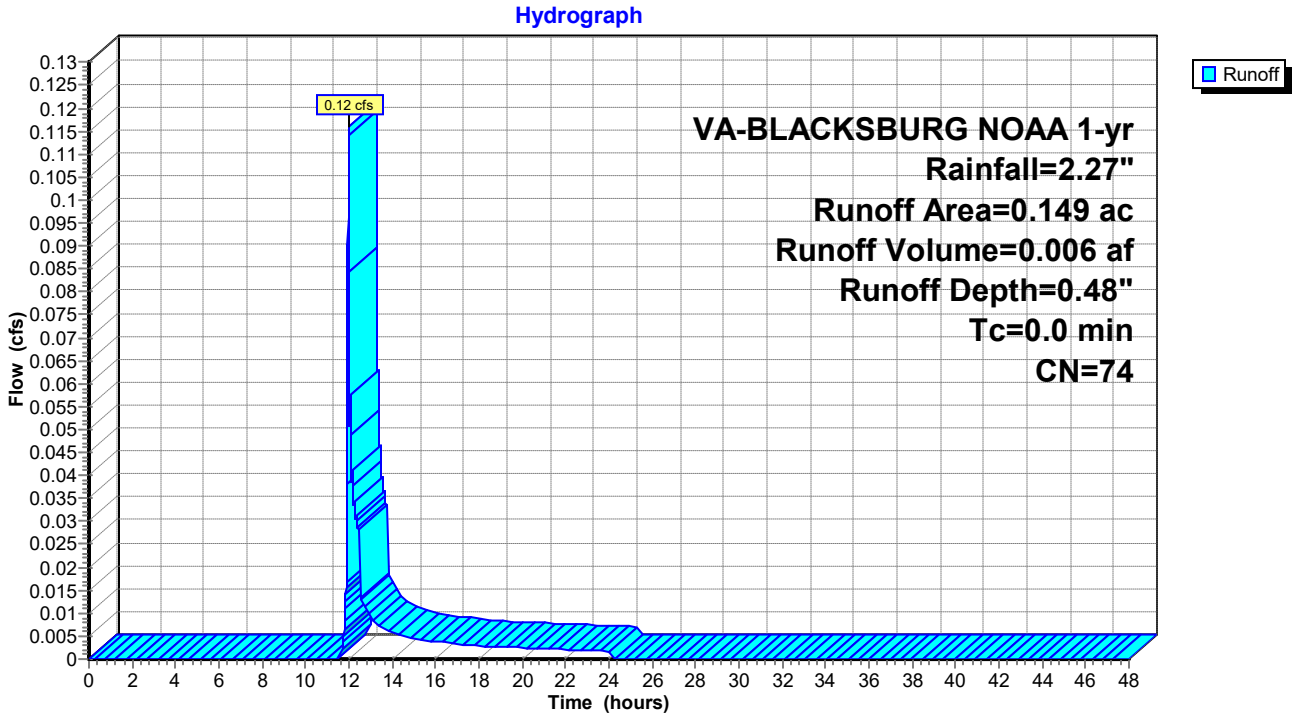
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.12 cfs @ 11.99 hrs, Volume= 0.006 af, Depth= 0.48"

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
0.149	74	>75% Grass cover, Good, HSG C
0.149		100.00% Pervious Area

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)



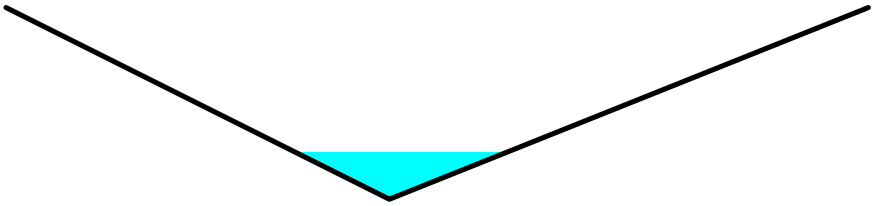
Summary for Reach 3R: ROADSIDE DITCH

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 1.57" for 1-yr event
Inflow = 0.23 cfs @ 12.05 hrs, Volume= 0.196 af
Outflow = 0.23 cfs @ 12.06 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.2 min

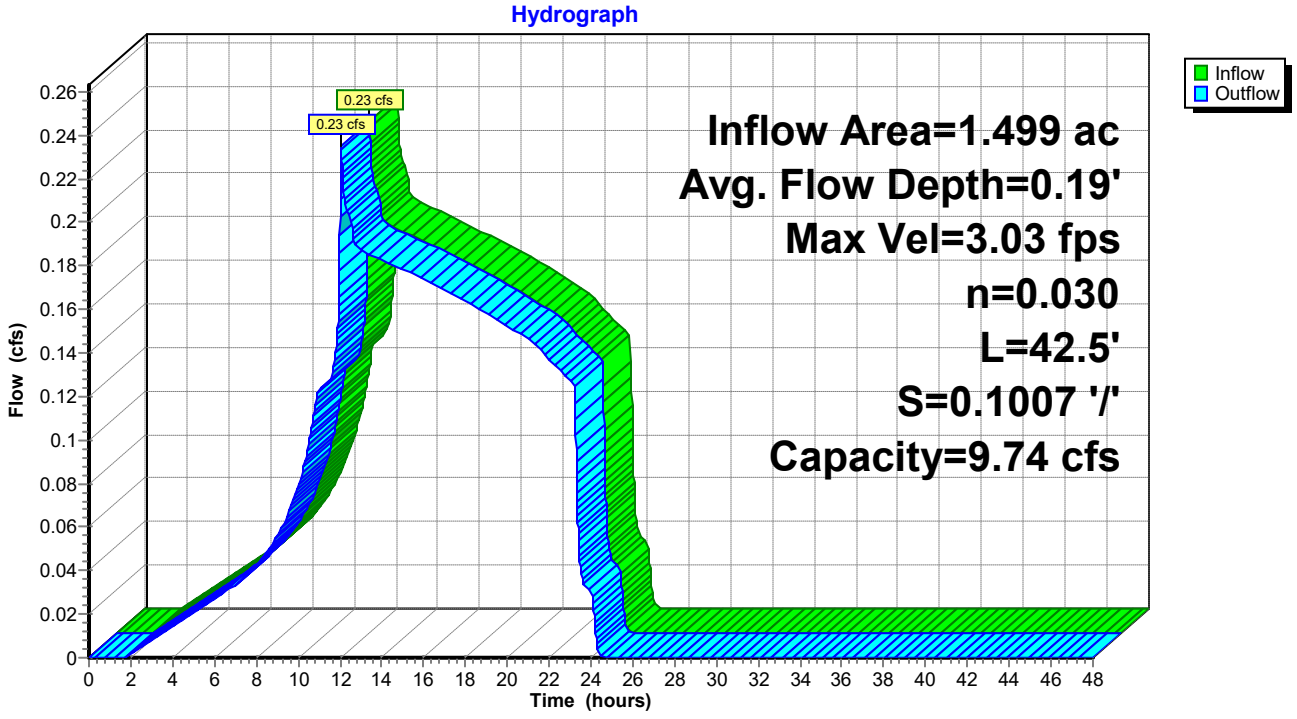
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.03 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 0.3 min

Peak Storage= 3 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.19' , Surface Width= 0.83'
Bank-Full Depth= 0.75' Flow Area= 1.3 sf, Capacity= 9.74 cfs

0.00' x 0.75' deep channel, n= 0.030
Side Slope Z-value= 2.0 2.5 '/' Top Width= 3.38'
Length= 42.5' Slope= 0.1007 '/'
Inlet Invert= 2,122.10', Outlet Invert= 2,117.82'



Reach 3R: ROADSIDE DITCH



Summary for Pond 1P: UNDERGROUND DETENTION #1

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

Inflow Area = 1.370 ac, 75.77% Impervious, Inflow Depth = 1.66" for 1-yr event
Inflow = 3.01 cfs @ 12.04 hrs, Volume= 0.190 af
Outflow = 0.18 cfs @ 13.08 hrs, Volume= 0.190 af, Atten= 94%, Lag= 62.3 min
Primary = 0.18 cfs @ 13.08 hrs, Volume= 0.190 af
Routed to Link 1L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,130.47' @ 13.08 hrs Surf.Area= 0.048 ac Storage= 0.083 af

Plug-Flow detention time= 172.8 min calculated for 0.190 af (100% of inflow)
Center-of-Mass det. time= 172.8 min (946.2 - 773.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,127.50'	0.065 af	**20.58'W x 102.50'L x 5.50'H Field A** 0.266 af Overall - 0.103 af Embedded = 0.163 af x 40.0% Voids
#2A	2,128.00'	0.086 af	**ADS N-12 48"** x 15 Inside #1 Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf Row Length Adjustment= -5.00' x 12.40 sf x 3 rows 17.58' Header x 12.40 sf x 1 = 218.0 cf Inside
		0.151 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,124.75'	**15.0" Round 15" HDPE Culvert** L= 63.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,124.75' / 2,124.44' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,124.85'	**1.7" Vert. 1.75" Dia. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,130.50'	**10.0" W x 4.0" H Vert. 10"W x 4"H Rect. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,131.90'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.18 cfs @ 13.08 hrs HW=2,130.47' (Free Discharge)
└**1=15" HDPE Culvert** (Passes 0.18 cfs of 12.49 cfs potential flow)
├**2=1.75" Dia. Orifice** (Orifice Controls 0.18 cfs @ 11.34 fps)
├**3=10"W x 4"H Rect. Orifice** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND DETENTION #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 48" (ADS N-12® Pipe)
Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf
Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf
Row Length Adjustment= -5.00' x 12.40 sf x 3 rows

54.0" Wide + 24.5" Spacing = 78.5" C-C Row Spacing

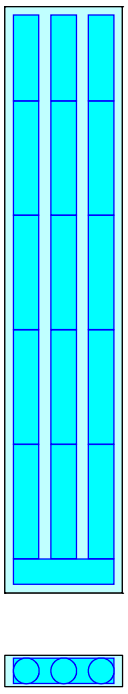
5 Chambers/Row x 20.00' Long -5.00' Row Adjustment +4.50' Header x 1 = 99.50' Row Length +18.0" End Stone x 2 = 102.50' Base Length
3 Rows x 54.0" Wide + 24.5" Spacing x 2 + 18.0" Side Stone x 2 = 20.58' Base Width
6.0" Stone Base + 54.0" Chamber Height + 6.0" Stone Cover = 5.50' Field Height

15 Chambers x 248.0 cf -5.00' Row Adjustment x 12.40 sf x 3 Rows + 17.58' Header x 12.40 sf = 3,752.0 cf Chamber Storage
15 Chambers x 297.1 cf -5.00' Row Adjustment x 14.86 sf x 3 Rows + 17.58' Header x 14.86 sf = 4,495.0 cf Displacement

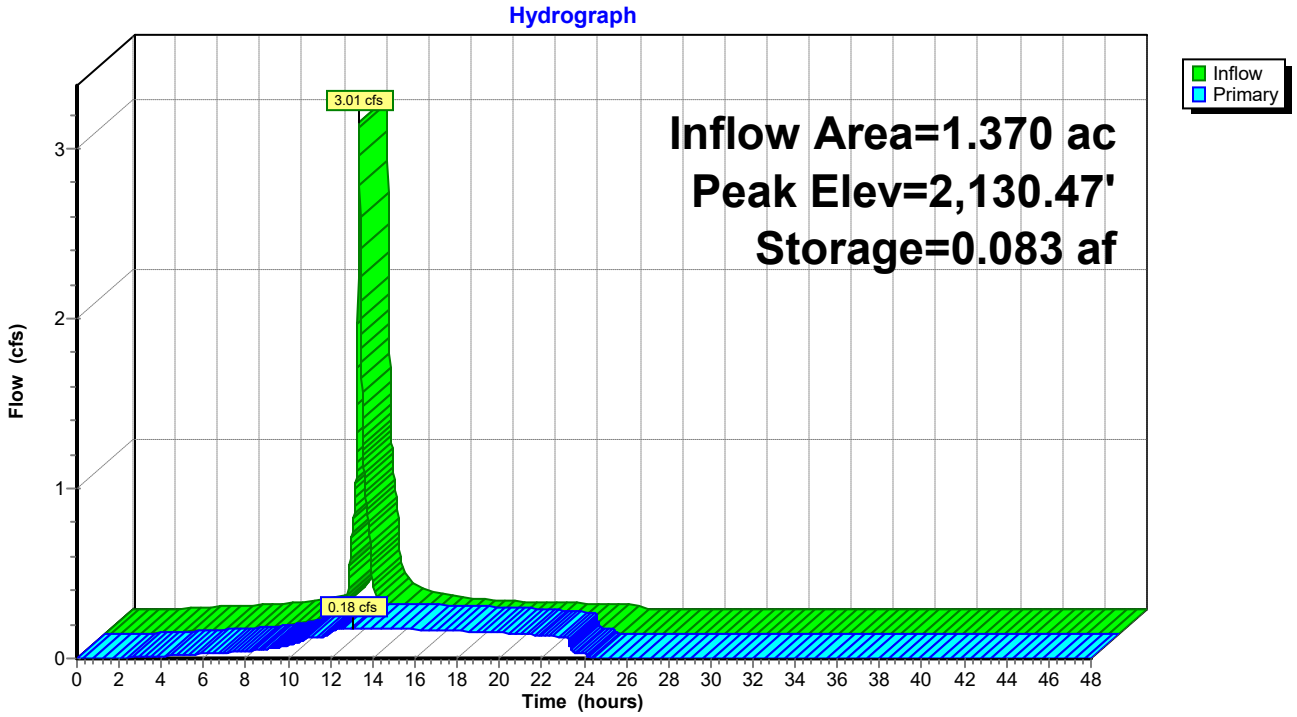
11,604.2 cf Field - 4,495.0 cf Chambers = 7,109.3 cf Stone x 40.0% Voids = 2,843.7 cf Stone Storage

Chamber Storage + Stone Storage = 6,595.7 cf = 0.151 af
Overall Storage Efficiency = 56.8%
Overall System Size = 102.50' x 20.58' x 5.50'

