BALZER
AND ASSOCIATES INC.
REFLECTING TOMORROW

October 6, 2017

Ms. Kafi Howard
Town of Blacksburg, Town Engineer
400 South Main Street
Blacksburg, Virginia 24060

RE: Old Blacksburg Middle School Site Rezoning Application
B&A Job #B1200098.00

Dear Kafi,

Included in this packet are the Stormwater Management calculations for the proposed Old Blacksburg Middle School Site rezoning application. If you have any questions or comments please feel free to call.

Thank you again for all of your and the staff's assistance with this project.

Sincerely,
BALZER AND ASSOCIATES, INC.

Steven M. Semones, LA
Vice President

STORMWATER MANAGEMENT CALCULATIONS

FOR

OLD BLACKSBURG MIDDLE SCHOOL SITE
REZONING APPLICATION

TOWN OF BLACKSBURG
MONTGOMERY COUNTY, VA

B&A Job #B1200098.00

OCTOBER 6, 2017

COMMONWEALTH OF VIRGINIA
STEVEN MICHAEL SEMONES
Lic. No. 962
10/6/17
LANDSCAPE ARCHITECT

PREPARED BY:

BALZER AND ASSOCIATES, INC.
448 PEPPERS FERRY ROAD
CHRISTIANSBURG, VIRGINIA 24073
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SECTION I: PROJECT NARRATIVE

Project Description

The purpose of this project is the redevelopment of 21.26 acres of land to a mixed-use development for Midtown Redevelopment Partners, LLC. The site is located along South Main Street between Clay Street, Eheart Street and Willard Drive in the Town of Blacksburg.

Existing Site Conditions

The site[1] consists of five parcels totaling 21.26 acres, the majority of which made up the former Blacksburg Middle School property. Aside from a 0.214 acre parcel at the corner of Eheart Street and Willard Drive, the existing site consists of a former educational facility with an impervious coverage of 5.85 acres (27.2%). A sixth parcel owned by the Virginia Tech Foundation with an area of 1.7 acres is included in the rezoning but will handle their stormwater onsite, therefore this parcel is not included in the attached stormwater management system design. The site is bound by South Main Street and a mixed-use structure ("Clay Court") owned by Hill Companies LLC to the southwest, Clay Street to the north, the properties of Scott Noonkester, Gary J. Ashton & John C. Ashton III, Roger M. and Vicki S. Powell, and Betty Estes Trust and Willard Drive to the northwest and Eheart Street to the southeast. The existing site consists of graveled/impervious areas and open grassed field. Existing soil conditions onsite include the types listed below with slopes of 2%-50%, although the majority of the site is relatively flat. There are no wetlands or jurisdictional waters present on site. There is currently no stormwater management BMP on site. Stormwater leaves the site through one of three discharge points, which transport water approximately 500 feet to the Central Branch of Stroubles Creek. Surrounding areas consist of developed urban land, with the majority of the neighboring properties consisting of commercial and residential parcels.

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: 0.28
Texture: Clay loam

18C – Groseclose - Urban Land Complex, 7 to 15 percent slopes
K-Factor: 0.28
Texture: Clay loam

29 – Udorthents and Urban Land
K-Factor: Variable
Texture: Variable

[1] For the purposes of the Project Narrative, "site" shall be defined as the area within the subject property boundary, 21.26 acres as Tax Map #257-A-94, 257-A-94A, 257-A-217, 257-A-218, & 257-25 C.

Development Plans

The proposed development will consist of a variety of commercial, civic, residential, and multi-use buildings, as well as several areas of future development, and associated improvements to serve the proposed uses. The proposed site will include an entry plaza, a common area, a large park, and several other open space areas. The project is also proposing at least one parking garage and multiple areas of surface parking. For the purposes of providing stormwater management, the future development areas have been included in the calculations with an assumption of 70% impervious. The proposed right of ways may be dedicated as public streets to the Town of Blacksburg. Stormwater management for these public streets will be handled within the stormwater management facilities on the site.

During Construction

The existing site consists of stabilized grassed areas that may become disturbed during construction activities. Any runoff from the site shall be controlled with temporary measures such as a construction entrance, silt fence, sediment traps and 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 sheets SW3 and SW4 for drainage area maps.

In the pre-development condition, the majority of the site drains either directly to the Central Branch of Stroubles Creek off the northern border of the property, or to one of two storm sewer drains, labeled on the plan as Existing Manhole "B" and Existing Manhole "C". A 3.27 acre portion of the site drains to Manhole "C", a DI-3B curb inlet, and then through a 15" RCP to a manhole and through an 18" RCP to Manhole "A", which has been chosen as Point of Analysis 1. The existing storm sewer is adequate to convey existing flows up to this point. A 4.65 acre portion of the site drains to Manhole "B", and then through a 15" CMP to its outfall in Stroubles Creek under Church Street. This portion of storm sewer is currently inadequate to convey even frequent storm events. The remainder of the site drains directly to the Central Branch of Stroubles Creek, upstream of a 50"x31" elliptical CMP under Wharton Street and a 5'x3' concrete box culvert under Church Street. An area of 169.60 acres drains to the culvert under Wharton Street, which is the beginning of an 850' section of creek and storm sewer that is known to be inadequate to convey large storm events. Ponds upstream of this point have been included in the model using design data obtained from the Town of Blacksburg. While certain areas within the Fiddlers Green development, as designated on Sheet SW3, were designed to contain all runoff within infiltration pits, a safety factor of 1.25 has been incorporated into the model to account for surface runoff that may occur. This safety factor assumes 25% of the runoff continues to the downstream drainage area due to alterations to the original drainage design caused by individual homeowners and lots which houses are not yet constructed and thus infiltration pits are not yet installed. The 5'x3' concrete box culvert under Church Street has been chosen as Point of Analysis 2. All flows in this model have been analyzed using the SCS/TR-55 method. See HydroCAD report for time of concentration calculations.

Point of Analysis 1

Total Drainage Area= 3.27 acres

PRE-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
OPEN SPACE	1.727	D	98
IMPERVIOUS	0.830	D	98
PAVED ROADS W/ CURBS & SEWERS	0.716	D	98

The CN number has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All land cover values were taken from table 4-6a and table 4-6b of the Virginia Stormwater Management Handbook.

The peak pre-development runoff flows at the point of analysis are as follows:
(See HydroCAD report)

1-year 4.02 cfs
2-year 5.25 cfs
10-year 8.32 cfs
100-year 12.74 cfs

Point of Analysis 2

Total Drainage Area = 192.44 acres

PRE-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
2 ACRE LOTS	0.017	D	82
1 ACRE LOTS	2.116	C	79
1/2 ACRE LOTS	9.079	C	80
1/2 ACRE LOTS	0.122	D	85
1/3 ACRE LOTS	5.519	B	72
1/3 ACRE LOTS	25.110	C	81
1/3 ACRE LOTS	0.020	D	86
1/4 ACRE LOTS	21.835	C	83
1/4 ACRE LOTS	3.126	D	87
1/8 ACRE LOTS	17.398	C	90
1/8 ACRE LOTS	2.695	D	92
OPEN SPACE	31.533	C	74
OPEN SPACE	11.878	D	80
IMPERVIOUS	2.167	C	98
IMPERVIOUS	5.228	D	98
PAVED ROADS W/ OPEN DITCHES	0.485	B	89
PAVED ROADS W/ OPEN DITCHES	21.995	C	92
PAVED ROADS W/ OPEN DITCHES	2.296	D	93
URBAN COMMERCIAL	2.006	C	94
URBAN COMMERCIAL	0.202	D	95
WOODS	0.103	B	55
WOODS	20.432	C	70
WOODS	1.722	D	77
CARRY OVER FROM JEFFERSON STREET INFILTRATION PITS	0.680		80
CARRY OVER FROM PROSPECT STREET INFILTRATION PITS	0.663		83
CARRY OVER FROM THE VILLAS INFILTRATION PITS	4.015		90

The CN number has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All land cover values were taken from table 4-6a and table 4-6b of the Virginia Stormwater Management Handbook.

The peak pre-development runoff flows at the point of analysis are as follows:
(See HydroCAD report)

1-year	**89.58 cfs**
2-year	**139.60 cfs**
10-year	**256.50 cfs**
100-year	**482.94 cfs**

POST-DEVELOPMENT SUMMARY

Please see sheet SW5 and SW6 for drainage area map.

The proposed site will be graded such that the majority of the developed land will drain to a StormTech MC-4500 underground chamber system located underneath the central area labeled as "Old School Common". The chamber system will outfall to Manhole "B" in Clay Street, which is an existing manhole but will be replaced in order to get a lower invert. The existing 15" storm sewer under Church Street will be replaced with a 30" A-2000 PVC drainage pipe to adequately convey flows from Manhole "B" to Point of Analysis 2. This strategy of reducing the runoff from the site entering Stroubles Creek at Wharton Street and discharging it at Church Street is an effort to reduce the known flooding problems between Wharton and Church Streets. A 0.67 acre area encompassing a small portion of the parking lot on the northern side of the site will discharge directly into Manhole B. This parking lot will be accessed from Clay Street and therefore must match the grade along the existing pavement, which is considerably lower than the central area of the site where the detention system will be located. A 1.99 acre portion of the site along Main Street will drain to existing Manhole "C" as in the pre-development condition. See HydroCAD report for area and time of concentration calculations.

Point of Analysis 1

Total Drainage Area= 1.99 acres

POST-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
IMPERVIOUS	1.048	N/A	98
PAVED ROADS W/ CURBS & SEWERS	0.716	N/A	98
OPEN SPACE	0.224	D	80

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational "C" coefficients are derived from VSMH Table 4-3 "Rational Equation Runoff Coefficients".

The peak post-development runoff flows at Point of Analysis 1 are as follows:
(See HydroCAD report)

1-year 3.58 cfs
2-year 4.42 cfs
10-year 6.34 cfs
100-year 8.91 cfs

As shown above, the post-development flow at Point of Analysis 1 is less than the pre-development flow for the 1-year, 2-year, and 10-year storms, thus meeting the Town of Blacksburg stormwater management requirements.

Point of Analysis 2

Total Drainage Area = 187.95 acres

POST-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
2 ACRE LOTS	0.017	D	82
1 ACRE LOTS	2.116	C	79
1/2 ACRE LOTS	9.079	C	80
1/2 ACRE LOTS	0.122	D	85
1/3 ACRE LOTS	5.519	B	72
1/3 ACRE LOTS	25.110	C	81
1/3 ACRE LOTS	0.020	D	86
1/4 ACRE LOTS	21.835	C	83
1/4 ACRE LOTS	3.126	D	87
1/8 ACRE LOTS	17.398	C	90
1/8 ACRE LOTS	2.695	D	92
URBAN COMMERCIAL	2.006	C	94
URBAN COMMERCIAL	0.201	D	95
PAVED ROADS W/ OPEN DITCHES	0.485	B	89
PAVED ROADS W/ OPEN DITCHES	21.251	C	92
PAVED ROADS W/ OPEN DITCHES	0.604	D	93
PAVED ROADS W/ CURBS & SEWERS	2.285	N/A	98
IMPERVIOUS	12.216	N/A	98
WOODS	0.103	B	55
WOODS	20.432	C	70
WOODS	1.722	D	77
OPEN SPACE	28.513	C	74
OPEN SPACE	4.512	D	80
PRD PARCEL #3 FUTURE DEV	0.846		91
PRD PARCEL #4 FUTURE DEV	1.965		92
PRD PARCEL #5 FUTURE DEV	2.079		93
PRD PARCEL #6 FUTURE DEV	1.692		92
CARRY OVER FROM JEFFERSON STREET INFILTRATION PITS	0.680		80
CARRY OVER FROM PROSPECT STREET INFILTRATION PITS	0.663		83
CARRY OVER FROM THE VILLAS INFILTRATION PITS	4.015		90

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational "C" coefficients are derived from VSMH Table 4-3 "Rational Equation Runoff Coefficients".

The peak post-development runoff flows at Point of Analysis 2 are as follows:
(See HydroCAD report)

1-year	**82.49 cfs**
2-year	**133.81 cfs**
10-year	**253.88 cfs**
100-year	**481.45 cfs**

As shown above, the post-development flow at Point of Analysis 2 is less than the pre-development flow for the 1-year, 2-year, and 10-year storms, thus meeting the Town of Blacksburg stormwater management requirements.

100-Year Storm Safe Passage

The proposed BMP has been designed with consideration of the flow path of floodwaters from the 100-year design storm. As shown on the attached HydroCAD calculations, the 100-year storm will exit the top of the system, however, an additional calculation is included in which the underground system has been removed completely. This calculation assumes that the 100-year storm bypasses the inlets and flows straight to the culvert. As shown in the calculations, in the case of a storm exiting the top of the system, or even in the case of a complete bypass of the system, the 100-year storm can safely flow through the culvert.

Channel Protection

In accordance with 9VAC25-870-66 (B), concentrated stormwater flows have been discharged directly to a manmade stormwater conveyance system. From Point of Analysis 1, flows will be carried through a manmade conveyance system located within the public right of way. This conveyance system carries flows from the site to a junction box in Draper Road where the contributing drainage area is less than or equal to 1.0% of the total watershed area as defined in subdivision 4(a) of the regulations (at least 199 acres). Per subdivision 1(a), the post-development peak flow rate from the two-year 24-hour storm shall not cause erosion of the system. No erosion of the manmade system components (metal, concrete, and brick) can be expected from these stormwater flows.

Channel protection requirements for Point of Analysis 2 are met for the concentrated discharge point as follows. At the discharge point, the point of analysis unavoidably includes runoff from adjacent areas not part of the project site[2]. Since the energy balance requirement is to be applied to the development site only, this flow rate reduction has been entered into the pre-development model to obtain a maximum flow rate at the downstream point of analysis, accounting for the energy balance reduction on the development site drainage area. Per the equations below, the pre-development flows from the site have been multiplied by the prescribed reduction rates in the attached HydroCAD calculations labeled "Channel Protection".

Per subdivision (3)(a), the maximum post-development peak flow rate from the one-year 24-hour storm shall be calculated per the equations below:

<u>Rv Calculation</u> (site area)
Pre-developed = 2.021 acre*ft – See HydroCAD "Rv CALCULATION" Report Pg. 3

Developed = 2.879 acre*ft – See HydroCAD "Rv CALCULATION" Report Pg. 3

$$Q_{Developed} \leq I.F. \times \left(Q_{\Pr e-developed} \times RV_{\Pr e-Developed}\right) / RV_{Developed}$$
$$Q_{Developed} \leq 0.8 \times \left(Q_{\Pr e-developed} \times 2.021\ af\right) / 2.879\ af$$
$$Q_{Developed} \leq 0.56 \times Q_{\Pr e-developed}$$

The resulting maximum allowable peak flow rate for the one-year 24-hour storm at Point of Analysis 2 is 85.91 cfs. The actual post-development peak flow rate achieved is 82.49 cfs.

[2] In the context of channel and flood protection, "site" shall be defined as the land or water area where the land-disturbing activity is physically conducted (the area of land disturbance, approx. 21.00 acres), including the limits of any off-site land disturbance. See Sheets SW3-SW6.

Flood Protection

In accordance with 9VAC25-870-66 subsection C, concentrated stormwater flows have been discharged directly to a manmade stormwater conveyance system, PVC or CMP storm sewer located within the public right-of-way. This conveyance system carries flows from the site to a point where the contributing drainage area is less than or equal to 1.0% of the total watershed area as defined in subdivision 3 (a) of the regulations (at least 2100 acres for the 21.00 acre area of disturbance). As shown on the attached HydroCAD calculations, the points of discharge release post-development peak flow rates 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:

Water quality compliance will be achieved through the use of a manufactured device in accordance with the design criteria set forth in 9VAC25-870-65. The existing site[3] has a pre-development impervious land cover of 5.85 acres (27.2%). The post development site will have a maximum impervious cover of 14.37 ac (66.8%) resulting in a composite runoff coefficient (R_v) of 0.75. The total disturbed area is 21.00 acres and the required phosphorus removal on site is 19.00 pounds per year, which will be handled as described below.

The central onsite drainage area, which flows to the underground detention system, is 19.76 acres, with 33.65 pounds of phosphorus available for removal. A StormTech chamber system will be utilized for underground detention, which will also serve as a filtering device and provide 40% phosphorus removal efficiency, or approximately 13.45 pounds. The detention system will outfall to a Jellyfish prior to exiting the site, which will provide 50% phosphorus removal, bringing the total phosphorus removed to approximately 23.53 pounds, which is 4.53 pounds above the requirement. Please see attached calculation sheets.

[3] In the context of water quality compliance, "site" shall be defined as the land or water area where the land-disturbing activity is physically conducted (the area of land disturbance, 21.00 acres), including the limits of any off-site land disturbance. See Sheets SW3-SW6.

Jellyfish Filter Calculations

Per the manufacturer, Jellyfish filters shall be sized based on the regulatory agency specified treatment flow rate (q_{pTv}), anticipated sediment mass load and required pollutant storage capacities in order to achieve the target phosphorus removal efficiency of 50%. (Note: Sizing criteria has been calculated using the total area draining to the Jellyfish.)

Flow rate sizing:

Derivation of adjusted CN for contributing drainage area

$T_v = 53{,}558\ ft^3 - the\ volume\ reduced\ by\ an\ upstream\ BMP$

$T_v = 53{,}558\ ft^3 - 0\ ft^3$ (treatment volume from VRRM worksheet)

$T_v = 53{,}558\ ft^3$

$P = 1.0"\ (inches)$

$Q_a = \frac{53{,}588\ ft^3}{892{,}544\ ft^2} \times \frac{12\ in}{ft} = 0.72\ watershed\ inches$

$CN = \frac{1000}{\left[10+5P+10Q_a-10\left(Q_a^2+1.25Q_aP\right)^{0.5}\right]} = 97$ (VSMH Eq. 11.11)

Calculation of Water Quality Treatment Volume peak discharge (q_{pTv})

$q_u = 1200\ cfs/mi^2/in$ (from TR-55 Graphical Peak Discharge Method, Exhibit 4-II)

$A = 0.03202\ mi^2$

$Q_a = 0.72\ watershed\ inches$

$q_{pTv} = 1200\frac{csm}{in} \times 0.03202\ mi^2 \times 0.72\ in = 27.7\ cfs$ (VSMH Eq. 11.12)

The Jellyfish filter shall be sized to treat a peak *runoff rate* of 27.7 cfs from the site. Since the filter is located downstream of the detention facility, the filter will actually receive a much smaller flow rate from the storm that produces 27.7 cfs. The storm that produces a runoff rate of 27.7 cfs will create an outflow from the detention facility of 2.01 cfs, therefore the Jellyfish will need to be sized to handle 2.01 cfs.

Sediment Mass Load and Storage Sizing:

The Jellyfish filter shall be sized for sediment loading and storage to permit a reasonable interval between maintenance cleanouts and filter cartridge service. The system will be designed to accommodate a minimum four month interval between maintenance services. A design value of 440 lb/ac/yr has been selected for the contributing drainage area based on the following table.

Table D-1 Typical Urban Areas and Pollutant Yields (lb/ac/yr)

Commercial	Parking Lot	Residential Density			Highways	Industrial	Shopping Center
		High	Med.	Low			
1,000	400	420	250	10	880	500	440

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1

$$m = 440 \frac{lbs}{ac \cdot yr} \times 20.49\ ac = 9{,}015 \frac{lbs}{yr}$$

Per the manufacturer, each standard 54" draindown cartridge has a design sediment mass loading capacity of 63 lbs and each standard 54" Hi-Flow cartridge has a design sediment mass loading capacity of 125 lbs.

A model JF10-16-4 has 16 Hi-Flo cartridges and 4 draindown cartridges with a total sediment mass loading capacity of 2,252 lbs and a maximum treatment flow rate of 3.21 cfs, which meets the design requirements above for a maintenance schedule of four times per year.

SECTION IV: DOWNSTREAM ANALYSIS

Runoff from the proposed development enters the Central Branch of Stroubles Creek, which flows in a westerly direction near the site, under Main Street and downtown Blacksburg, and through the Virginia Tech campus towards the Duck Pond. The watershed reaches the 1% analysis point (2100 acres) approximately 1,200 feet downstream of the Duck Pond. Portions of the channel to the 1% point are known to be inadequate to convey existing drainage flows.

Per 9VAC25-870-66 subsection A, compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations has been satisfied by meeting the requirements for channel protection and flood protection as shown in the Post Development Summary. In addition to installing a detention system that will reduce the volume of runoff leaving the site, the project is also proposing to improve the downstream storm sewer under Church Street. 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.

Required Action:

1. Every six (6) months the owner shall complete the "Operation and Maintenance Checklist" provided in Appendix 3B of the Virginia Stormwater Management Handbook (VSMH) (may also be obtained from the town of Blacksburg engineering and GIS offices) and make any repairs necessary to areas of failure/concern discovered during inspection.
2. Jellyfish units shall be inspected annually per the manufacturer's recommendations including inspection for damage to the structure or filter membranes, removal of trash and debris, and pumping of accumulated solids, and cartridge replacement (if necessary).
3. The outfall structures of all basins 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.
4. Regular maintenance and inspection activities for the underground detention basins include cleanout of any debris or sediment in the structure as well as a visual inspection for structural deterioration, spalling, or cracking of the structural components. The outfall structures of proposed detention facilities shall be inspected after each runoff producing storm event to check for debris and/or sediment accumulation that may compromise the performance of the structure. Such debris and sediments shall be removed immediately.

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

APPENDIX A:
SOIL MAPS & SOIL DESCRIPTIONS

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Montgomery County, Virginia

June 22, 2017

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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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.

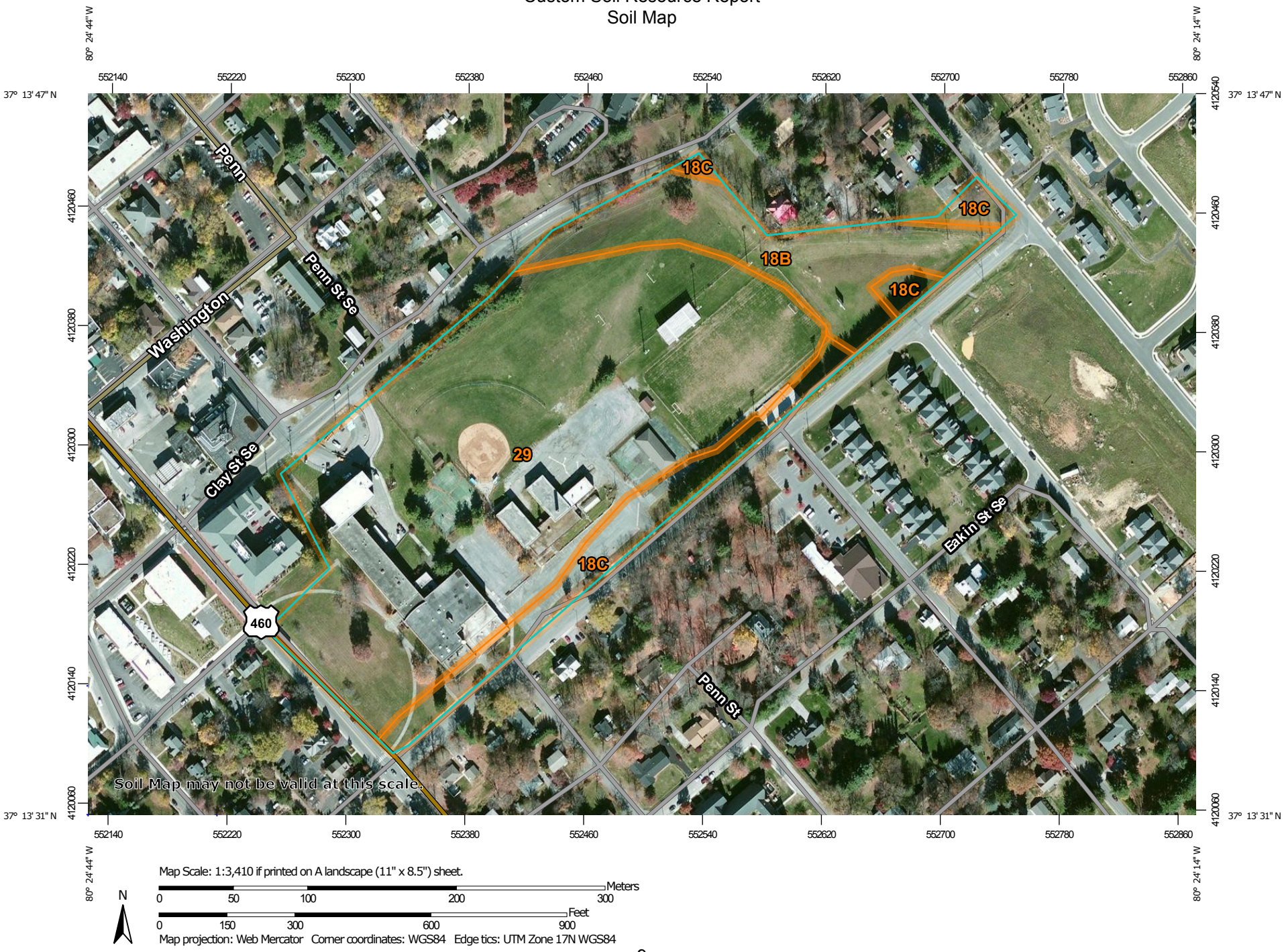
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:3,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 9, Dec 11, 2013

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

Date(s) aerial images were photographed: Nov 11, 2010—Mar 17, 2011

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

Montgomery County, Virginia (VA121)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	3.2	15.5%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	2.4	11.7%
29	Udorthents and Urban land	15.2	72.8%
Totals for Area of Interest		**20.8**	**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
Natural 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 storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Unnamed (G128XB000VA)
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

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: No

Minor Components

Purdy

Percent of map unit: 3 percent
Landform: Stream terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Unnamed (G128XY000VA)
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): Backslope, summit
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
Natural 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 storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Unnamed (G128XB000VA)
Hydric soil rating: No

Description of Urban Land

Setting

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

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: No

Minor Components

Purdy

Percent of map unit: 3 percent
Landform: Depressions, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: Yes

29—Udorthents and Urban land

Map Unit Setting

National map unit symbol: kc2r
Elevation: 1,300 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: No

Description of Urban Land

Setting

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

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: No

Minor Components

Purdy

Percent of map unit: 3 percent
Landform: Depressions, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Unnamed (G128XY000VA)
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 Chemical Properties

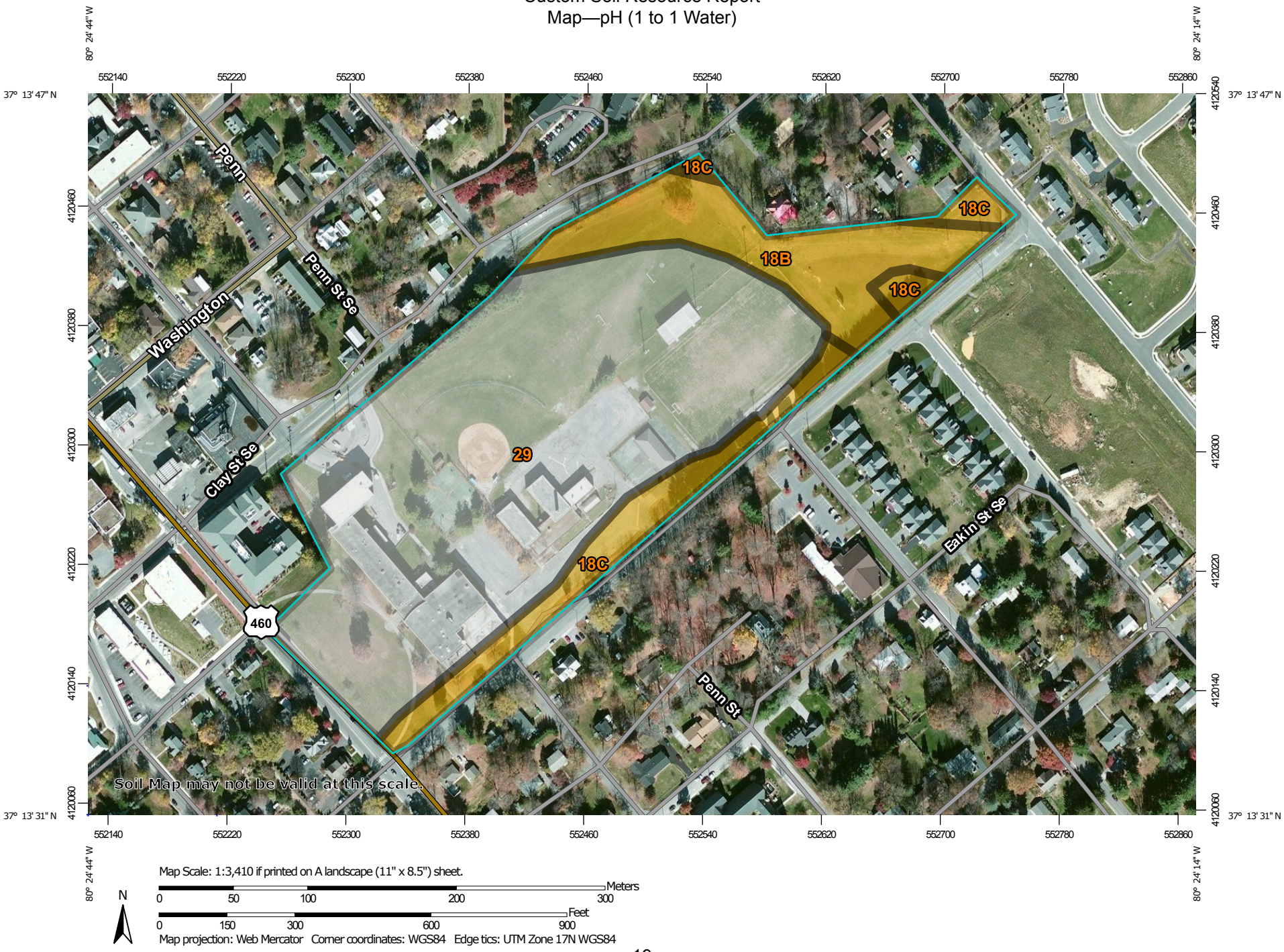
Soil Chemical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

pH (1 to 1 Water)

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

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

Map—pH (1 to 1 Water)



Map Scale: 1:3,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

Ultra acid (ph < 3.5)

Extremely acid (pH 3.5 - 4.4)

Very strongly acid (pH 4.5 - 5.0)

Strongly acid (pH 5.1 - 5.5)

Moderately acid (pH 5.6 - 6.0)

Slightly acid (pH 6.1 - 6.5)

Neutral (pH 6.6 - 7.3)

Slightly alkaline (pH 7.4 - 7.8)

Moderately alkaline (pH 7.9 - 8.4)

Strongly alkaline (pH 8.5 - 9.0)

Very strongly alkaline (pH > 9.0)

Not rated or not available

Soil Rating Lines

Ultra acid (ph < 3.5)

Extremely acid (pH 3.5 - 4.4)

Very strongly acid (pH 4.5 - 5.0)

Strongly acid (pH 5.1 - 5.5)

Moderately acid (pH 5.6 - 6.0)

Slightly acid (pH 6.1 - 6.5)

Neutral (pH 6.6 - 7.3)

Slightly alkaline (pH 7.4 - 7.8)

Moderately alkaline (pH 7.9 - 8.4)

Strongly alkaline (pH 8.5 - 9.0)

Very strongly alkaline (pH > 9.0)

Not rated or not available

Soil Rating Points

Ultra acid (ph < 3.5)

Extremely acid (pH 3.5 - 4.4)

Very strongly acid (pH 4.5 - 5.0)

Strongly acid (pH 5.1 - 5.5)

Moderately acid (pH 5.6 - 6.0)

Slightly acid (pH 6.1 - 6.5)

Neutral (pH 6.6 - 7.3)

Slightly alkaline (pH 7.4 - 7.8)

Moderately alkaline (pH 7.9 - 8.4)

Strongly alkaline (pH 8.5 - 9.0)

Very strongly alkaline (pH > 9.0)

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Montgomery County, Virginia
Survey Area Data: Version 9, Dec 11, 2013

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

Date(s) aerial images were photographed: Nov 11, 2010—Mar 17, 2011

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

Table—pH (1 to 1 Water)

pH (1 to 1 Water)— Summary by Map Unit — Montgomery County, Virginia (VA121)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	4.6	3.2	15.5%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	4.6	2.4	11.7%
29	Udorthents and Urban land		15.2	72.8%
Totals for Area of Interest			**20.8**	**100.0%**

Rating Options—pH (1 to 1 Water)

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

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

Top Depth: 0

Bottom Depth: 60

Units of Measure: Inches

Soil Erosion Factors

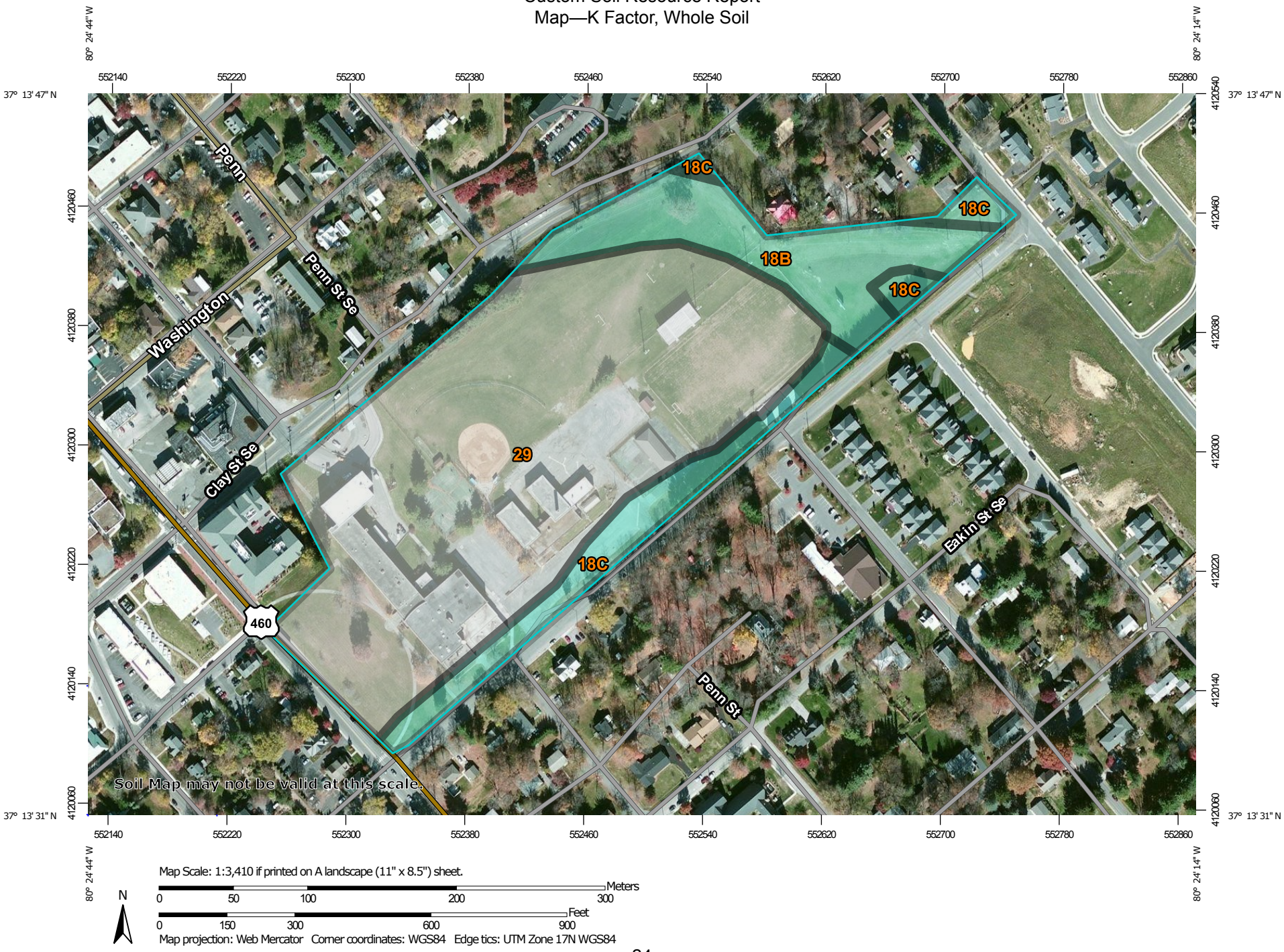
Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

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.