15 Chambers
429.8 cy Field
263.3 cy Stone



Pond 1P: UNDERGROUND DETENTION #1

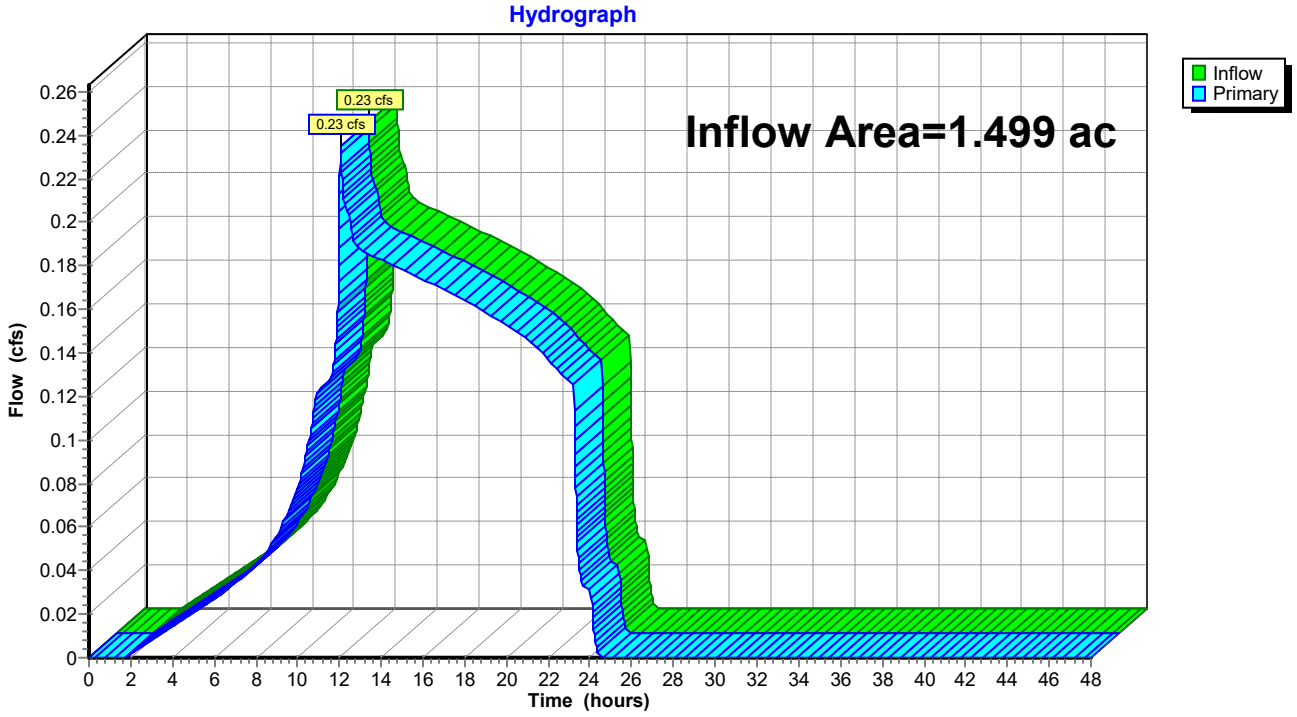


Summary for Link 1L: POA

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 1.57" for 1-yr event
Inflow = 0.23 cfs @ 12.05 hrs, Volume= 0.196 af
Primary = 0.23 cfs @ 12.05 hrs, Volume= 0.196 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 3R : ROADSIDE DITCH

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

Link 1L: POA



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

Subcatchment 1S-A: TO SWM FACILITY Runoff Area=1.370 ac 75.77% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=WQ Runoff=3.76 cfs 0.239 af

Subcatchment 1S-B: BYPASS AREA Runoff Area=0.129 ac 2.33% Impervious Runoff Depth=0.79"
Flow Length=173' Tc=6.0 min CN=WQ Runoff=0.13 cfs 0.009 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.132 ac 0.00% Impervious Runoff Depth=0.75"
Tc=0.0 min CN=74 Runoff=0.17 cfs 0.008 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.149 ac 0.00% Impervious Runoff Depth=0.75"
Tc=0.0 min CN=74 Runoff=0.19 cfs 0.009 af

Reach 3R: ROADSIDE DITCH Avg. Flow Depth=0.29' Max Vel=4.05 fps Inflow=0.75 cfs 0.247 af
n=0.030 L=42.5' S=0.1007 '/' Capacity=9.74 cfs Outflow=0.75 cfs 0.247 af

Pond 1P: UNDERGROUND DETENTION #1 Peak Elev=2,130.84' Storage=0.096 af Inflow=3.76 cfs 0.239 af
Outflow=0.71 cfs 0.239 af

Link 1L: POA Inflow=0.75 cfs 0.247 af
Primary=0.75 cfs 0.247 af

Total Runoff Area = 1.780 ac Runoff Volume = 0.265 af Average Runoff Depth = 1.79"
41.52% Pervious = 0.739 ac 58.48% Impervious = 1.041 ac

Summary for Subcatchment 1S-A: TO SWM FACILITY

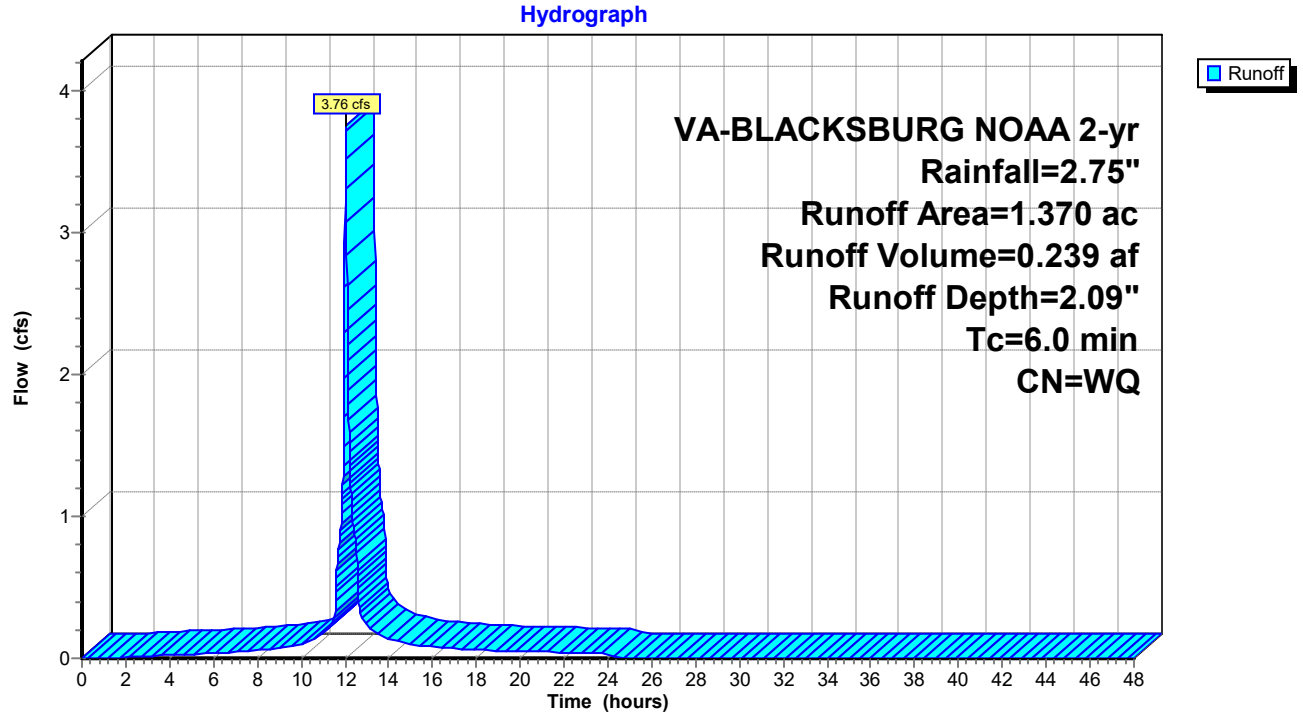
Runoff = 3.76 cfs @ 12.04 hrs, Volume= 0.239 af, Depth= 2.09"
Routed to Pond 1P : UNDERGROUND DETENTION #1

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
0.332	74	>75% Grass cover, Good, HSG C
1.038	98	Paved parking, HSG C
1.370		Weighted Average
0.332		24.23% Pervious Area
1.038		75.77% Impervious Area

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

Subcatchment 1S-A: TO SWM FACILITY



Summary for Subcatchment 1S-B: BYPASS AREA

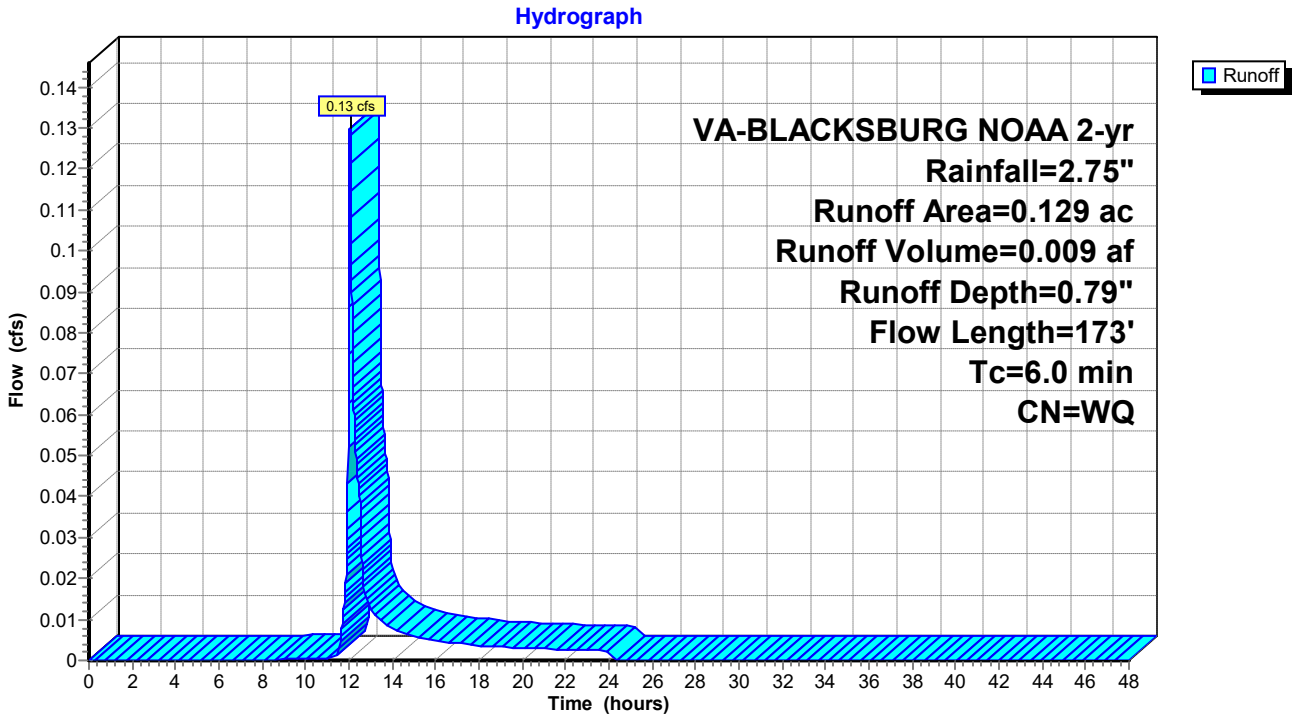
Runoff = 0.13 cfs @ 12.05 hrs, Volume= 0.009 af, Depth= 0.79"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.126	74	>75% Grass cover, Good, HSG C
0.003	98	Paved parking, HSG C
0.129		Weighted Average
0.126		97.67% Pervious Area
0.003		2.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1250	0.33		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
0.2	73	0.1710	6.66		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
5.3	173	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S-B: BYPASS AREA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

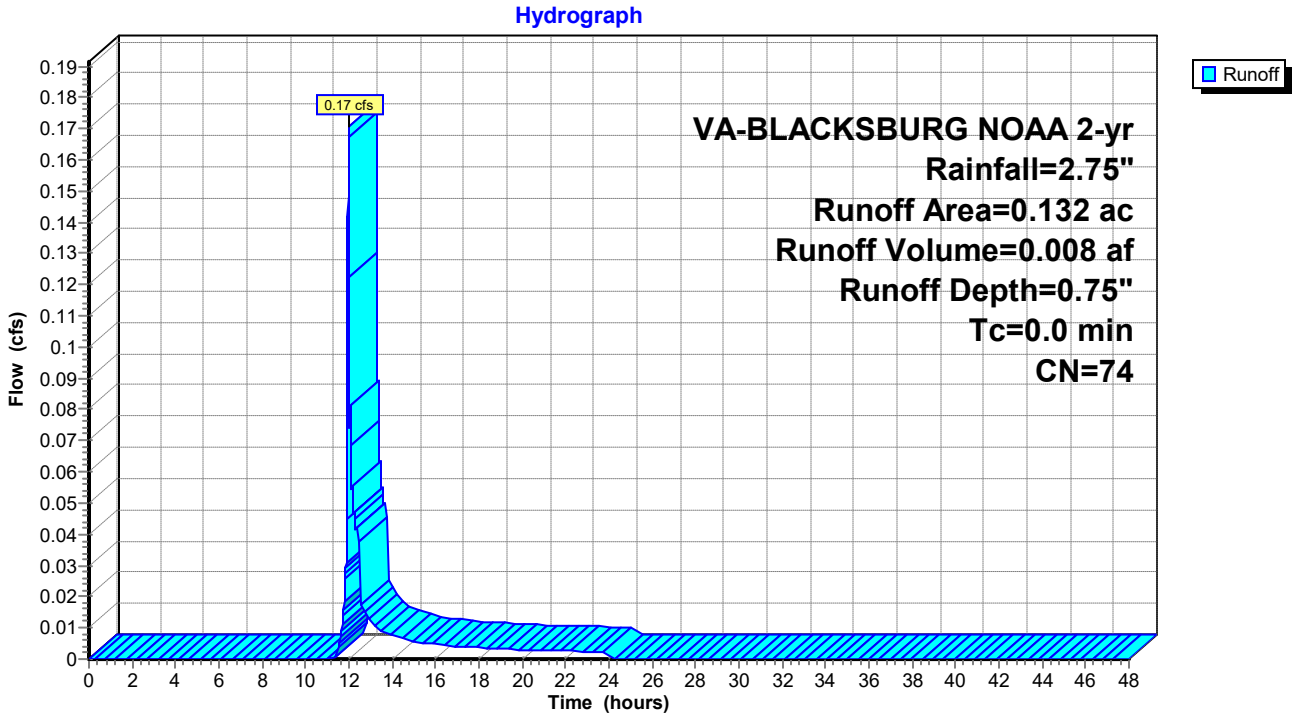
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.17 cfs @ 11.99 hrs, Volume= 0.008 af, Depth= 0.75"