Custom Soil Resource Report
Map—K Factor, Whole Soil



Map Scale: 1:3,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

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Survey Area Data: Version 9, Dec 11, 2013

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Date(s) aerial images were photographed: Nov 11, 2010—Mar 17, 2011

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

K Factor, Whole Soil— Summary by Map Unit — Montgomery County, Virginia (VA121)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	.32	3.2	15.5%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	.32	2.4	11.7%
29	Udorthents and Urban land		15.2	72.8%
Totals for Area of Interest			**20.8**	**100.0%**

Rating Options—K Factor, Whole Soil

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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

Soil Physical Properties

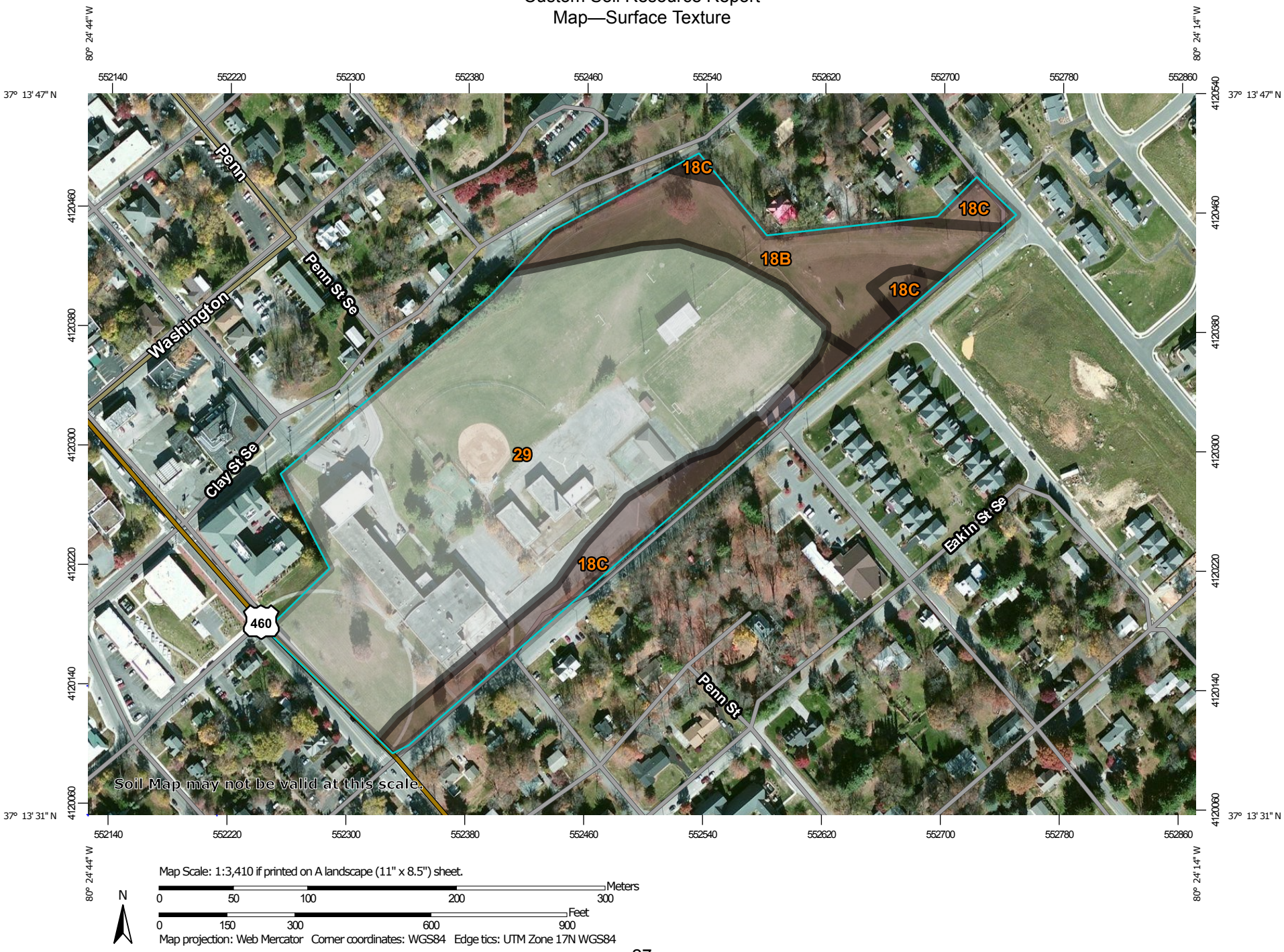
Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Surface Texture

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

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

Custom Soil Resource Report
Map—Surface Texture



Map Scale: 1:3,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Loam

Not rated or not available

Soil Rating Lines

Loam

Not rated or not available

Soil Rating Points

Loam

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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 9, Dec 11, 2013

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

Date(s) aerial images were photographed: Nov 11, 2010—Mar 17, 2011

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

Surface Texture— Summary by Map Unit — Montgomery County, Virginia (VA121)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	Loam	3.2	15.5%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	Loam	2.4	11.7%
29	Udorthents and Urban land		15.2	72.8%
Totals for Area of Interest			**20.8**	**100.0%**

Rating Options—Surface Texture

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

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

Soil Qualities and Features

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

Hydrologic Soil Group

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

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

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

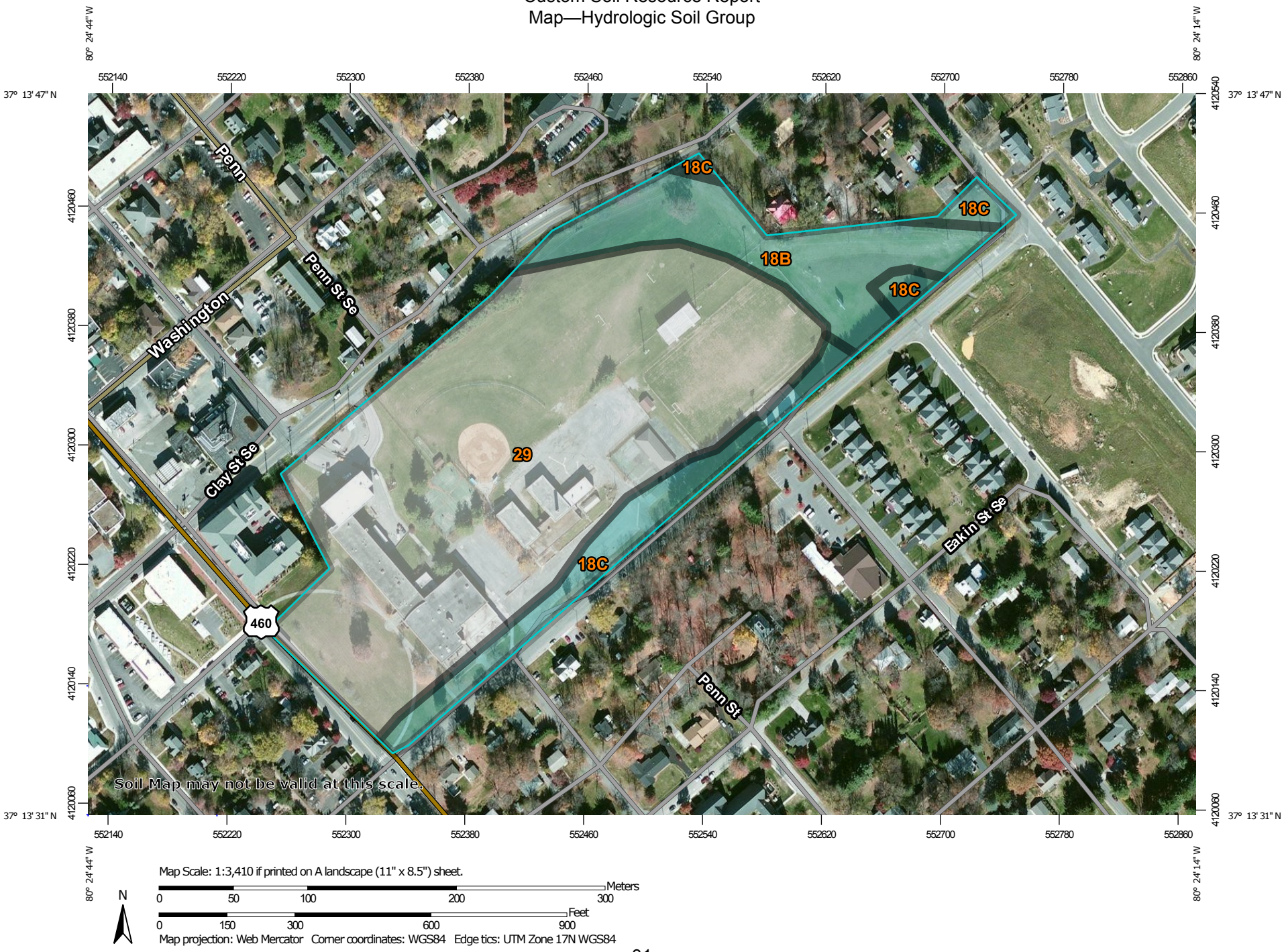
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:3,410 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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 9, Dec 11, 2013

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

Date(s) aerial images were photographed: Nov 11, 2010—Mar 17, 2011

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

Hydrologic Soil Group— Summary by Map Unit — Montgomery County, Virginia (VA121)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
18B	Groseclose-Urban land complex, 2 to 7 percent slopes	C	3.2	15.5%
18C	Groseclose-Urban land complex, 7 to 15 percent slopes	C	2.4	11.7%
29	Udorthents and Urban land		15.2	72.8%
Totals for Area of Interest			**20.8**	**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

POINT OF ANALYSIS #2
TOTAL DRAINAGE AREA=192.44 AC

EX. 15" CMP (TO BE REPLACED)
EX. APPROX. INV. OUT=2075.02
NEW 30" PVC INV. OUT=2075.02

WASHINGTON STREET

BERRYFIELD SWM POND
TOTAL DRAINAGE
AREA=153.20 AC

BERRYFIELD LANE

POINT OF ANALYSIS #1
TOTAL DRAINAGE AREA=3.27 AC

CLAY STREET

EX. STORM MH "B" (TO BE REPLACED)
TOP=2106.82
EX. 15" CMP INV. OUT=2106.01
NEW 30" PVC INV. IN=2104.10
NEW 30" PVC INV. OUT=2096.25

CLAY ST. SWM BOX
48" HDPE OUTLET PIPE

TO EX. 5'x3' CONC. BOX
DIRECT RUNOFF AREA=14.98 AC.
CN=87

TO EX. 50"x31" CMP
VIA EX. 24" RCP
AREA=4.30 AC.
CN=77

LIMITS OF DISTURBANCE
(WATER QUALITY AREA)
21.00 AC

TO EX. MH "A"
AREA=3.27 AC.
CN=88

TO EX. MH "B"
AREA=4.65 AC.
CN=90

TO EX. 50"x31" CMP
DIRECT RUNOFF AREA=7.42 AC.
CN=83
25% CARRY OVER FROM THE
VILLAS INFILTRATION PITS

TO FIDDLERS GREEN
INFILTRATION PITS
TOTAL AREA=2.65 AC.

EHEART STREET

EHEART ST.

INFILTRATION PIT

MOUNTAIN VIEW DRIVE

EAKIN STREET

EAKIN ST.

INFILTRATION PIT

Scale 1" = 80'

APPROVAL BLOCK

BLACKSBURG TOWN PLANNER DATE

BLACKSBURG TOWN ENGINEER DATE

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FAX 540-381-4291
COMMONWEALTH OF VIRGINIA
STEVEN MICHAEL SEMONES
Lic. No. 962
10/6/17
LANDSCAPE ARCHITECT

OLD BLACKSBURG MIDDLE SCHOOL SITE

501 SOUTH MAIN STREET

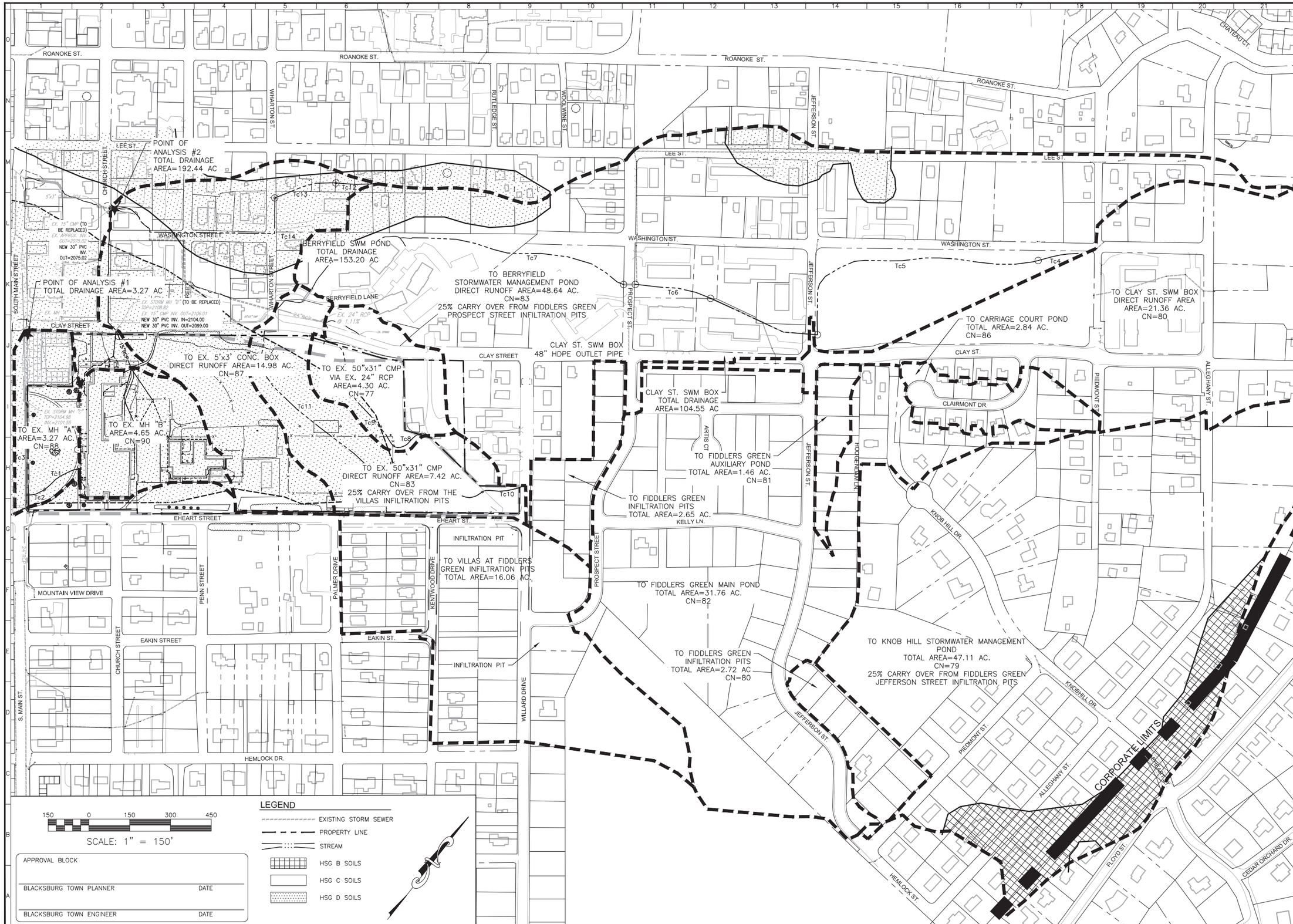
PRE-DEVELOPMENT DRAINAGE MAP

TOWN OF BLACKSBURG
MONTGOMERY COUNTY, VIRGINIA

DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	SMS
DATE	10/6/17
SCALE	1" = 80'
REVISIONS:	

SHEET NO.
SW3

JOB NO. B1200098.00



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10/6/17
LANDSCAPE ARCHITECT

OLD BLACKSBURG MIDDLE SCHOOL SITE

501 SOUTH MAIN STREET

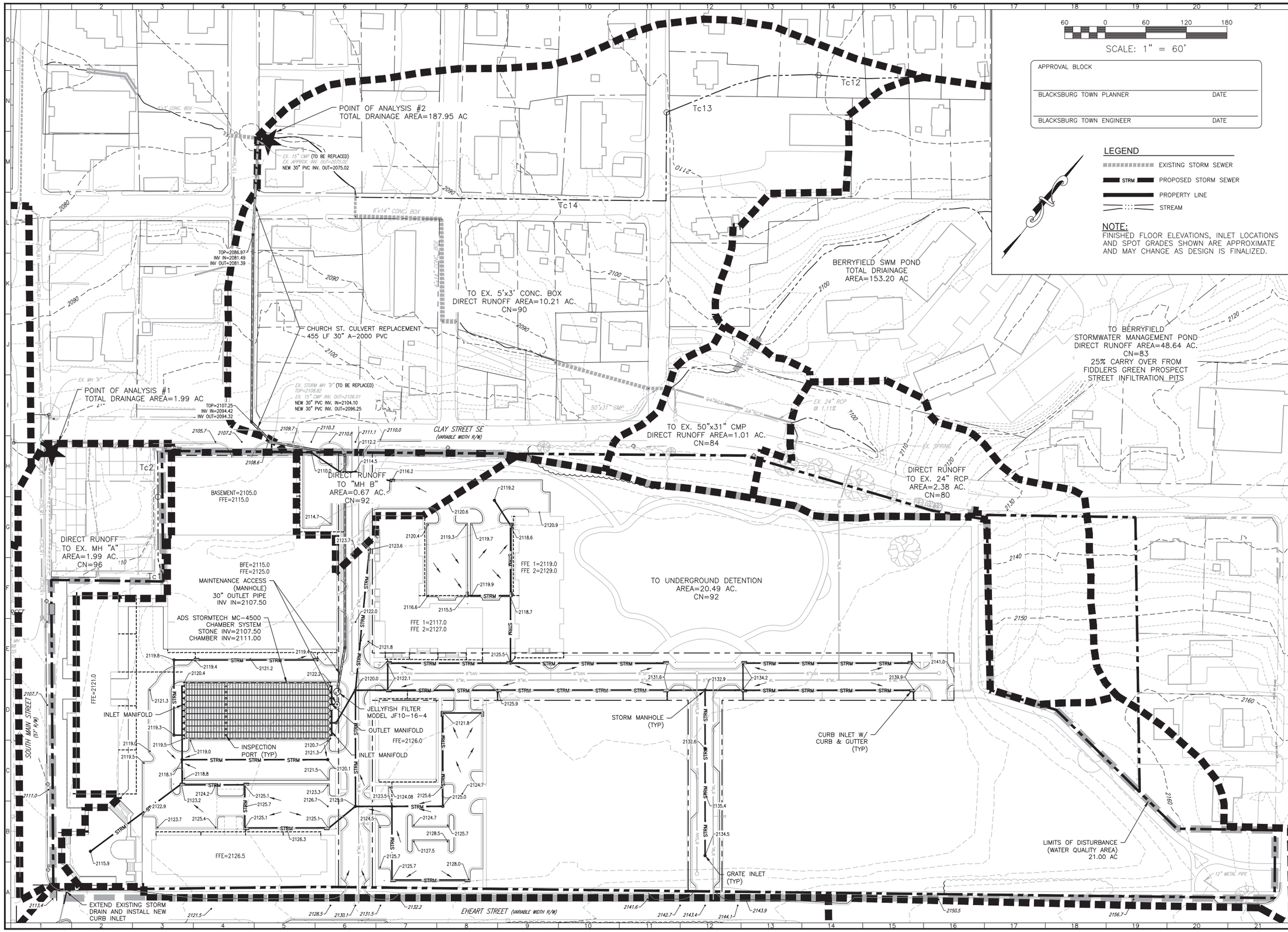
PRE-DEVELOPMENT DRAINAGE MAP

TOWN OF BLACKSBURG
MONTGOMERY COUNTY, VIRGINIA

DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	SMS
DATE	10/6/17
SCALE	1" = 150'
REVISIONS:	

SHEET NO.
SW4

JOB NO. B1200098.00



SCALE: 1" = 60'

APPROVAL BLOCK

BLACKSBURG TOWN PLANNER DATE

BLACKSBURG TOWN ENGINEER DATE

LEGEND

- EXISTING STORM SEWER
- STRM PROPOSED STORM SEWER
- PROPERTY LINE
- STREAM

NOTE:
FINISHED FLOOR ELEVATIONS, INLET LOCATIONS AND SPOT GRADES SHOWN ARE APPROXIMATE AND MAY CHANGE AS DESIGN IS FINALIZED.

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OLD BLACKSBURG MIDDLE SCHOOL SITE

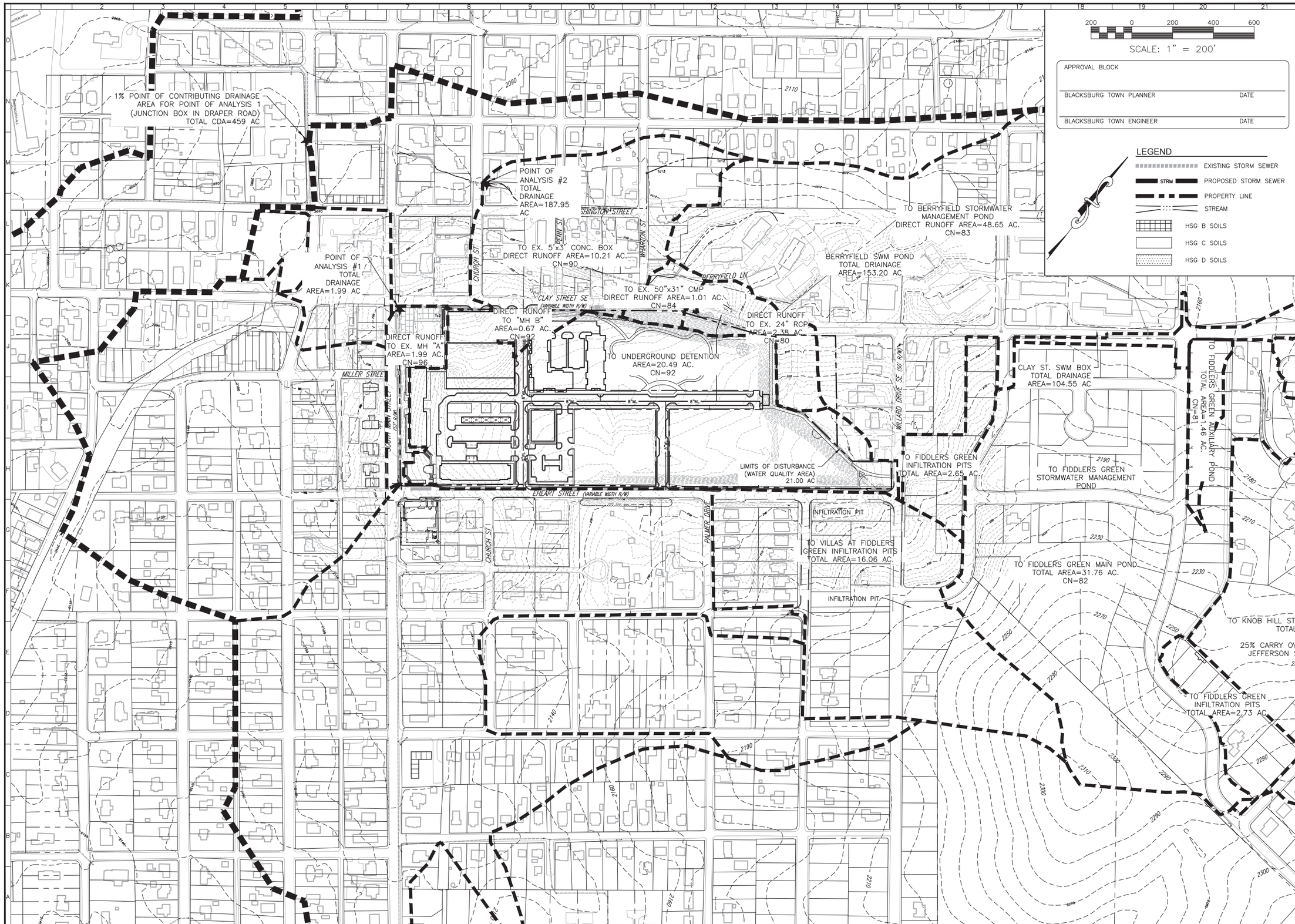
501 SOUTH MAIN STREET

POST-DEVELOPMENT DRAINAGE MAP

TOWN OF BLACKSBURG
MONTGOMERY COUNTY, VIRGINIA

DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	SMS
DATE	10/6/17
SCALE	1" = 60'
REVISIONS:	

SHEET NO.
SW5
JOB NO. B1200098.00



APPROVAL BLOCK

BLACKSBURG TOWN PLANNER DATE

BLACKSBURG TOWN ENGINEER DATE

LEGEND

- EXISTING STORM SEWER
- STRM PROPOSED STORM SEWER
- PROPERTY LINE
- STREAM
- HSG B SOILS
- HSG C SOILS
- HSG D SOILS

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10/6/17
LANDSCAPE ARCHITECT

OLD BLACKSBURG MIDDLE SCHOOL SITE

501 SOUTH MAIN STREET

POST-DEVELOPMENT DRAINAGE MAP

TOWN OF BLACKSBURG
MONTGOMERY COUNTY, VIRGINIA

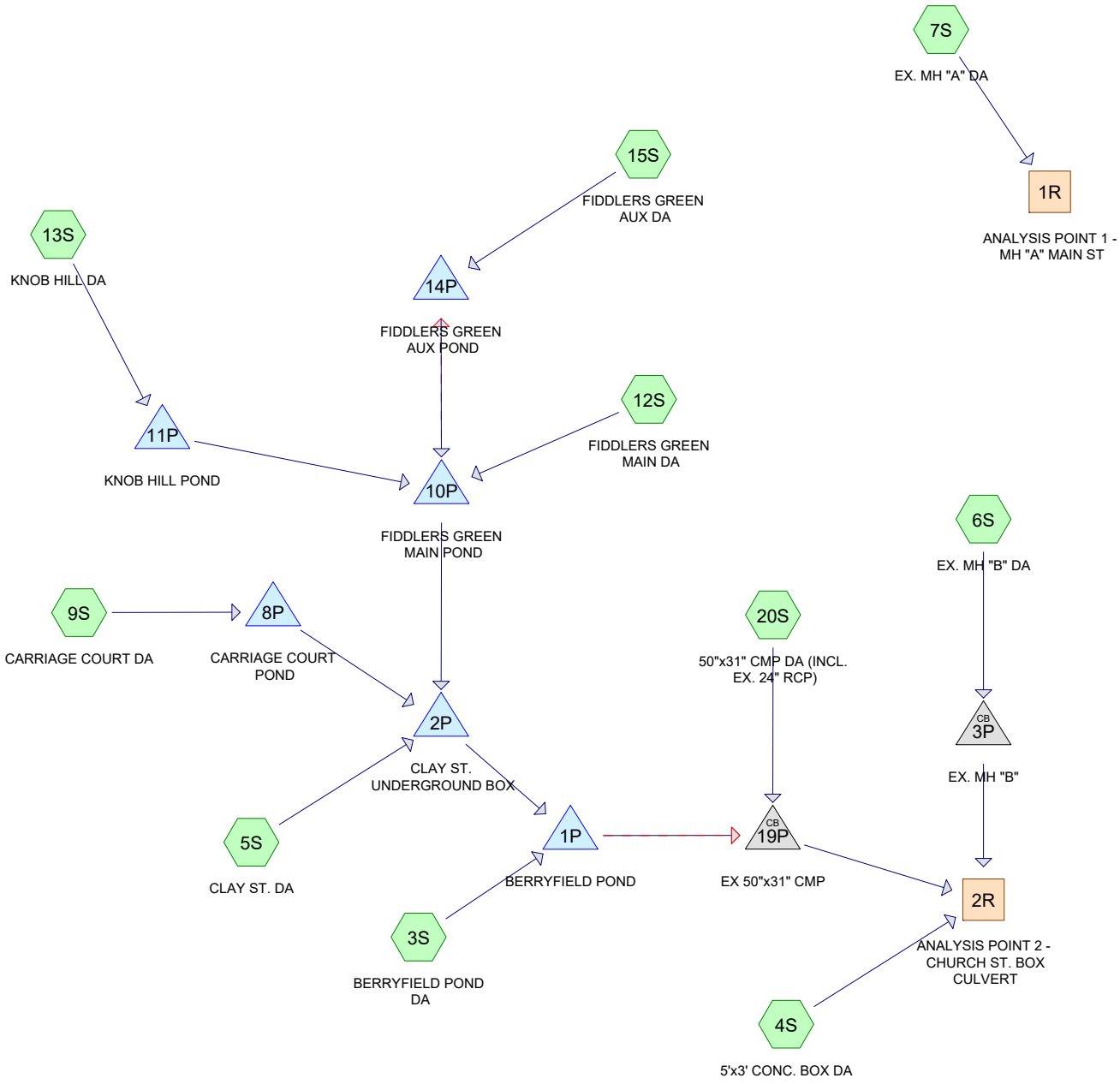
DRAWN BY	GLM
DESIGNED BY	GLM
CHECKED BY	SMS
DATE	10/6/17
SCALE	1" = 200'

REVISIONS:

SHEET NO.
SW6

JOB NO. B1200098.00

APPENDIX C:
STORMWATER MANAGEMENT CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for OBMS-PRE
Prepared by Balzer & Associates, Inc., Printed 10/5/2017
HydroCAD® 10.00-20 s/n 07713 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.116	79	1 acre lots, 20% imp, HSG C (3S, 13S)
9.079	80	1/2 acre lots, 25% imp, HSG C (3S, 4S, 12S, 13S)
0.122	85	1/2 acre lots, 25% imp, HSG D (4S)
5.519	72	1/3 acre lots, 30% imp, HSG B (13S)
25.110	81	1/3 acre lots, 30% imp, HSG C (3S, 5S, 12S, 13S, 20S)
0.020	86	1/3 acre lots, 30% imp, HSG D (3S)
21.835	83	1/4 acre lots, 38% imp, HSG C (3S, 4S, 5S, 9S, 12S, 13S, 15S)
3.126	87	1/4 acre lots, 38% imp, HSG D (3S, 4S)
17.398	90	1/8 acre lots, 65% imp, HSG C (3S, 4S, 5S)
2.695	92	1/8 acre lots, 65% imp, HSG D (3S, 4S)
0.017	82	2 acre lots, 12% imp, HSG D (3S)
0.680	80	25% Carry Over from Jefferson Street Infiltration Pits (13S)
0.663	83	25% Carry Over from Prospect Street Infiltration Pits (3S)
4.015	90	25% Carry Over from Villas Infiltration Pits (20S)
31.533	74	>75% Grass cover, Good, HSG C (3S, 4S, 5S, 12S, 13S, 15S, 20S)
11.878	80	>75% Grass cover, Good, HSG D (3S, 4S, 6S, 7S, 20S)
2.167	98	Paved parking, HSG C (3S, 4S, 6S, 12S, 20S)
5.228	98	Paved parking, HSG D (4S, 6S, 7S, 20S)
0.716	98	Paved roads w/curbs & sewers, HSG D (7S)
0.485	89	Paved roads w/open ditches, 50% imp, HSG B (13S)
21.995	92	Paved roads w/open ditches, 50% imp, HSG C (3S, 4S, 5S, 9S, 12S, 13S, 20S)
2.296	93	Paved roads w/open ditches, 50% imp, HSG D (3S, 4S)
2.006	94	Urban commercial, 85% imp, HSG C (4S, 13S)
0.202	95	Urban commercial, 85% imp, HSG D (4S)
0.103	55	Woods, Good, HSG B (13S)
20.432	70	Woods, Good, HSG C (3S, 5S, 12S, 13S, 20S)
1.722	77	Woods, Good, HSG D (3S)
193.158	**82**	**TOTAL AREA**

Summary for Subcatchment 3S: BERRYFIELD POND DA

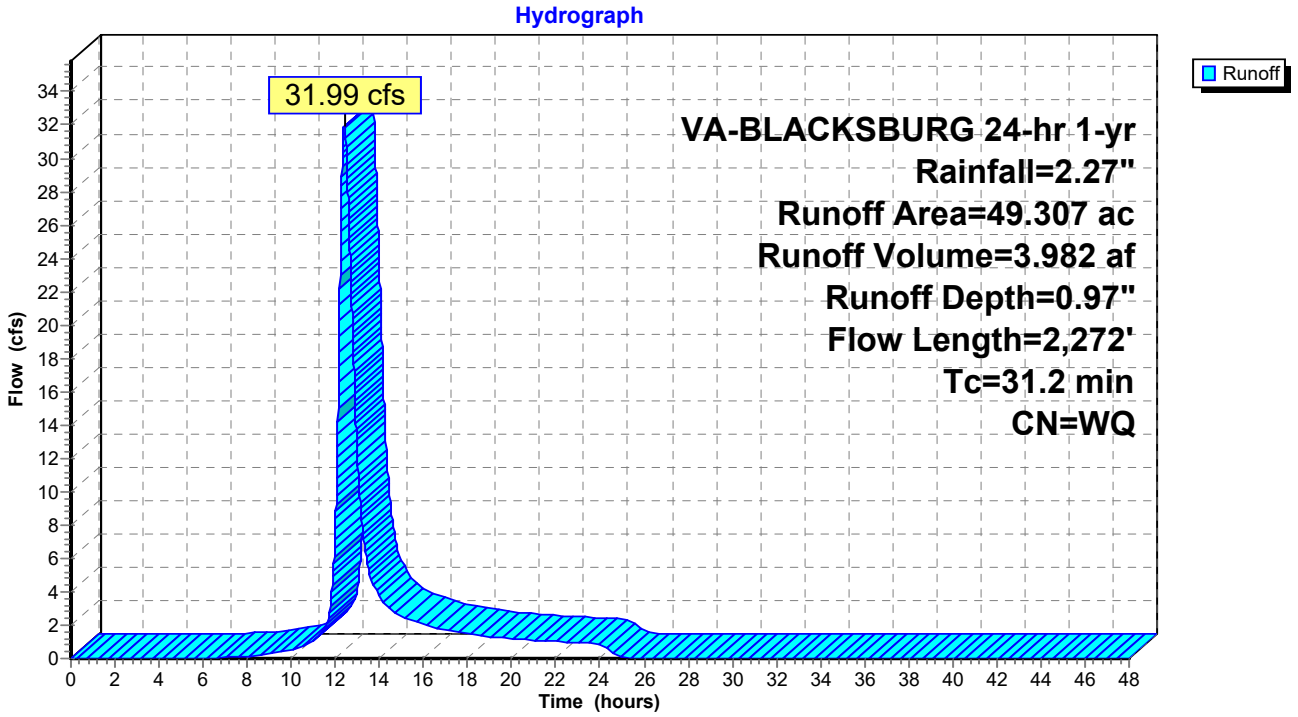
Runoff = 31.99 cfs @ 12.41 hrs, Volume= 3.982 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	3.627	70	Woods, Good, HSG C
	1.722	77	Woods, Good, HSG D
	11.203	74	>75% Grass cover, Good, HSG C
	0.649	80	>75% Grass cover, Good, HSG D
	0.017	82	2 acre lots, 12% imp, HSG D
	0.988	79	1 acre lots, 20% imp, HSG C
	1.522	80	1/2 acre lots, 25% imp, HSG C
	2.739	81	1/3 acre lots, 30% imp, HSG C
	0.020	86	1/3 acre lots, 30% imp, HSG D
	3.233	83	1/4 acre lots, 38% imp, HSG C
	0.390	87	1/4 acre lots, 38% imp, HSG D
	13.958	90	1/8 acre lots, 65% imp, HSG C
	1.013	92	1/8 acre lots, 65% imp, HSG D
	6.184	92	Paved roads w/open ditches, 50% imp, HSG C
	0.599	93	Paved roads w/open ditches, 50% imp, HSG D
	0.780	98	Paved parking, HSG C
*	0.663	83	25% Carry Over from Prospect Street Infiltration Pits
	49.307		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.0633	0.12		**Sheet Flow, Tc4** Woods: Light underbrush n= 0.400 P2= 2.76"
3.6	1,024	0.0869	4.75		**Shallow Concentrated Flow, Tc5** Unpaved Kv= 16.1 fps
2.2	284	0.0176	2.14		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
5.2	814	0.0307	2.63		**Shallow Concentrated Flow, Tc7** Grassed Waterway Kv= 15.0 fps
31.2	2,272	Total			

Subcatchment 3S: BERRYFIELD POND DA



Summary for Subcatchment 4S: 5'x3' CONC. BOX DA

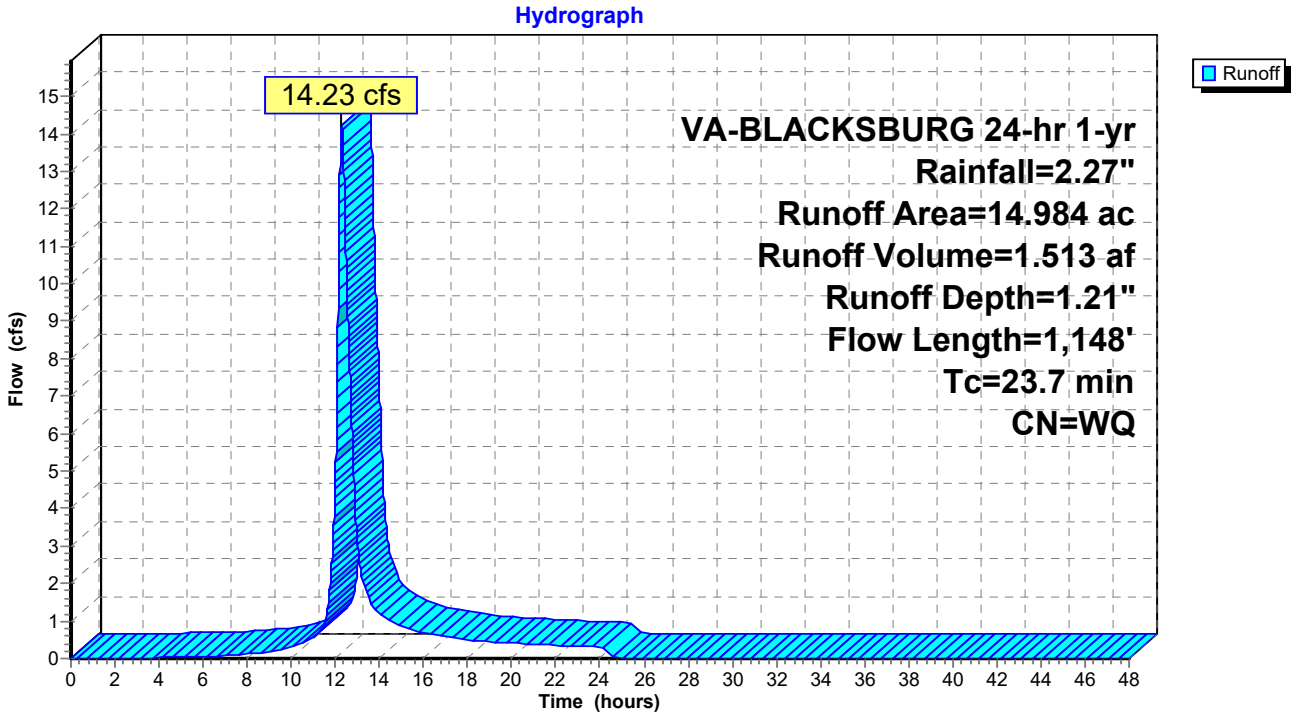
Runoff = 14.23 cfs @ 12.29 hrs, Volume= 1.513 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.444	74	>75% Grass cover, Good, HSG C
3.534	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.202	95	Urban commercial, 85% imp, HSG D
0.593	92	Paved roads w/open ditches, 50% imp, HSG C
1.697	93	Paved roads w/open ditches, 50% imp, HSG D
0.147	98	Paved parking, HSG C
1.587	98	Paved parking, HSG D
14.984		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 4S: 5'x3' CONC. BOX DA



Summary for Subcatchment 5S: CLAY ST. DA

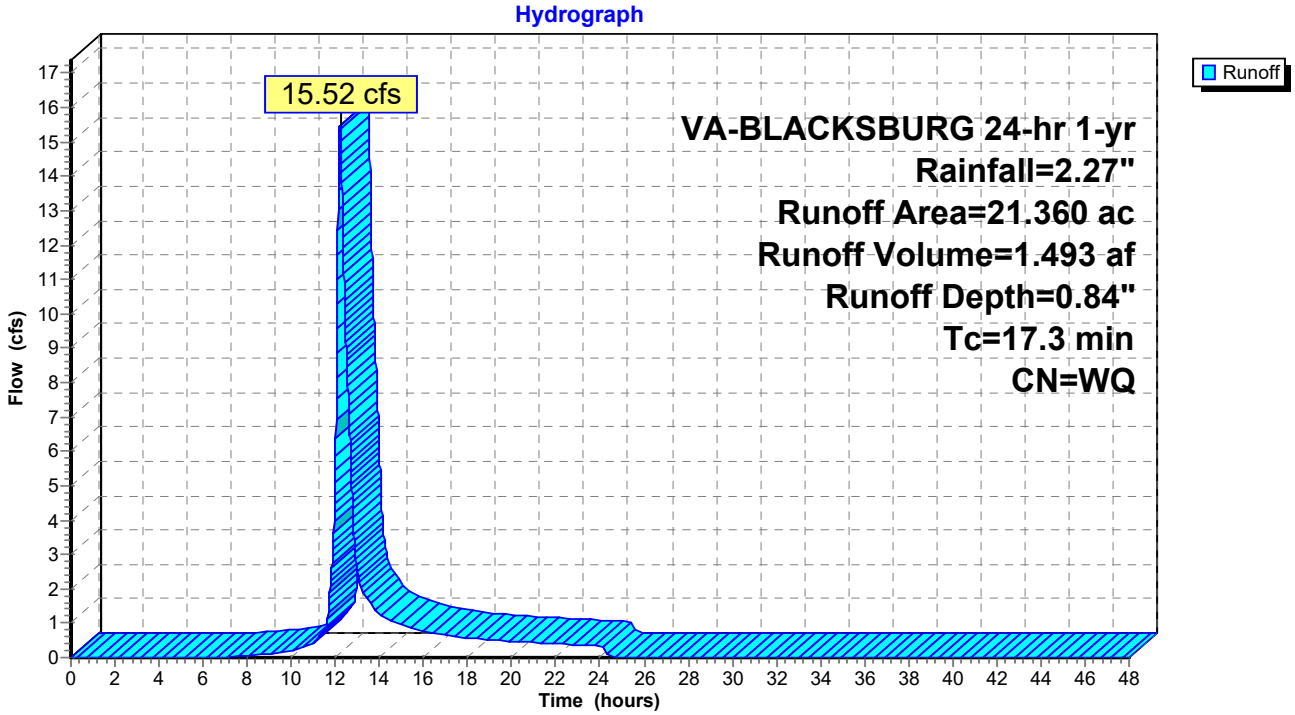
Runoff = 15.52 cfs @ 12.21 hrs, Volume= 1.493 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.332	70	Woods, Good, HSG C
4.382	74	>75% Grass cover, Good, HSG C
2.136	81	1/3 acre lots, 30% imp, HSG C
2.246	83	1/4 acre lots, 38% imp, HSG C
3.153	90	1/8 acre lots, 65% imp, HSG C
4.111	92	Paved roads w/open ditches, 50% imp, HSG C
21.360		Weighted Average

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

Subcatchment 5S: CLAY ST. DA



Summary for Subcatchment 6S: EX. MH "B" DA

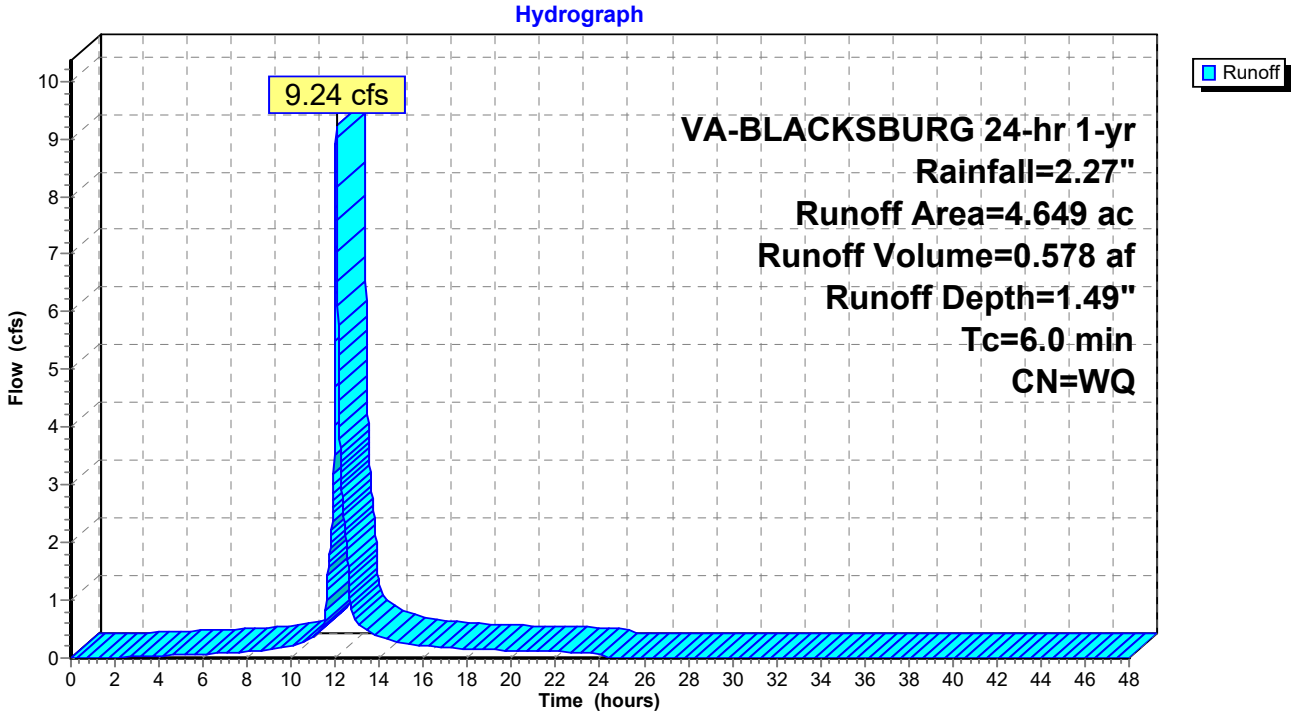
Runoff = 9.24 cfs @ 12.04 hrs, Volume= 0.578 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
1.958	80	>75% Grass cover, Good, HSG D
2.685	98	Paved parking, HSG D
0.006	98	Paved parking, HSG C
4.649		Weighted Average

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

Subcatchment 6S: EX. MH "B" DA



Summary for Subcatchment 7S: EX. MH "A" DA

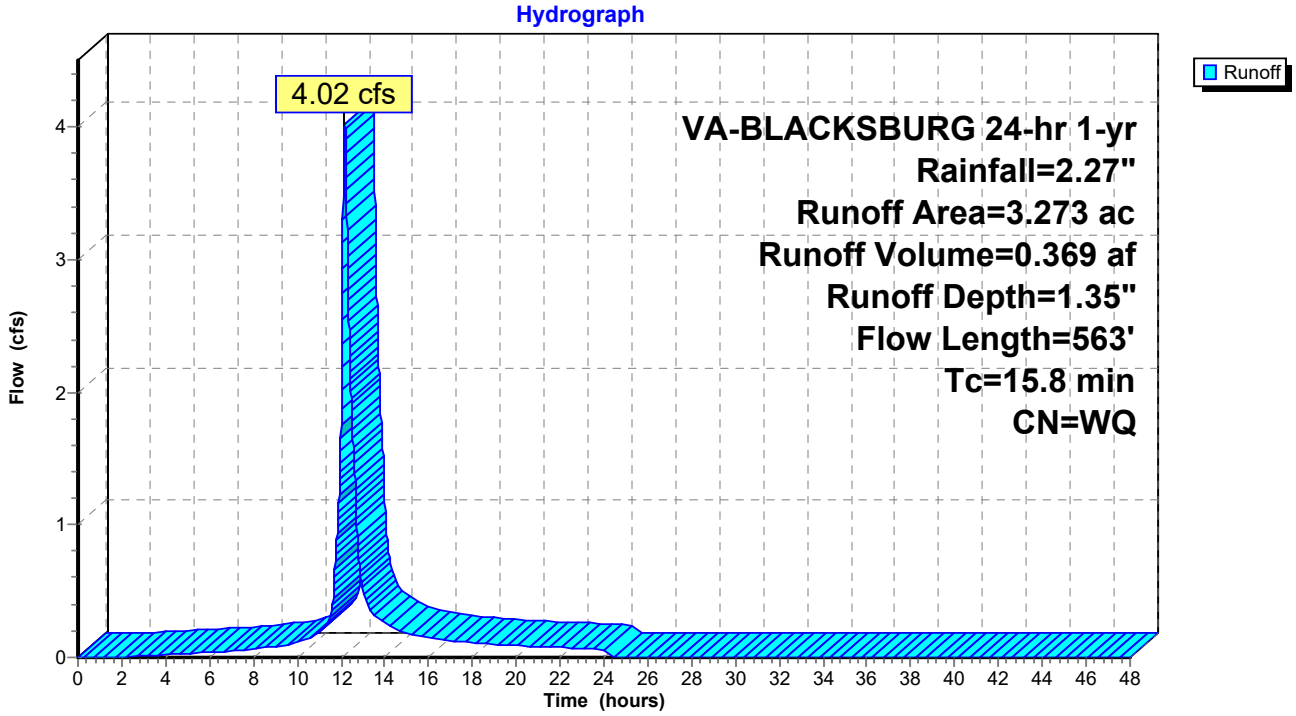
Runoff = 4.02 cfs @ 12.17 hrs, Volume= 0.369 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.830	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
1.727	80	>75% Grass cover, Good, HSG D
3.273		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0600	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	74	0.0598	3.94		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
1.8	339	0.0229	3.07		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
15.8	563	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 9S: CARRIAGE COURT DA

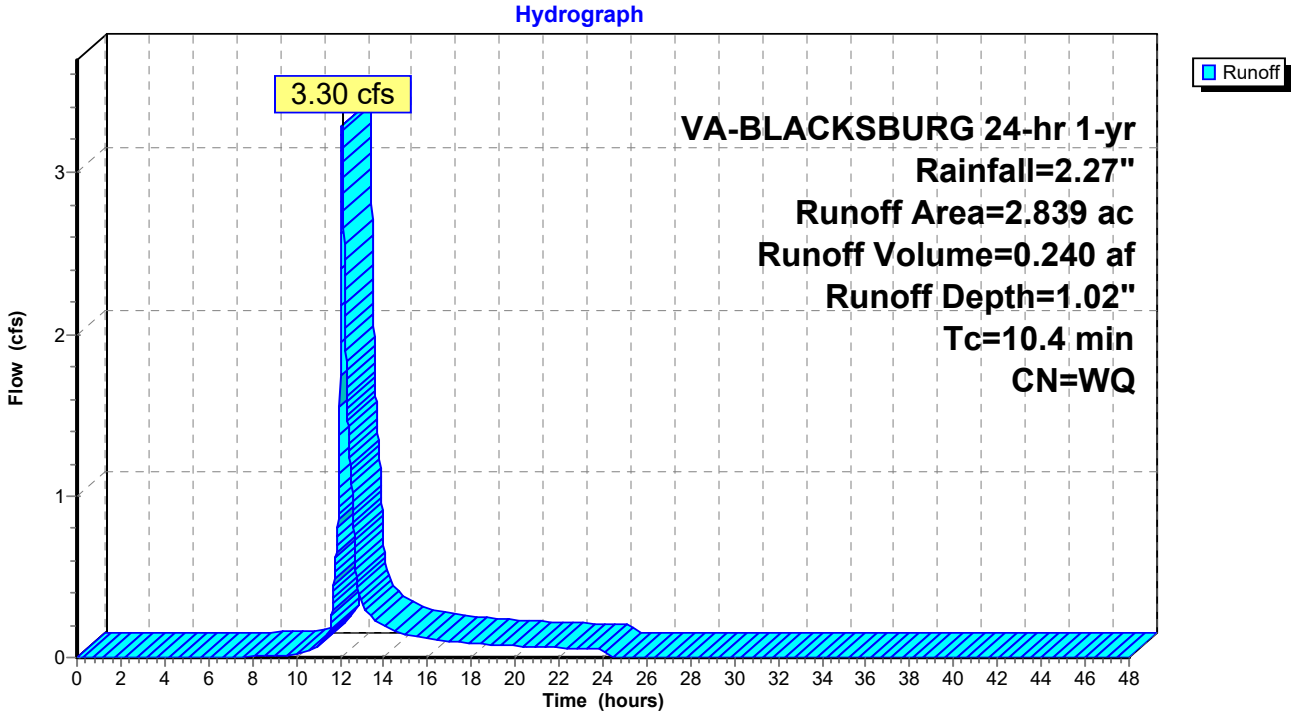
Runoff = 3.30 cfs @ 12.10 hrs, Volume= 0.240 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
2.217	83	1/4 acre lots, 38% imp, HSG C
0.622	92	Paved roads w/open ditches, 50% imp, HSG C
2.839		Weighted Average

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

Subcatchment 9S: CARRIAGE COURT DA



Summary for Subcatchment 12S: FIDDLERS GREEN MAIN DA

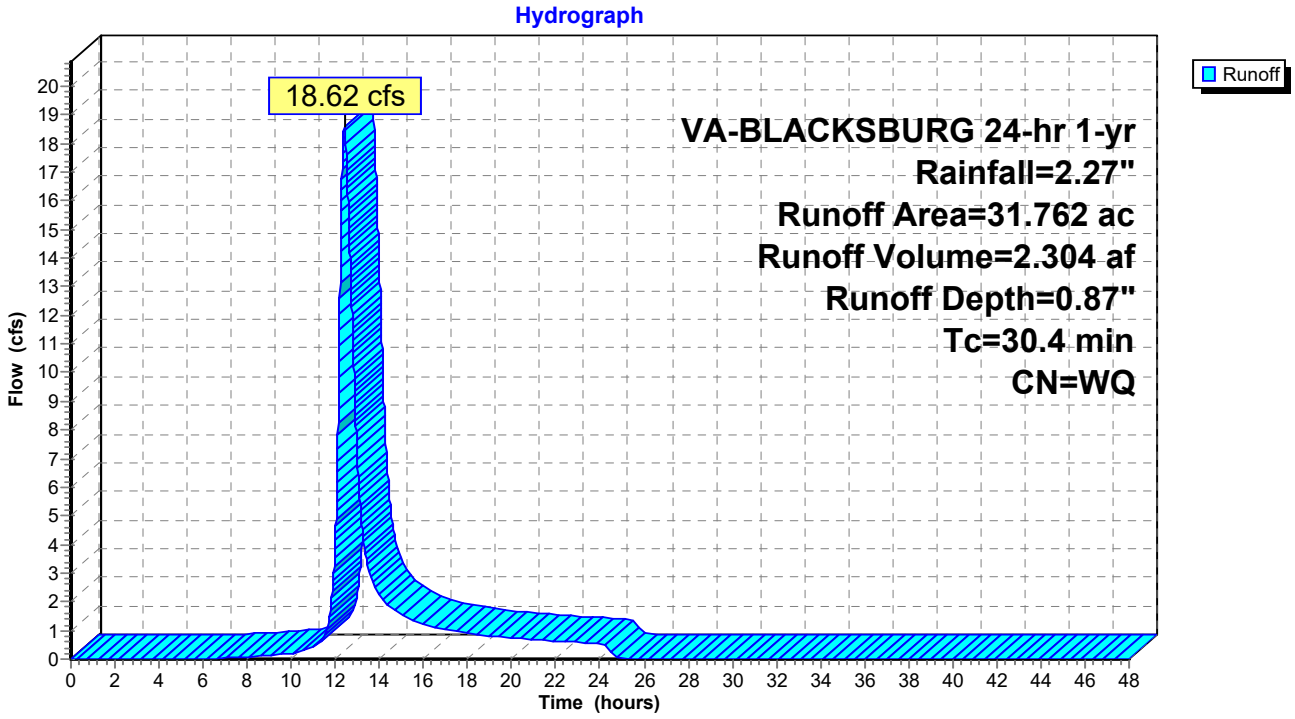
Runoff = 18.62 cfs @ 12.40 hrs, Volume= 2.304 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.116	70	Woods, Good, HSG C
8.691	74	>75% Grass cover, Good, HSG C
2.424	80	1/2 acre lots, 25% imp, HSG C
4.428	81	1/3 acre lots, 30% imp, HSG C
10.306	83	1/4 acre lots, 38% imp, HSG C
4.998	92	Paved roads w/open ditches, 50% imp, HSG C
0.799	98	Paved parking, HSG C
31.762		Weighted Average

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

Subcatchment 12S: FIDDLERS GREEN MAIN DA



Summary for Subcatchment 13S: KNOB HILL DA

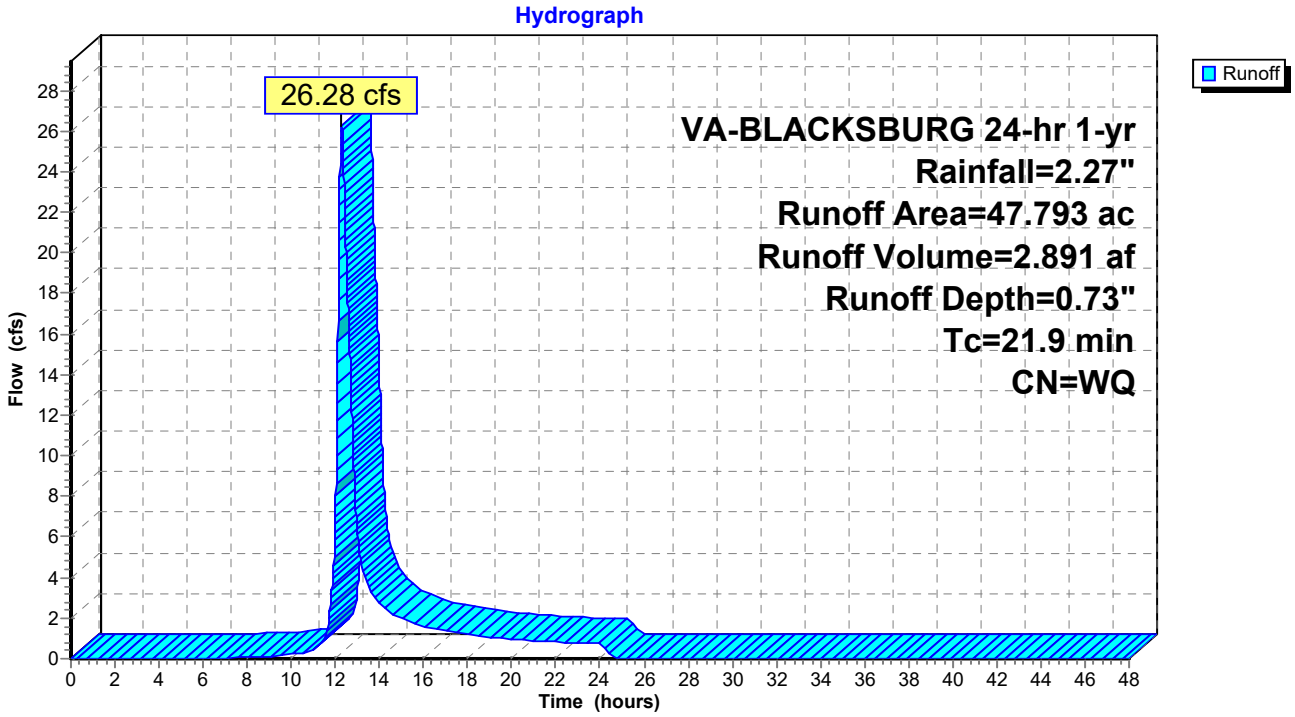
Runoff = 26.28 cfs @ 12.29 hrs, Volume= 2.891 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	0.103	55	Woods, Good, HSG B
	10.773	70	Woods, Good, HSG C
	1.435	74	>75% Grass cover, Good, HSG C
	1.128	79	1 acre lots, 20% imp, HSG C
	5.039	80	1/2 acre lots, 25% imp, HSG C
	5.519	72	1/3 acre lots, 30% imp, HSG B
	15.477	81	1/3 acre lots, 30% imp, HSG C
	1.091	83	1/4 acre lots, 38% imp, HSG C
	1.823	94	Urban commercial, 85% imp, HSG C
	0.485	89	Paved roads w/open ditches, 50% imp, HSG B
	4.240	92	Paved roads w/open ditches, 50% imp, HSG C
*	0.680	80	25% Carry Over from Jefferson Street Infiltration Pits
	47.793		Weighted Average

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

Subcatchment 13S: KNOB HILL DA



Summary for Subcatchment 15S: FIDDLERS GREEN AUX DA

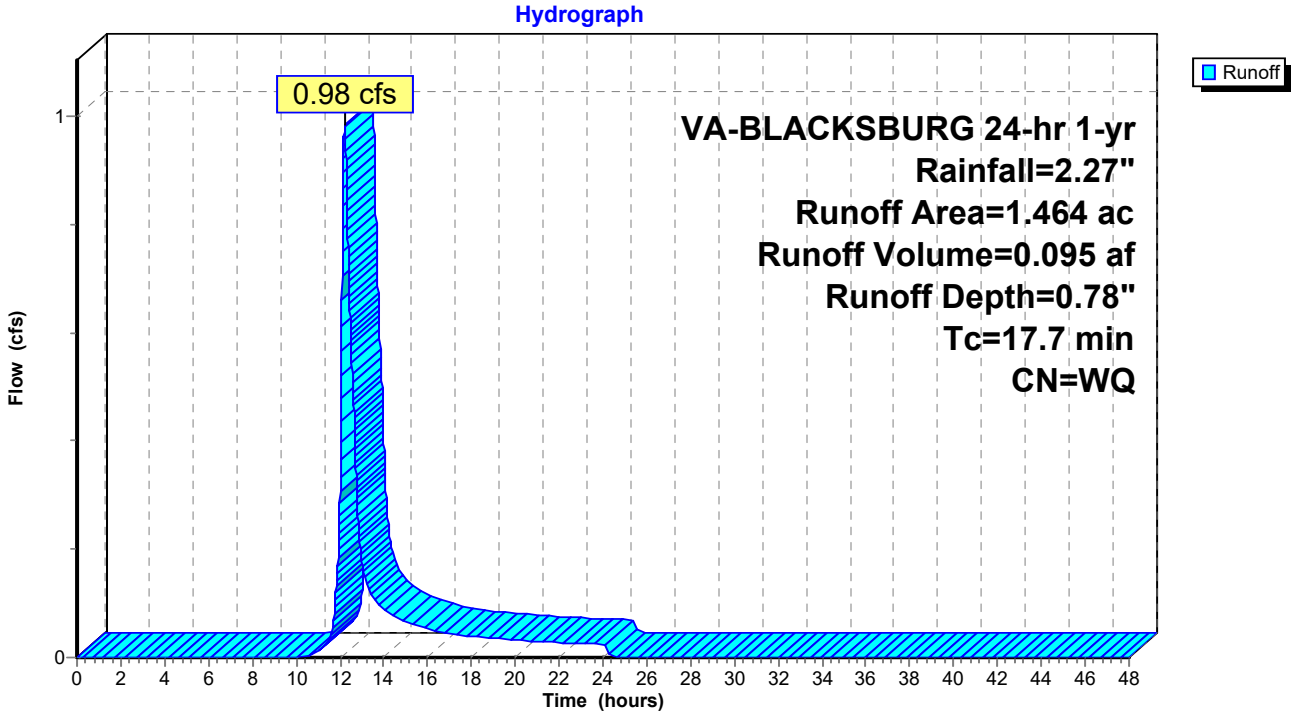
Runoff = 0.98 cfs @ 12.21 hrs, Volume= 0.095 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.398	74	>75% Grass cover, Good, HSG C
1.066	83	1/4 acre lots, 38% imp, HSG C
1.464		Weighted Average

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

Subcatchment 15S: FIDDLERS GREEN AUX DA



Summary for Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)

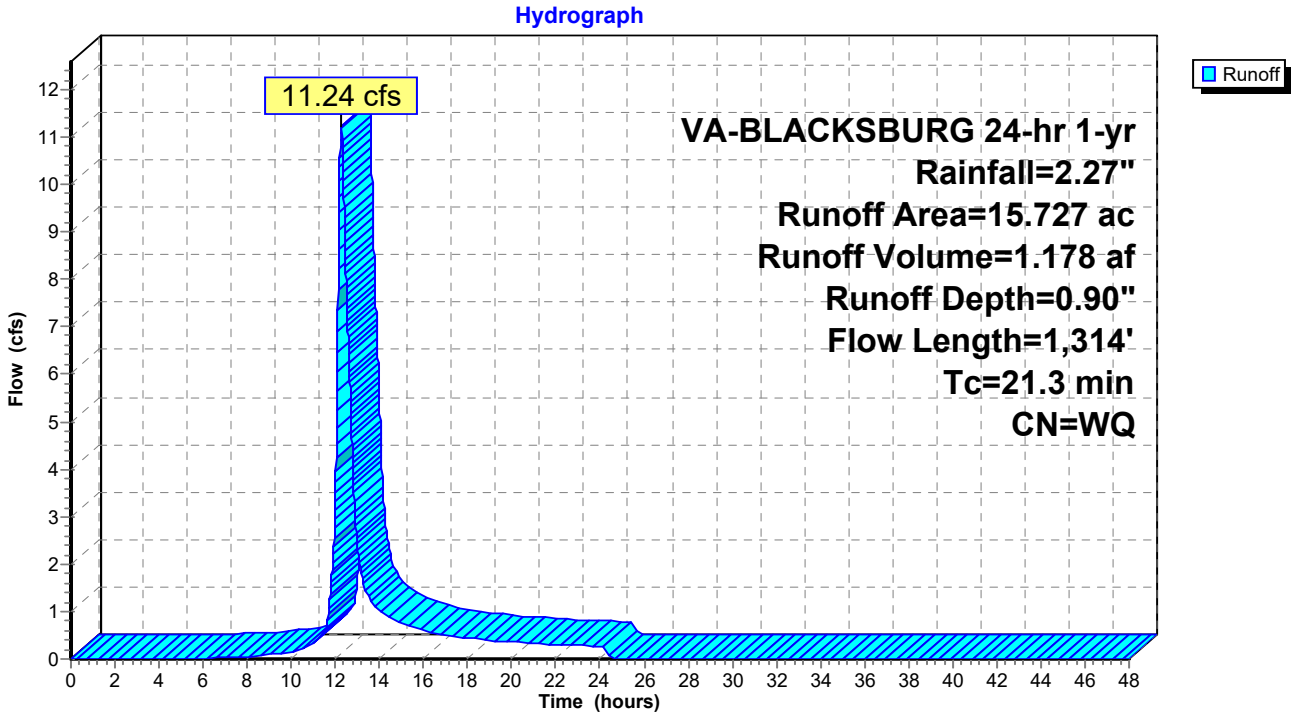
Runoff = 11.24 cfs @ 12.26 hrs, Volume= 1.178 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	0.584	70	Woods, Good, HSG C
	4.980	74	>75% Grass cover, Good, HSG C
	4.010	80	>75% Grass cover, Good, HSG D
	0.330	81	1/3 acre lots, 30% imp, HSG C
	1.247	92	Paved roads w/open ditches, 50% imp, HSG C
	0.435	98	Paved parking, HSG C
	0.126	98	Paved parking, HSG D
*	4.015	90	25% Carry Over from Villas Infiltration Pits
	15.727		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)



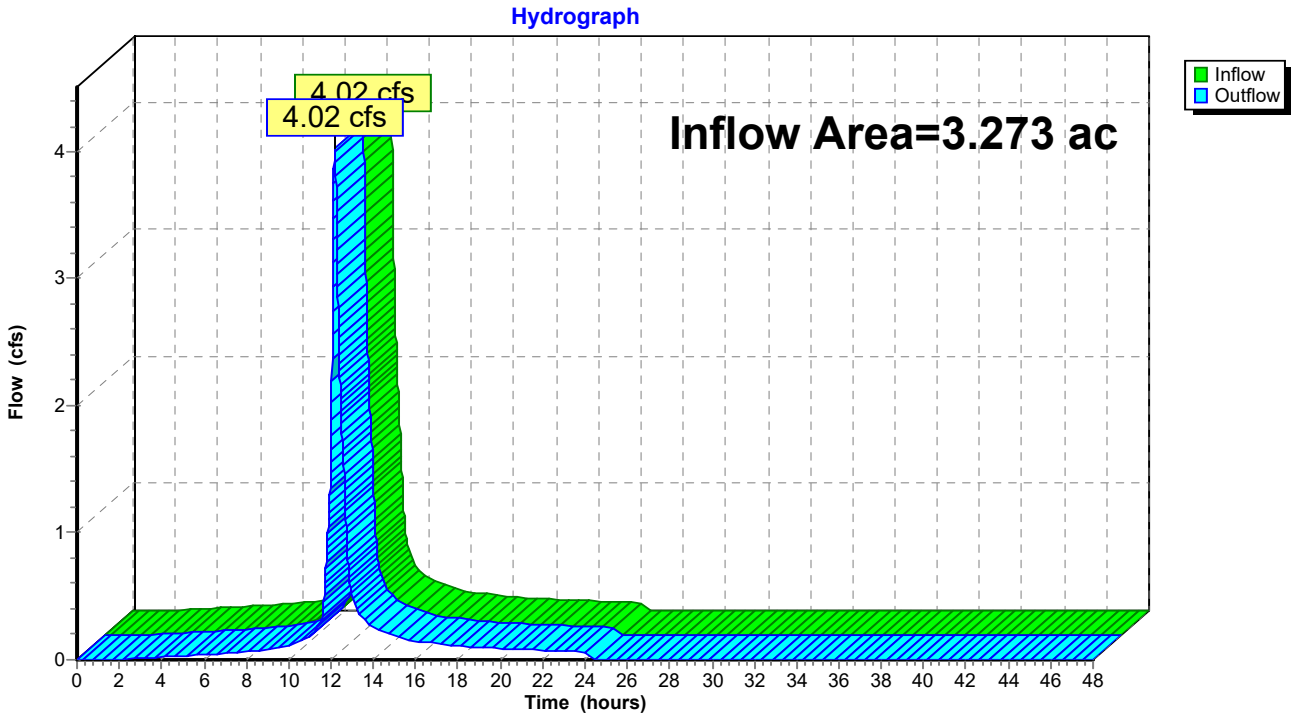
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.273 ac, Inflow Depth = 1.35" for 1-yr event
Inflow = 4.02 cfs @ 12.17 hrs, Volume= 0.369 af
Outflow = 4.02 cfs @ 12.18 hrs, Volume= 0.369 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



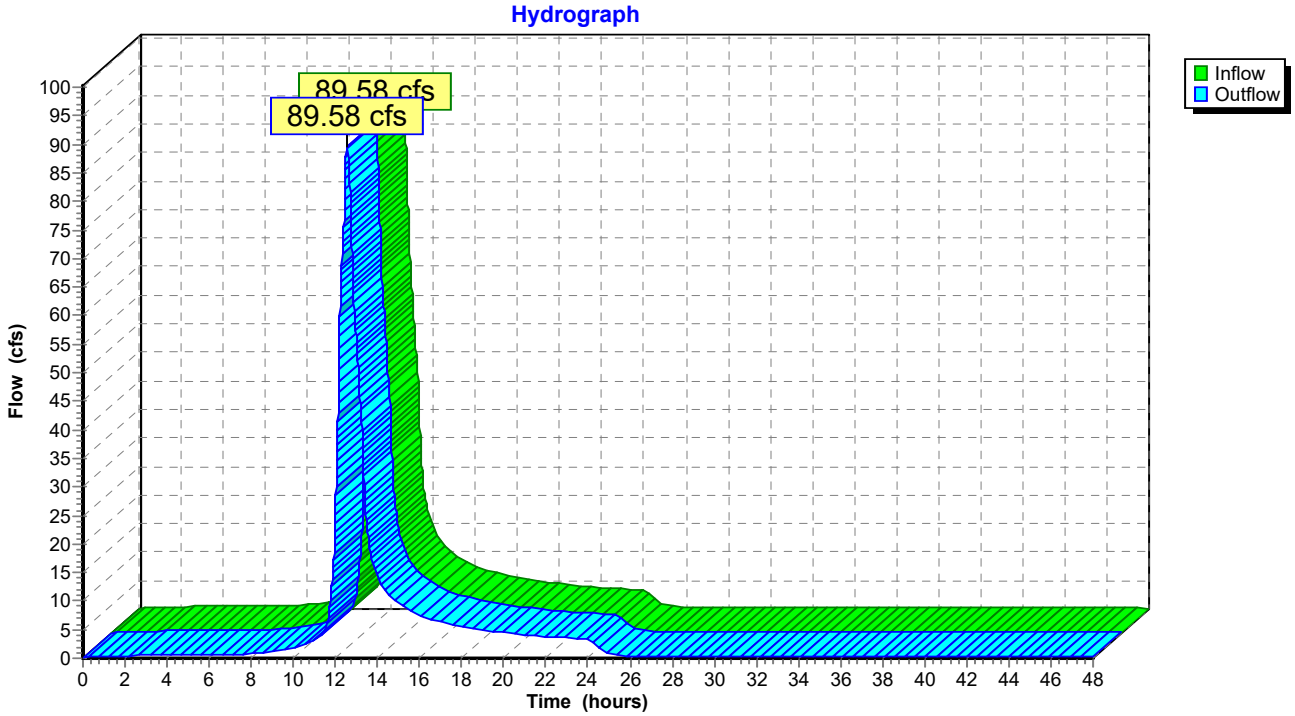
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	89.58 cfs @	12.54 hrs,	Volume=	14.894 af
Outflow	=	89.58 cfs @	12.55 hrs,	Volume=	14.894 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT



Summary for Pond 1P: BERRYFIELD POND

Inflow	=	71.94 cfs @	12.53 hrs,	Volume=	11.626 af
Outflow	=	71.62 cfs @	12.57 hrs,	Volume=	11.626 af, Atten= 0%, Lag= 2.0 min
Primary	=	71.62 cfs @	12.57 hrs,	Volume=	11.626 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,099.89' @ 12.57 hrs Surf.Area= 11,934 sf Storage= 21,779 cf
Flood Elev= 2,101.00' Surf.Area= 23,595 sf Storage= 41,004 cf

Plug-Flow detention time= 3.4 min calculated for 11.626 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (933.4 - 930.1)

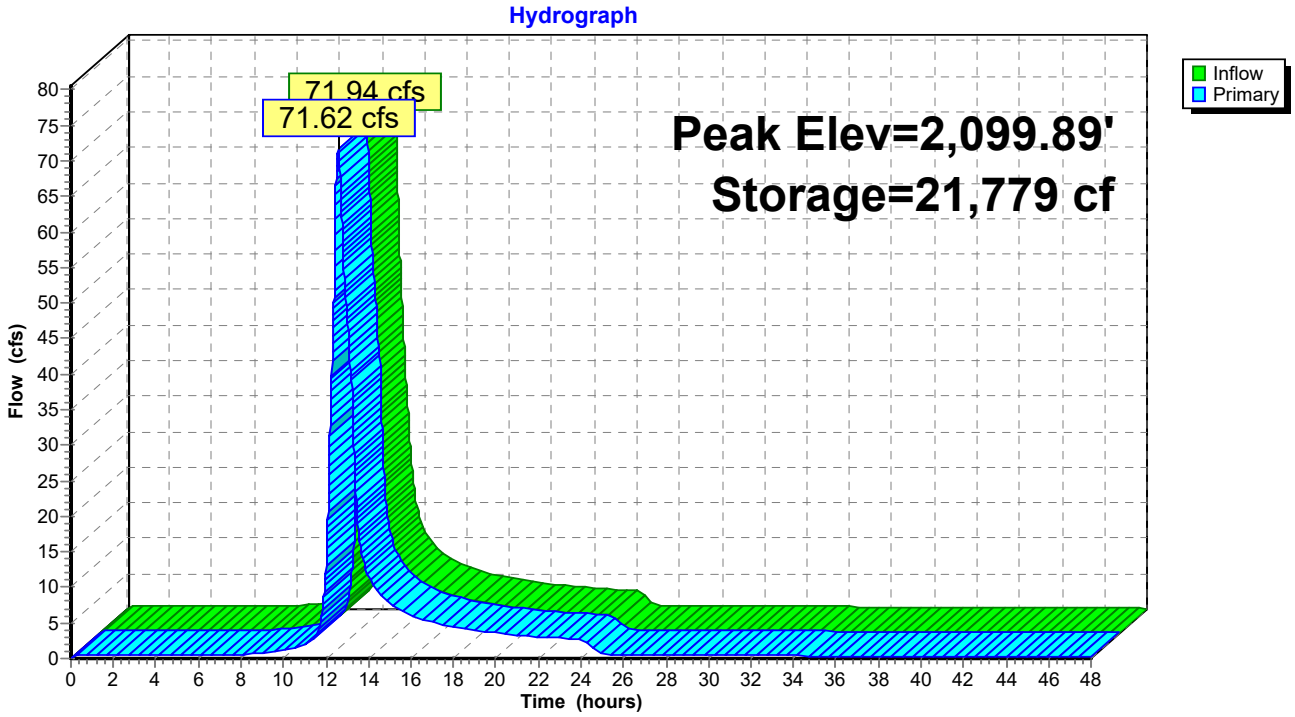
Volume	Invert	Avail.Storage	Storage Description
#1	2,096.00'	41,004 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,096.00	0	0	0
2,098.00	5,379	5,379	5,379
2,100.00	12,299	17,678	23,057
2,101.00	23,595	17,947	41,004

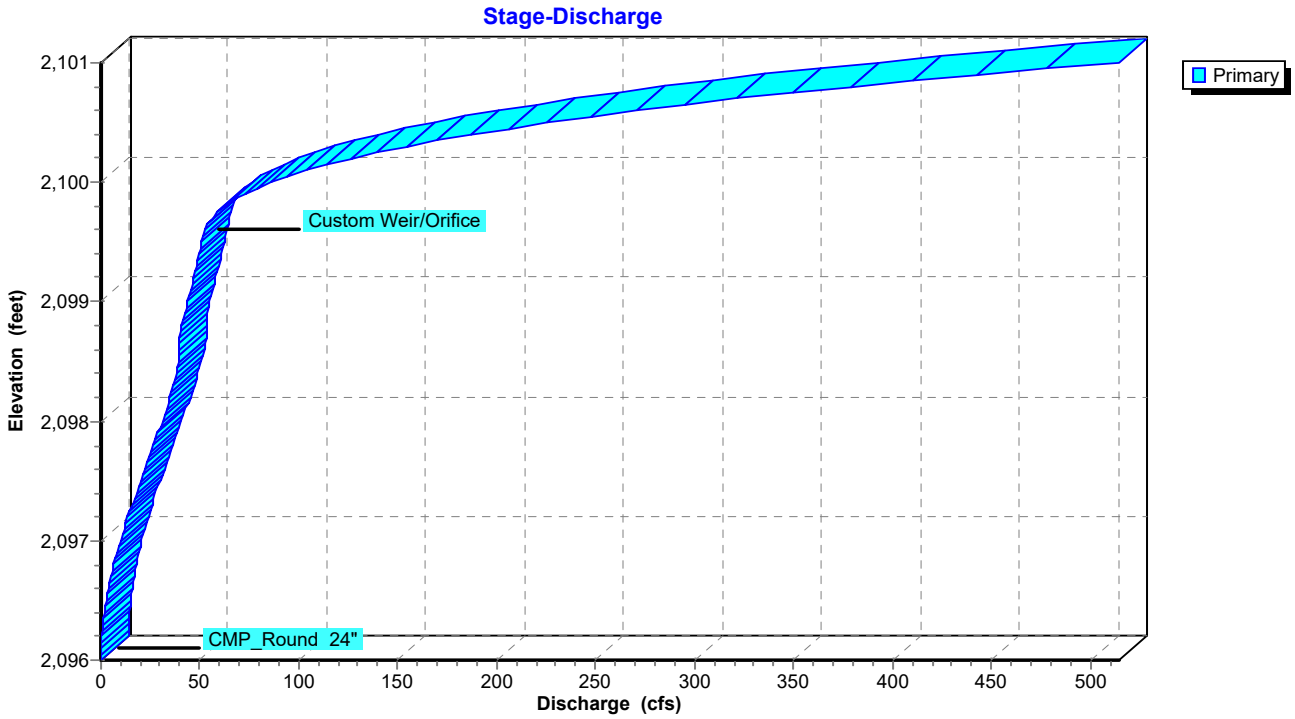
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.00'	**24.0" Round CMP_Round 24" X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,096.00' / 2,095.50' S= 0.0083 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 3.14 sf
#2	Primary	2,099.50'	**Custom Weir/Orifice, Cv= 3.00 (C= 3.75)** Head (feet) 0.00 0.50 1.50 Width (feet) 0.00 55.00 160.00

Primary OutFlow Max=71.61 cfs @ 12.57 hrs HW=2,099.89' TW=2,096.67' (Dynamic Tailwater)
└─**1=CMP_Round 24"** (Barrel Controls 55.49 cfs @ 5.89 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 16.12 cfs @ 1.88 fps)