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
0.132	74	>75% Grass cover, Good, HSG C
0.132		100.00% Pervious Area

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

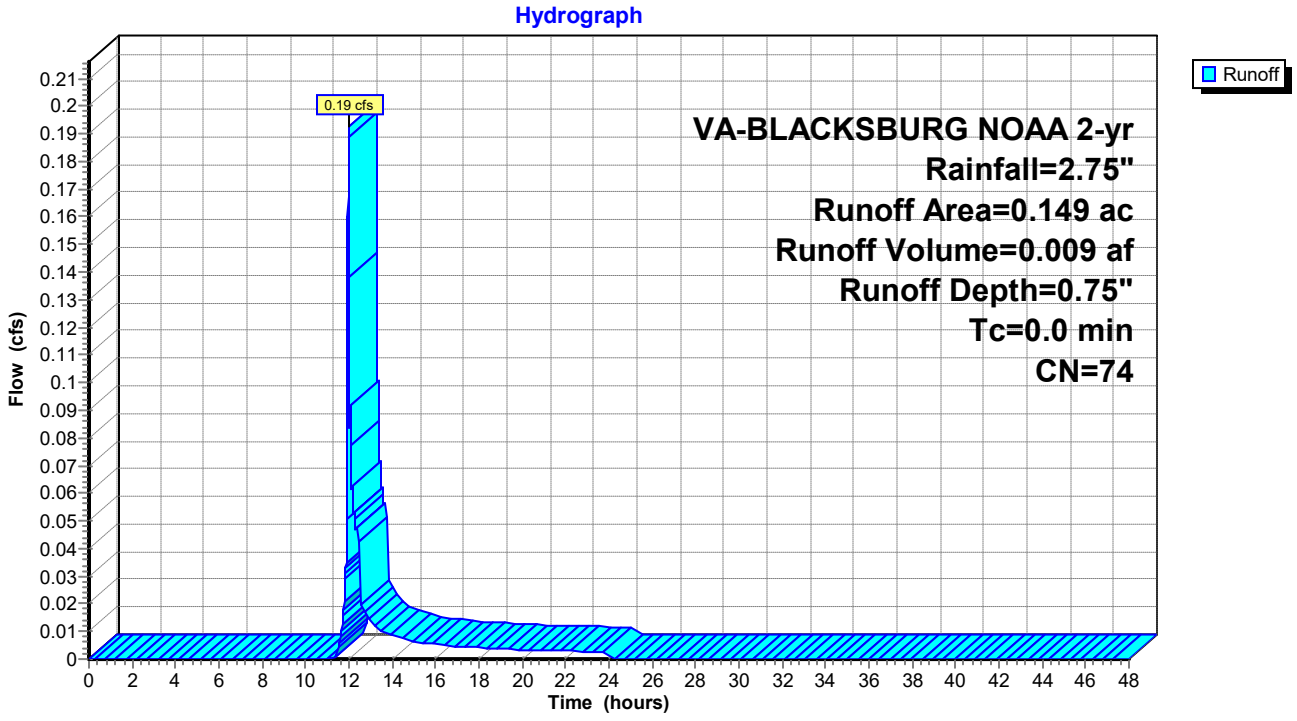
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.19 cfs @ 11.99 hrs, Volume= 0.009 af, Depth= 0.75"

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
0.149	74	>75% Grass cover, Good, HSG C
0.149		100.00% Pervious Area

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)



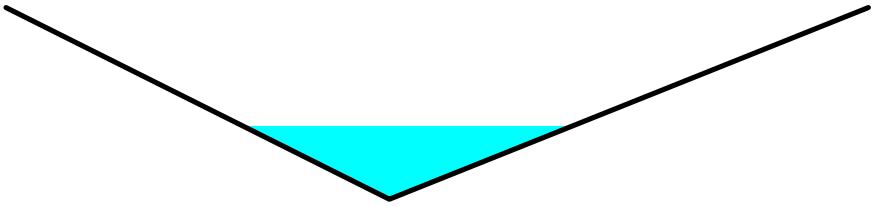
Summary for Reach 3R: ROADSIDE DITCH

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 1.98" for 2-yr event
Inflow = 0.75 cfs @ 12.54 hrs, Volume= 0.247 af
Outflow = 0.75 cfs @ 12.54 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.1 min

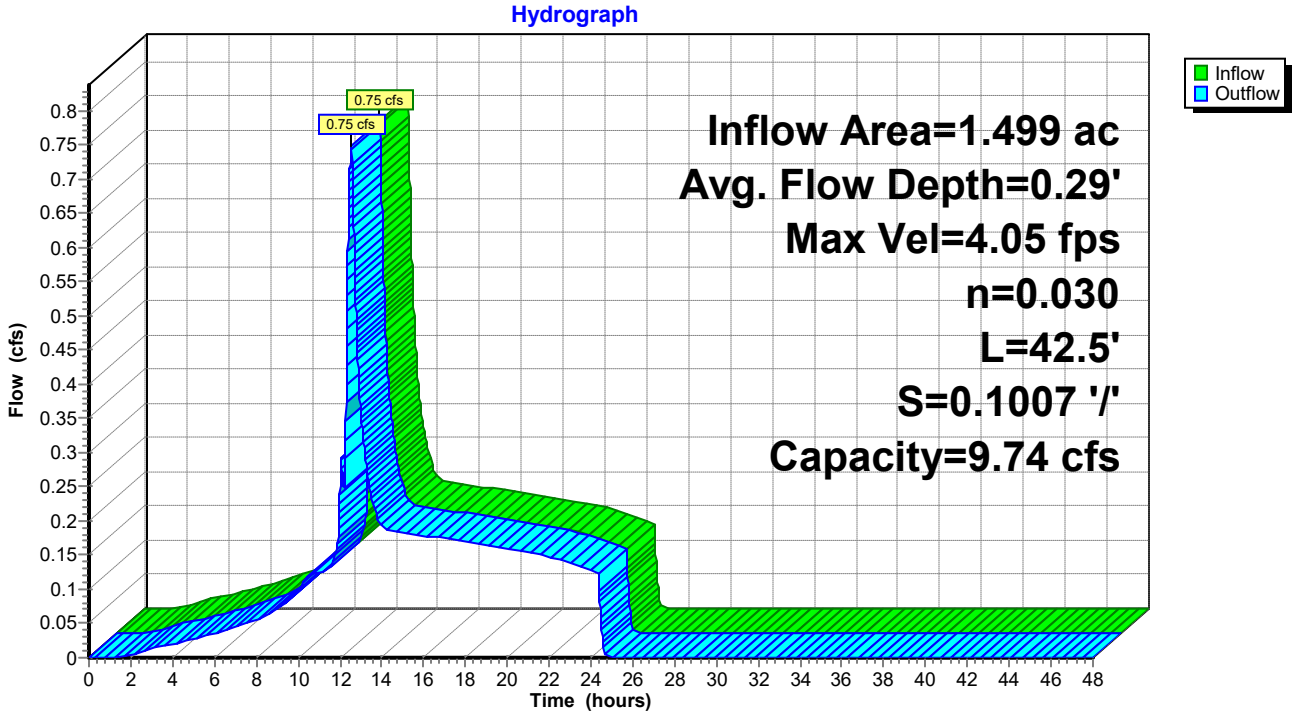
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 0.3 min

Peak Storage= 8 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 1.29'
Bank-Full Depth= 0.75' Flow Area= 1.3 sf, Capacity= 9.74 cfs

0.00' x 0.75' deep channel, n= 0.030
Side Slope Z-value= 2.0 2.5 '/' Top Width= 3.38'
Length= 42.5' Slope= 0.1007 '/'
Inlet Invert= 2,122.10', Outlet Invert= 2,117.82'



Reach 3R: ROADSIDE DITCH



Summary for Pond 1P: UNDERGROUND DETENTION #1

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

Inflow Area = 1.370 ac, 75.77% Impervious, Inflow Depth = 2.09" for 2-yr event
Inflow = 3.76 cfs @ 12.04 hrs, Volume= 0.239 af
Outflow = 0.71 cfs @ 12.55 hrs, Volume= 0.239 af, Atten= 81%, Lag= 30.8 min
Primary = 0.71 cfs @ 12.55 hrs, Volume= 0.239 af
Routed to Link 1L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,130.84' @ 12.55 hrs Surf.Area= 0.048 ac Storage= 0.096 af

Plug-Flow detention time= 165.1 min calculated for 0.239 af (100% of inflow)
Center-of-Mass det. time= 165.1 min (934.9 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,127.50'	0.065 af	**20.58'W x 102.50'L x 5.50'H Field A** 0.266 af Overall - 0.103 af Embedded = 0.163 af x 40.0% Voids
#2A	2,128.00'	0.086 af	**ADS N-12 48"** x 15 Inside #1 Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf Row Length Adjustment= -5.00' x 12.40 sf x 3 rows 17.58' Header x 12.40 sf x 1 = 218.0 cf Inside
		0.151 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,124.75'	**15.0" Round 15" HDPE Culvert** L= 63.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,124.75' / 2,124.44' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,124.85'	**1.7" Vert. 1.75" Dia. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,130.50'	**10.0" W x 4.0" H Vert. 10"W x 4"H Rect. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,131.90'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.71 cfs @ 12.55 hrs HW=2,130.84' (Free Discharge)
└**1=15" HDPE Culvert** (Passes 0.71 cfs of 12.96 cfs potential flow)
├**2=1.75" Dia. Orifice** (Orifice Controls 0.18 cfs @ 11.71 fps)
├**3=10"W x 4"H Rect. Orifice** (Orifice Controls 0.53 cfs @ 1.89 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND DETENTION #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 48" (ADS N-12® Pipe)
Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf
Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf
Row Length Adjustment= -5.00' x 12.40 sf x 3 rows

54.0" Wide + 24.5" Spacing = 78.5" C-C Row Spacing

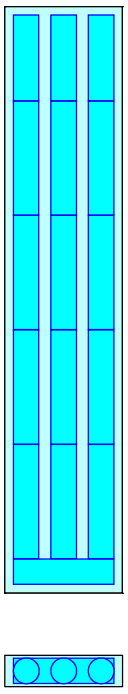
5 Chambers/Row x 20.00' Long -5.00' Row Adjustment +4.50' Header x 1 = 99.50' Row Length +18.0" End Stone x 2 = 102.50' Base Length
3 Rows x 54.0" Wide + 24.5" Spacing x 2 + 18.0" Side Stone x 2 = 20.58' Base Width
6.0" Stone Base + 54.0" Chamber Height + 6.0" Stone Cover = 5.50' Field Height

15 Chambers x 248.0 cf -5.00' Row Adjustment x 12.40 sf x 3 Rows + 17.58' Header x 12.40 sf = 3,752.0 cf Chamber Storage
15 Chambers x 297.1 cf -5.00' Row Adjustment x 14.86 sf x 3 Rows + 17.58' Header x 14.86 sf = 4,495.0 cf Displacement

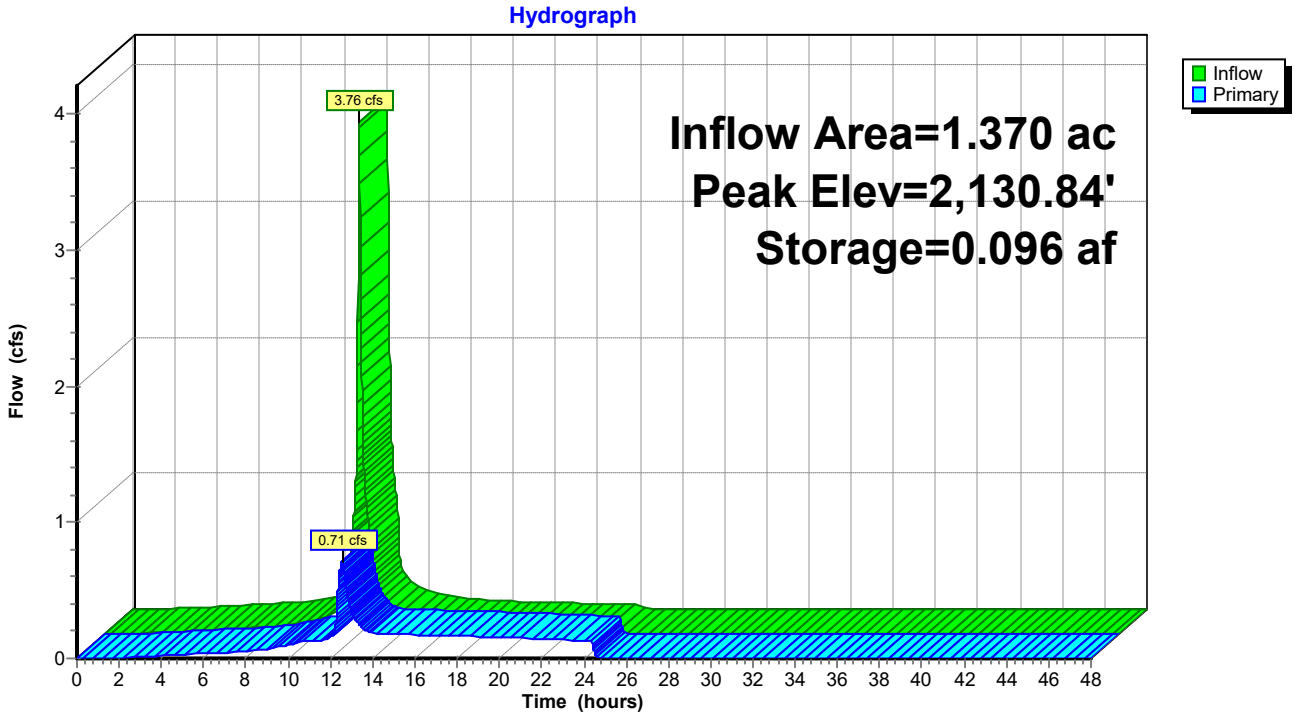
11,604.2 cf Field - 4,495.0 cf Chambers = 7,109.3 cf Stone x 40.0% Voids = 2,843.7 cf Stone Storage

Chamber Storage + Stone Storage = 6,595.7 cf = 0.151 af
Overall Storage Efficiency = 56.8%
Overall System Size = 102.50' x 20.58' x 5.50'

15 Chambers
429.8 cy Field
263.3 cy Stone



Pond 1P: UNDERGROUND DETENTION #1

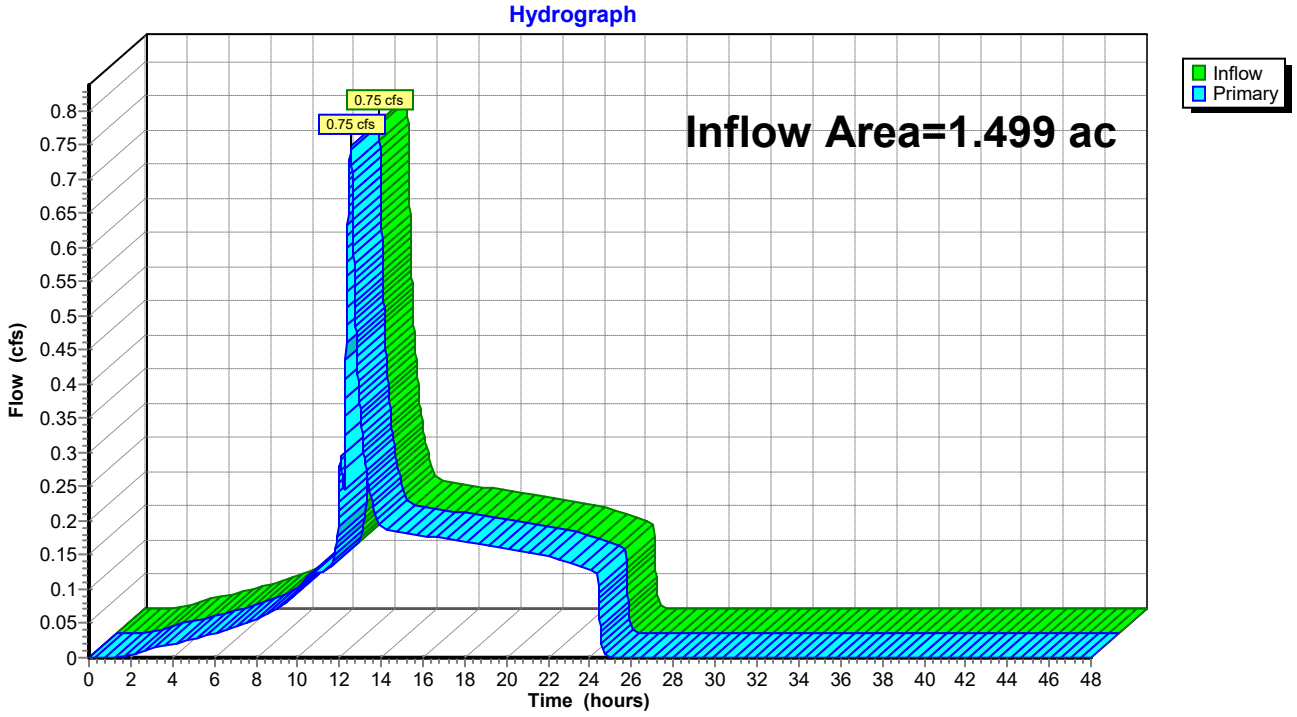


Summary for Link 1L: POA

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 1.98" for 2-yr event
Inflow = 0.75 cfs @ 12.54 hrs, Volume= 0.247 af
Primary = 0.75 cfs @ 12.54 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 3R : ROADSIDE DITCH

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

Link 1L: POA



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

Subcatchment 1S-A: TO SWM FACILITY Runoff Area=1.370 ac 75.77% Impervious Runoff Depth=3.32"
Tc=6.0 min CN=WQ Runoff=5.44 cfs 0.379 af

Subcatchment 1S-B: BYPASS AREA Runoff Area=0.129 ac 2.33% Impervious Runoff Depth=1.71"
Flow Length=173' Tc=6.0 min CN=WQ Runoff=0.28 cfs 0.018 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.132 ac 0.00% Impervious Runoff Depth=1.66"
Tc=0.0 min CN=74 Runoff=0.36 cfs 0.018 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.149 ac 0.00% Impervious Runoff Depth=1.66"
Tc=0.0 min CN=74 Runoff=0.40 cfs 0.021 af

Reach 3R: ROADSIDE DITCH Avg. Flow Depth=0.39' Max Vel=5.00 fps Inflow=1.74 cfs 0.398 af
n=0.030 L=42.5' S=0.1007 '/' Capacity=9.74 cfs Outflow=1.74 cfs 0.398 af

Pond 1P: UNDERGROUND DETENTION #1 Peak Elev=2,131.82' Storage=0.128 af Inflow=5.44 cfs 0.379 af
Outflow=1.64 cfs 0.379 af

Link 1L: POA Inflow=1.74 cfs 0.398 af
Primary=1.74 cfs 0.398 af

Total Runoff Area = 1.780 ac Runoff Volume = 0.437 af Average Runoff Depth = 2.94"
41.52% Pervious = 0.739 ac 58.48% Impervious = 1.041 ac

Summary for Subcatchment 1S-A: TO SWM FACILITY

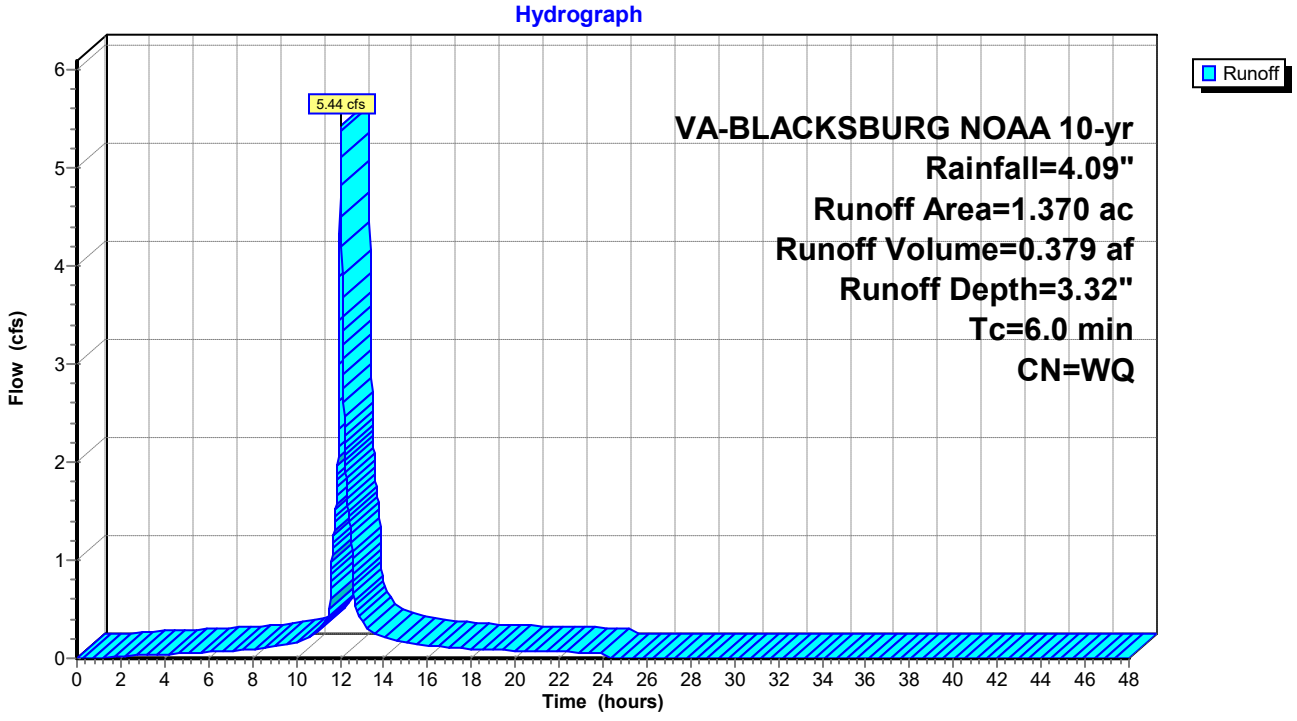
Runoff = 5.44 cfs @ 12.04 hrs, Volume= 0.379 af, Depth= 3.32"
Routed to Pond 1P : UNDERGROUND DETENTION #1

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
0.332	74	>75% Grass cover, Good, HSG C
1.038	98	Paved parking, HSG C
1.370		Weighted Average
0.332		24.23% Pervious Area
1.038		75.77% Impervious Area

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

Subcatchment 1S-A: TO SWM FACILITY



Summary for Subcatchment 1S-B: BYPASS AREA

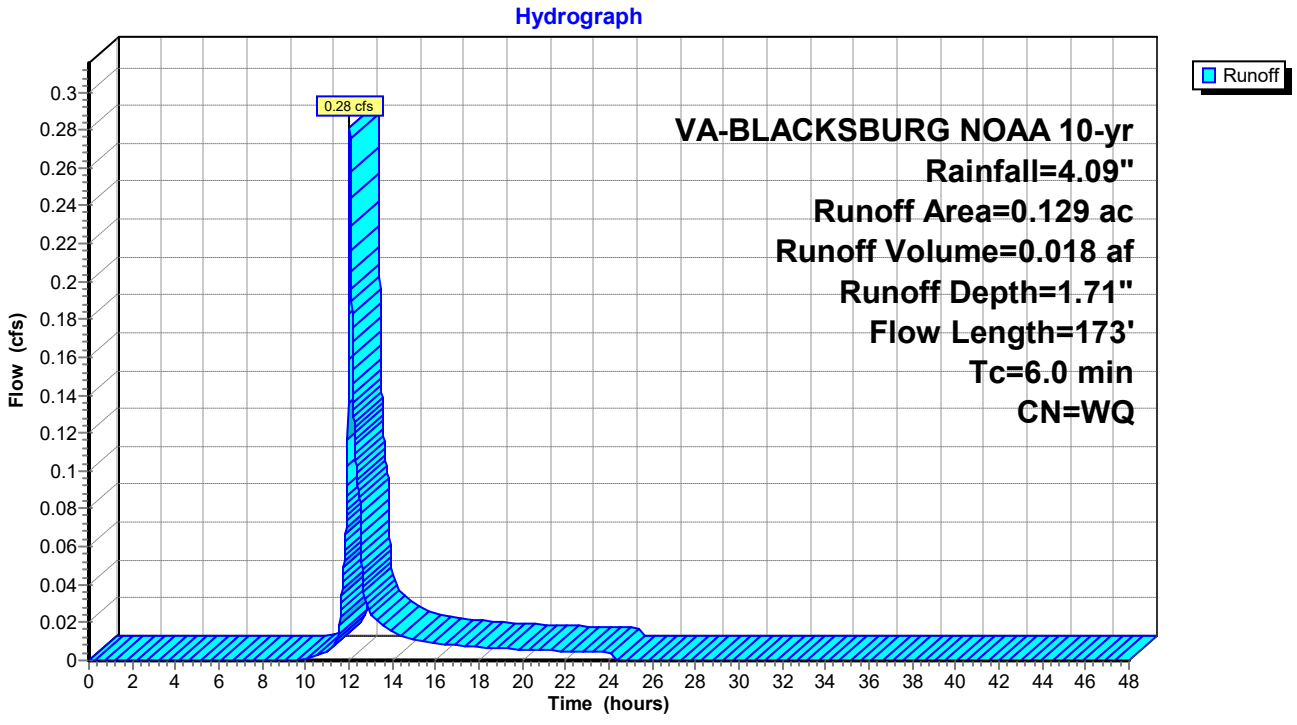
Runoff = 0.28 cfs @ 12.04 hrs, Volume= 0.018 af, Depth= 1.71"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.126	74	>75% Grass cover, Good, HSG C
0.003	98	Paved parking, HSG C
0.129		Weighted Average
0.126		97.67% Pervious Area
0.003		2.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1250	0.33		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
0.2	73	0.1710	6.66		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
5.3	173	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S-B: BYPASS AREA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