Pond 1P: BERRYFIELD POND



Pond 1P: BERRYFIELD POND



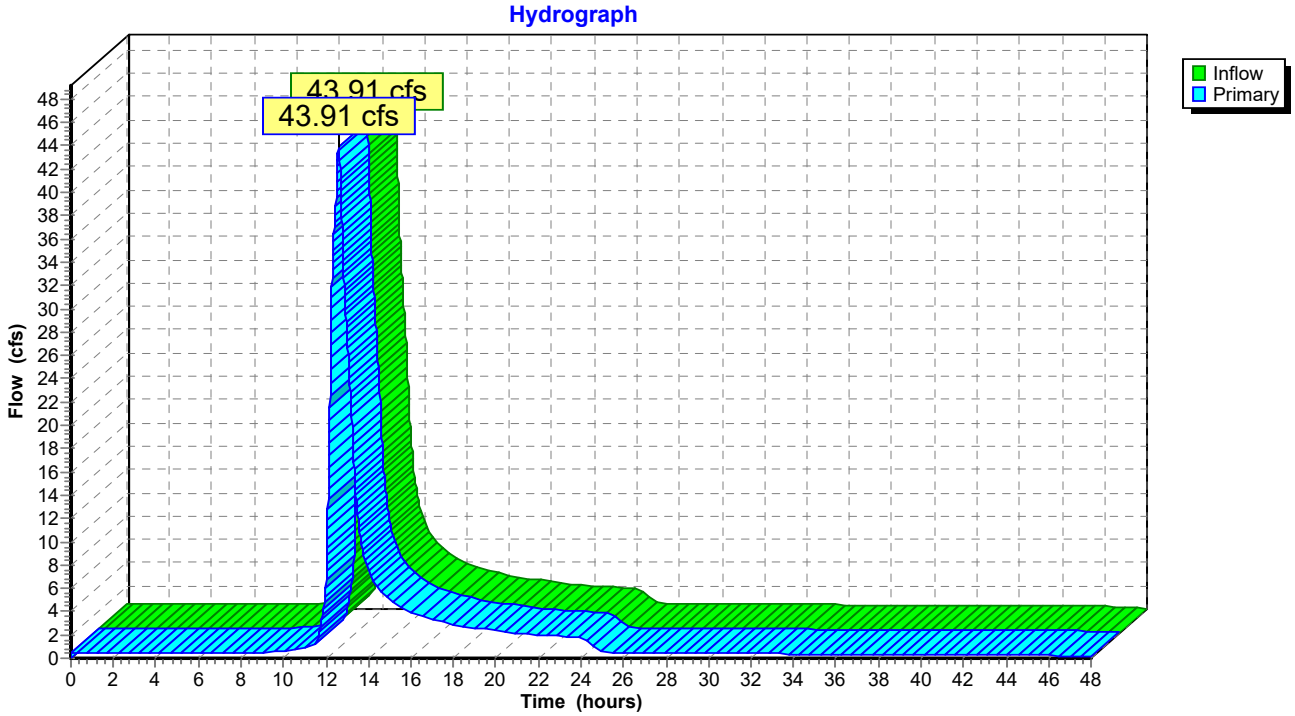
Summary for Pond 2P: CLAY ST. UNDERGROUND BOX

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	43.91 cfs @	12.58 hrs,	Volume=	7.645 af
Primary	=	43.91 cfs @	12.59 hrs,	Volume=	7.645 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 2P: CLAY ST. UNDERGROUND BOX



Summary for Pond 3P: EX. MH "B"

[58] Hint: Peaked 0.79' above defined flood level

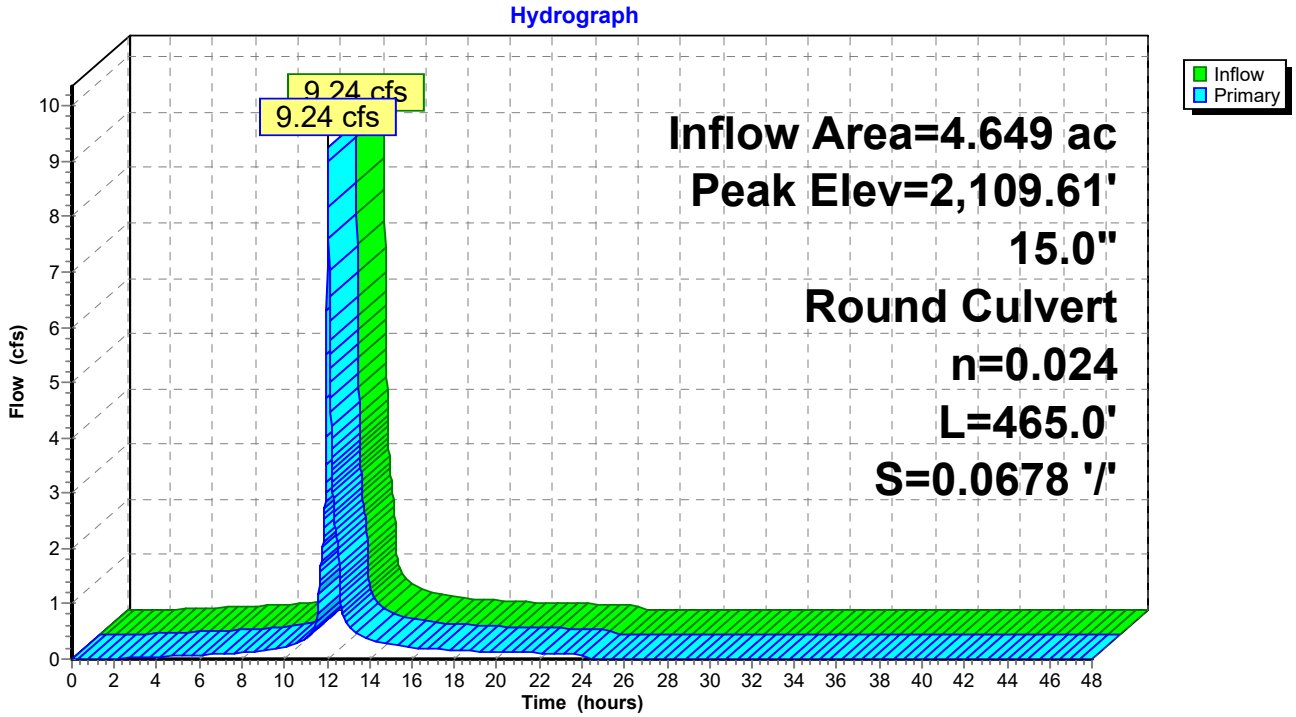
Inflow Area =	4.649 ac,	Inflow Depth =	1.49"	for	1-yr event
Inflow =	9.24 cfs @	12.04 hrs,	Volume=	0.578 af	
Outflow =	9.24 cfs @	12.05 hrs,	Volume=	0.578 af,	Atten= 0%, Lag= 0.6 min
Primary =	9.24 cfs @	12.05 hrs,	Volume=	0.578 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,109.61' @ 12.05 hrs
Flood Elev= 2,108.82'

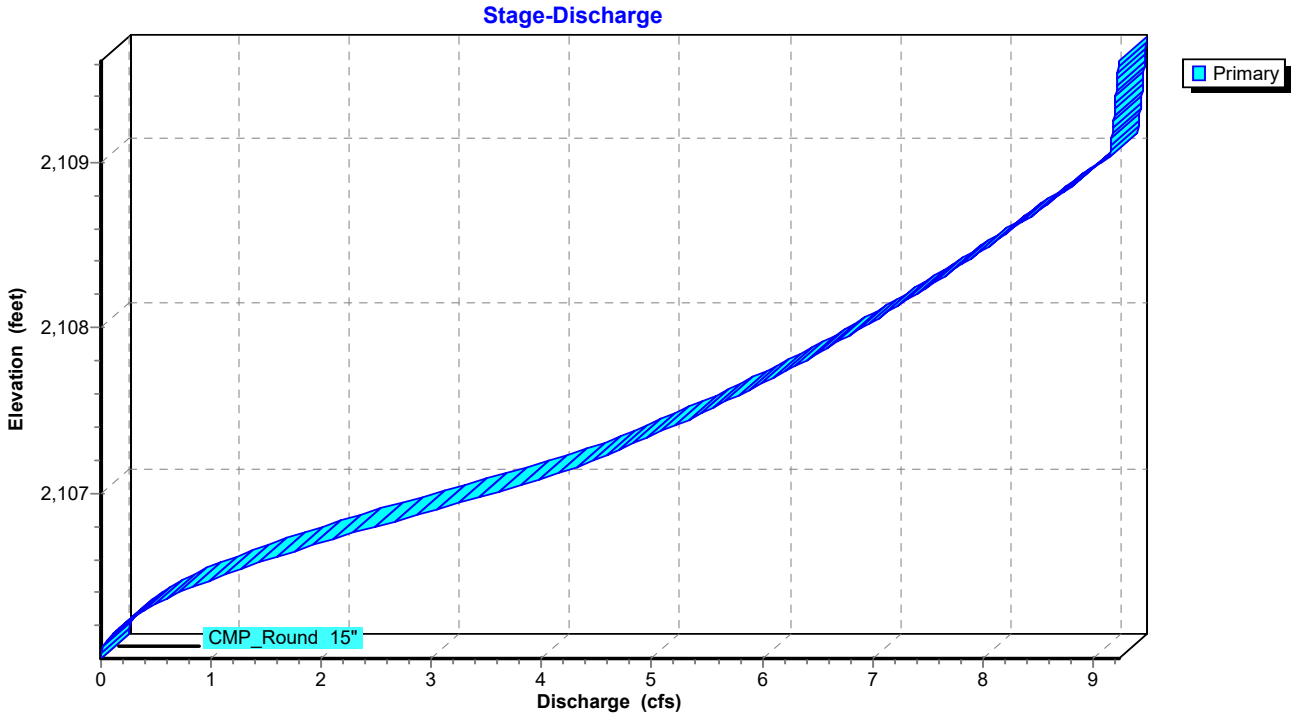
Device	Routing	Invert	Outlet Devices
#1	Primary	2,106.01'	**15.0" Round CMP_Round 15"** L= 465.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,106.01' / 2,074.50' S= 0.0678 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=9.23 cfs @ 12.05 hrs HW=2,109.50' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Round 15"** (Barrel Controls 9.23 cfs @ 7.52 fps)

Pond 3P: EX. MH "B"



Pond 3P: EX. MH "B"



Summary for Pond 8P: CARRIAGE COURT POND

Inflow Area = 2.839 ac, Inflow Depth = 1.02" for 1-yr event
Inflow = 3.30 cfs @ 12.10 hrs, Volume= 0.240 af
Outflow = 2.44 cfs @ 12.21 hrs, Volume= 0.240 af, Atten= 26%, Lag= 6.5 min
Primary = 2.44 cfs @ 12.21 hrs, Volume= 0.240 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,174.22' @ 12.21 hrs Surf.Area= 1,224 sf Storage= 819 cf

Plug-Flow detention time= 3.4 min calculated for 0.240 af (100% of inflow)
Center-of-Mass det. time= 3.2 min (847.6 - 844.3)

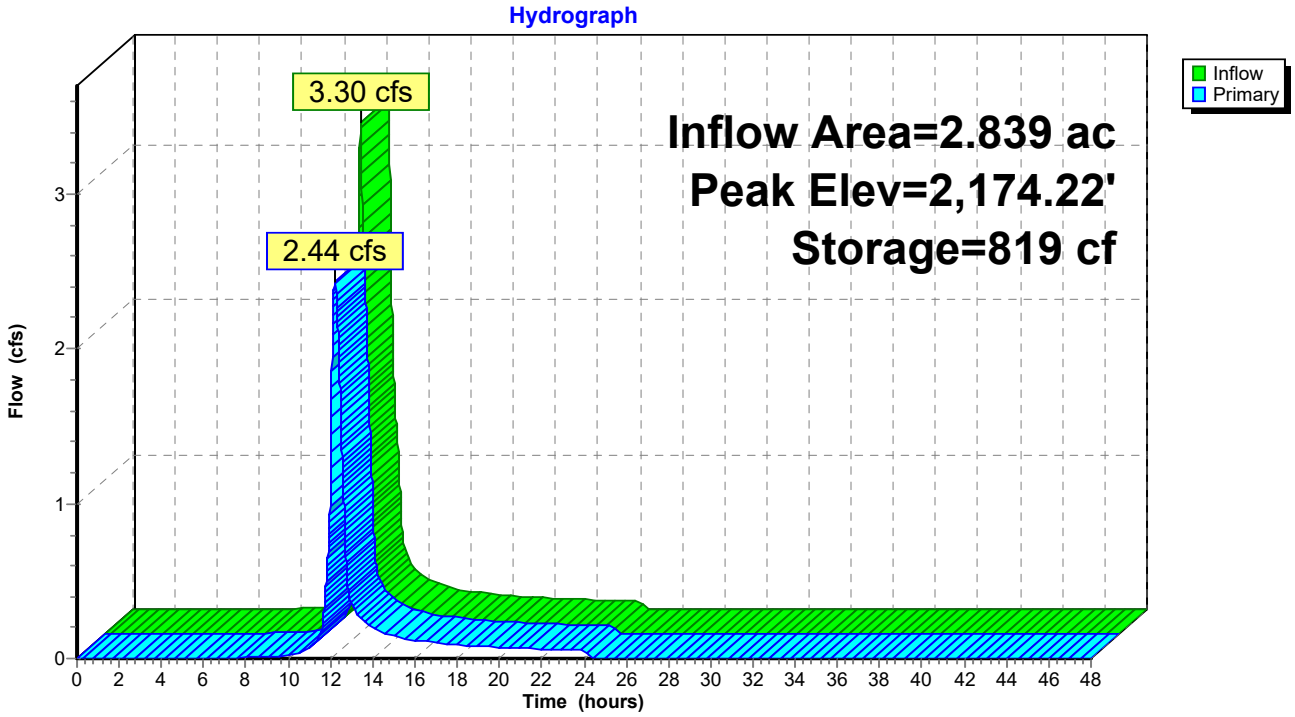
Volume	Invert	Avail.Storage	Storage Description
#1	2,173.00'	5,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,173.00	0	0	0
2,174.00	1,116	558	558
2,175.00	1,600	1,358	1,916
2,176.00	2,142	1,871	3,787
2,176.80	2,616	1,903	5,690

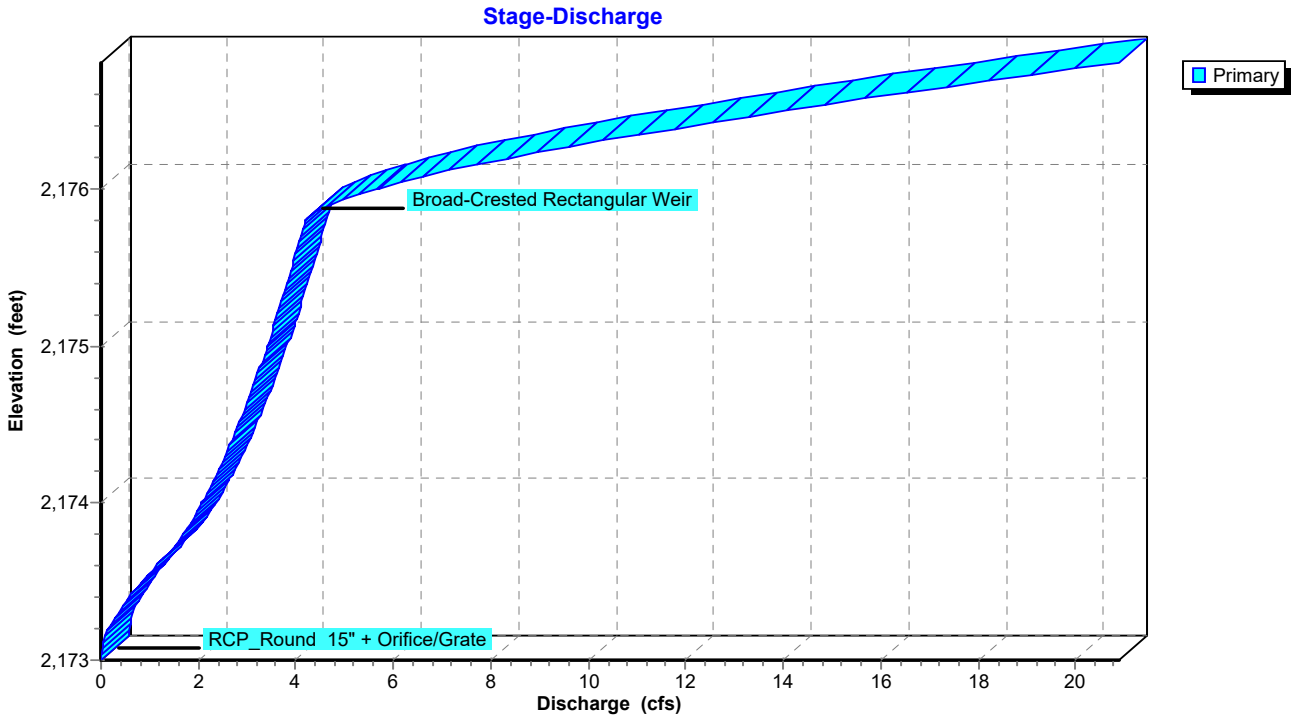
Device	Routing	Invert	Outlet Devices
#1	Primary	2,173.00'	**15.0" Round RCP_Round 15"** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 2,173.00' / 2,172.59' S= 0.0102 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,173.00'	**10.0" Vert. Orifice/Grate** C= 0.620
#3	Primary	2,175.80'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=2.44 cfs @ 12.21 hrs HW=2,174.22' TW=0.00' (Dynamic Tailwater)
- **1=RCP_Round 15"** (Passes 2.44 cfs of 4.39 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.44 cfs @ 4.47 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: CARRIAGE COURT POND



Pond 8P: CARRIAGE COURT POND



Summary for Pond 10P: FIDDLERS GREEN MAIN POND

Inflow	=	42.45 cfs @	12.39 hrs,	Volume=	5.292 af
Outflow	=	35.43 cfs @	12.61 hrs,	Volume=	5.913 af, Atten= 17%, Lag= 13.0 min
Primary	=	35.43 cfs @	12.61 hrs,	Volume=	5.911 af
Secondary	=	0.43 cfs @	12.54 hrs,	Volume=	0.002 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 2,153.35' Surf.Area= 10,860 sf Storage= 28,479 cf
Peak Elev= 2,155.92' @ 12.61 hrs Surf.Area= 13,657 sf Storage= 59,529 cf (31,050 cf above start)

Plug-Flow detention time= 194.8 min calculated for 5.260 af (99% of inflow)
Center-of-Mass det. time= 128.7 min (999.5 - 870.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,149.70'	113,149 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,149.70	0	0	0
2,150.00	1,312	197	197
2,151.00	8,894	5,103	5,300
2,152.00	9,707	9,301	14,600
2,153.00	10,555	10,131	24,731
2,153.35	10,860	3,748	28,479
2,154.00	11,438	7,247	35,726
2,155.00	12,358	11,898	47,624
2,156.00	13,777	13,068	60,691
2,157.00	16,078	14,928	75,619
2,158.00	18,823	17,451	93,069
2,159.00	21,337	20,080	113,149

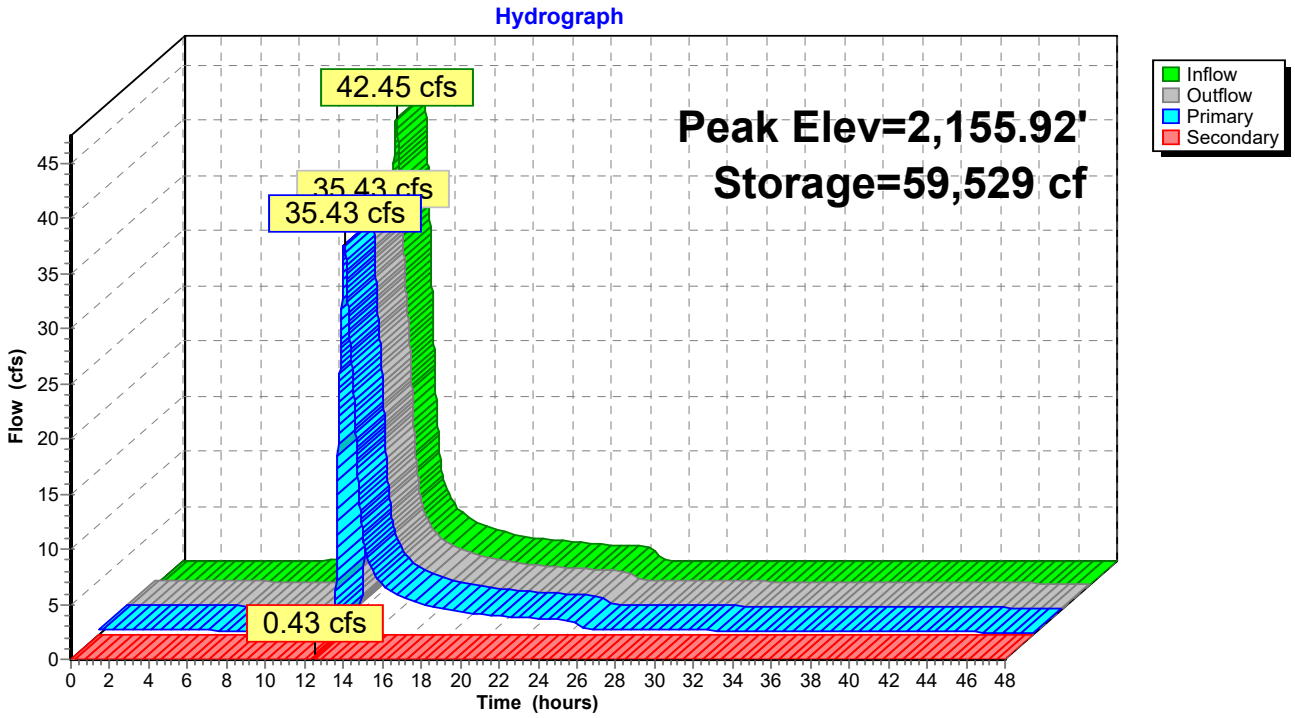
Device	Routing	Invert	Outlet Devices
#1	Primary	2,149.70'	**36.0" Round Culvert** L= 34.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,149.70' / 2,149.53' S= 0.0049 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Device 1	2,149.70'	**3.0" Vert. Orifice/Grate** C= 0.620
#3	Device 1	2,153.35'	**20.0" Vert. Orifice/Grate X 2.00** C= 0.620
#4	Device 1	2,155.63'	**48.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#5	Primary	2,156.63'	**17.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#6	Secondary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf
#7	Secondary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900
n= 0.011, Flow Area= 3.14 sf

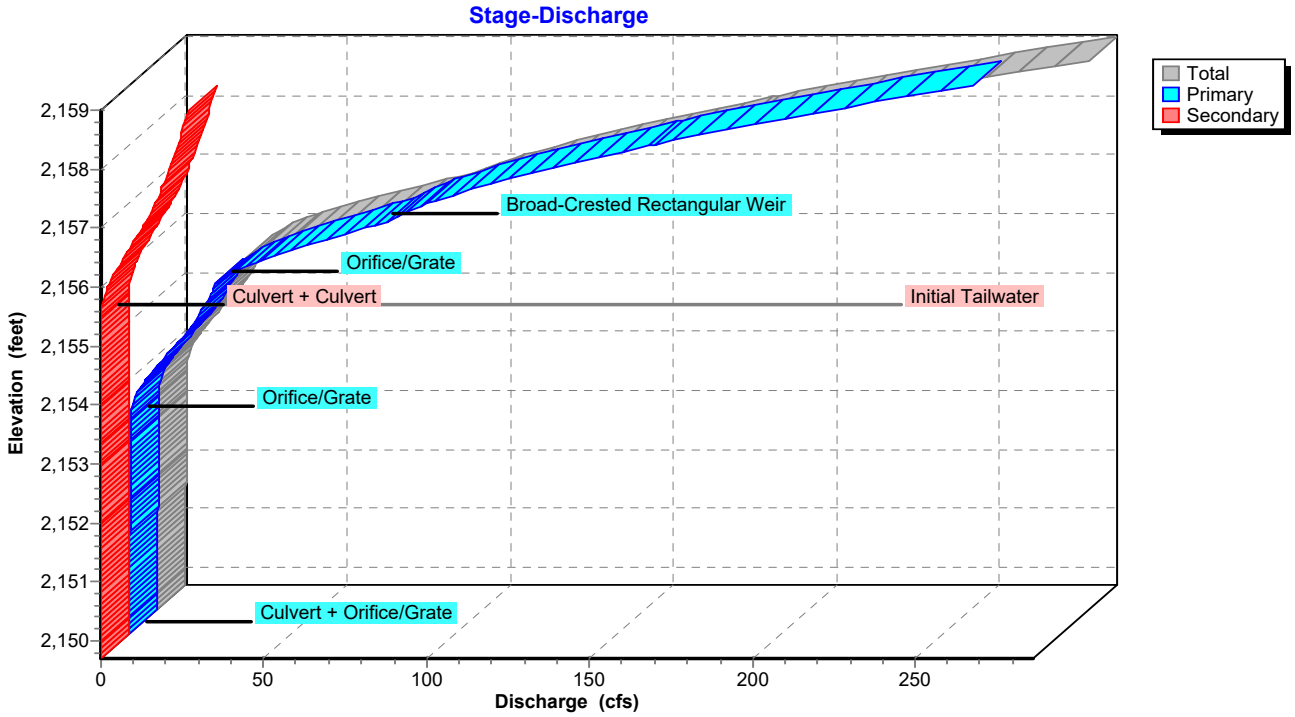
Primary OutFlow Max=35.43 cfs @ 12.61 hrs HW=2,155.92' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 35.43 cfs of 73.91 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.60 cfs @ 12.28 fps)
  - **3=Orifice/Grate** (Orifice Controls 28.57 cfs @ 6.55 fps)
  - **4=Orifice/Grate** (Weir Controls 6.26 cfs @ 1.75 fps)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.27 cfs @ 12.54 hrs HW=2,155.88' TW=2,155.87' (Dynamic Tailwater)
- **6=Culvert** (Inlet Controls 0.12 cfs @ 0.38 fps)
- **7=Culvert** (Inlet Controls 0.16 cfs @ 0.38 fps)

Pond 10P: FIDDLERS GREEN MAIN POND



Pond 10P: FIDDLERS GREEN MAIN POND



Summary for Pond 11P: KNOB HILL POND

Inflow Area = 47.793 ac, Inflow Depth = 0.73" for 1-yr event
Inflow = 26.28 cfs @ 12.29 hrs, Volume= 2.891 af
Outflow = 23.04 cfs @ 12.40 hrs, Volume= 2.891 af, Atten= 12%, Lag= 7.0 min
Primary = 23.04 cfs @ 12.40 hrs, Volume= 2.891 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,171.33' @ 12.40 hrs Surf.Area= 0 sf Storage= 6,727 cf

Plug-Flow detention time= 3.2 min calculated for 2.891 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (873.5 - 870.5)

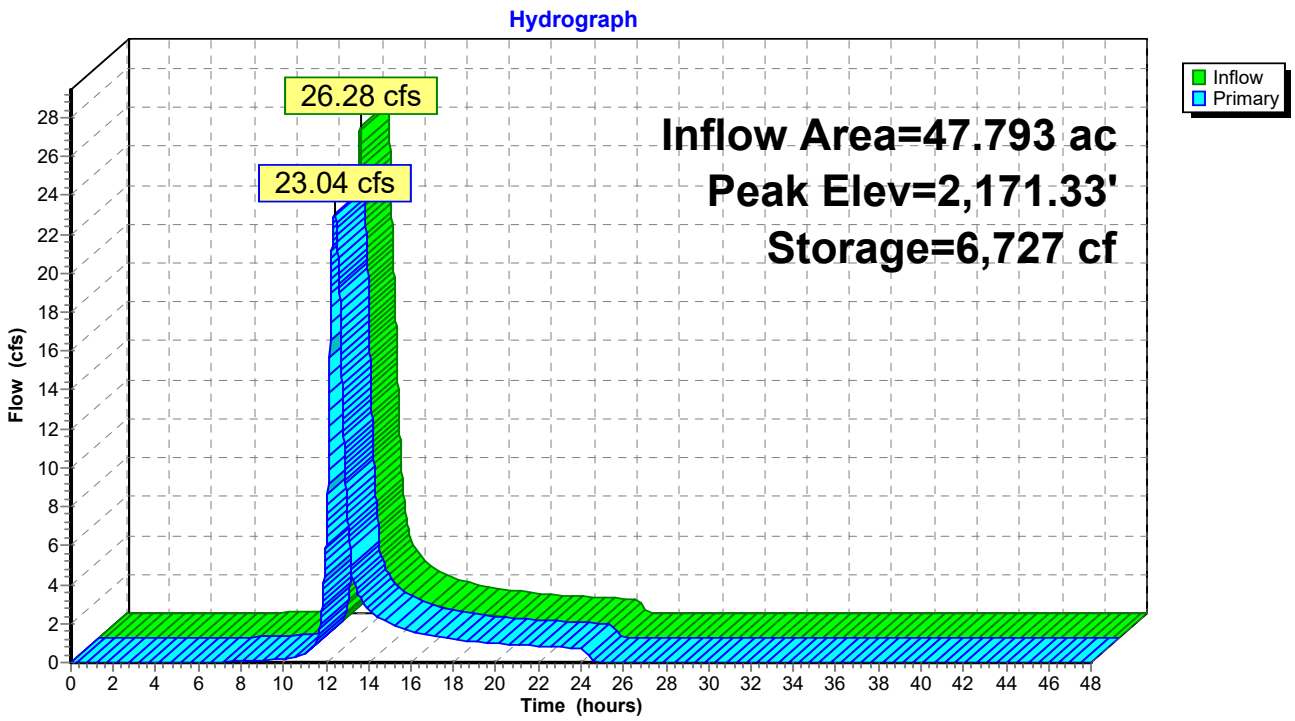
Volume	Invert	Avail.Storage	Storage Description
#1	2,169.00'	56,234 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
2,169.00	0
2,170.00	401
2,171.00	4,203
2,172.00	11,900
2,174.00	31,514
2,176.00	56,234

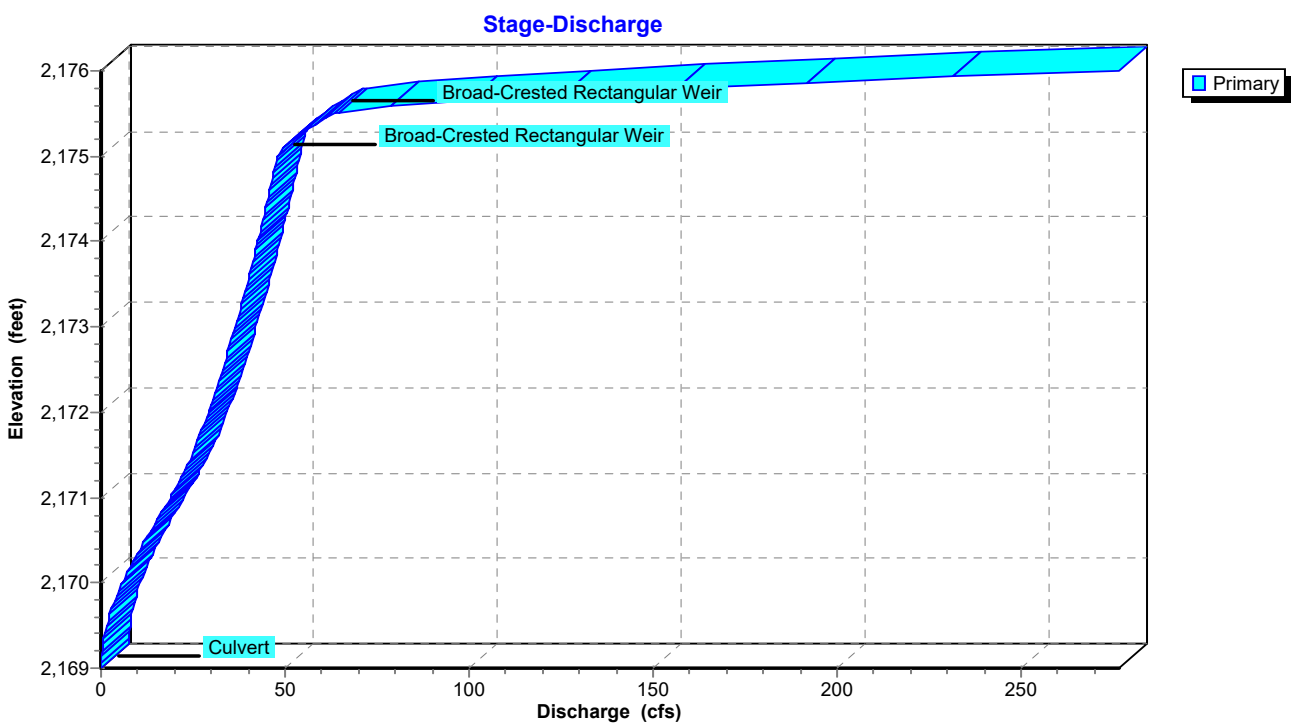
Device	Routing	Invert	Outlet Devices
#1	Primary	2,169.00'	**30.0" Round Culvert** L= 35.0' Ke= 0.610 Inlet / Outlet Invert= 2,169.00' / 2,168.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 HDPE, Flow Area= 4.91 sf
#2	Primary	2,175.00'	**14.5' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	2,175.50'	**200.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=23.04 cfs @ 12.40 hrs HW=2,171.33' TW=2,155.43' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 23.04 cfs @ 4.84 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 11P: KNOB HILL POND



Pond 11P: KNOB HILL POND



Summary for Pond 14P: FIDDLERS GREEN AUX POND

Inflow	=	0.98 cfs @	12.21 hrs,	Volume=	0.097 af
Outflow	=	0.87 cfs @	12.31 hrs,	Volume=	0.097 af, Atten= 12%, Lag= 5.9 min
Primary	=	0.87 cfs @	12.31 hrs,	Volume=	0.097 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,155.94' @ 12.67 hrs Surf.Area= 2,672 sf Storage= 588 cf

Plug-Flow detention time= 8.3 min calculated for 0.097 af (100% of inflow)
Center-of-Mass det. time= 8.3 min (876.2 - 867.8)

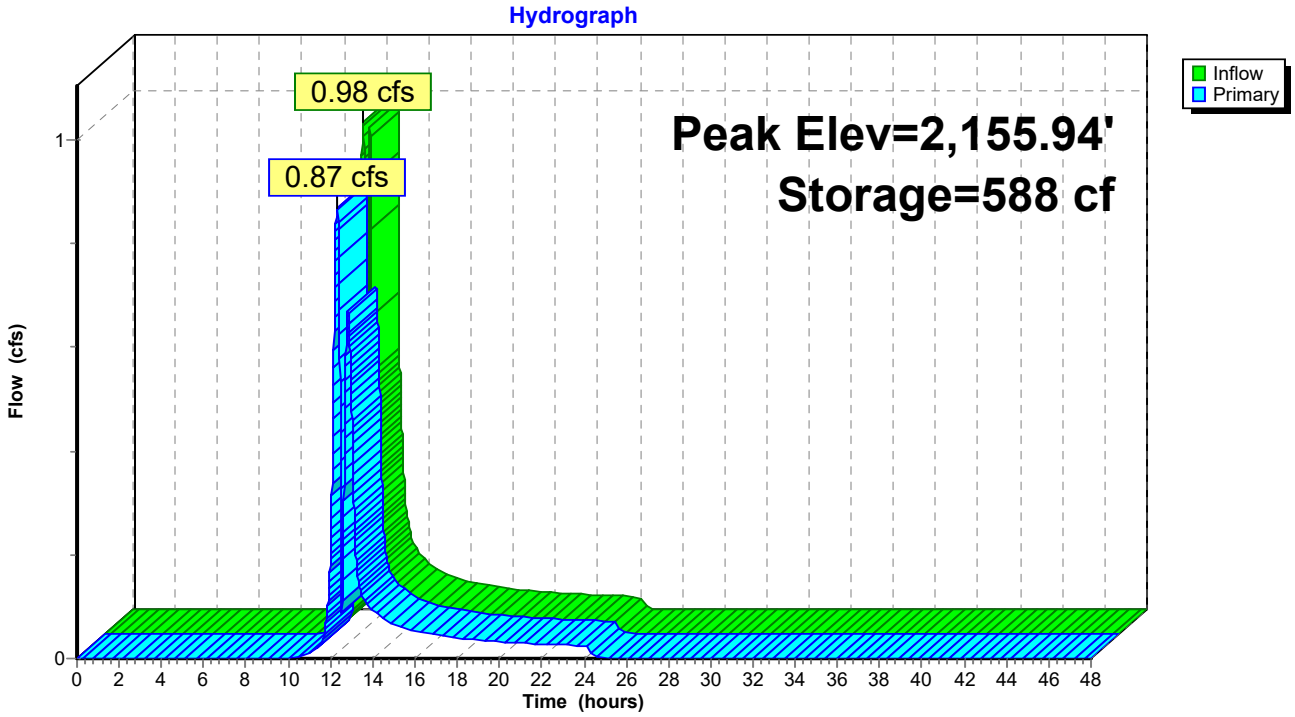
Volume	Invert	Avail.Storage	Storage Description
#1	2,155.50'	27,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,155.50	0	0	0
2,156.00	3,036	759	759
2,157.00	6,522	4,779	5,538
2,158.00	7,134	6,828	12,366
2,159.00	7,772	7,453	19,819
2,160.00	8,436	8,104	27,923

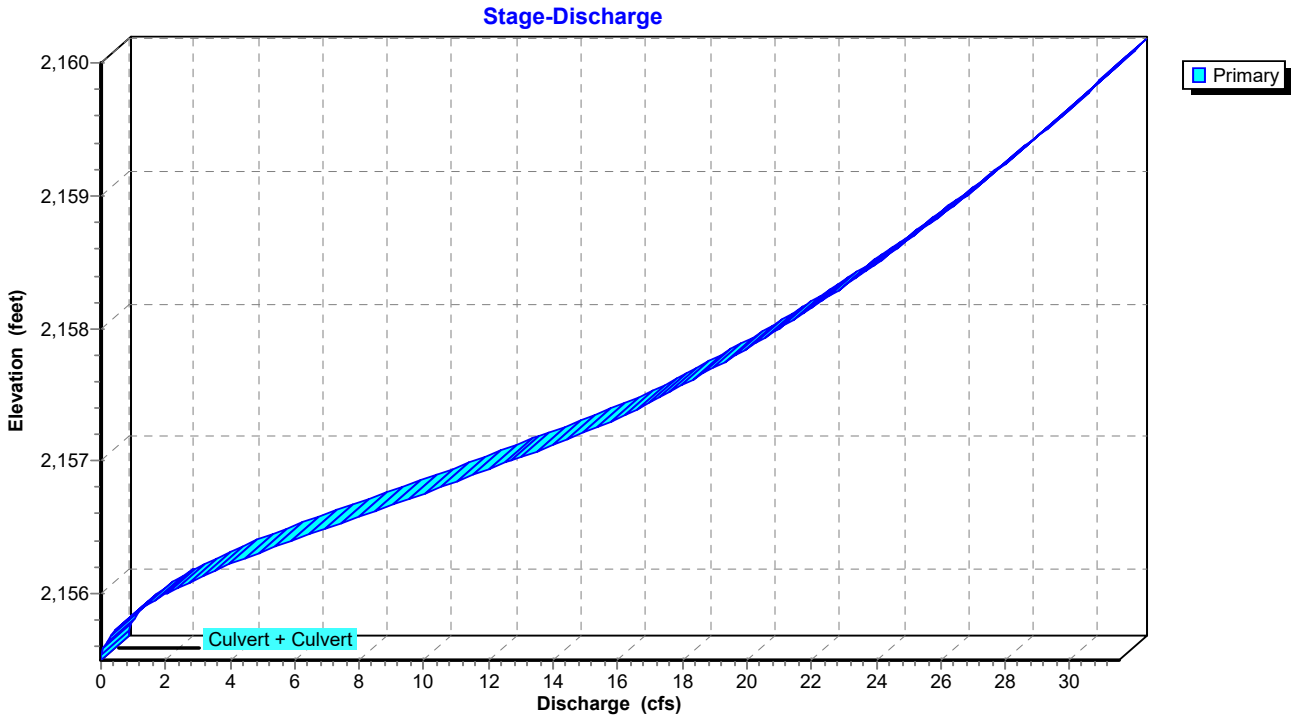
Device	Routing	Invert	Outlet Devices
#1	Primary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Primary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