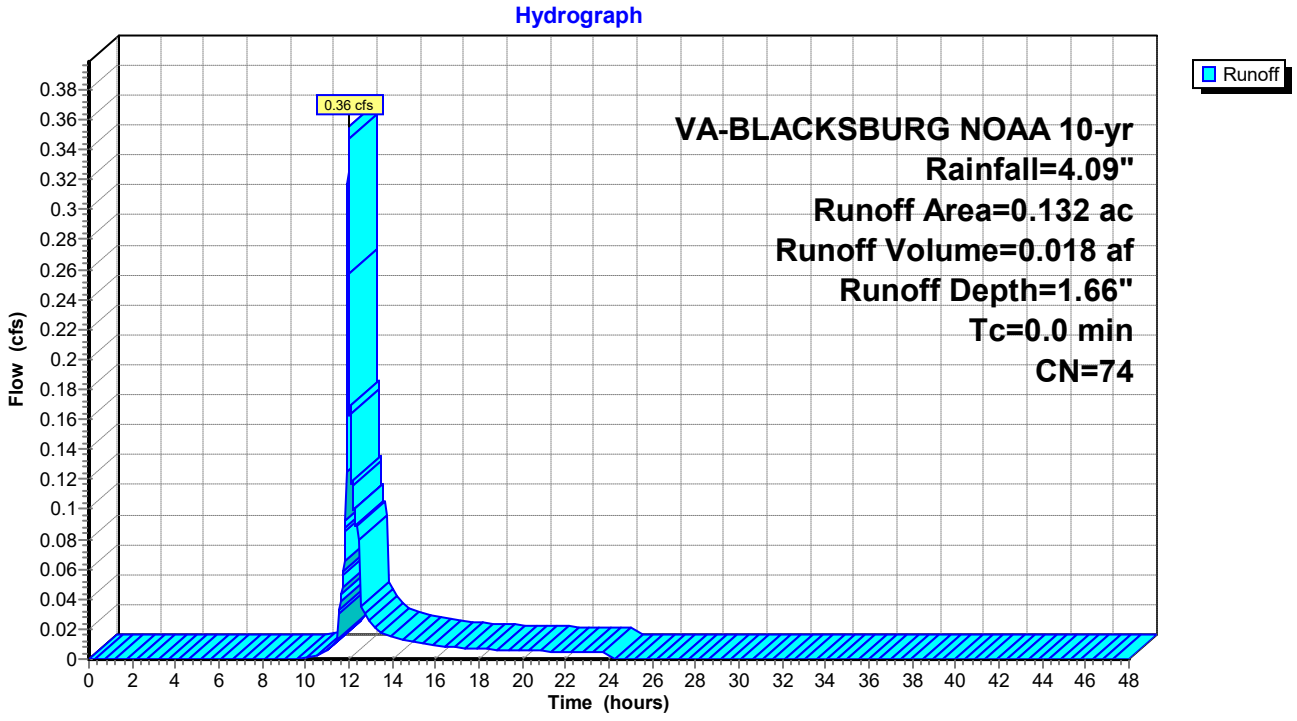
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.36 cfs @ 11.99 hrs, Volume= 0.018 af, Depth= 1.66"

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
0.132	74	>75% Grass cover, Good, HSG C
0.132		100.00% Pervious Area

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

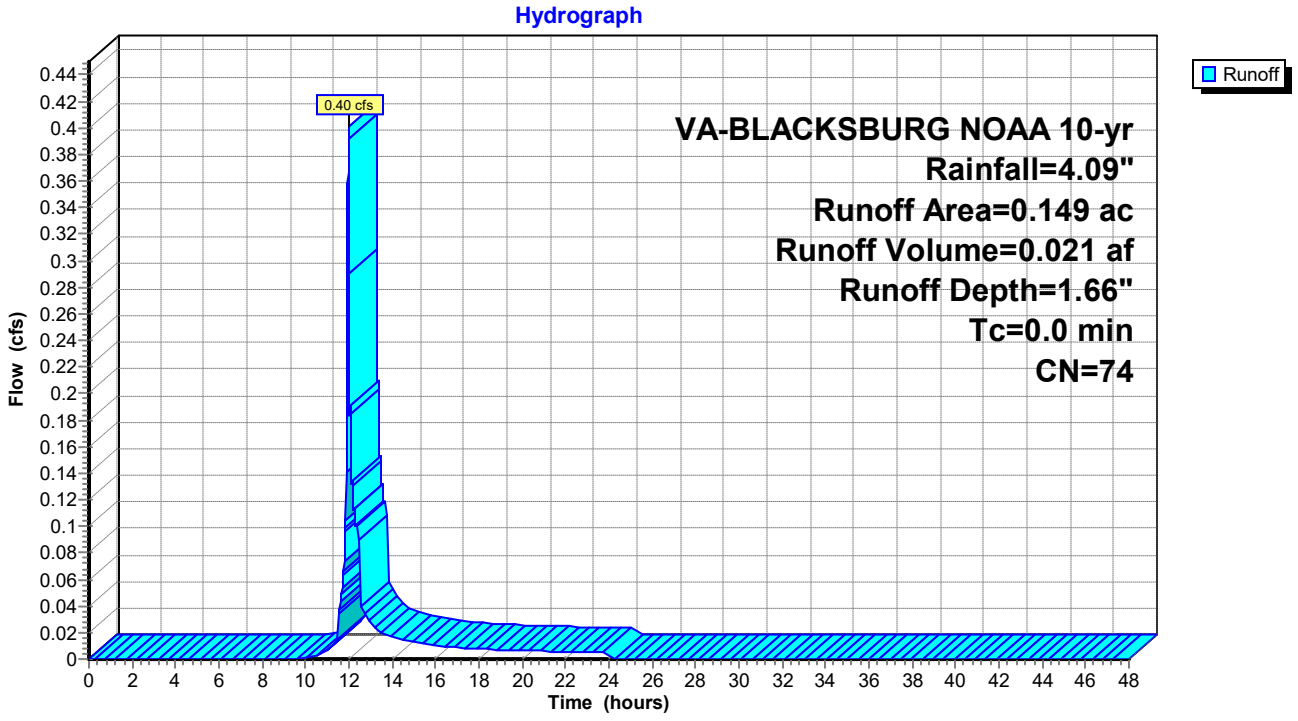
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.40 cfs @ 11.99 hrs, Volume= 0.021 af, Depth= 1.66"

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
0.149	74	>75% Grass cover, Good, HSG C
0.149		100.00% Pervious Area

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)



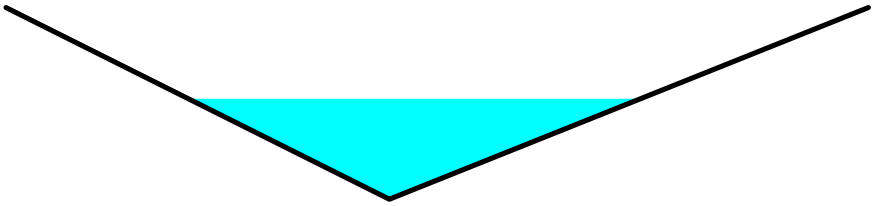
Summary for Reach 3R: ROADSIDE DITCH

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 1.74 cfs @ 12.30 hrs, Volume= 0.398 af
Outflow = 1.74 cfs @ 12.30 hrs, Volume= 0.398 af, Atten= 0%, Lag= 0.1 min

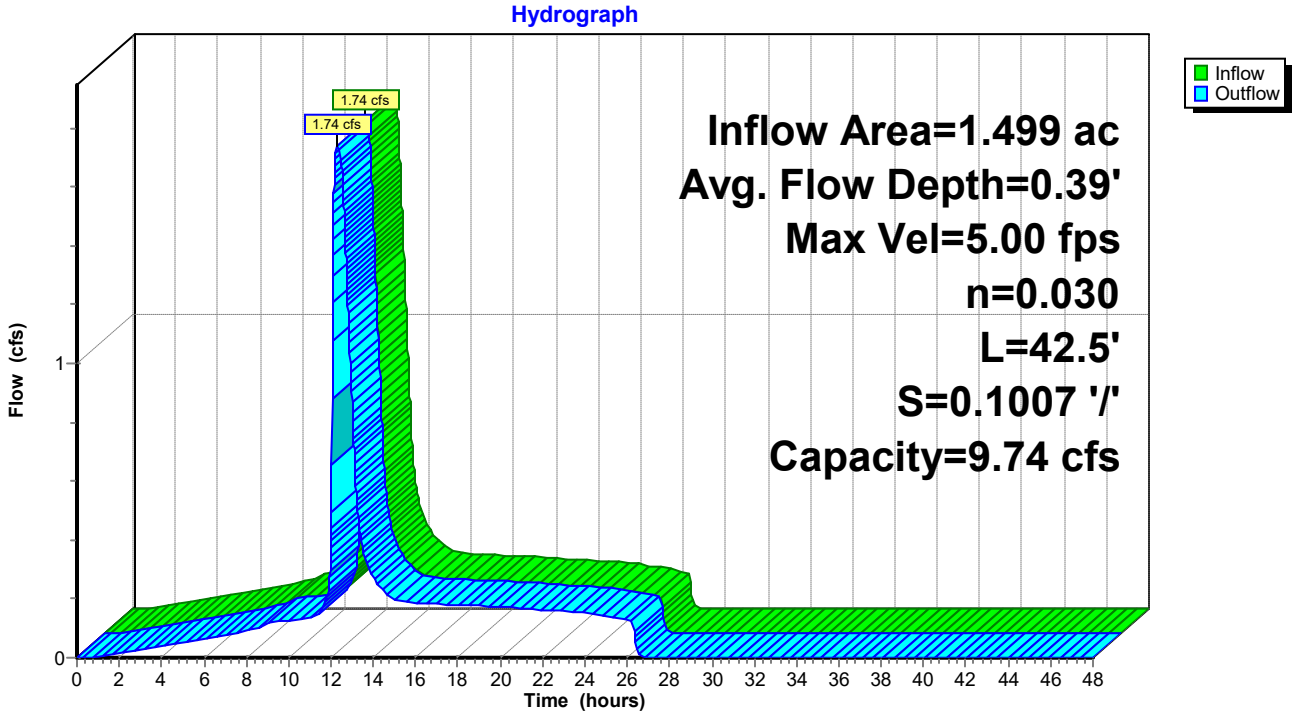
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.00 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 0.3 min

Peak Storage= 15 cf @ 12.30 hrs
Average Depth at Peak Storage= 0.39' , Surface Width= 1.77'
Bank-Full Depth= 0.75' Flow Area= 1.3 sf, Capacity= 9.74 cfs

0.00' x 0.75' deep channel, n= 0.030
Side Slope Z-value= 2.0 2.5 '/' Top Width= 3.38'
Length= 42.5' Slope= 0.1007 '/'
Inlet Invert= 2,122.10', Outlet Invert= 2,117.82'



Reach 3R: ROADSIDE DITCH



Summary for Pond 1P: UNDERGROUND DETENTION #1

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

Inflow Area = 1.370 ac, 75.77% Impervious, Inflow Depth = 3.32" for 10-yr event
Inflow = 5.44 cfs @ 12.04 hrs, Volume= 0.379 af
Outflow = 1.64 cfs @ 12.34 hrs, Volume= 0.379 af, Atten= 70%, Lag= 18.0 min
Primary = 1.64 cfs @ 12.34 hrs, Volume= 0.379 af
Routed to Link 1L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,131.82' @ 12.34 hrs Surf.Area= 0.048 ac Storage= 0.128 af

Plug-Flow detention time= 141.4 min calculated for 0.379 af (100% of inflow)
Center-of-Mass det. time= 141.4 min (905.1 - 763.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,127.50'	0.065 af	**20.58'W x 102.50'L x 5.50'H Field A** 0.266 af Overall - 0.103 af Embedded = 0.163 af x 40.0% Voids
#2A	2,128.00'	0.086 af	**ADS N-12 48"** x 15 Inside #1 Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf Row Length Adjustment= -5.00' x 12.40 sf x 3 rows 17.58' Header x 12.40 sf x 1 = 218.0 cf Inside
		0.151 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,124.75'	**15.0" Round 15" HDPE Culvert** L= 63.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,124.75' / 2,124.44' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,124.85'	**1.7" Vert. 1.75" Dia. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,130.50'	**10.0" W x 4.0" H Vert. 10"W x 4"H Rect. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,131.90'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.64 cfs @ 12.34 hrs HW=2,131.82' (Free Discharge)
└**1=15" HDPE Culvert** (Passes 1.64 cfs of 14.15 cfs potential flow)
├**2=1.75" Dia. Orifice** (Orifice Controls 0.20 cfs @ 12.65 fps)
├**3=10"W x 4"H Rect. Orifice** (Orifice Controls 1.44 cfs @ 5.17 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: UNDERGROUND DETENTION #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 48" (ADS N-12® Pipe)
Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf
Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf
Row Length Adjustment= -5.00' x 12.40 sf x 3 rows

54.0" Wide + 24.5" Spacing = 78.5" C-C Row Spacing

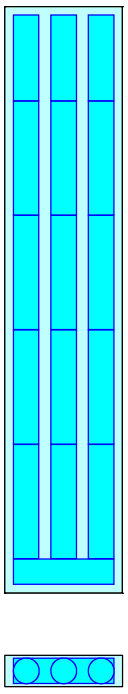
5 Chambers/Row x 20.00' Long -5.00' Row Adjustment +4.50' Header x 1 = 99.50' Row Length +18.0" End Stone x 2 = 102.50' Base Length
3 Rows x 54.0" Wide + 24.5" Spacing x 2 + 18.0" Side Stone x 2 = 20.58' Base Width
6.0" Stone Base + 54.0" Chamber Height + 6.0" Stone Cover = 5.50' Field Height

15 Chambers x 248.0 cf -5.00' Row Adjustment x 12.40 sf x 3 Rows + 17.58' Header x 12.40 sf = 3,752.0 cf Chamber Storage
15 Chambers x 297.1 cf -5.00' Row Adjustment x 14.86 sf x 3 Rows + 17.58' Header x 14.86 sf = 4,495.0 cf Displacement

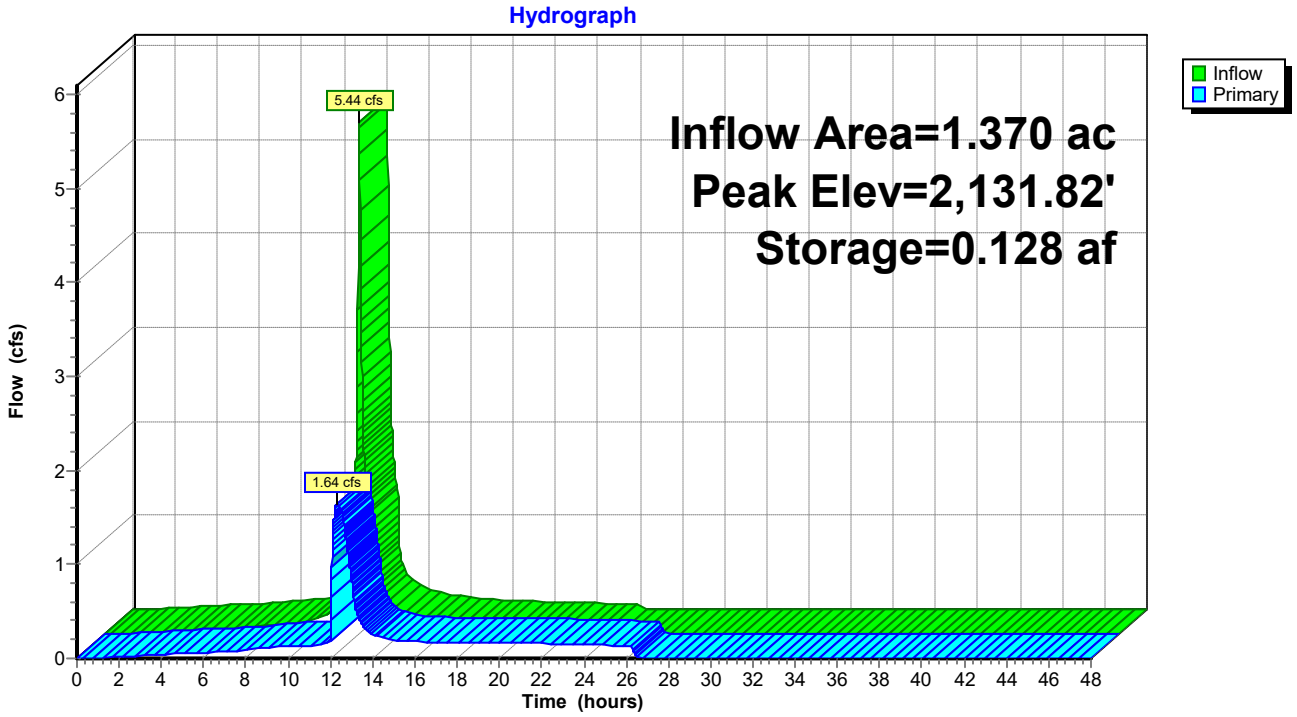
11,604.2 cf Field - 4,495.0 cf Chambers = 7,109.3 cf Stone x 40.0% Voids = 2,843.7 cf Stone Storage

Chamber Storage + Stone Storage = 6,595.7 cf = 0.151 af
Overall Storage Efficiency = 56.8%
Overall System Size = 102.50' x 20.58' x 5.50'

15 Chambers
429.8 cy Field
263.3 cy Stone



Pond 1P: UNDERGROUND DETENTION #1

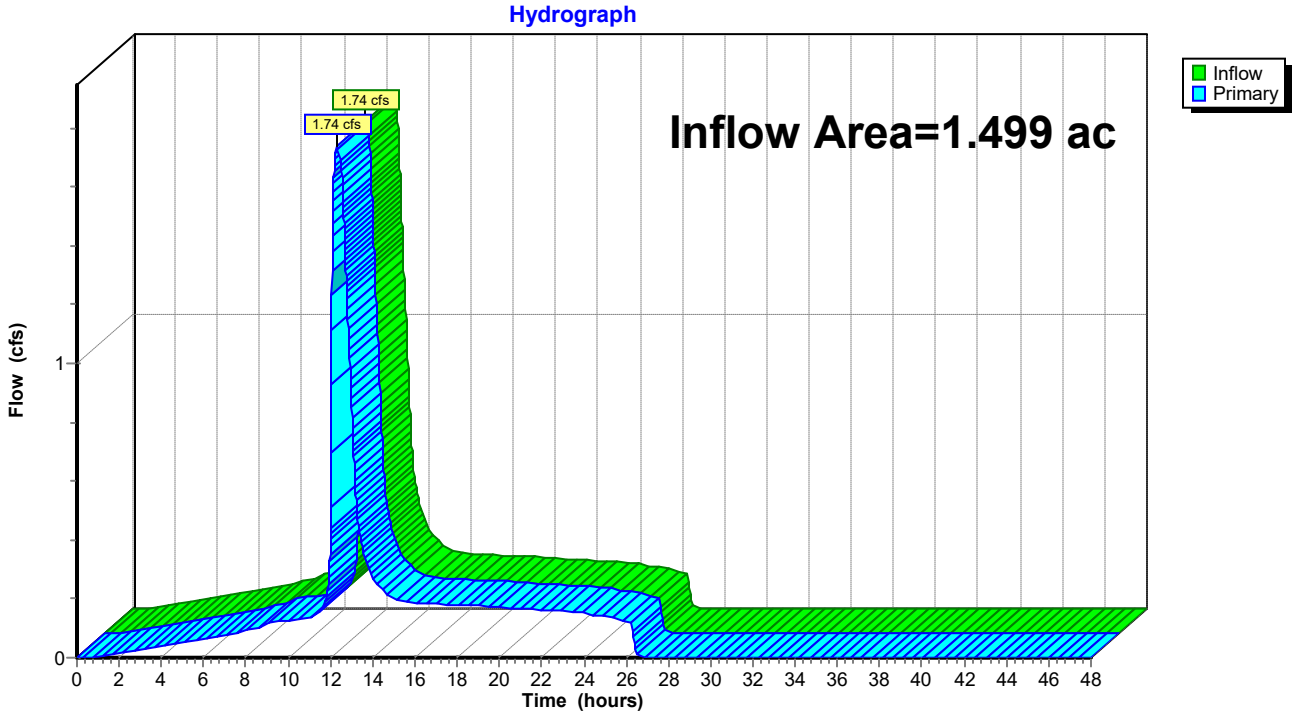


Summary for Link 1L: POA

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 3.19" for 10-yr event
Inflow = 1.74 cfs @ 12.30 hrs, Volume= 0.398 af
Primary = 1.74 cfs @ 12.30 hrs, Volume= 0.398 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 3R : ROADSIDE DITCH

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

Link 1L: POA



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

Subcatchment 1S-A: TO SWM FACILITY Runoff Area=1.370 ac 75.77% Impervious Runoff Depth=5.60"
Tc=6.0 min CN=WQ Runoff=7.71 cfs 0.639 af

Subcatchment 1S-B: BYPASS AREA Runoff Area=0.129 ac 2.33% Impervious Runoff Depth=3.65"
Flow Length=173' Tc=6.0 min CN=WQ Runoff=0.52 cfs 0.039 af

Subcatchment 2S: DIRECT RUNOFF #1 (TO Runoff Area=0.132 ac 0.00% Impervious Runoff Depth=3.59"
Tc=0.0 min CN=74 Runoff=0.62 cfs 0.040 af

Subcatchment 3S: DIRECT RUNOFF #2 (TO Runoff Area=0.149 ac 0.00% Impervious Runoff Depth=3.59"
Tc=0.0 min CN=74 Runoff=0.70 cfs 0.045 af

Reach 3R: ROADSIDE DITCH Avg. Flow Depth=0.70' Max Vel=7.34 fps Inflow=8.07 cfs 0.679 af
n=0.030 L=42.5' S=0.1007 '/' Capacity=9.74 cfs Outflow=8.05 cfs 0.679 af

Pond 1P: UNDERGROUND DETENTION #1 Peak Elev=2,132.42' Storage=0.140 af Inflow=7.71 cfs 0.639 af
Outflow=7.56 cfs 0.639 af

Link 1L: POA Inflow=8.07 cfs 0.679 af
Primary=8.07 cfs 0.679 af

Total Runoff Area = 1.780 ac Runoff Volume = 0.763 af Average Runoff Depth = 5.14"
41.52% Pervious = 0.739 ac 58.48% Impervious = 1.041 ac

Summary for Subcatchment 1S-A: TO SWM FACILITY

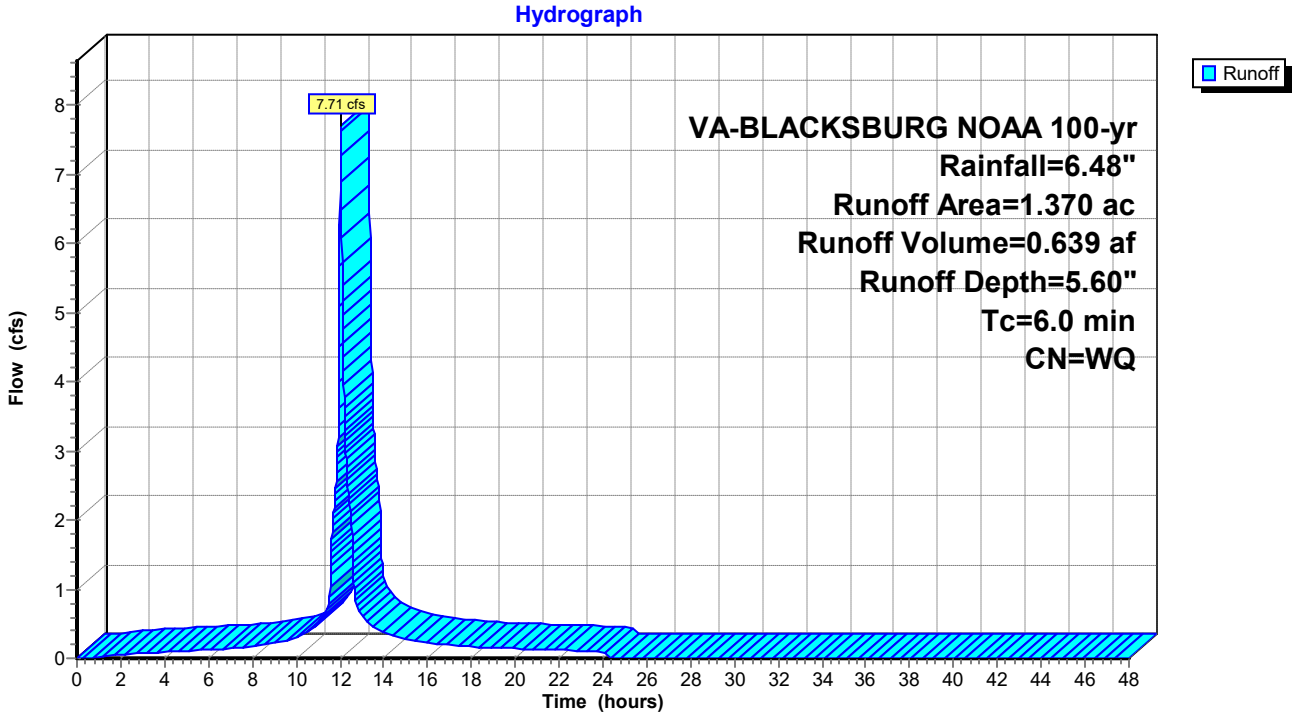
Runoff = 7.71 cfs @ 12.04 hrs, Volume= 0.639 af, Depth= 5.60"
Routed to Pond 1P : UNDERGROUND DETENTION #1

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
0.332	74	>75% Grass cover, Good, HSG C
1.038	98	Paved parking, HSG C
1.370		Weighted Average
0.332		24.23% Pervious Area
1.038		75.77% Impervious Area

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

Subcatchment 1S-A: TO SWM FACILITY



Summary for Subcatchment 1S-B: BYPASS AREA

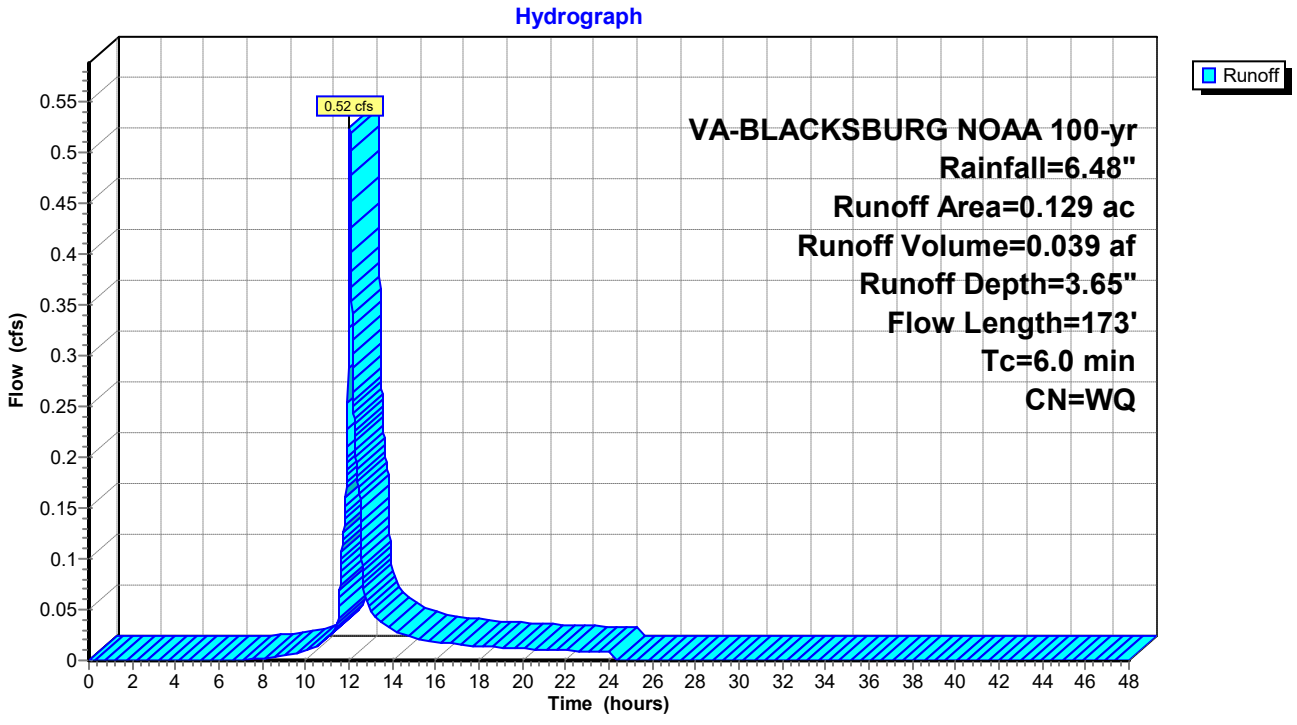
Runoff = 0.52 cfs @ 12.04 hrs, Volume= 0.039 af, Depth= 3.65"
Routed to Link 1L : POA