Primary OutFlow Max=0.87 cfs @ 12.31 hrs HW=2,155.82' TW=2,154.92' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.49 cfs @ 1.52 fps)
└─**2=Culvert** (Inlet Controls 0.38 cfs @ 1.52 fps)

Pond 14P: FIDDLERS GREEN AUX POND



Pond 14P: FIDDLERS GREEN AUX POND



Summary for Pond 19P: EX 50"x31" CMP

[58] Hint: Peaked 0.17' above defined flood level

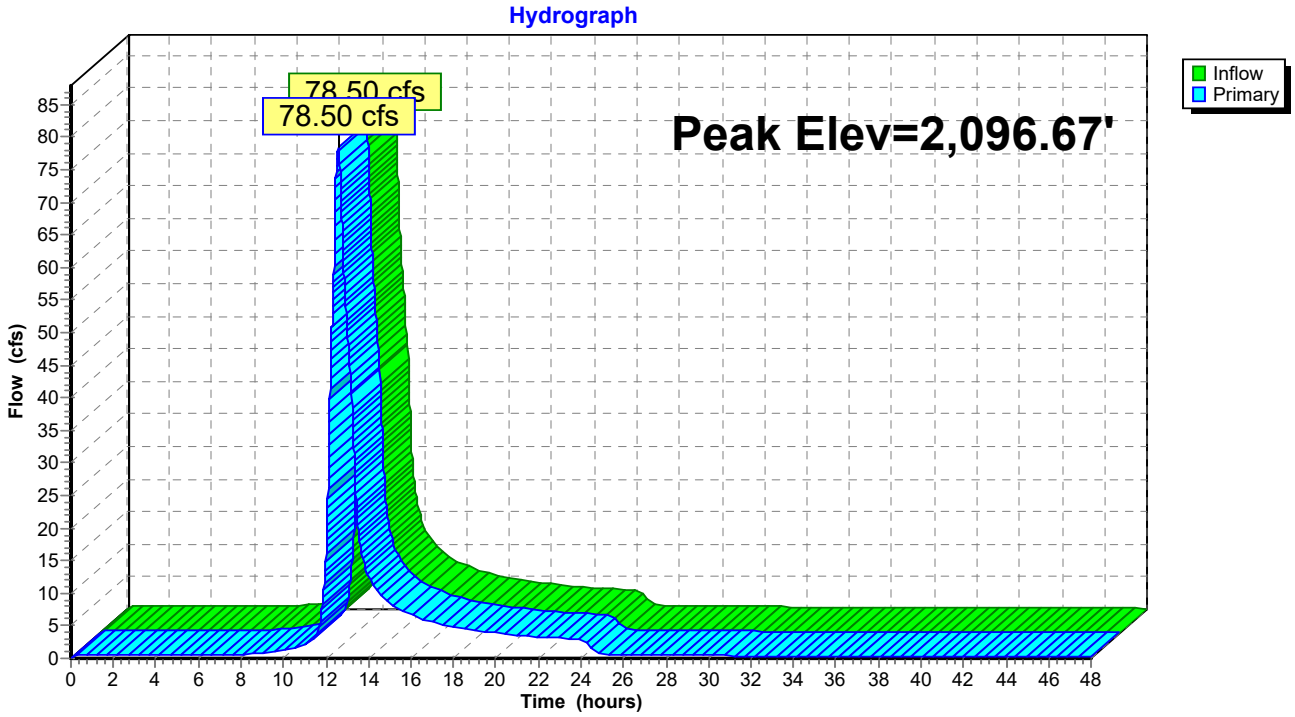
Inflow	=	78.50 cfs @	12.55 hrs,	Volume=	12.804 af
Outflow	=	78.50 cfs @	12.56 hrs,	Volume=	12.804 af, Atten= 0%, Lag= 0.6 min
Primary	=	78.50 cfs @	12.56 hrs,	Volume=	12.804 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.67' @ 12.56 hrs
Flood Elev= 2,096.50'

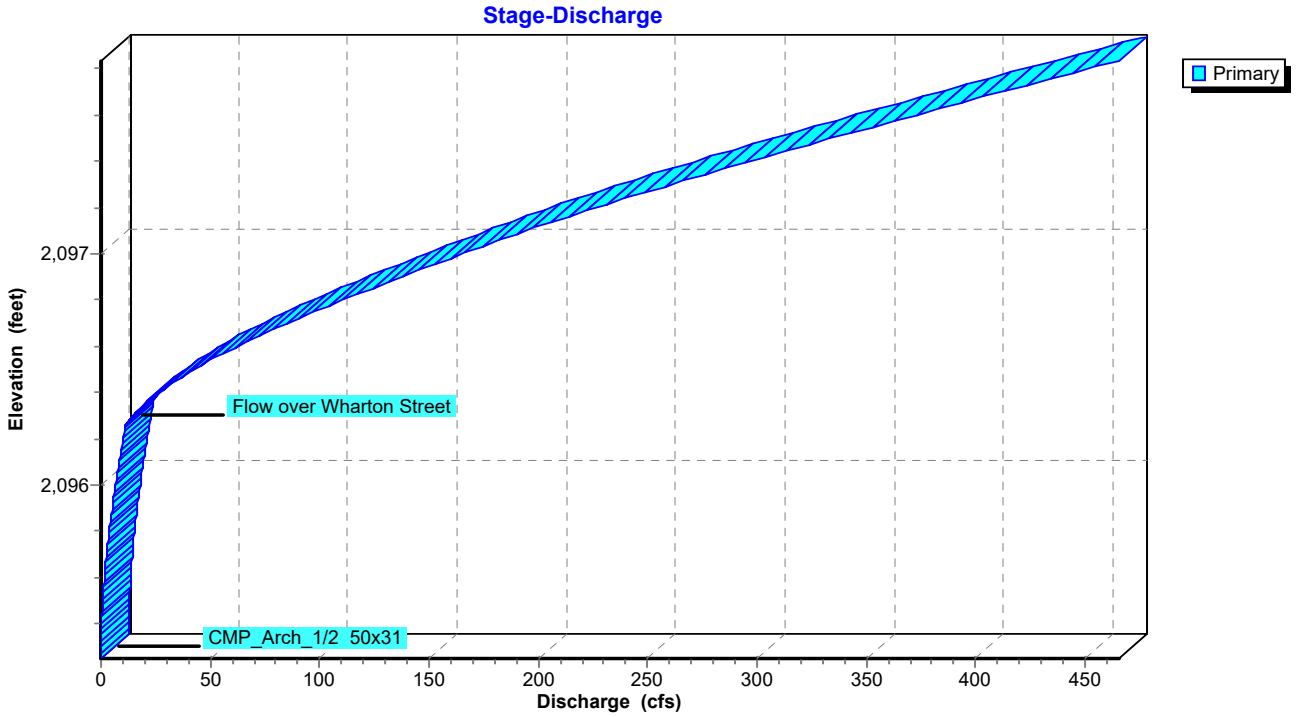
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=78.49 cfs @ 12.56 hrs HW=2,096.67' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 19.60 cfs @ 3.71 fps)
└─**2=Flow over Wharton Street** (Weir Controls 58.89 cfs @ 1.75 fps)

Pond 19P: EX 50"x31" CMP



Pond 19P: EX 50"x31" CMP



Summary for Subcatchment 3S: BERRYFIELD POND DA

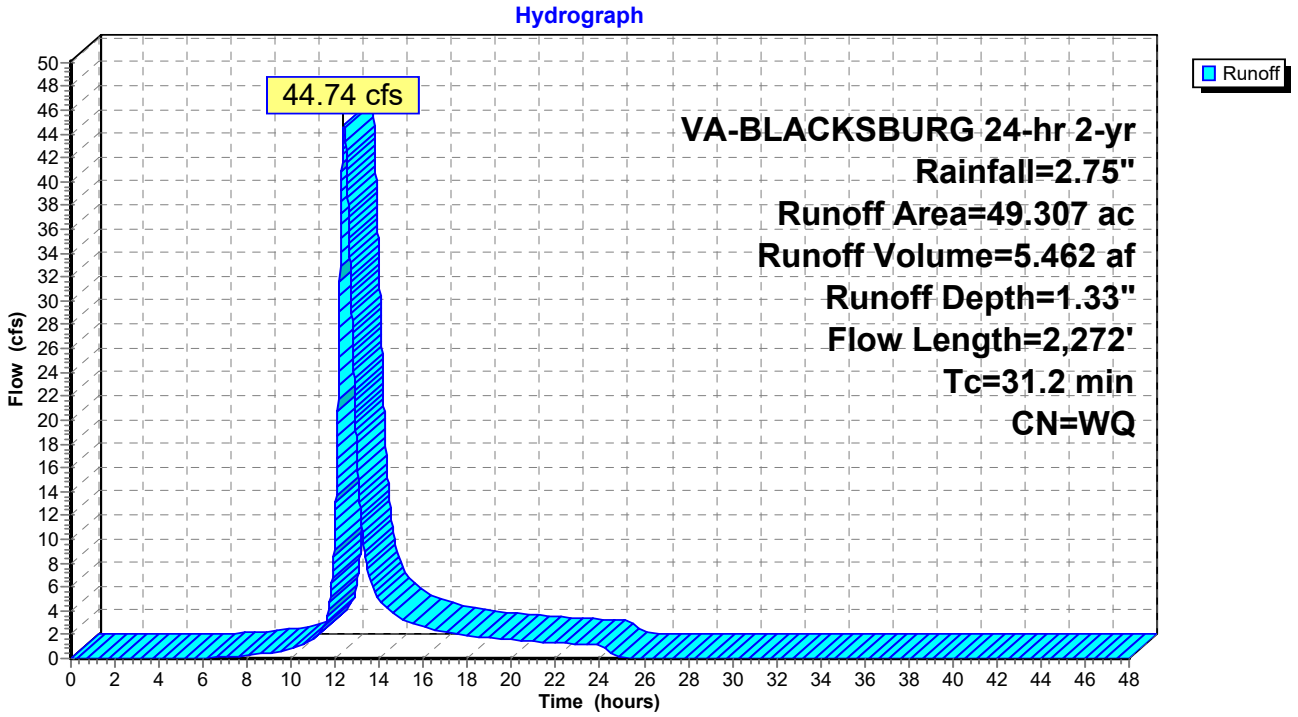
Runoff = 44.74 cfs @ 12.38 hrs, Volume= 5.462 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	3.627	70	Woods, Good, HSG C
	1.722	77	Woods, Good, HSG D
	11.203	74	>75% Grass cover, Good, HSG C
	0.649	80	>75% Grass cover, Good, HSG D
	0.017	82	2 acre lots, 12% imp, HSG D
	0.988	79	1 acre lots, 20% imp, HSG C
	1.522	80	1/2 acre lots, 25% imp, HSG C
	2.739	81	1/3 acre lots, 30% imp, HSG C
	0.020	86	1/3 acre lots, 30% imp, HSG D
	3.233	83	1/4 acre lots, 38% imp, HSG C
	0.390	87	1/4 acre lots, 38% imp, HSG D
	13.958	90	1/8 acre lots, 65% imp, HSG C
	1.013	92	1/8 acre lots, 65% imp, HSG D
	6.184	92	Paved roads w/open ditches, 50% imp, HSG C
	0.599	93	Paved roads w/open ditches, 50% imp, HSG D
	0.780	98	Paved parking, HSG C
*	0.663	83	25% Carry Over from Prospect Street Infiltration Pits
	49.307		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.0633	0.12		**Sheet Flow, Tc4** Woods: Light underbrush n= 0.400 P2= 2.76"
3.6	1,024	0.0869	4.75		**Shallow Concentrated Flow, Tc5** Unpaved Kv= 16.1 fps
2.2	284	0.0176	2.14		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
5.2	814	0.0307	2.63		**Shallow Concentrated Flow, Tc7** Grassed Waterway Kv= 15.0 fps
31.2	2,272	Total			

Subcatchment 3S: BERRYFIELD POND DA



Summary for Subcatchment 4S: 5'x3' CONC. BOX DA

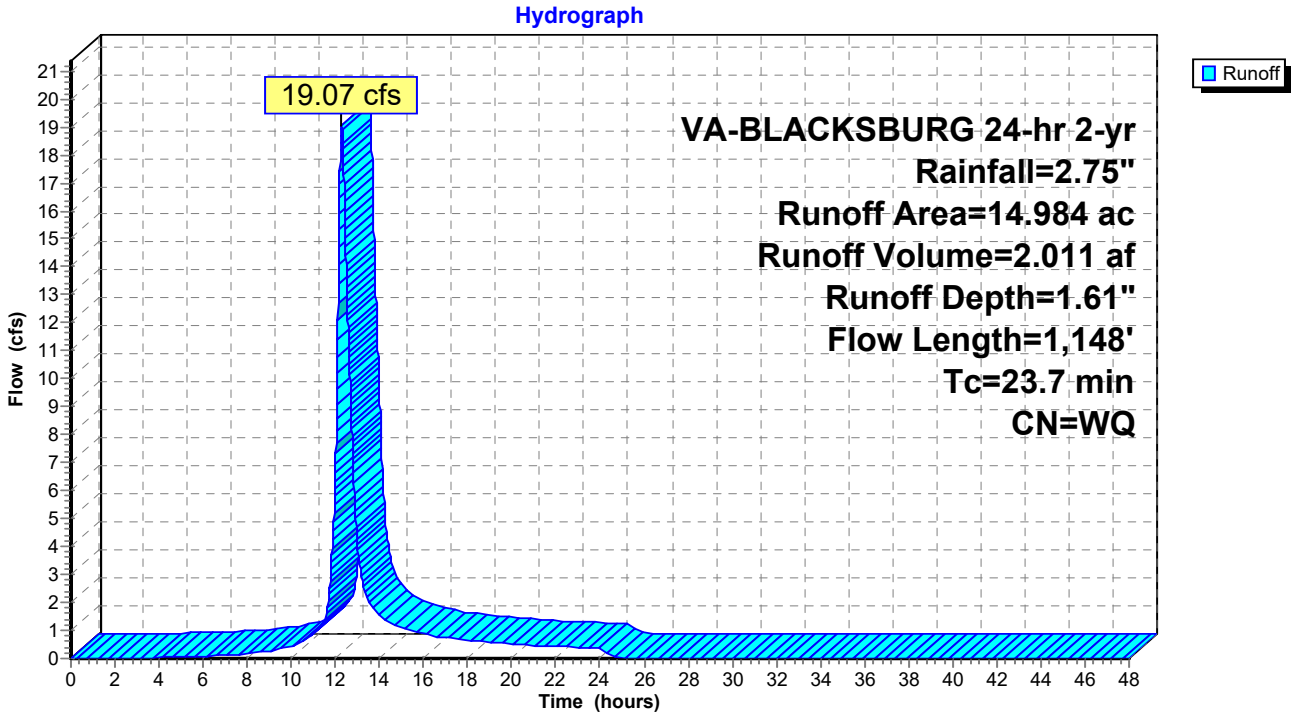
Runoff = 19.07 cfs @ 12.29 hrs, Volume= 2.011 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.444	74	>75% Grass cover, Good, HSG C
3.534	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.202	95	Urban commercial, 85% imp, HSG D
0.593	92	Paved roads w/open ditches, 50% imp, HSG C
1.697	93	Paved roads w/open ditches, 50% imp, HSG D
0.147	98	Paved parking, HSG C
1.587	98	Paved parking, HSG D
14.984		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 4S: 5'x3' CONC. BOX DA



Summary for Subcatchment 5S: CLAY ST. DA

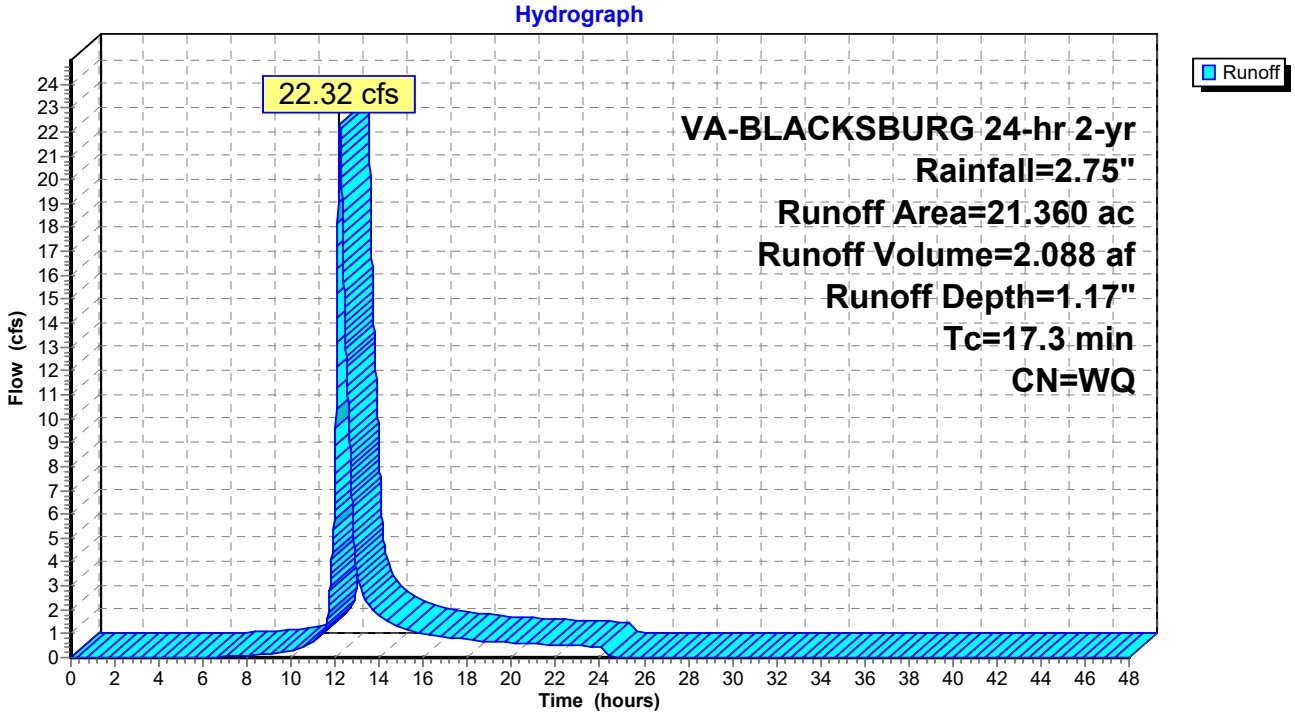
Runoff = 22.32 cfs @ 12.20 hrs, Volume= 2.088 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
5.332	70	Woods, Good, HSG C
4.382	74	>75% Grass cover, Good, HSG C
2.136	81	1/3 acre lots, 30% imp, HSG C
2.246	83	1/4 acre lots, 38% imp, HSG C
3.153	90	1/8 acre lots, 65% imp, HSG C
4.111	92	Paved roads w/open ditches, 50% imp, HSG C
21.360		Weighted Average

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

Subcatchment 5S: CLAY ST. DA



Summary for Subcatchment 6S: EX. MH "B" DA

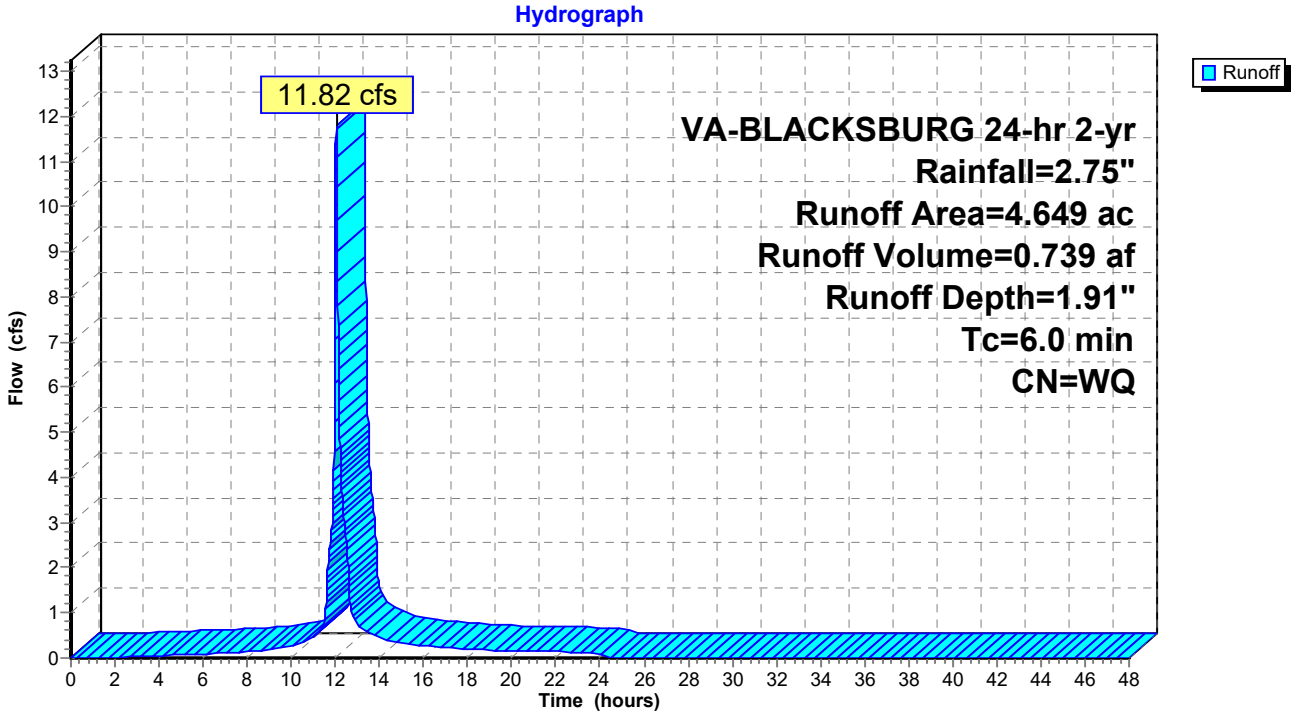
Runoff = 11.82 cfs @ 12.04 hrs, Volume= 0.739 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
1.958	80	>75% Grass cover, Good, HSG D
2.685	98	Paved parking, HSG D
0.006	98	Paved parking, HSG C
4.649		Weighted Average

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

Subcatchment 6S: EX. MH "B" DA



Summary for Subcatchment 7S: EX. MH "A" DA

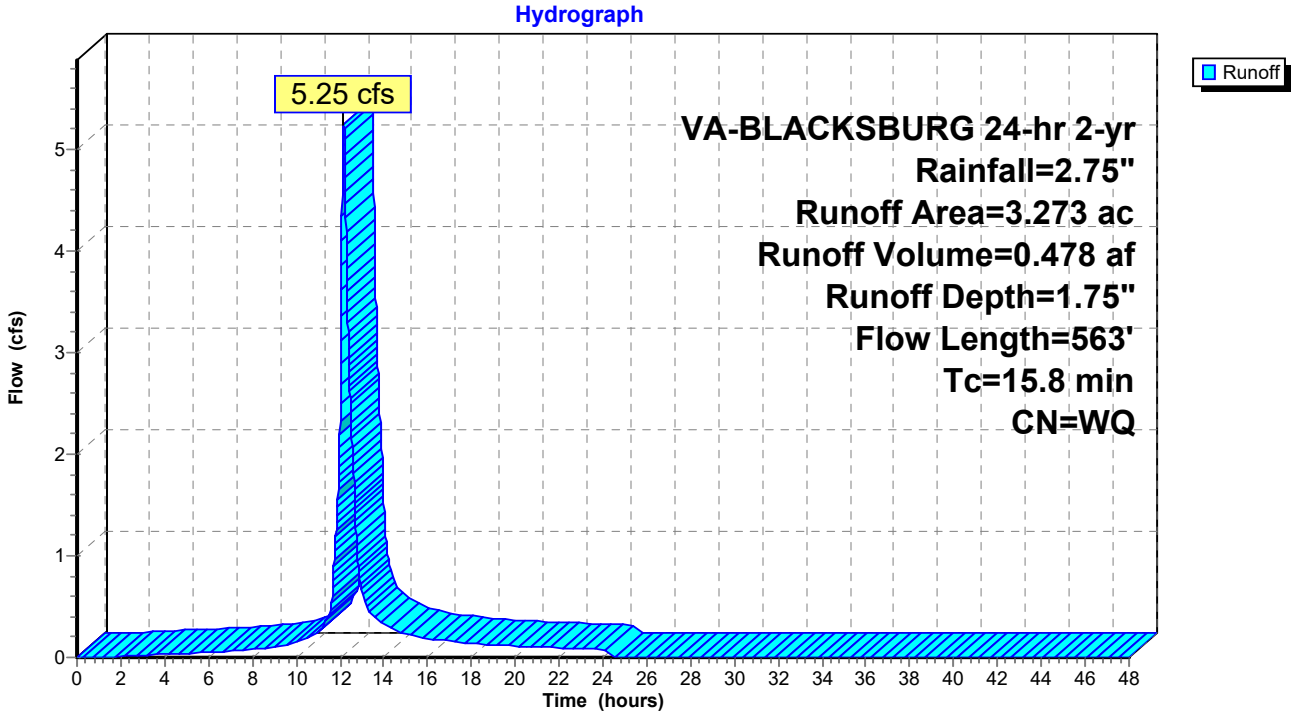
Runoff = 5.25 cfs @ 12.17 hrs, Volume= 0.478 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.830	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
1.727	80	>75% Grass cover, Good, HSG D
3.273		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0600	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	74	0.0598	3.94		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
1.8	339	0.0229	3.07		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
15.8	563	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 9S: CARRIAGE COURT DA

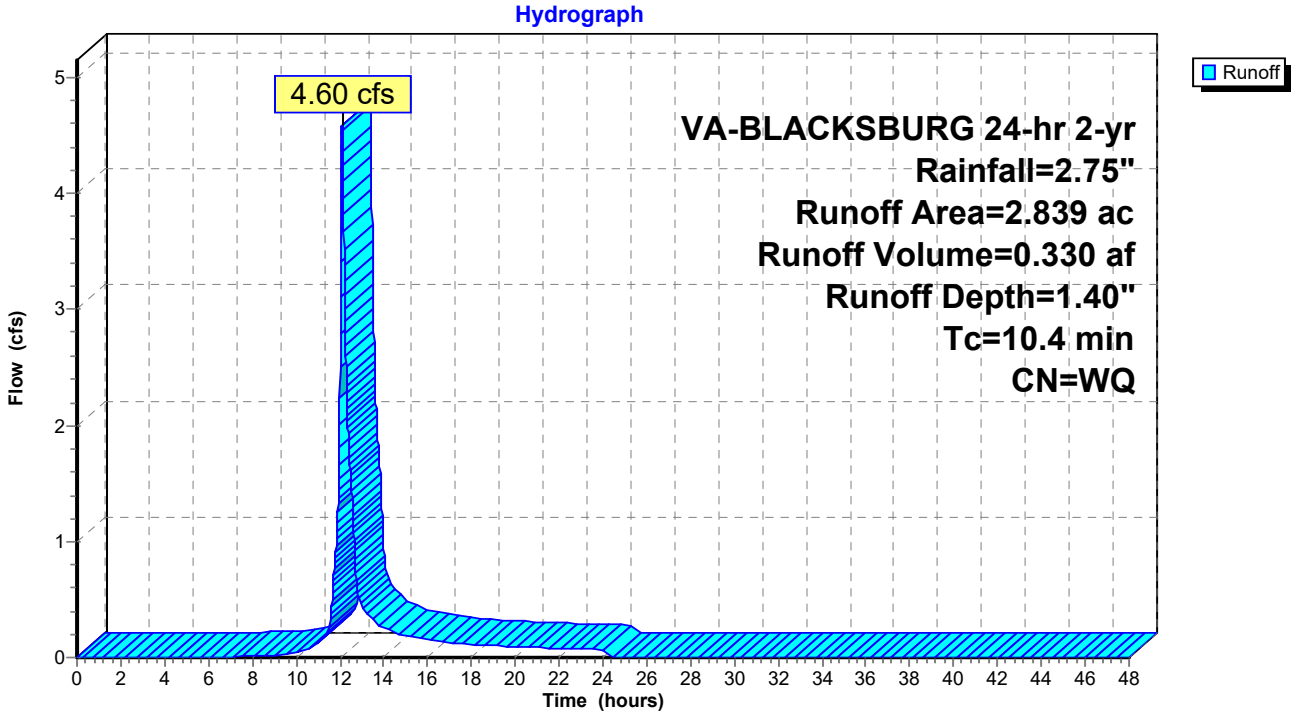
Runoff = 4.60 cfs @ 12.10 hrs, Volume= 0.330 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
2.217	83	1/4 acre lots, 38% imp, HSG C
0.622	92	Paved roads w/open ditches, 50% imp, HSG C
2.839		Weighted Average

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

Subcatchment 9S: CARRIAGE COURT DA



Summary for Subcatchment 12S: FIDDLERS GREEN MAIN DA

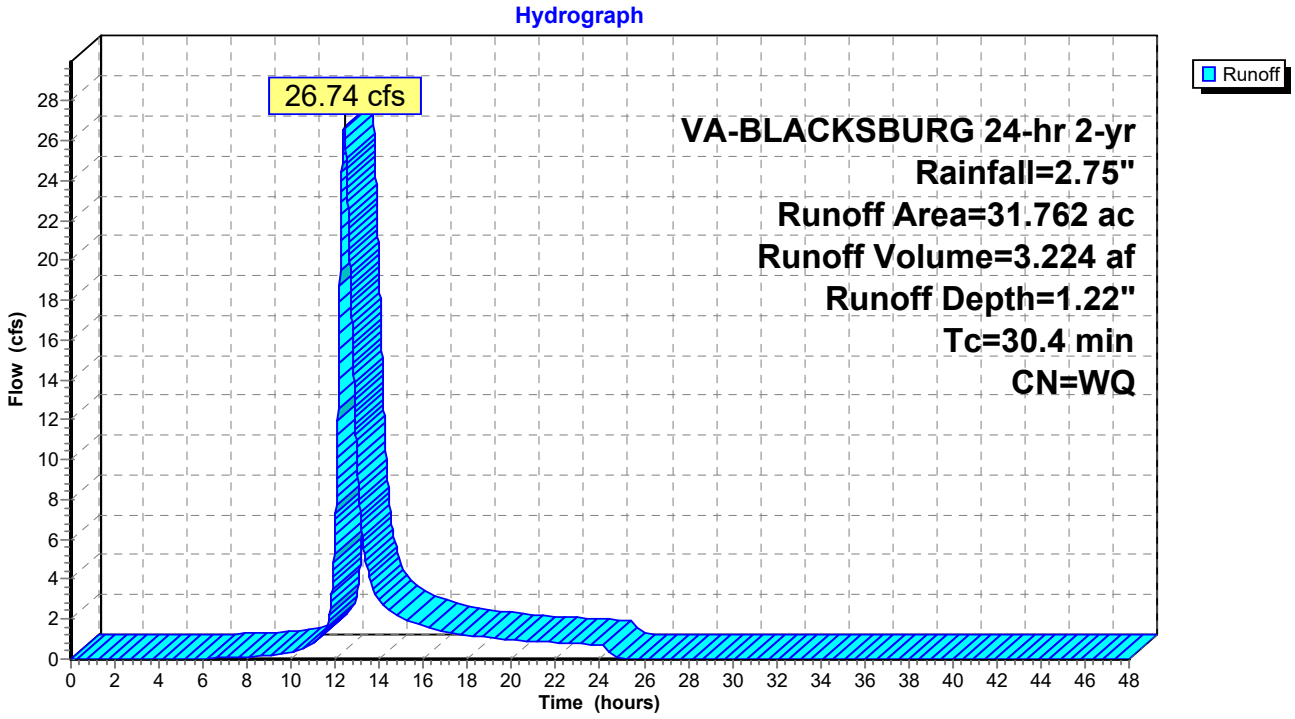
Runoff = 26.74 cfs @ 12.40 hrs, Volume= 3.224 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.116	70	Woods, Good, HSG C
8.691	74	>75% Grass cover, Good, HSG C
2.424	80	1/2 acre lots, 25% imp, HSG C
4.428	81	1/3 acre lots, 30% imp, HSG C
10.306	83	1/4 acre lots, 38% imp, HSG C
4.998	92	Paved roads w/open ditches, 50% imp, HSG C
0.799	98	Paved parking, HSG C
31.762		Weighted Average

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

Subcatchment 12S: FIDDLERS GREEN MAIN DA



Summary for Subcatchment 13S: KNOB HILL DA

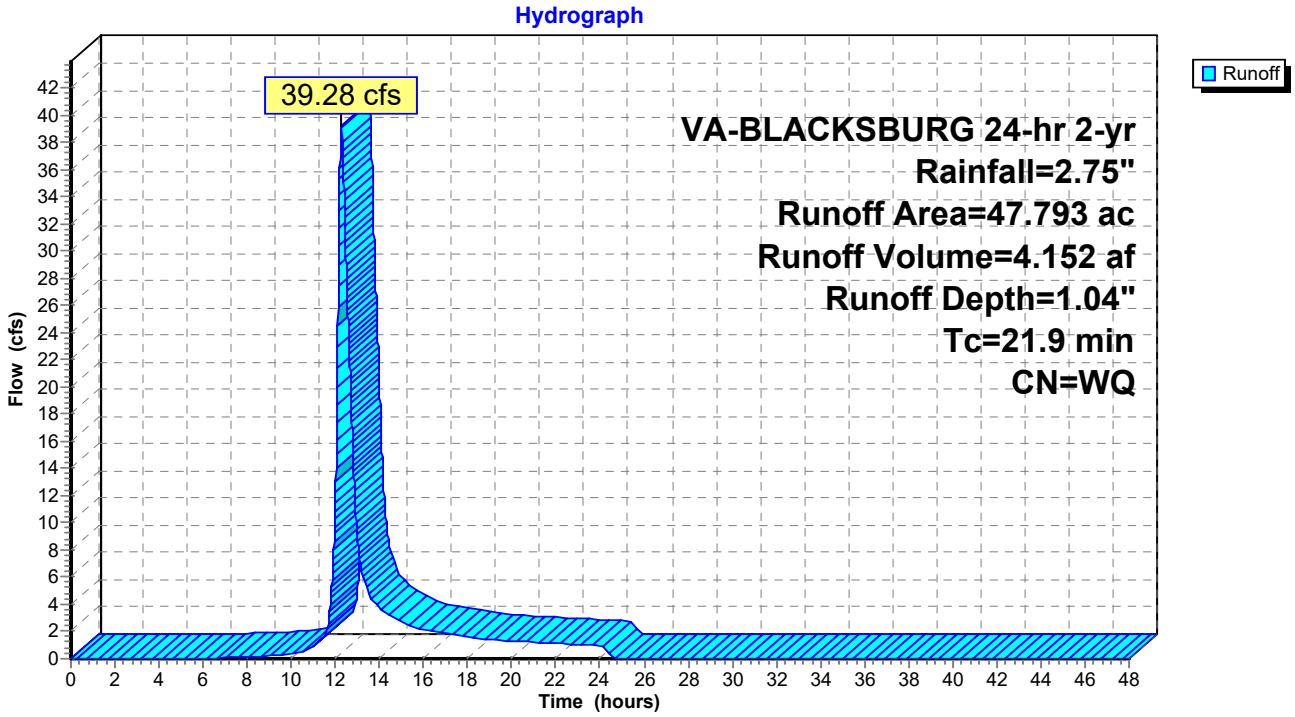
Runoff = 39.28 cfs @ 12.28 hrs, Volume= 4.152 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	0.103	55	Woods, Good, HSG B
	10.773	70	Woods, Good, HSG C
	1.435	74	>75% Grass cover, Good, HSG C
	1.128	79	1 acre lots, 20% imp, HSG C
	5.039	80	1/2 acre lots, 25% imp, HSG C
	5.519	72	1/3 acre lots, 30% imp, HSG B
	15.477	81	1/3 acre lots, 30% imp, HSG C
	1.091	83	1/4 acre lots, 38% imp, HSG C
	1.823	94	Urban commercial, 85% imp, HSG C
	0.485	89	Paved roads w/open ditches, 50% imp, HSG B
	4.240	92	Paved roads w/open ditches, 50% imp, HSG C
*	0.680	80	25% Carry Over from Jefferson Street Infiltration Pits
	47.793		Weighted Average

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

Subcatchment 13S: KNOB HILL DA



Summary for Subcatchment 15S: FIDDLERS GREEN AUX DA

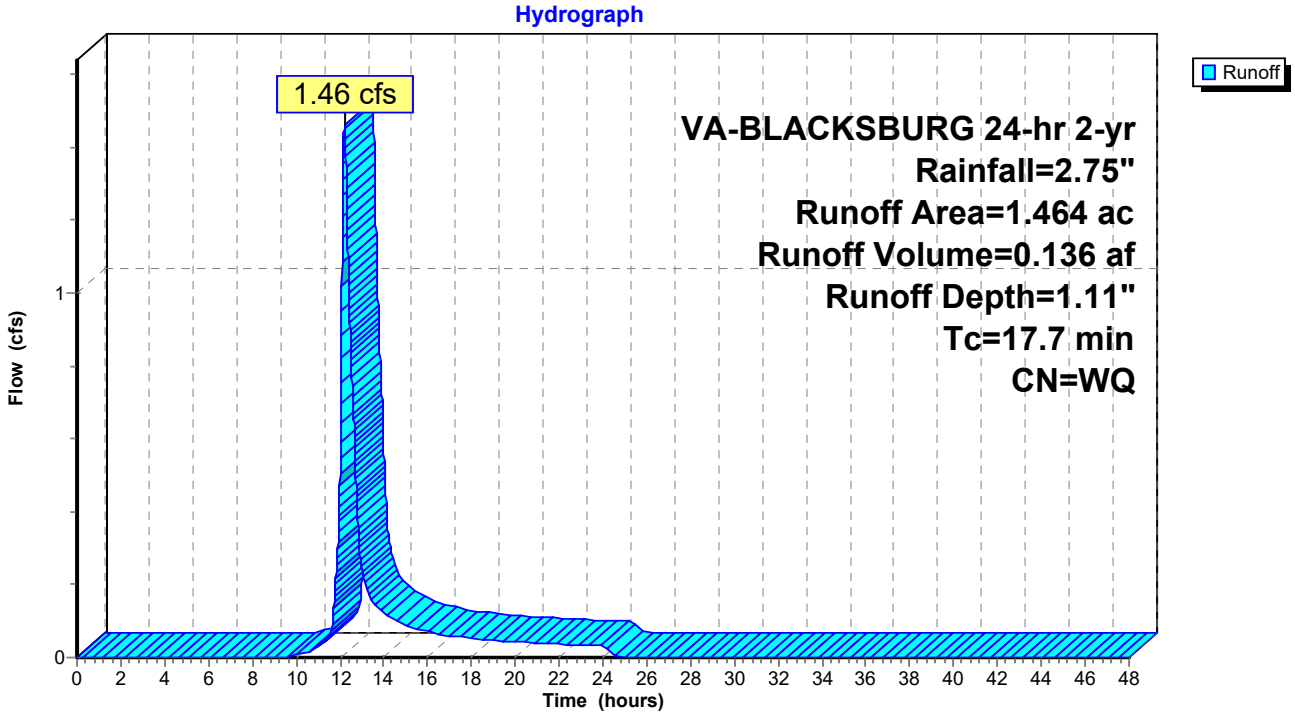
Runoff = 1.46 cfs @ 12.21 hrs, Volume= 0.136 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.398	74	>75% Grass cover, Good, HSG C
1.066	83	1/4 acre lots, 38% imp, HSG C
1.464		Weighted Average