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

Area (ac)	CN	Description
0.126	74	>75% Grass cover, Good, HSG C
0.003	98	Paved parking, HSG C
0.129		Weighted Average
0.126		97.67% Pervious Area
0.003		2.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1250	0.33		**Sheet Flow, Tc1** Grass: Short n= 0.150 P2= 2.76"
0.2	73	0.1710	6.66		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
5.3	173	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S-B: BYPASS AREA



Summary for Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)

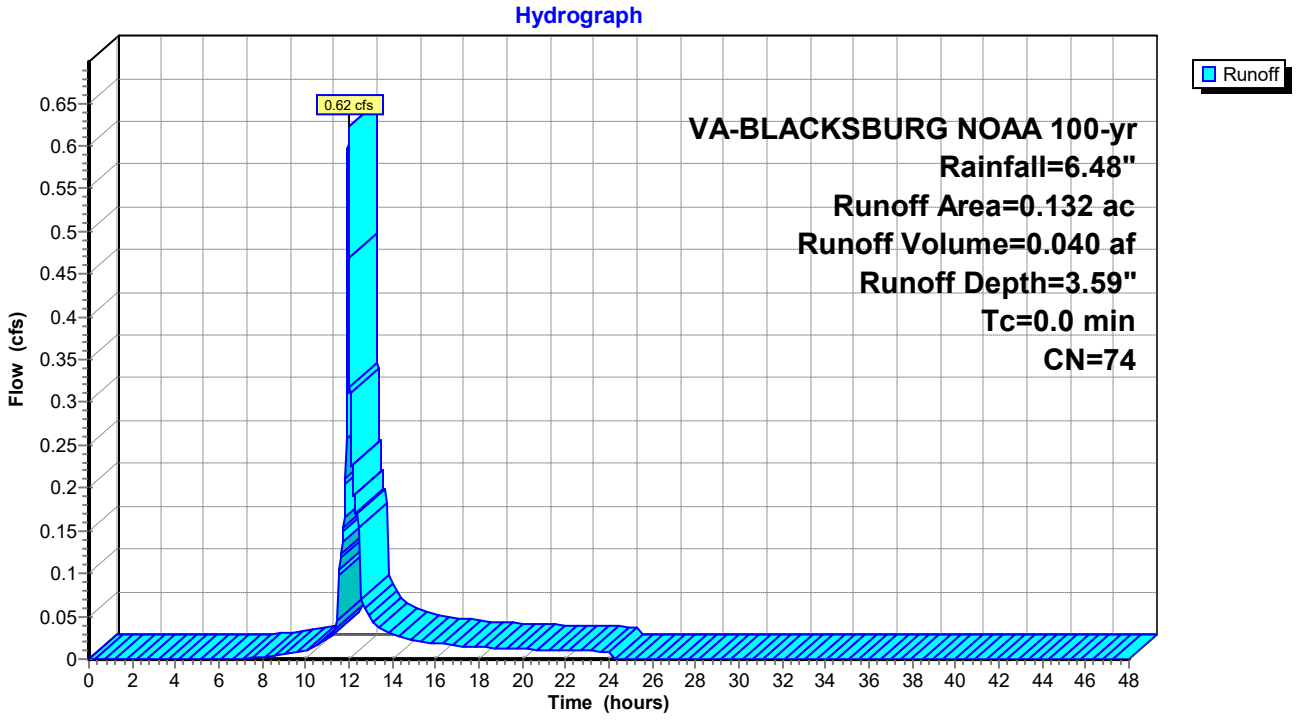
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.62 cfs @ 11.99 hrs, Volume= 0.040 af, Depth= 3.59"

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
0.132	74	>75% Grass cover, Good, HSG C
0.132		100.00% Pervious Area

Subcatchment 2S: DIRECT RUNOFF #1 (TO MIDTOWN SWM FACILITY)



Summary for Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)

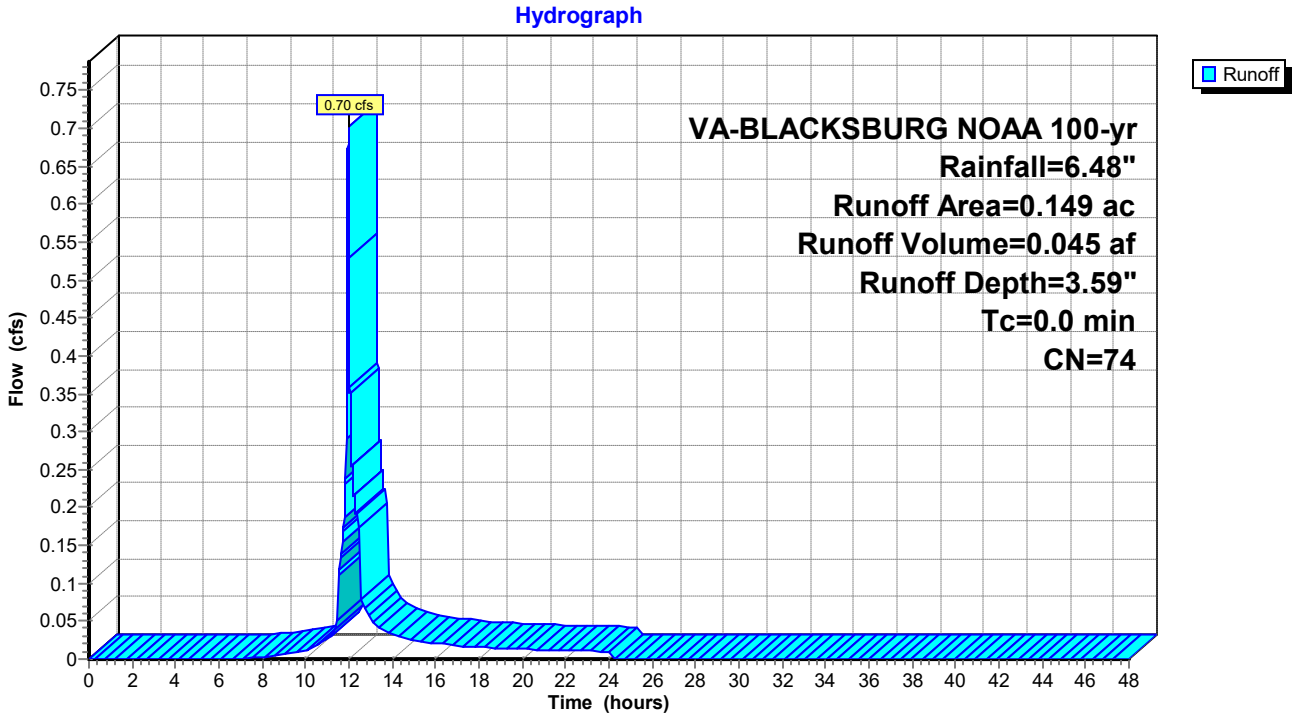
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.70 cfs @ 11.99 hrs, Volume= 0.045 af, Depth= 3.59"

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
0.149	74	>75% Grass cover, Good, HSG C
0.149		100.00% Pervious Area

Subcatchment 3S: DIRECT RUNOFF #2 (TO CLAY STREET)



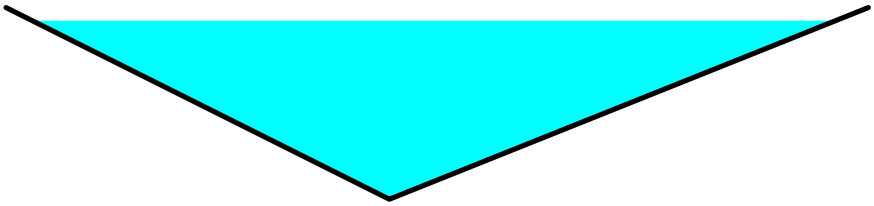
Summary for Reach 3R: ROADSIDE DITCH

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 5.43" for 100-yr event
Inflow = 8.07 cfs @ 12.05 hrs, Volume= 0.679 af
Outflow = 8.05 cfs @ 12.05 hrs, Volume= 0.679 af, Atten= 0%, Lag= 0.1 min

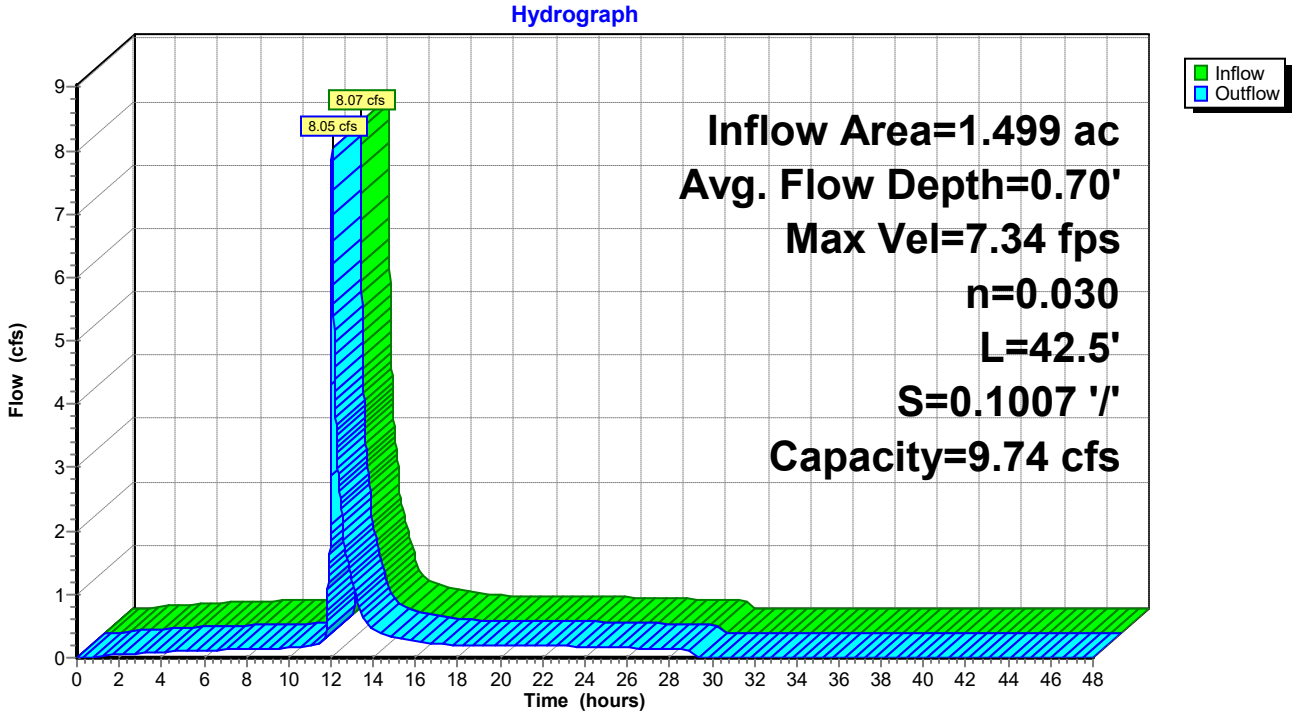
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.34 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.81 fps, Avg. Travel Time= 0.3 min

Peak Storage= 47 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.70' , Surface Width= 3.14'
Bank-Full Depth= 0.75' Flow Area= 1.3 sf, Capacity= 9.74 cfs

0.00' x 0.75' deep channel, n= 0.030
Side Slope Z-value= 2.0 2.5 '/' Top Width= 3.38'
Length= 42.5' Slope= 0.1007 '/'
Inlet Invert= 2,122.10', Outlet Invert= 2,117.82'



Reach 3R: ROADSIDE DITCH



Summary for Pond 1P: UNDERGROUND DETENTION #1

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

Inflow Area = 1.370 ac, 75.77% Impervious, Inflow Depth = 5.60" for 100-yr event
Inflow = 7.71 cfs @ 12.04 hrs, Volume= 0.639 af
Outflow = 7.56 cfs @ 12.05 hrs, Volume= 0.639 af, Atten= 2%, Lag= 0.9 min
Primary = 7.56 cfs @ 12.05 hrs, Volume= 0.639 af
Routed to Link 1L : POA

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,132.42' @ 12.05 hrs Surf.Area= 0.048 ac Storage= 0.140 af

Plug-Flow detention time= 122.8 min calculated for 0.639 af (100% of inflow)
Center-of-Mass det. time= 122.8 min (881.2 - 758.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,127.50'	0.065 af	**20.58'W x 102.50'L x 5.50'H Field A** 0.266 af Overall - 0.103 af Embedded = 0.163 af x 40.0% Voids
#2A	2,128.00'	0.086 af	**ADS N-12 48"** x 15 Inside #1 Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf Row Length Adjustment= -5.00' x 12.40 sf x 3 rows 17.58' Header x 12.40 sf x 1 = 218.0 cf Inside
		0.151 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,124.75'	**15.0" Round 15" HDPE Culvert** L= 63.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,124.75' / 2,124.44' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,124.85'	**1.7" Vert. 1.75" Dia. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,130.50'	**10.0" W x 4.0" H Vert. 10"W x 4"H Rect. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 1	2,131.90'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=7.54 cfs @ 12.05 hrs HW=2,132.41' (Free Discharge)
└**1=15" HDPE Culvert** (Passes 7.54 cfs of 14.82 cfs potential flow)
├**2=1.75" Dia. Orifice** (Orifice Controls 0.21 cfs @ 13.18 fps)
├**3=10"W x 4"H Rect. Orifice** (Orifice Controls 1.77 cfs @ 6.36 fps)
└**4=Broad-Crested Rectangular Weir** (Weir Controls 5.56 cfs @ 2.16 fps)