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

Subcatchment 15S: FIDDLERS GREEN AUX DA



Summary for Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)

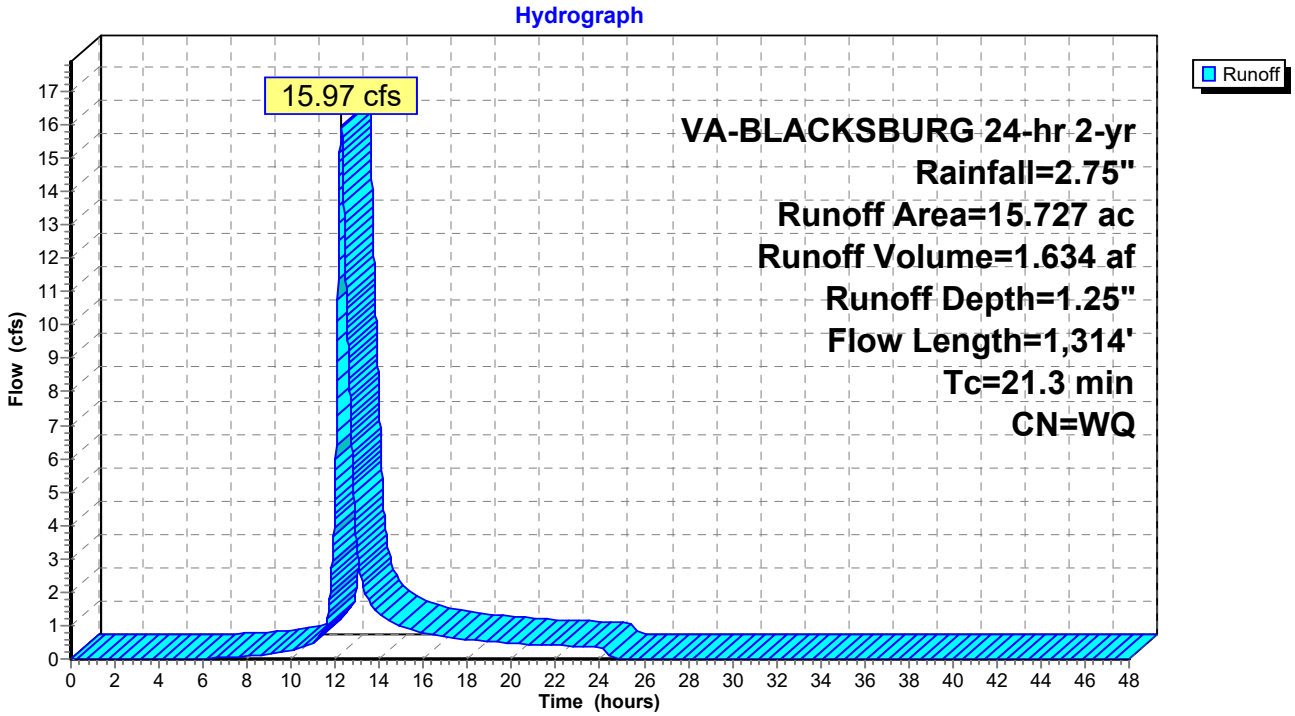
Runoff = 15.97 cfs @ 12.26 hrs, Volume= 1.634 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	0.584	70	Woods, Good, HSG C
	4.980	74	>75% Grass cover, Good, HSG C
	4.010	80	>75% Grass cover, Good, HSG D
	0.330	81	1/3 acre lots, 30% imp, HSG C
	1.247	92	Paved roads w/open ditches, 50% imp, HSG C
	0.435	98	Paved parking, HSG C
	0.126	98	Paved parking, HSG D
*	4.015	90	25% Carry Over from Villas Infiltration Pits
	15.727		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)



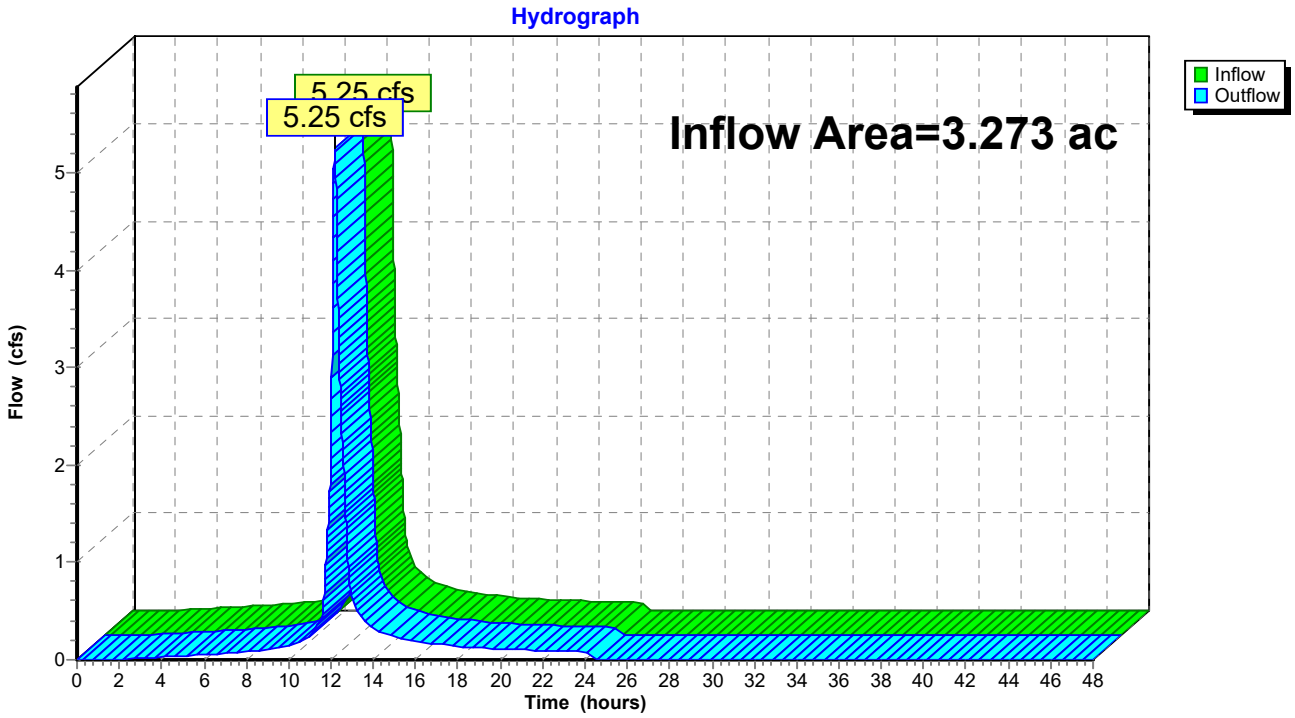
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.273 ac, Inflow Depth = 1.75" for 2-yr event
Inflow = 5.25 cfs @ 12.17 hrs, Volume= 0.478 af
Outflow = 5.25 cfs @ 12.18 hrs, Volume= 0.478 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



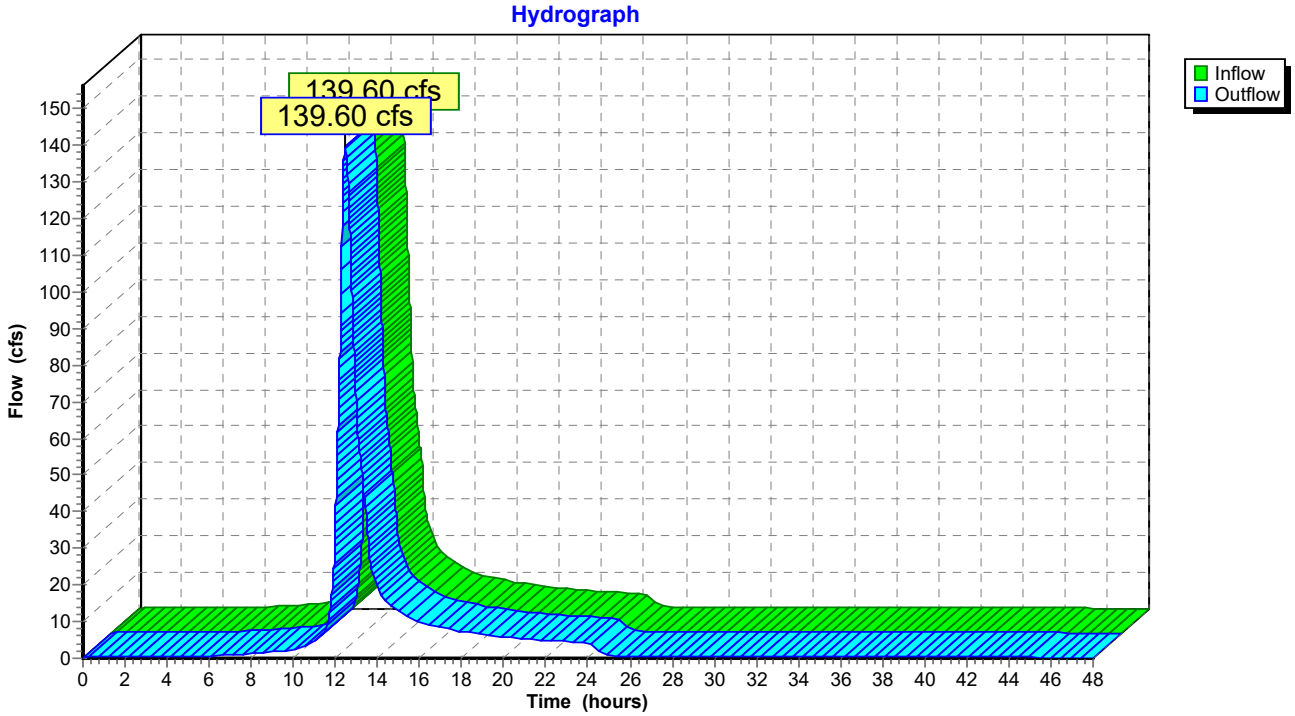
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	139.60 cfs @	12.45 hrs,	Volume=	20.393 af
Outflow	=	139.60 cfs @	12.46 hrs,	Volume=	20.393 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT



Summary for Pond 1P: BERRYFIELD POND

Inflow	=	110.97 cfs @	12.46 hrs,	Volume=	16.010 af
Outflow	=	110.88 cfs @	12.48 hrs,	Volume=	16.010 af, Atten= 0%, Lag= 1.4 min
Primary	=	110.88 cfs @	12.48 hrs,	Volume=	16.010 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,100.13' @ 12.48 hrs Surf.Area= 13,808 sf Storage= 24,801 cf
Flood Elev= 2,101.00' Surf.Area= 23,595 sf Storage= 41,004 cf

Plug-Flow detention time= 3.4 min calculated for 16.007 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (910.0 - 906.7)

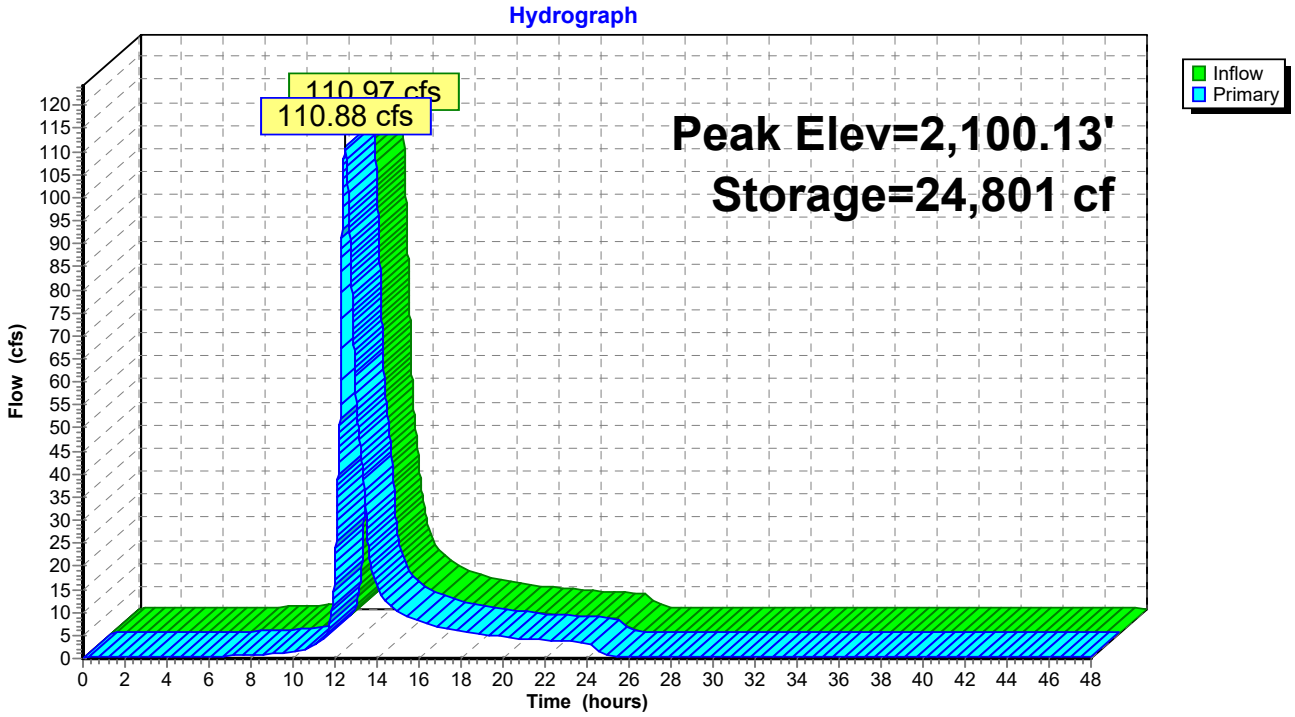
Volume	Invert	Avail.Storage	Storage Description
#1	2,096.00'	41,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,096.00	0	0	0
2,098.00	5,379	5,379	5,379
2,100.00	12,299	17,678	23,057
2,101.00	23,595	17,947	41,004

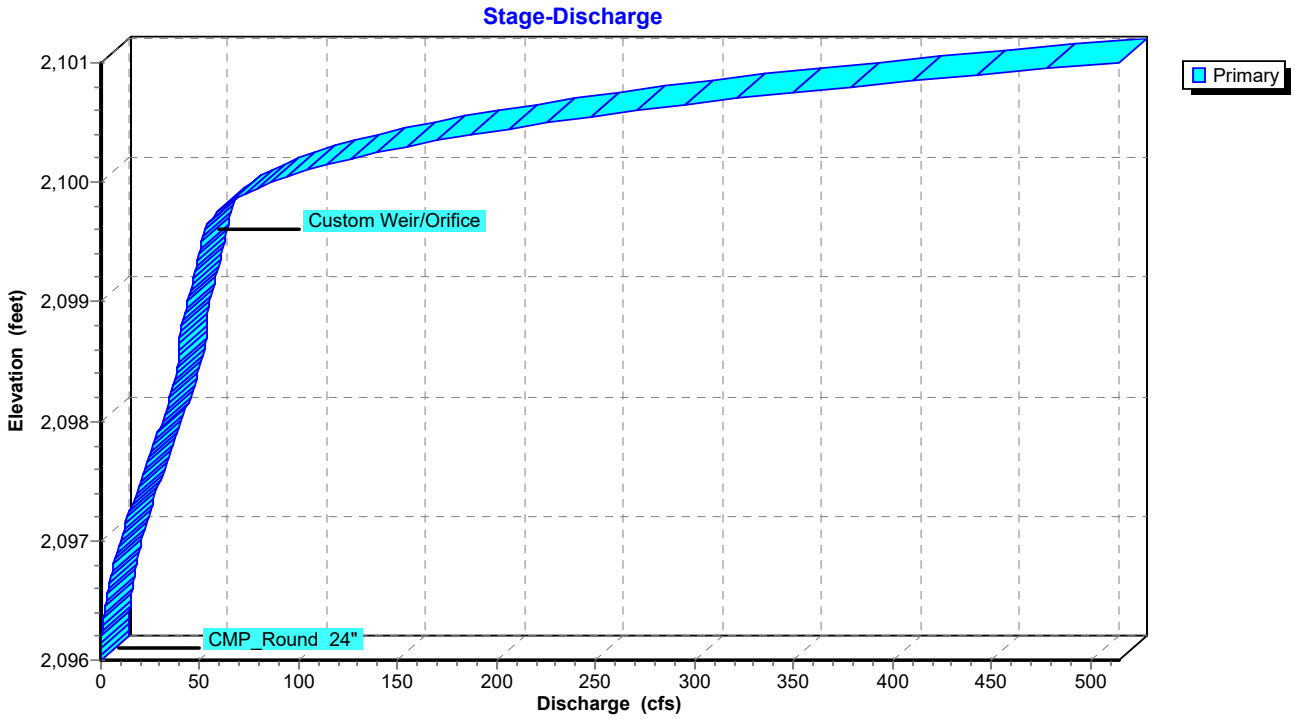
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.00'	**24.0" Round CMP_Round 24" X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,096.00' / 2,095.50' S= 0.0083 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 3.14 sf
#2	Primary	2,099.50'	**Custom Weir/Orifice, Cv= 3.00 (C= 3.75)** Head (feet) 0.00 0.50 1.50 Width (feet) 0.00 55.00 160.00

Primary OutFlow Max=110.88 cfs @ 12.48 hrs HW=2,100.13' TW=2,096.84' (Dynamic Tailwater)
└─**1=CMP_Round 24"** (Barrel Controls 58.19 cfs @ 6.17 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 52.68 cfs @ 2.39 fps)

Pond 1P: BERRYFIELD POND



Pond 1P: BERRYFIELD POND



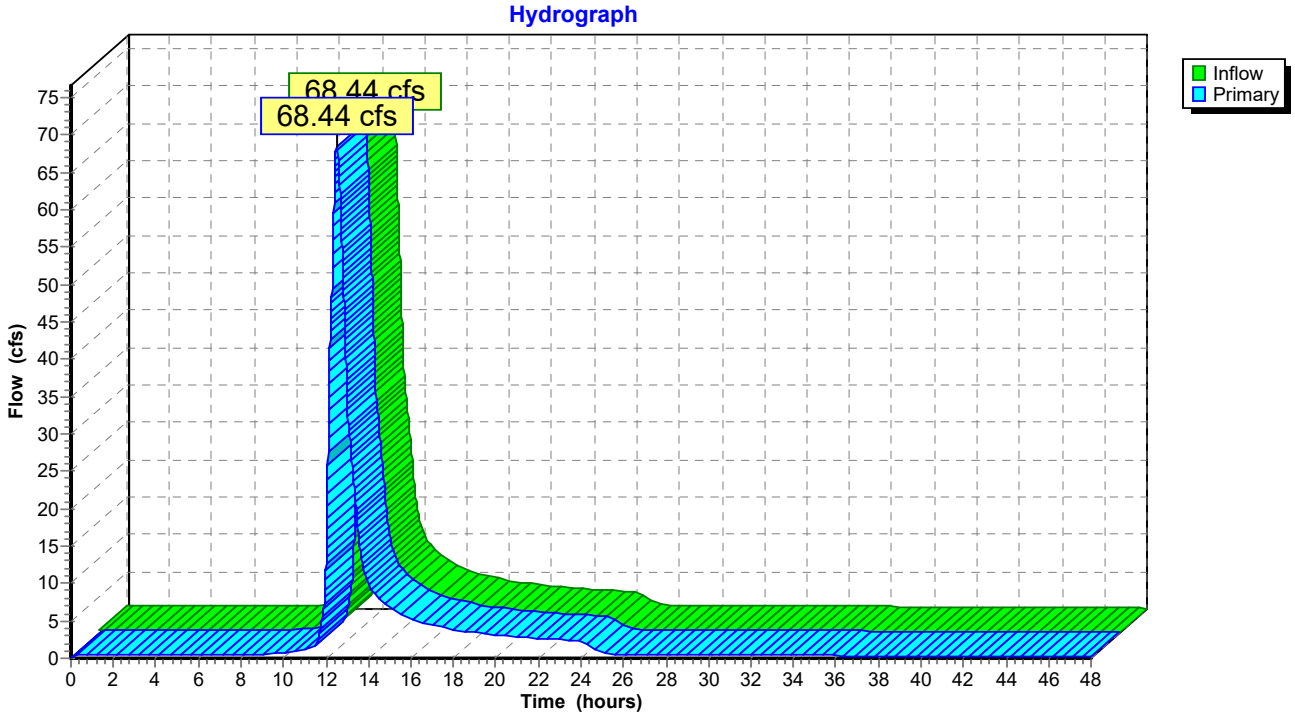
Summary for Pond 2P: CLAY ST. UNDERGROUND BOX

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	68.44 cfs @	12.51 hrs,	Volume=	10.549 af
Primary	=	68.44 cfs @	12.52 hrs,	Volume=	10.549 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 2P: CLAY ST. UNDERGROUND BOX



Summary for Pond 3P: EX. MH "B"

[58] Hint: Peaked 22.33' above defined flood level

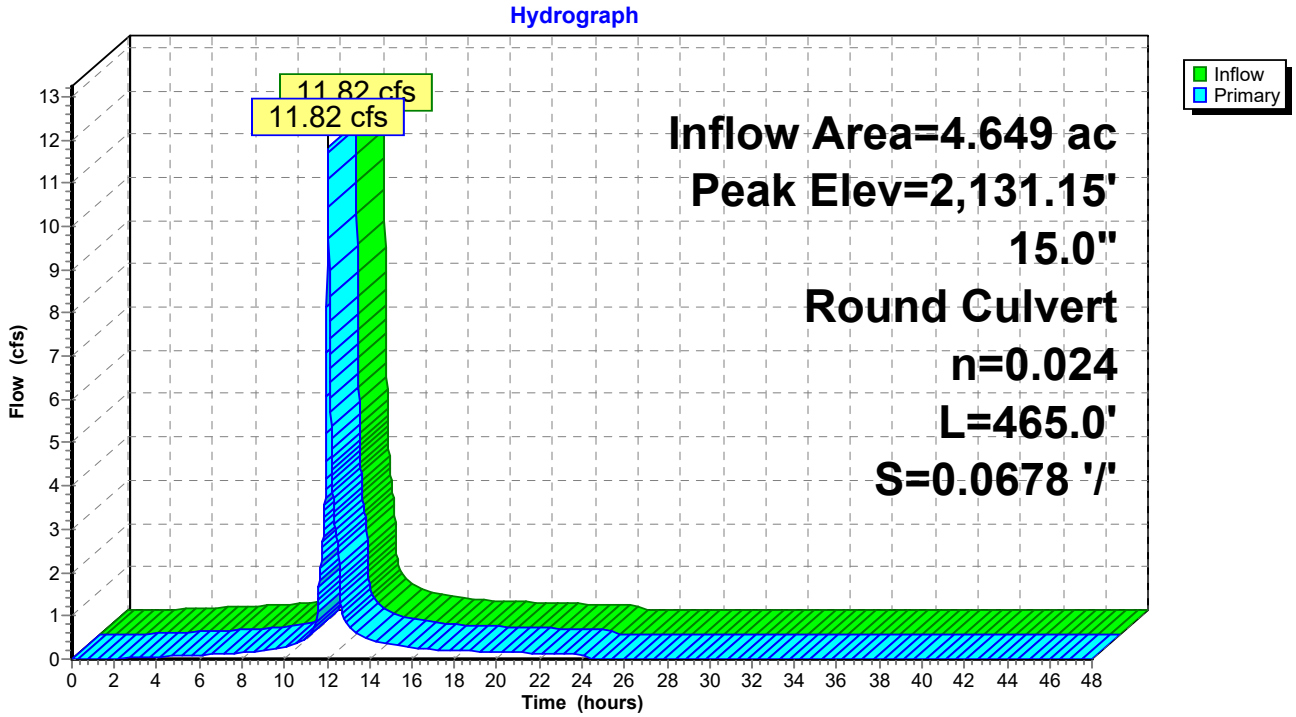
Inflow Area =	4.649 ac,	Inflow Depth =	1.91"	for	2-yr event
Inflow =	11.82 cfs @	12.04 hrs,	Volume=	0.739 af	
Outflow =	11.82 cfs @	12.05 hrs,	Volume=	0.739 af,	Atten= 0%, Lag= 0.6 min
Primary =	11.82 cfs @	12.05 hrs,	Volume=	0.739 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,131.15' @ 12.05 hrs
Flood Elev= 2,108.82'

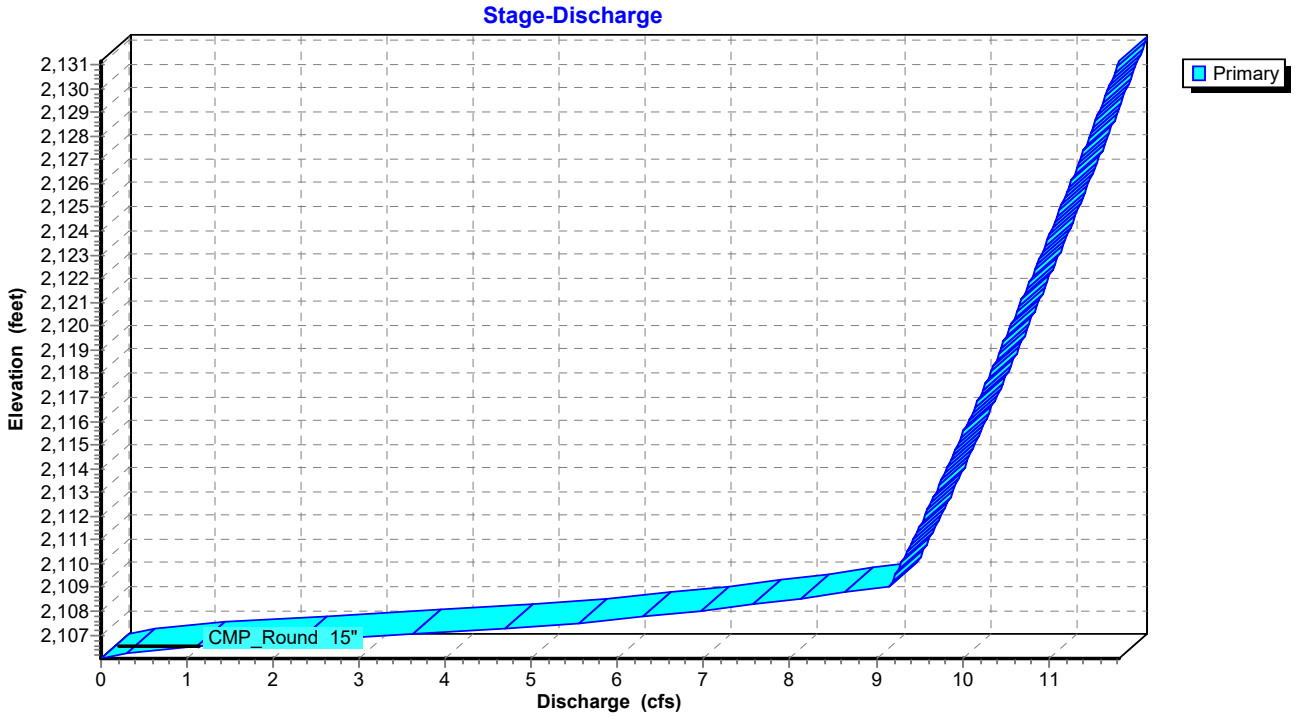
Device	Routing	Invert	Outlet Devices
#1	Primary	2,106.01'	**15.0" Round CMP_Round 15"** L= 465.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,106.01' / 2,074.50' S= 0.0678 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=11.80 cfs @ 12.05 hrs HW=2,130.92' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Round 15"** (Barrel Controls 11.80 cfs @ 9.61 fps)

Pond 3P: EX. MH "B"



Pond 3P: EX. MH "B"



Summary for Pond 8P: CARRIAGE COURT POND

Inflow Area = 2.839 ac, Inflow Depth = 1.40" for 2-yr event
Inflow = 4.60 cfs @ 12.10 hrs, Volume= 0.330 af
Outflow = 3.04 cfs @ 12.23 hrs, Volume= 0.330 af, Atten= 34%, Lag= 8.1 min
Primary = 3.04 cfs @ 12.23 hrs, Volume= 0.330 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,174.67' @ 12.23 hrs Surf.Area= 1,441 sf Storage= 1,417 cf

Plug-Flow detention time= 4.2 min calculated for 0.330 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (839.2 - 835.1)

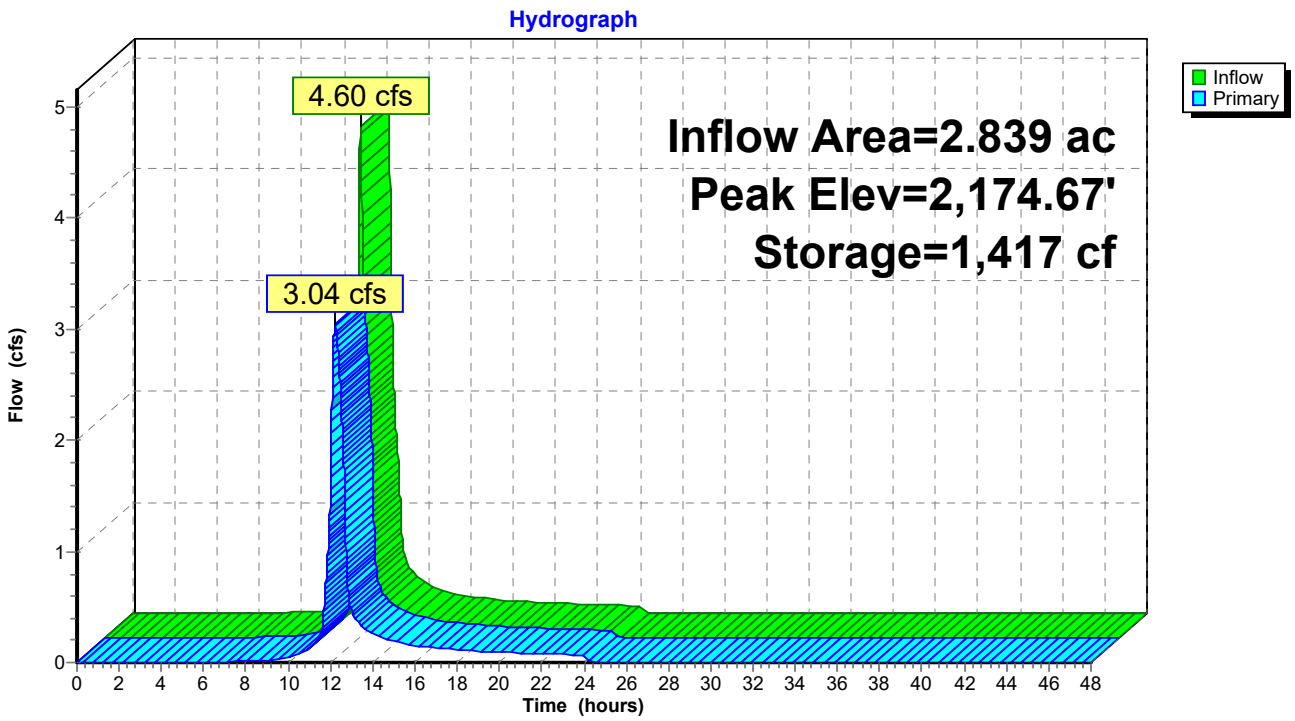
Volume	Invert	Avail.Storage	Storage Description
#1	2,173.00'	5,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,173.00	0	0	0
2,174.00	1,116	558	558
2,175.00	1,600	1,358	1,916
2,176.00	2,142	1,871	3,787
2,176.80	2,616	1,903	5,690

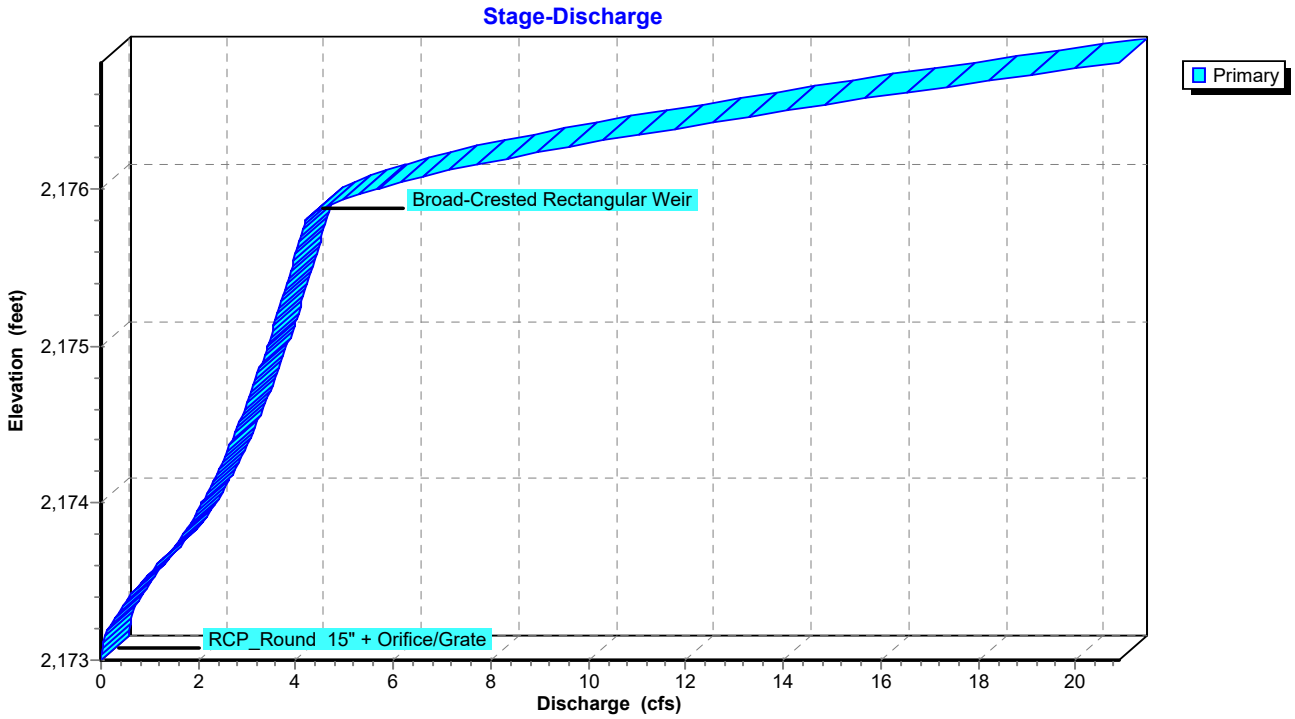
Device	Routing	Invert	Outlet Devices
#1	Primary	2,173.00'	**15.0" Round RCP_Round 15"** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 2,173.00' / 2,172.59' S= 0.0102 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,173.00'	**10.0" Vert. Orifice/Grate** C= 0.620
#3	Primary	2,175.80'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=3.04 cfs @ 12.23 hrs HW=2,174.67' TW=0.00' (Dynamic Tailwater)
- **1=RCP_Round 15"** (Passes 3.04 cfs of 5.76 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.04 cfs @ 5.57 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: CARRIAGE COURT POND



Pond 8P: CARRIAGE COURT POND



Summary for Pond 10P: FIDDLERS GREEN MAIN POND

Inflow	=	57.57 cfs @	12.40 hrs,	Volume=	7.530 af
Outflow	=	54.66 cfs @	12.54 hrs,	Volume=	8.149 af, Atten= 5%, Lag= 8.3 min
Primary	=	54.66 cfs @	12.54 hrs,	Volume=	8.131 af
Secondary	=	1.88 cfs @	12.40 hrs,	Volume=	0.018 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 2,153.35' Surf.Area= 10,860 sf Storage= 28,479 cf
Peak Elev= 2,156.30' @ 12.54 hrs Surf.Area= 14,464 sf Storage= 64,907 cf (36,428 cf above start)

Plug-Flow detention time= 143.0 min calculated for 7.495 af (100% of inflow)
Center-of-Mass det. time= 99.4 min (961.2 - 861.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,149.70'	113,149 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,149.70	0	0	0
2,150.00	1,312	197	197
2,151.00	8,894	5,103	5,300
2,152.00	9,707	9,301	14,600
2,153.00	10,555	10,131	24,731
2,153.35	10,860	3,748	28,479
2,154.00	11,438	7,247	35,726
2,155.00	12,358	11,898	47,624
2,156.00	13,777	13,068	60,691
2,157.00	16,078	14,928	75,619
2,158.00	18,823	17,451	93,069
2,159.00	21,337	20,080	113,149

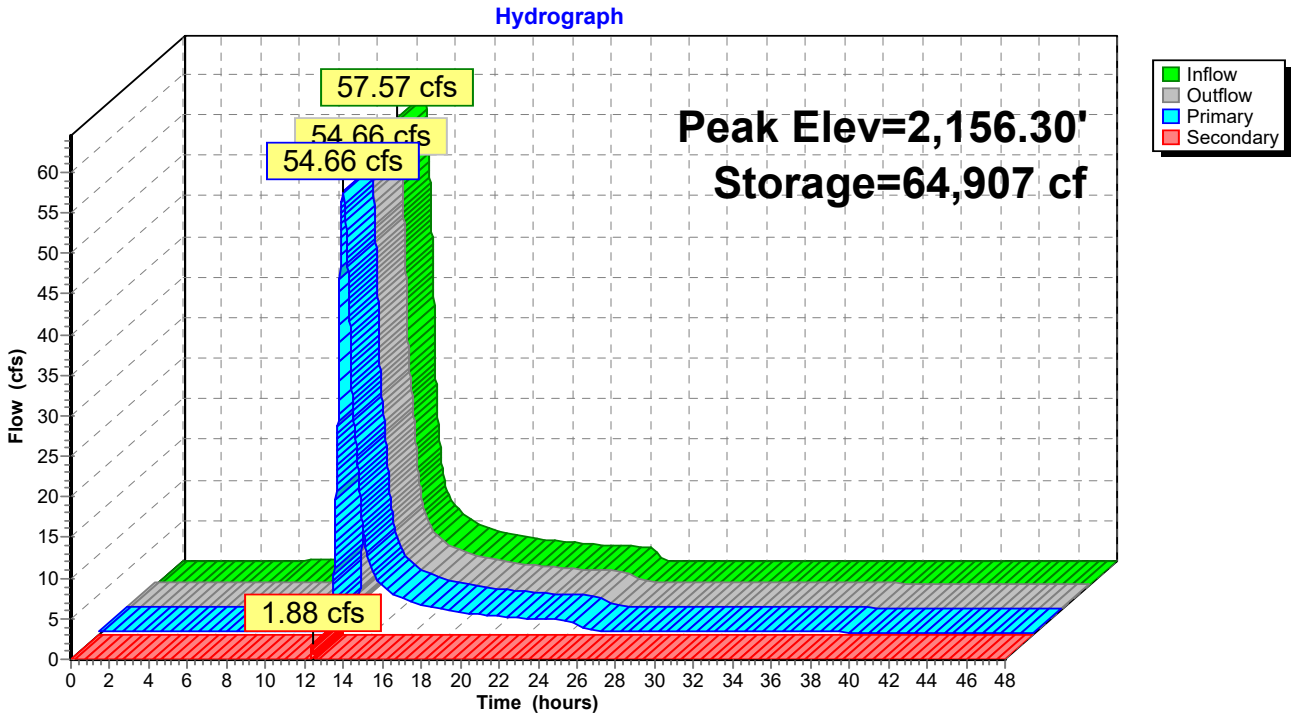
Device	Routing	Invert	Outlet Devices
#1	Primary	2,149.70'	**36.0" Round Culvert** L= 34.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,149.70' / 2,149.53' S= 0.0049 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Device 1	2,149.70'	**3.0" Vert. Orifice/Grate** C= 0.620
#3	Device 1	2,153.35'	**20.0" Vert. Orifice/Grate X 2.00** C= 0.620
#4	Device 1	2,155.63'	**48.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#5	Primary	2,156.63'	**17.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#6	Secondary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf
#7	Secondary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900
n= 0.011, Flow Area= 3.14 sf