Pond 1P: UNDERGROUND DETENTION #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 48" (ADS N-12® Pipe)
Inside= 47.7"W x 47.7"H => 12.40 sf x 20.00'L = 248.0 cf
Outside= 54.0"W x 54.0"H => 14.86 sf x 20.00'L = 297.1 cf
Row Length Adjustment= -5.00' x 12.40 sf x 3 rows

54.0" Wide + 24.5" Spacing = 78.5" C-C Row Spacing

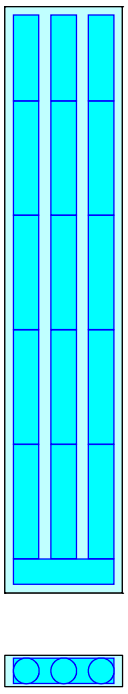
5 Chambers/Row x 20.00' Long -5.00' Row Adjustment +4.50' Header x 1 = 99.50' Row Length +18.0" End Stone x 2 = 102.50' Base Length
3 Rows x 54.0" Wide + 24.5" Spacing x 2 + 18.0" Side Stone x 2 = 20.58' Base Width
6.0" Stone Base + 54.0" Chamber Height + 6.0" Stone Cover = 5.50' Field Height

15 Chambers x 248.0 cf -5.00' Row Adjustment x 12.40 sf x 3 Rows + 17.58' Header x 12.40 sf = 3,752.0 cf Chamber Storage
15 Chambers x 297.1 cf -5.00' Row Adjustment x 14.86 sf x 3 Rows + 17.58' Header x 14.86 sf = 4,495.0 cf Displacement

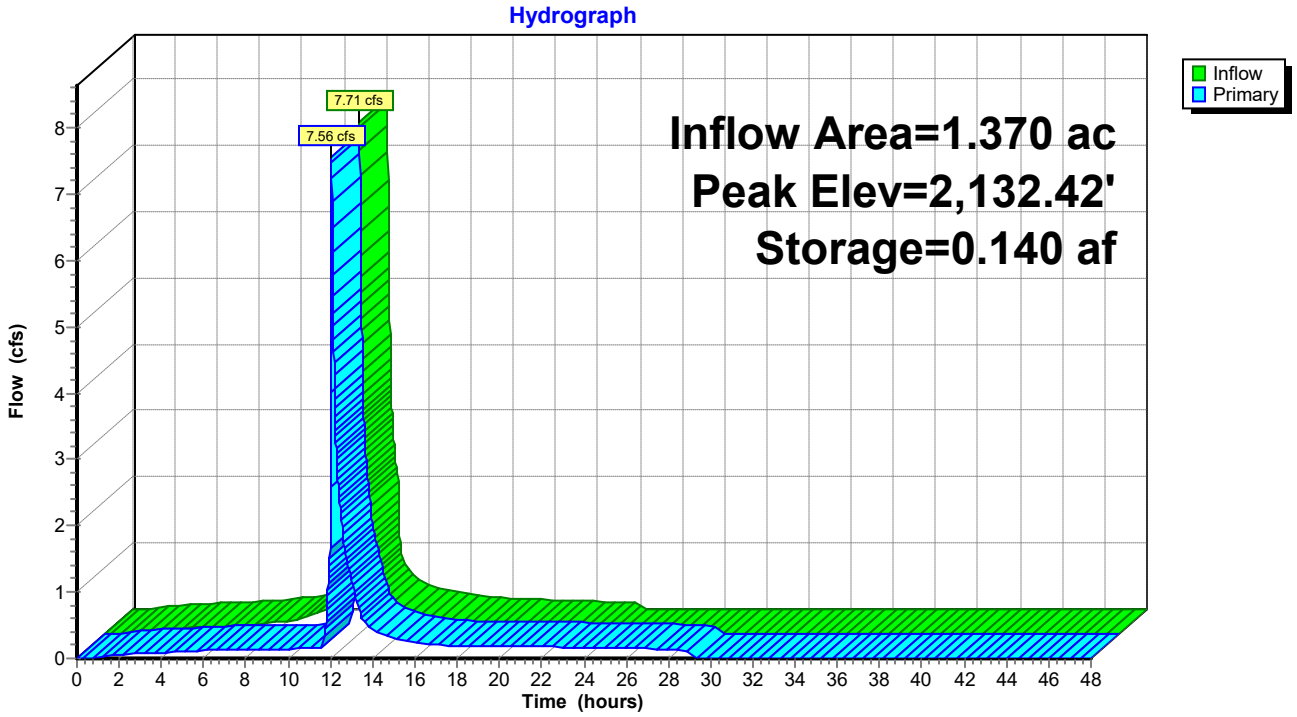
11,604.2 cf Field - 4,495.0 cf Chambers = 7,109.3 cf Stone x 40.0% Voids = 2,843.7 cf Stone Storage

Chamber Storage + Stone Storage = 6,595.7 cf = 0.151 af
Overall Storage Efficiency = 56.8%
Overall System Size = 102.50' x 20.58' x 5.50'

15 Chambers
429.8 cy Field
263.3 cy Stone



Pond 1P: UNDERGROUND DETENTION #1

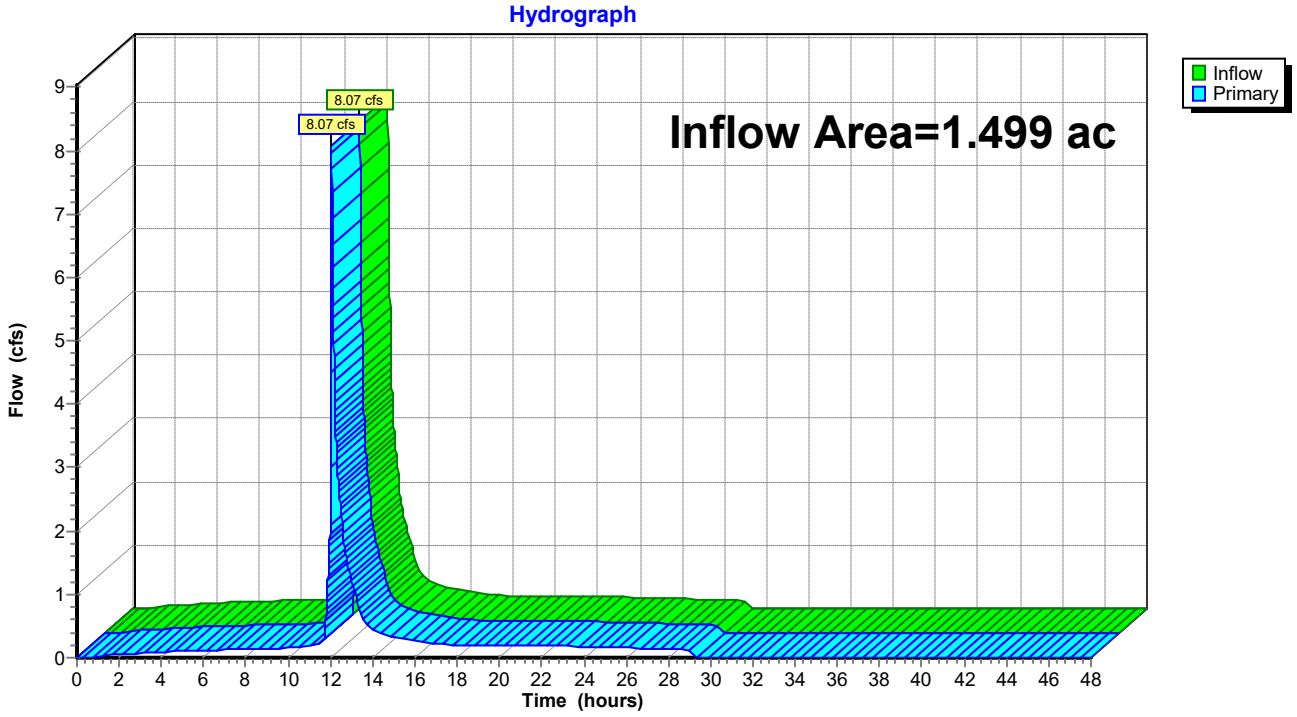


Summary for Link 1L: POA

Inflow Area = 1.499 ac, 69.45% Impervious, Inflow Depth = 5.43" for 100-yr event
Inflow = 8.07 cfs @ 12.05 hrs, Volume= 0.679 af
Primary = 8.07 cfs @ 12.05 hrs, Volume= 0.679 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 3R : ROADSIDE DITCH

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

Link 1L: POA



APPENDIX D:
STORMWATER QUALITY CALCULATIONS

DEQ Virginia Runoff Reduction Method Re-Development Compliance Spreadsheet - Version 4.1

CLEAR ALL (Ctrl+Shift+R)

data input cells
constant values
calculation cells
final results

Project Name: Clay Street Apartments
Date: 10/1/2024
Linear Development Project? No

Site Information

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area *(acres)* → 1.67

Maximum reduction required:	*20%*
The site's net increase in impervious cover (acres) is:	*0.58*
Post-Development TP Load Reduction for Site (lb/yr):	*0.52*

Check:
BMP Design Specifications List: 2024 Stds & Specs
Linear project? No
Land cover areas entered correctly? ✓
Total disturbed area entered? ✓

Pre-ReDevelopment Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			1.25		1.25
Impervious Cover (acres)			0.42		0.42
					1.67

Post-Development Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			0.67		0.67
Impervious Cover (acres)			1.00		1.00
Area Check	**OK.**	**OK.**	**OK.**	**OK.**	1.67

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**0.52**

Nitrogen Loads (Informational Purposes Only)

Pre-ReDevelopment TN Load (lb/yr)	15.09
Final Post-Development TN Load	17.65

LAND COVER SUMMARY -- PRE-REDEVELOPMENT

Land Cover Summary-Pre		
Pre-ReDevelopment	**Listed**	**Adjusted[1]**
Forest Cover (acres)	0.00	0.00
Weighted Rv(forest)	0.00	0.00
Weighted Loading Rate(forest)	0.00	0.00
% Forest	0%	0%
Mixed Open Cover (acres)	0.00	0.00
Weighted Rv(mixed)	0.00	0.00
Weighted Loading Rate(mixed)	0.00	0.00
% Mixed Open	0%	0%
Managed Turf Cover (acres)	1.25	0.67
Weighted Rv(turf)	0.22	0.22
Weighted Loading Rate(turf)	0.75	0.75
% Managed Turf	75%	61%
Impervious Cover (acres)	0.42	0.42
Rv(impervious)	0.95	0.95
Weighted Loading Rate(impervious)	0.86	0.86
% Impervious	25%	39%
Total Site Area (acres)	**1.67**	**1.09**
Site Rv	**0.40**	**0.50**

Treatment Volume and Nutrient Load

Pre-ReDevelopment Treatment Volume (acre-ft)	0.0562	0.0455
Pre-ReDevelopment Treatment Volume (cubic feet)	2,447	1,983
Pre-ReDevelopment TP Load (lb/yr)	**1.29**	**0.86**
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	0.77	0.79
Baseline TP Load (lb/yr) (0.26 lbs/acre/yr applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		*0.28*

[1] *Adjusted Land Cover Summary:*
Pre ReDevelopment land cover minus pervious land cover (forest, mixed open or managed turf) acreage proposed for new impervious cover.

Adjusted total acreage is consistent with Post-ReDevelopment acreage (minus acreage of new impervious cover).

Column I shows load reduction requriement for new impervious cover (based on new development load limit, 0.26 lbs/acre/year).

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary-Post (Final)	
Post ReDev. & New Impervious	
Forest Cover (acres)	0.00
Weighted Rv(forest)	0.00
Wgt. Ld. Rate(forest)	0.00
% Forest	0%
Mixed Open Cover (acres)	0.00
Weighted Rv(mixed)	0.00
Wgt. Ld. Rate(mixed)	0.00
% Mixed Open	0%
Managed Turf Cover (acres)	0.67
Weighted Rv (turf)	0.22
Wgt. Ld. Rate(turf)	0.75
% Managed Turf	40%
Impervious Cover (acres)	1.00
Rv(impervious)	0.95
Wgt. Ld. Rate(imperv.)	0.86
% Impervious	60%
Final Site Area (acres)	**1.67**
Final Post Dev Site Rv	**0.66**

Land Cover Summary-Post	
Post-ReDevelopment	
Forest Cover (acres)	0.00
Weighted Rv(forest)	0.00
Wgt. Ld. Rate(forest)	0.00
% Forest	0%
Mixed Open Cover (acres)	0.00
Weighted Rv(mixed)	0.00
Wgt. Ld. Rate(mixed)	0.00
% Mixed Open	0%
Managed Turf Cover (acres)	0.67
Weighted Rv (turf)	0.22
Wgt. Ld. Rate(turf)	0.75
% Managed Turf	61%
ReDev. Impervious Cover (acres)	0.42
Rv(impervious)	0.95
Wgt. Ld. Rate(imperv.)	0.86
% Impervious	39%
Total ReDev. Site Area (acres)	**1.09**
ReDev Site Rv	**0.50**

Land Cover Summary-Post	
Post-Development New Impervious	
New Impervious Cover (acres)	0.58
Rv(impervious)	0.95

Treatment Volume and Nutrient Load

Final Post-Development Treatment Volume (acre-ft)	0.0915	**Post-ReDevelopment Treatment Volume (acre-ft)**	0.0455	**Post-Development Treatment Volume (acre-ft)**	0.0459
Final Post-Development Treatment Volume (cubic feet)	3,984	**Post-ReDevelopment Treatment Volume (cubic feet)**	1,983	**Post-Development Treatment Volume (cubic feet)**	2,000
Final Post-Development TP Load (lb/yr)	**1.36**	**Post-ReDevelopment Load (TP) (lb/yr)***	**0.86**	**Post-Development TP Load (lb/yr)**	**0.50**
Final Post-Development TP Load per acre (lb/acre/yr)	0.81	**Post-ReDevelopment TP Load per acre (lb/acre/yr)**	0.79		
		Max. Reduction Required (Below Pre-ReDevelopment Load)	**20%**		
		TP Load Reduction Required for Redeveloped Area (lb/yr)	**0.17**	**TP Load Reduction Required for New Impervious Area (lb/yr)**	**0.35**