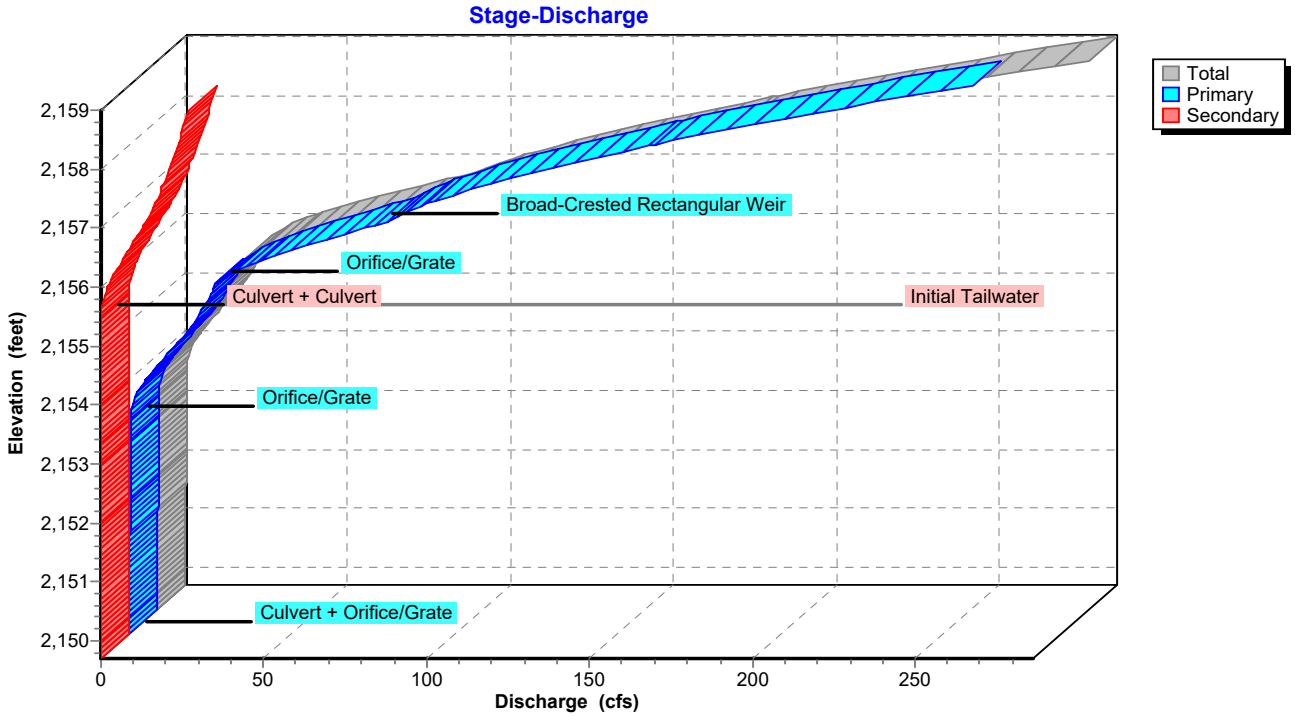
Primary OutFlow Max=54.65 cfs @ 12.54 hrs HW=2,156.30' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 54.65 cfs of 76.85 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.62 cfs @ 12.66 fps)
  - **3=Orifice/Grate** (Orifice Controls 31.57 cfs @ 7.24 fps)
  - **4=Orifice/Grate** (Weir Controls 22.45 cfs @ 2.67 fps)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=1.54 cfs @ 12.40 hrs HW=2,156.17' TW=2,156.10' (Dynamic Tailwater)
- **6=Culvert** (Inlet Controls 0.65 cfs @ 0.98 fps)
- **7=Culvert** (Inlet Controls 0.89 cfs @ 0.98 fps)

Pond 10P: FIDDLERS GREEN MAIN POND



Pond 10P: FIDDLERS GREEN MAIN POND



Summary for Pond 11P: KNOB HILL POND

Inflow Area = 47.793 ac, Inflow Depth = 1.04" for 2-yr event
Inflow = 39.28 cfs @ 12.28 hrs, Volume= 4.152 af
Outflow = 31.04 cfs @ 12.45 hrs, Volume= 4.152 af, Atten= 21%, Lag= 10.2 min
Primary = 31.04 cfs @ 12.45 hrs, Volume= 4.152 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,172.24' @ 12.45 hrs Surf.Area= 0 sf Storage= 14,222 cf

Plug-Flow detention time= 4.1 min calculated for 4.152 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (864.6 - 860.7)

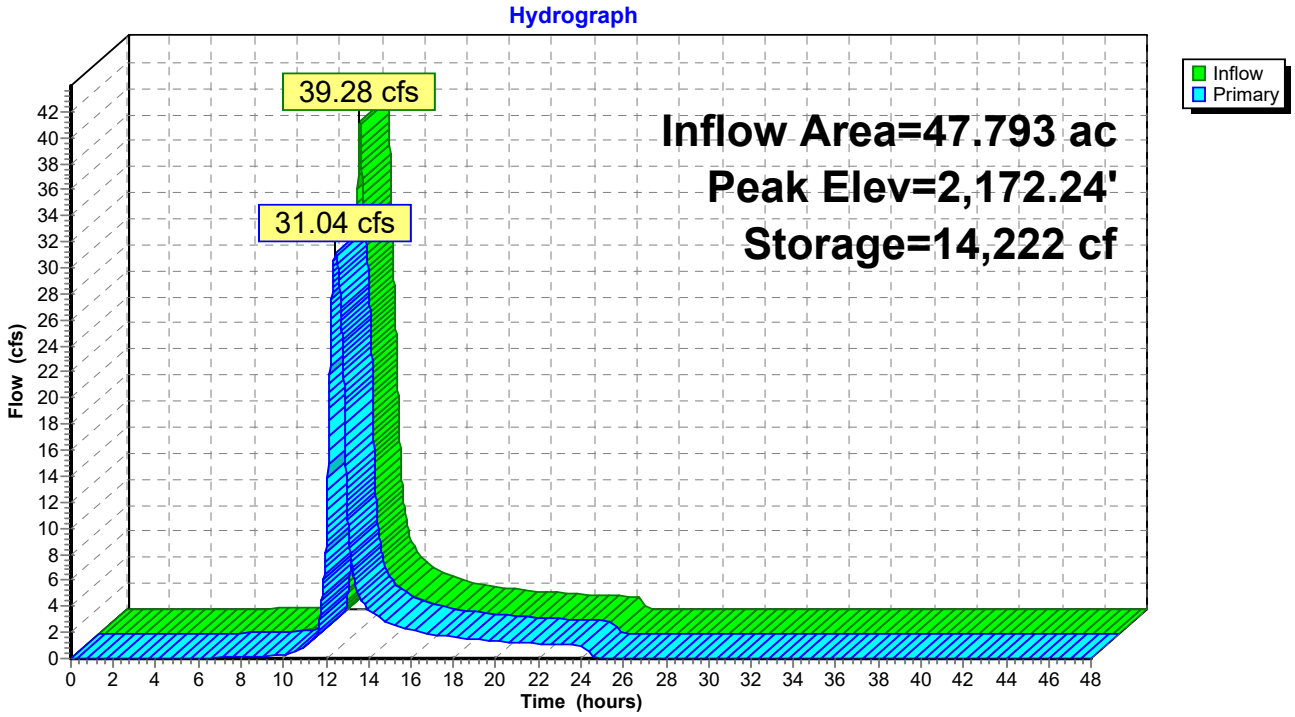
Volume	Invert	Avail.Storage	Storage Description
#1	2,169.00'	56,234 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
2,169.00	0
2,170.00	401
2,171.00	4,203
2,172.00	11,900
2,174.00	31,514
2,176.00	56,234

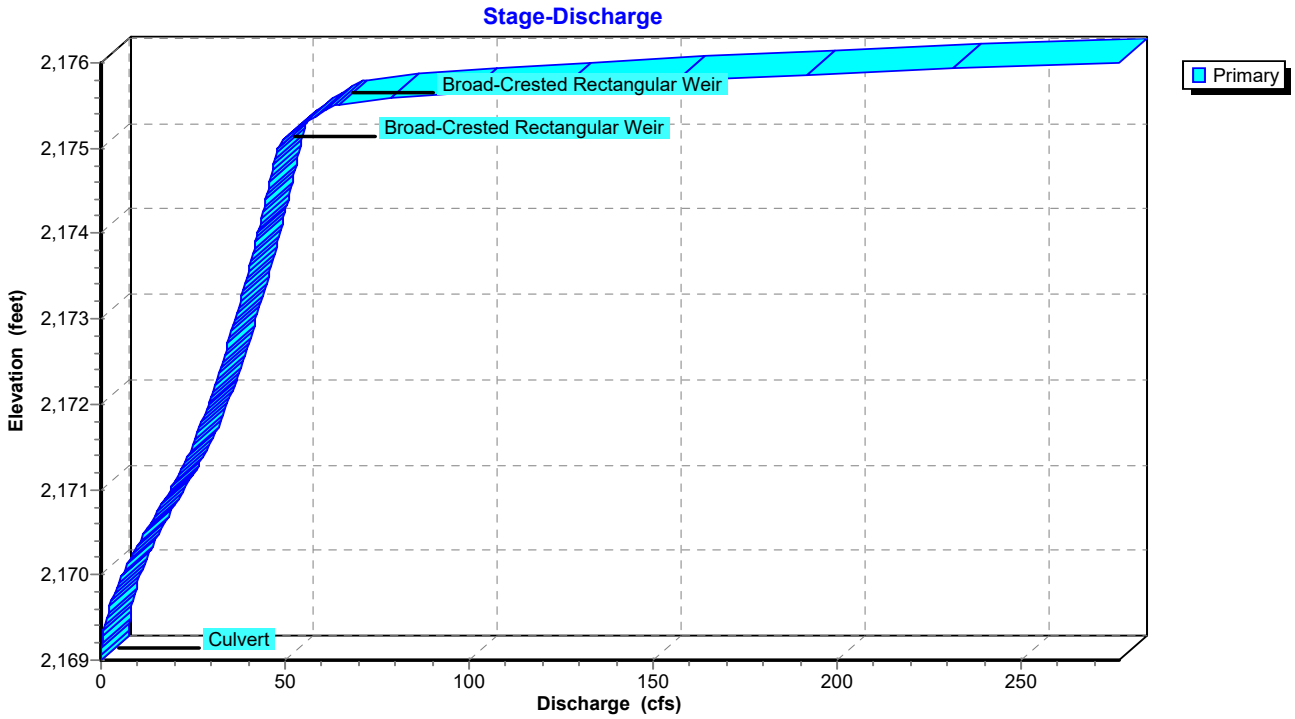
Device	Routing	Invert	Outlet Devices
#1	Primary	2,169.00'	**30.0" Round Culvert** L= 35.0' Ke= 0.610 Inlet / Outlet Invert= 2,169.00' / 2,168.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 HDPE, Flow Area= 4.91 sf
#2	Primary	2,175.00'	**14.5' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	2,175.50'	**200.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=31.04 cfs @ 12.45 hrs HW=2,172.24' TW=2,156.24' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 31.04 cfs @ 6.32 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 11P: KNOB HILL POND



Pond 11P: KNOB HILL POND



Summary for Pond 14P: FIDDLERS GREEN AUX POND

Inflow	=	2.89 cfs @	12.40 hrs,	Volume=	0.154 af
Outflow	=	1.29 cfs @	12.79 hrs,	Volume=	0.154 af, Atten= 55%, Lag= 23.3 min
Primary	=	1.29 cfs @	12.79 hrs,	Volume=	0.154 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,156.31' @ 12.58 hrs Surf.Area= 4,117 sf Storage= 1,868 cf

Plug-Flow detention time= 12.8 min calculated for 0.154 af (100% of inflow)
Center-of-Mass det. time= 12.9 min (858.4 - 845.5)

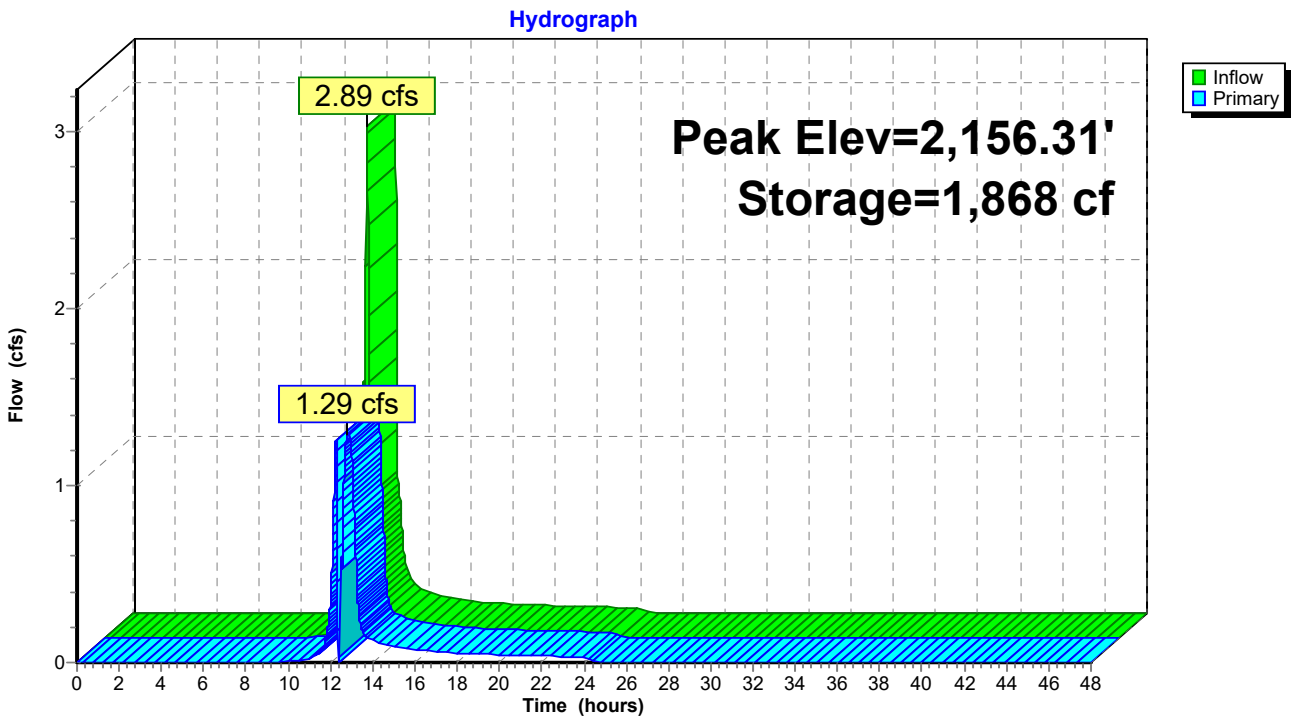
Volume	Invert	Avail.Storage	Storage Description
#1	2,155.50'	27,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,155.50	0	0	0
2,156.00	3,036	759	759
2,157.00	6,522	4,779	5,538
2,158.00	7,134	6,828	12,366
2,159.00	7,772	7,453	19,819
2,160.00	8,436	8,104	27,923

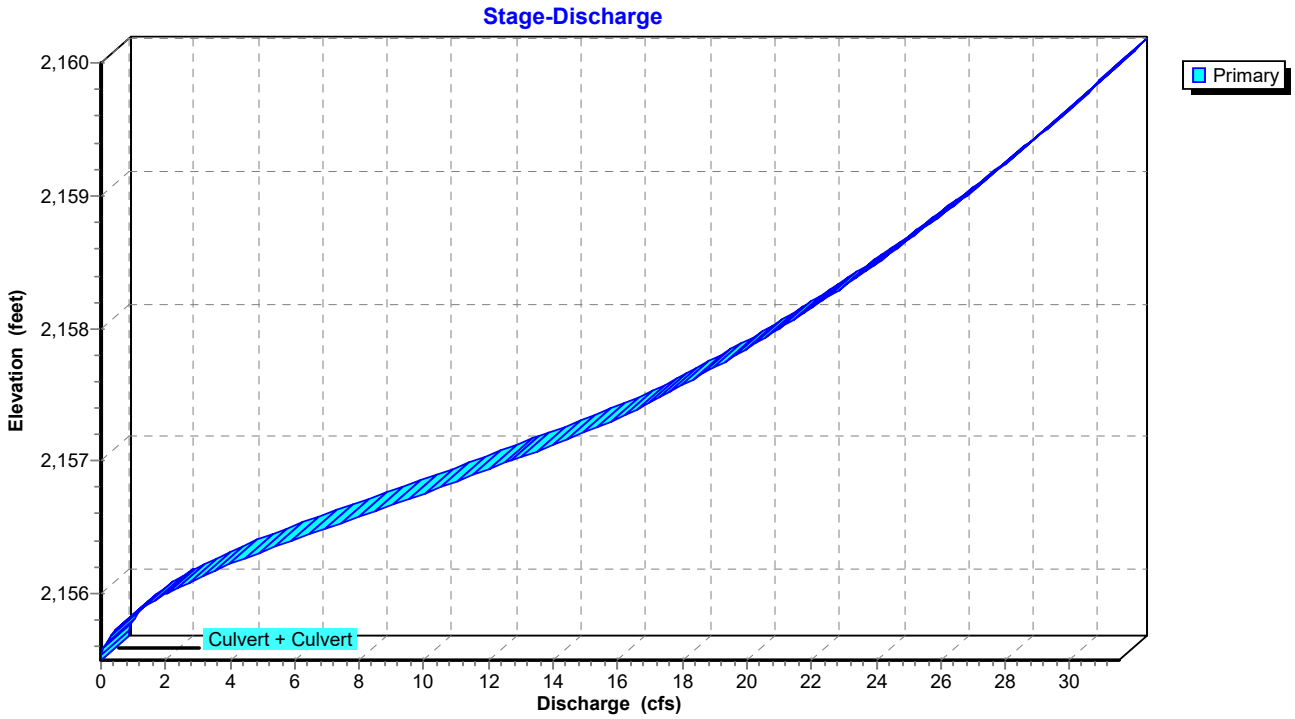
Device	Routing	Invert	Outlet Devices
#1	Primary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Primary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

Primary OutFlow Max=1.40 cfs @ 12.79 hrs HW=2,156.21' TW=2,156.13' (Dynamic Tailwater)
- **1=Culvert** (Outlet Controls 0.81 cfs @ 1.22 fps)
- **2=Culvert** (Outlet Controls 0.58 cfs @ 1.18 fps)

Pond 14P: FIDDLERS GREEN AUX POND



Pond 14P: FIDDLERS GREEN AUX POND



Summary for Pond 19P: EX 50"x31" CMP

[58] Hint: Peaked 0.34' above defined flood level

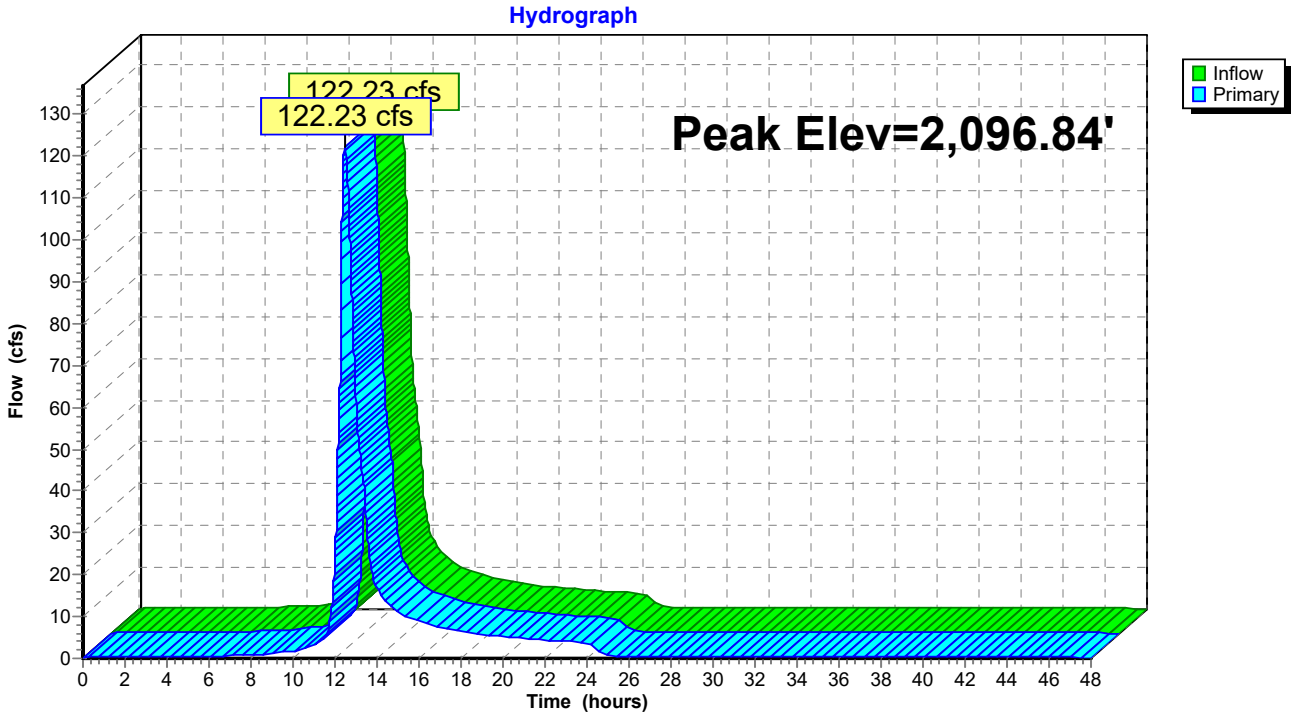
Inflow	=	122.23 cfs @	12.46 hrs,	Volume=	17.643 af
Outflow	=	122.23 cfs @	12.47 hrs,	Volume=	17.643 af, Atten= 0%, Lag= 0.6 min
Primary	=	122.23 cfs @	12.47 hrs,	Volume=	17.643 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.84' @ 12.47 hrs
Flood Elev= 2,096.50'

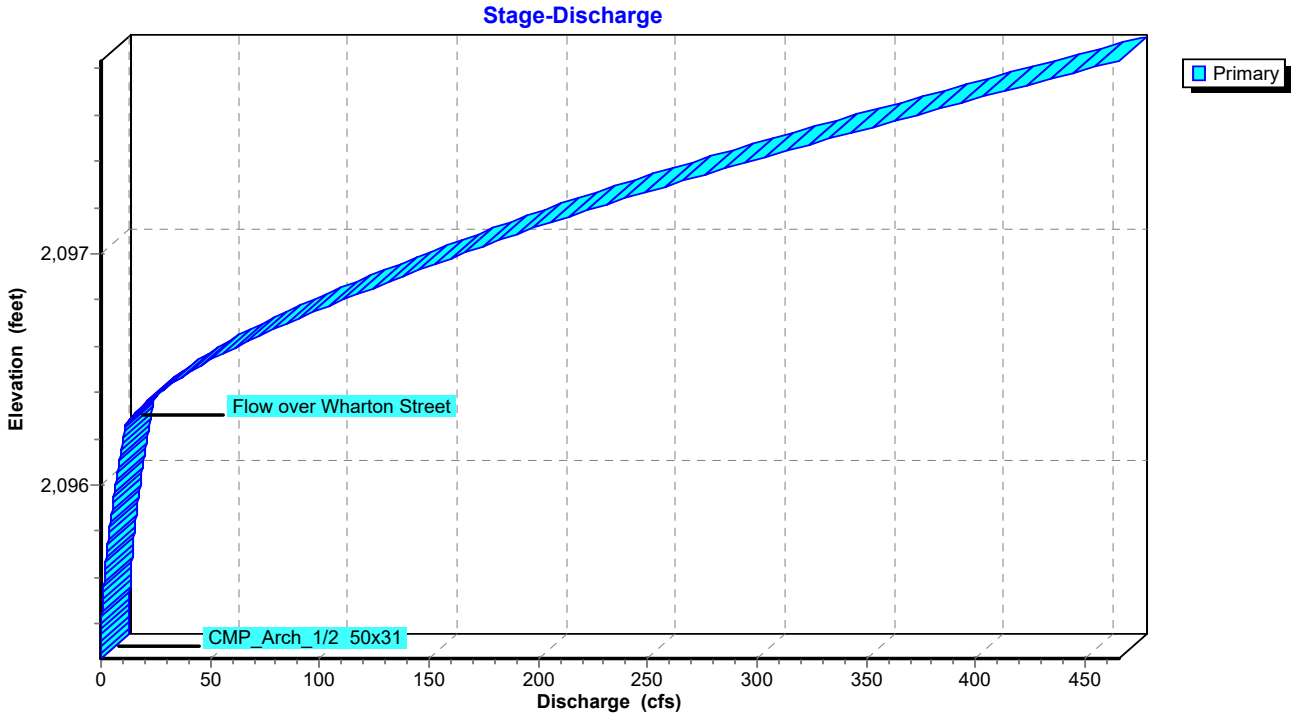
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=122.22 cfs @ 12.47 hrs HW=2,096.84' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 23.46 cfs @ 3.96 fps)
└─**2=Flow over Wharton Street** (Weir Controls 98.76 cfs @ 2.08 fps)

Pond 19P: EX 50"x31" CMP



Pond 19P: EX 50"x31" CMP



Summary for Subcatchment 3S: BERRYFIELD POND DA

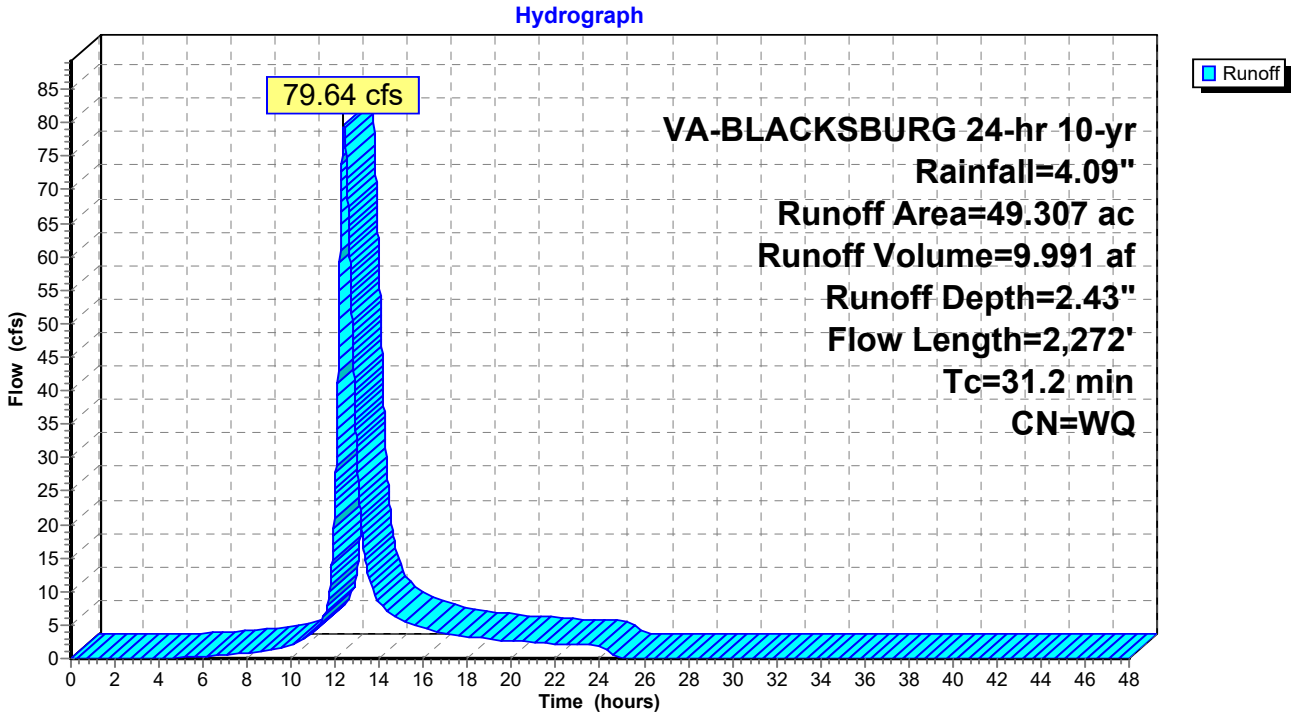
Runoff = 79.64 cfs @ 12.38 hrs, Volume= 9.991 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	3.627	70	Woods, Good, HSG C
	1.722	77	Woods, Good, HSG D
	11.203	74	>75% Grass cover, Good, HSG C
	0.649	80	>75% Grass cover, Good, HSG D
	0.017	82	2 acre lots, 12% imp, HSG D
	0.988	79	1 acre lots, 20% imp, HSG C
	1.522	80	1/2 acre lots, 25% imp, HSG C
	2.739	81	1/3 acre lots, 30% imp, HSG C
	0.020	86	1/3 acre lots, 30% imp, HSG D
	3.233	83	1/4 acre lots, 38% imp, HSG C
	0.390	87	1/4 acre lots, 38% imp, HSG D
	13.958	90	1/8 acre lots, 65% imp, HSG C
	1.013	92	1/8 acre lots, 65% imp, HSG D
	6.184	92	Paved roads w/open ditches, 50% imp, HSG C
	0.599	93	Paved roads w/open ditches, 50% imp, HSG D
	0.780	98	Paved parking, HSG C
*	0.663	83	25% Carry Over from Prospect Street Infiltration Pits
	49.307		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.0633	0.12		**Sheet Flow, Tc4** Woods: Light underbrush n= 0.400 P2= 2.76"
3.6	1,024	0.0869	4.75		**Shallow Concentrated Flow, Tc5** Unpaved Kv= 16.1 fps
2.2	284	0.0176	2.14		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
5.2	814	0.0307	2.63		**Shallow Concentrated Flow, Tc7** Grassed Waterway Kv= 15.0 fps
31.2	2,272	Total			

Subcatchment 3S: BERRYFIELD POND DA



Summary for Subcatchment 4S: 5'x3' CONC. BOX DA

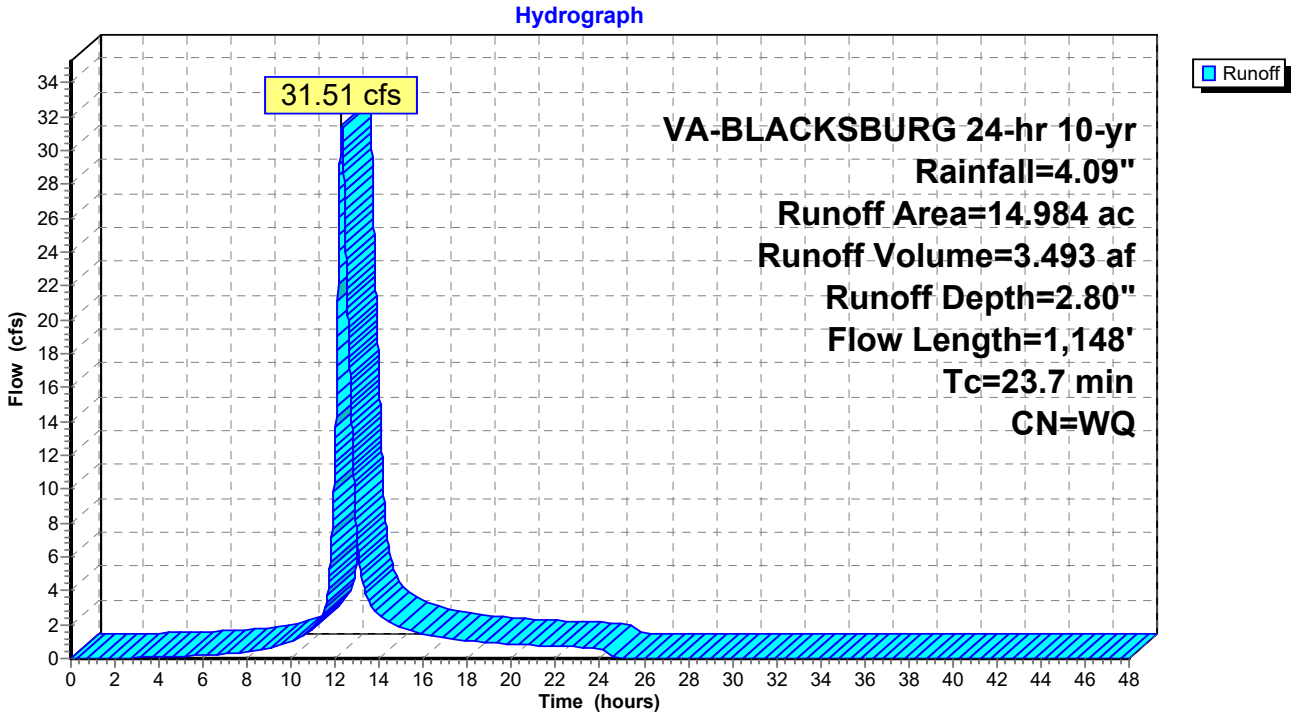
Runoff = 31.51 cfs @ 12.29 hrs, Volume= 3.493 af, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.444	74	>75% Grass cover, Good, HSG C
3.534	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.202	95	Urban commercial, 85% imp, HSG D
0.593	92	Paved roads w/open ditches, 50% imp, HSG C
1.697	93	Paved roads w/open ditches, 50% imp, HSG D
0.147	98	Paved parking, HSG C
1.587	98	Paved parking, HSG D
14.984		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 4S: 5'x3' CONC. BOX DA



Summary for Subcatchment 5S: CLAY ST. DA

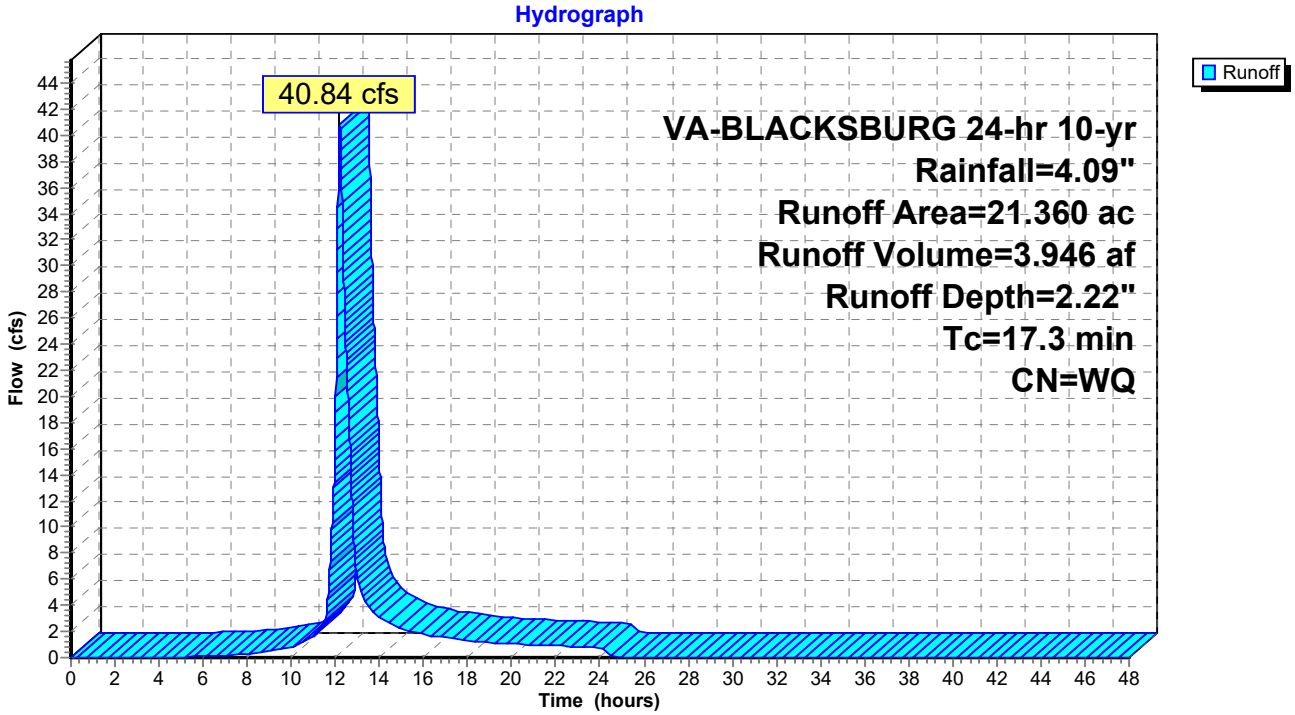
Runoff = 40.84 cfs @ 12.20 hrs, Volume= 3.946 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
5.332	70	Woods, Good, HSG C
4.382	74	>75% Grass cover, Good, HSG C
2.136	81	1/3 acre lots, 30% imp, HSG C
2.246	83	1/4 acre lots, 38% imp, HSG C
3.153	90	1/8 acre lots, 65% imp, HSG C
4.111	92	Paved roads w/open ditches, 50% imp, HSG C
21.360		Weighted Average

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

Subcatchment 5S: CLAY ST. DA



Summary for Subcatchment 6S: EX. MH "B" DA

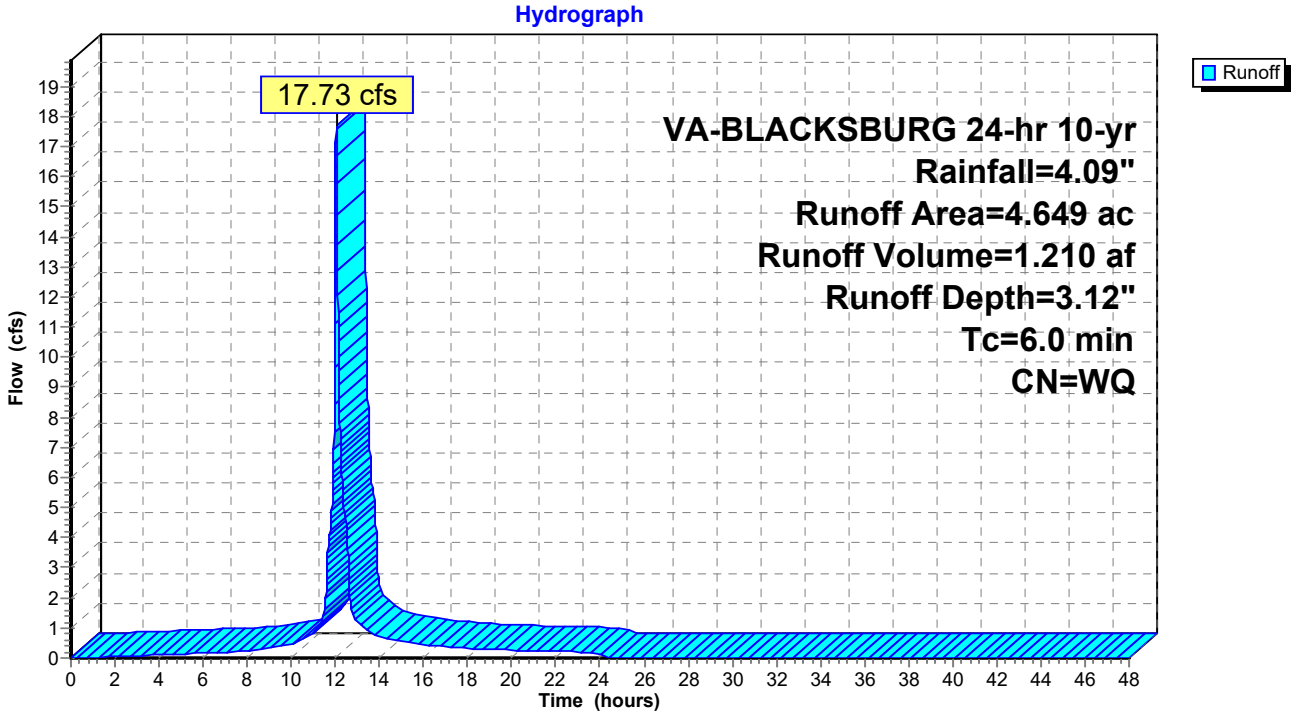
Runoff = 17.73 cfs @ 12.04 hrs, Volume= 1.210 af, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
1.958	80	>75% Grass cover, Good, HSG D
2.685	98	Paved parking, HSG D
0.006	98	Paved parking, HSG C
4.649		Weighted Average

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

Subcatchment 6S: EX. MH "B" DA



Summary for Subcatchment 7S: EX. MH "A" DA

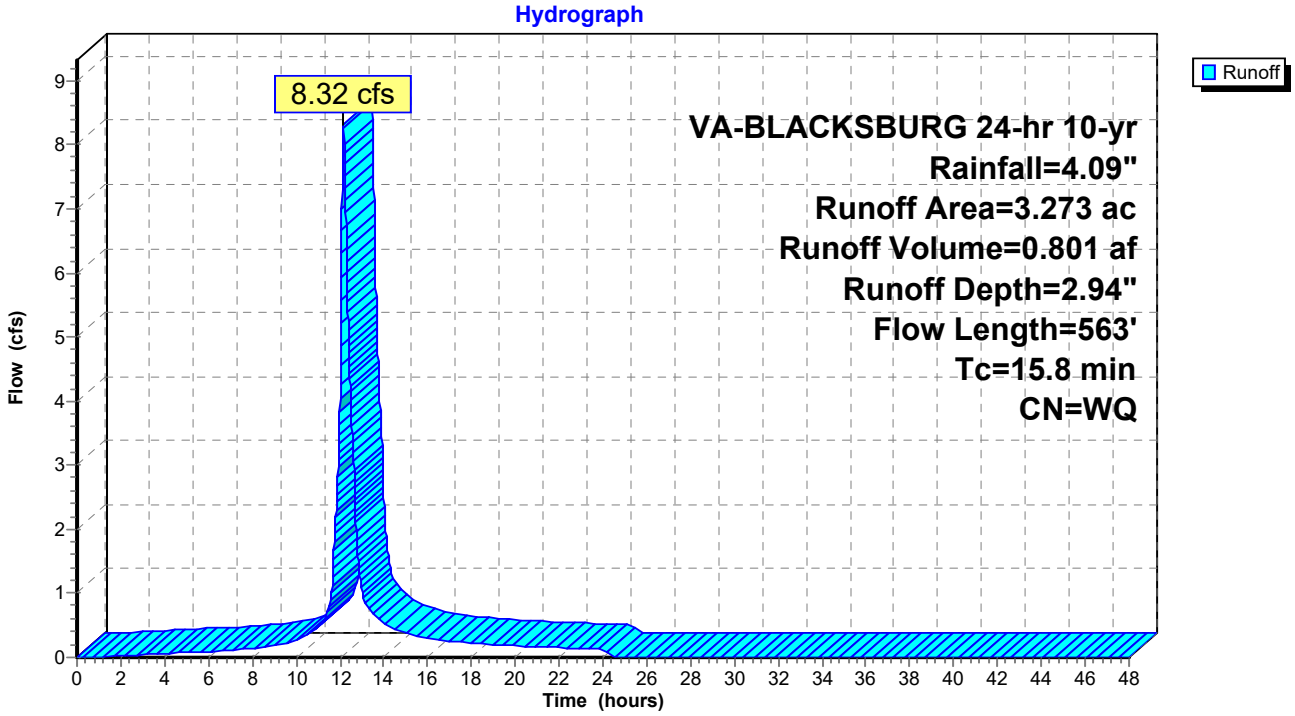
Runoff = 8.32 cfs @ 12.17 hrs, Volume= 0.801 af, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.830	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
1.727	80	>75% Grass cover, Good, HSG D
3.273		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0600	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	74	0.0598	3.94		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
1.8	339	0.0229	3.07		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
15.8	563	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 9S: CARRIAGE COURT DA

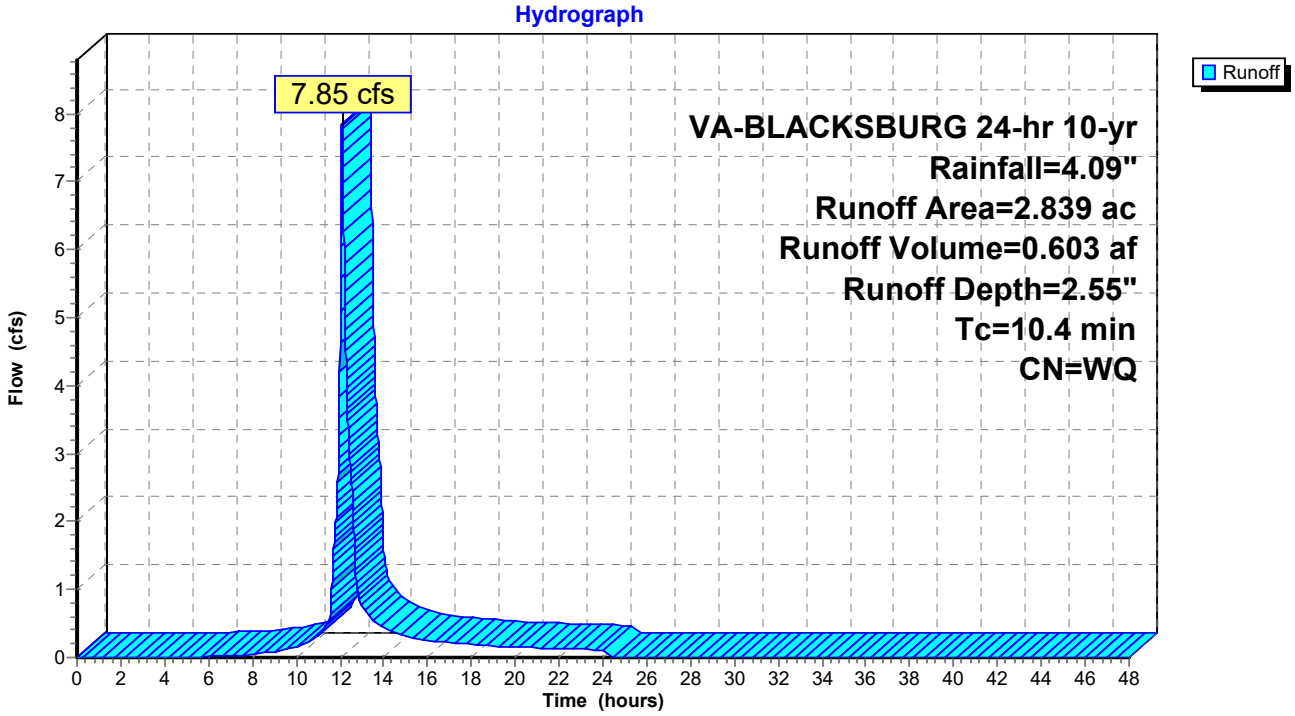
Runoff = 7.85 cfs @ 12.10 hrs, Volume= 0.603 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
2.217	83	1/4 acre lots, 38% imp, HSG C
0.622	92	Paved roads w/open ditches, 50% imp, HSG C
2.839		Weighted Average

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

Subcatchment 9S: CARRIAGE COURT DA



Summary for Subcatchment 12S: FIDDLERS GREEN MAIN DA

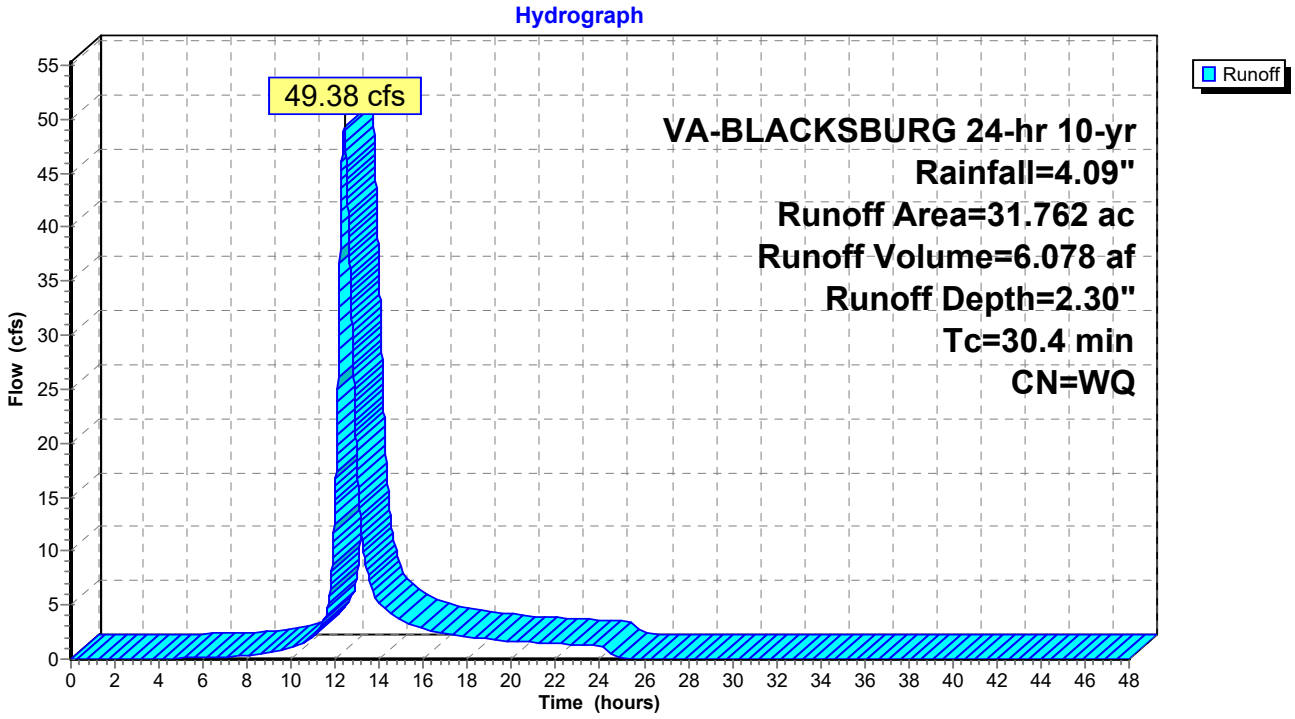
Runoff = 49.38 cfs @ 12.39 hrs, Volume= 6.078 af, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.116	70	Woods, Good, HSG C
8.691	74	>75% Grass cover, Good, HSG C
2.424	80	1/2 acre lots, 25% imp, HSG C
4.428	81	1/3 acre lots, 30% imp, HSG C
10.306	83	1/4 acre lots, 38% imp, HSG C
4.998	92	Paved roads w/open ditches, 50% imp, HSG C
0.799	98	Paved parking, HSG C
31.762		Weighted Average

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

Subcatchment 12S: FIDDLERS GREEN MAIN DA



Summary for Subcatchment 13S: KNOB HILL DA

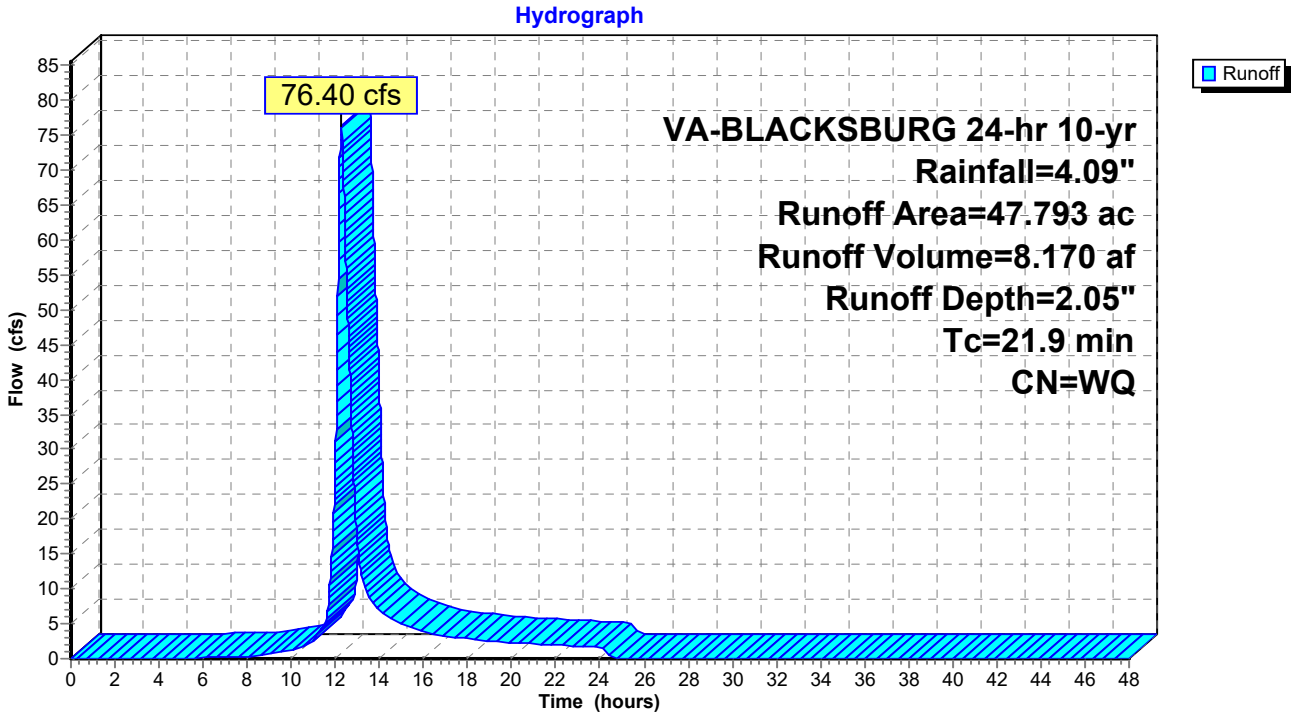
Runoff = 76.40 cfs @ 12.27 hrs, Volume= 8.170 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	0.103	55	Woods, Good, HSG B
	10.773	70	Woods, Good, HSG C
	1.435	74	>75% Grass cover, Good, HSG C
	1.128	79	1 acre lots, 20% imp, HSG C
	5.039	80	1/2 acre lots, 25% imp, HSG C
	5.519	72	1/3 acre lots, 30% imp, HSG B
	15.477	81	1/3 acre lots, 30% imp, HSG C
	1.091	83	1/4 acre lots, 38% imp, HSG C
	1.823	94	Urban commercial, 85% imp, HSG C
	0.485	89	Paved roads w/open ditches, 50% imp, HSG B
	4.240	92	Paved roads w/open ditches, 50% imp, HSG C
*	0.680	80	25% Carry Over from Jefferson Street Infiltration Pits
	47.793		Weighted Average

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

Subcatchment 13S: KNOB HILL DA



Summary for Subcatchment 15S: FIDDLERS GREEN AUX DA

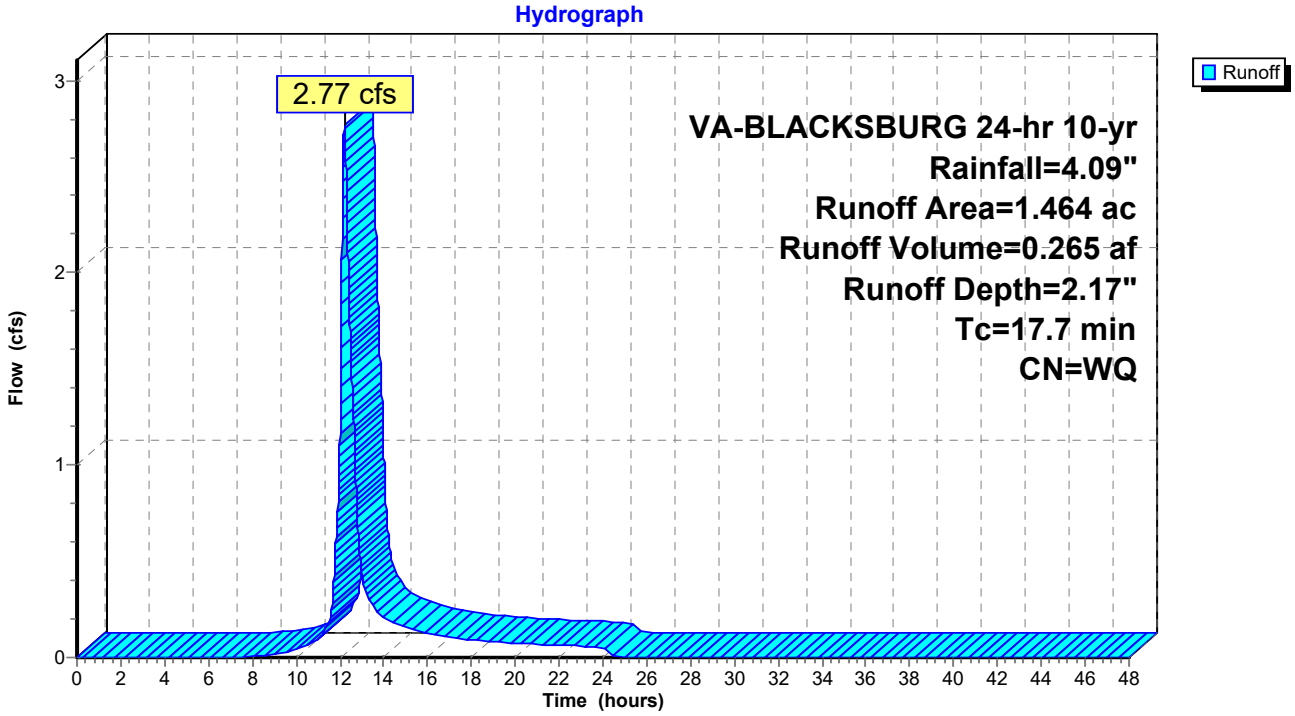
Runoff = 2.77 cfs @ 12.21 hrs, Volume= 0.265 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.398	74	>75% Grass cover, Good, HSG C
1.066	83	1/4 acre lots, 38% imp, HSG C
1.464		Weighted Average

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

Subcatchment 15S: FIDDLERS GREEN AUX DA



Summary for Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)

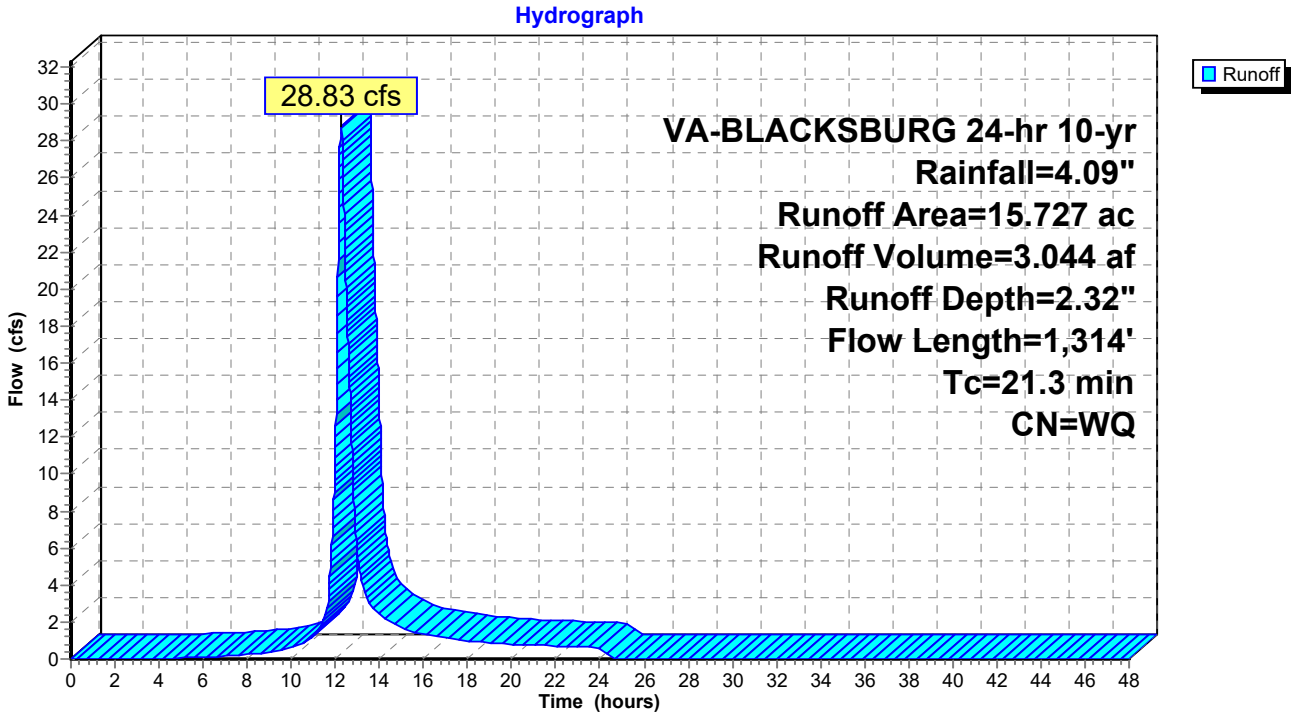
Runoff = 28.83 cfs @ 12.25 hrs, Volume= 3.044 af, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	0.584	70	Woods, Good, HSG C
	4.980	74	>75% Grass cover, Good, HSG C
	4.010	80	>75% Grass cover, Good, HSG D
	0.330	81	1/3 acre lots, 30% imp, HSG C
	1.247	92	Paved roads w/open ditches, 50% imp, HSG C
	0.435	98	Paved parking, HSG C
	0.126	98	Paved parking, HSG D
*	4.015	90	25% Carry Over from Villas Infiltration Pits
	15.727		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)



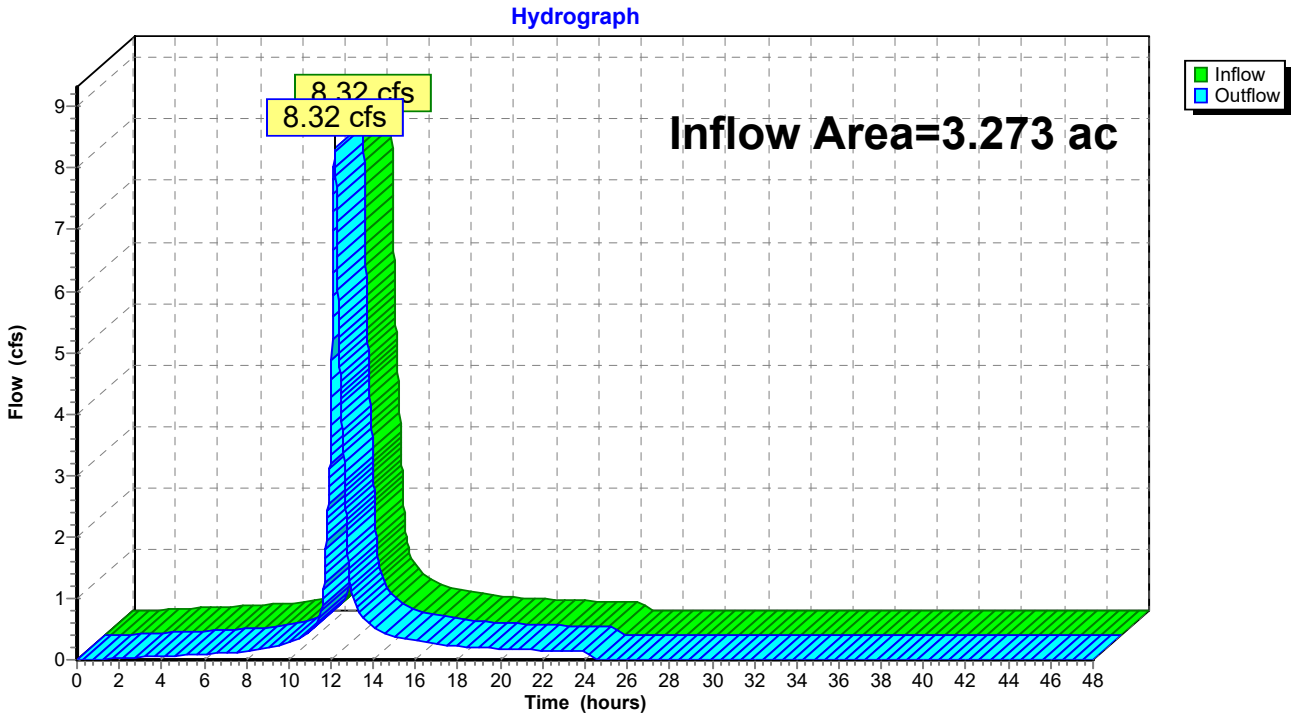
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.273 ac, Inflow Depth = 2.94" for 10-yr event
Inflow = 8.32 cfs @ 12.17 hrs, Volume= 0.801 af
Outflow = 8.32 cfs @ 12.18 hrs, Volume= 0.801 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



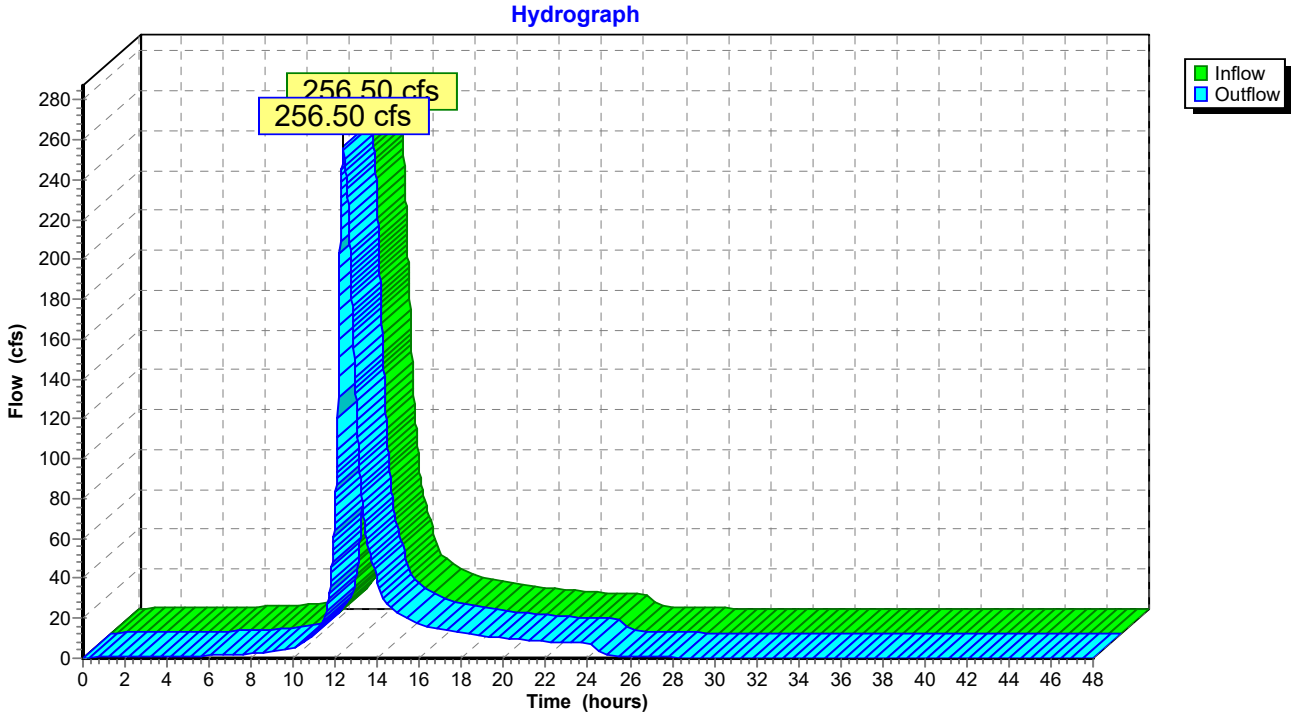
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	256.50 cfs @	12.35 hrs,	Volume=	37.413 af
Outflow	=	256.50 cfs @	12.36 hrs,	Volume=	37.413 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT



Summary for Pond 1P: BERRYFIELD POND

Inflow	=	197.18 cfs @	12.41 hrs,	Volume=	29.668 af
Outflow	=	197.16 cfs @	12.42 hrs,	Volume=	29.667 af, Atten= 0%, Lag= 0.7 min
Primary	=	197.16 cfs @	12.42 hrs,	Volume=	29.667 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,100.43' @ 12.42 hrs Surf.Area= 17,128 sf Storage= 29,347 cf
Flood Elev= 2,101.00' Surf.Area= 23,595 sf Storage= 41,004 cf

Plug-Flow detention time= 3.0 min calculated for 29.661 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (877.4 - 874.5)

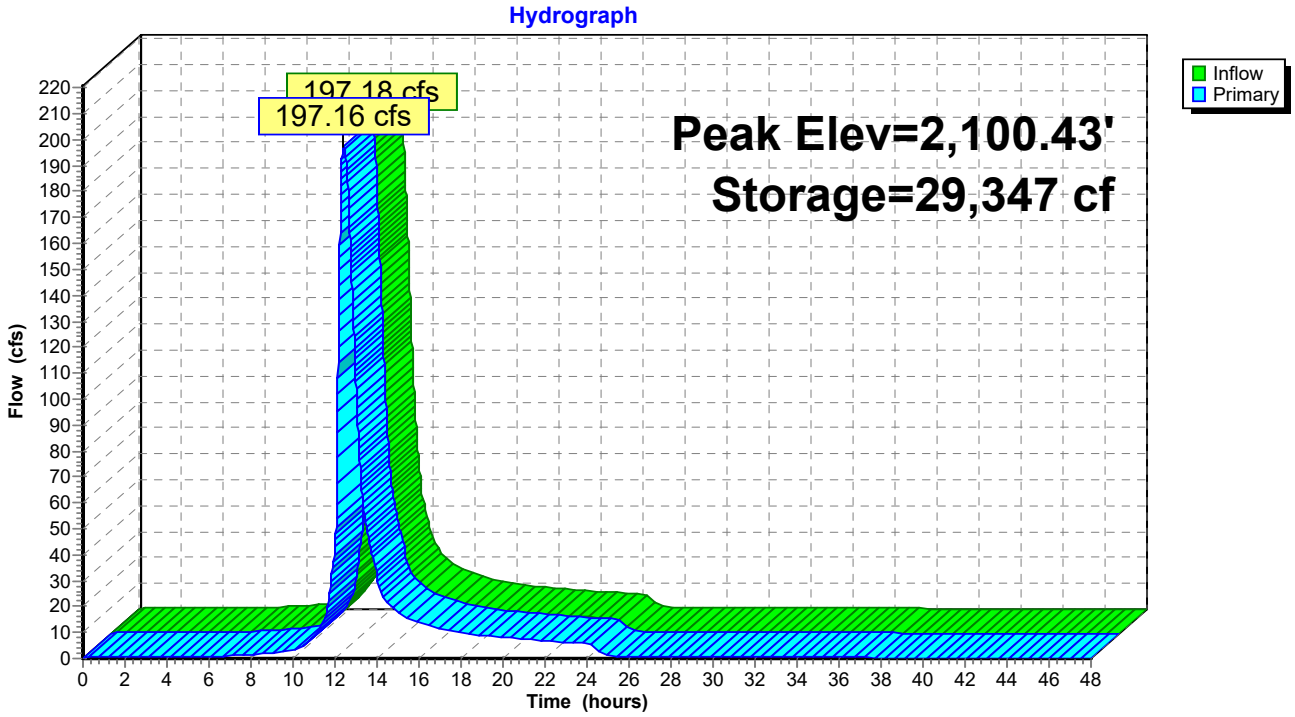
Volume	Invert	Avail.Storage	Storage Description
#1	2,096.00'	41,004 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,096.00	0	0	0
2,098.00	5,379	5,379	5,379
2,100.00	12,299	17,678	23,057
2,101.00	23,595	17,947	41,004

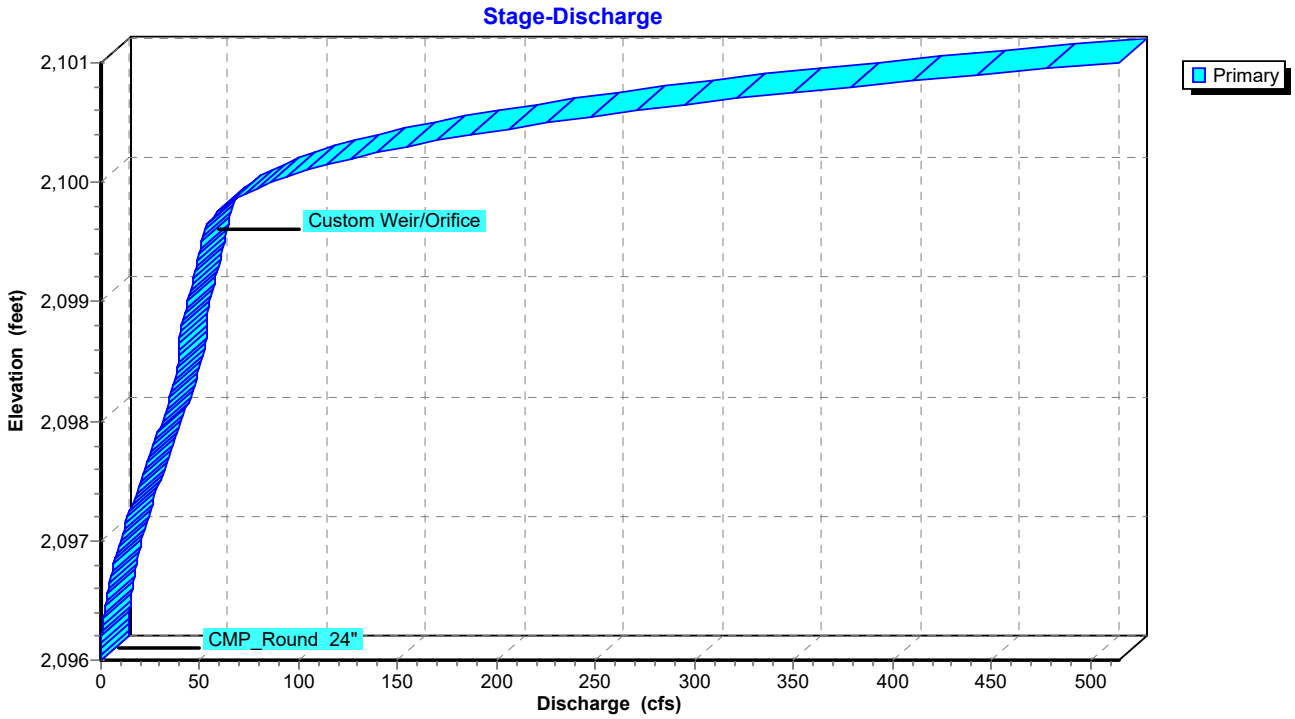
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.00'	**24.0" Round CMP_Round 24" X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,096.00' / 2,095.50' S= 0.0083 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 3.14 sf
#2	Primary	2,099.50'	**Custom Weir/Orifice, Cv= 3.00 (C= 3.75)** Head (feet) 0.00 0.50 1.50 Width (feet) 0.00 55.00 160.00

Primary OutFlow Max=197.16 cfs @ 12.42 hrs HW=2,100.43' TW=2,097.18' (Dynamic Tailwater)
└─**1=CMP_Round 24"** (Barrel Controls 61.35 cfs @ 6.51 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 135.80 cfs @ 2.90 fps)

Pond 1P: BERRYFIELD POND



Pond 1P: BERRYFIELD POND



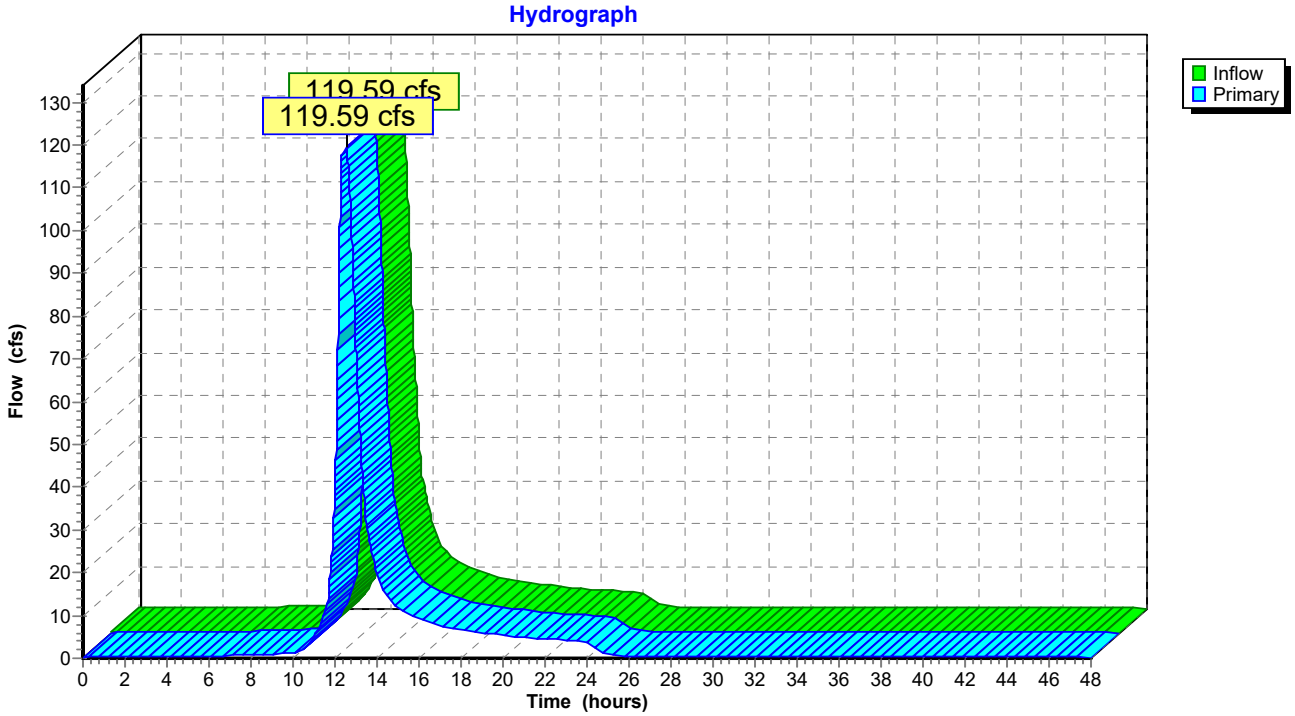
Summary for Pond 2P: CLAY ST. UNDERGROUND BOX

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	119.59 cfs @	12.52 hrs,	Volume=	19.677 af
Primary	=	119.59 cfs @	12.53 hrs,	Volume=	19.677 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 2P: CLAY ST. UNDERGROUND BOX



Summary for Pond 3P: EX. MH "B"

[58] Hint: Peaked 91.55' above defined flood level

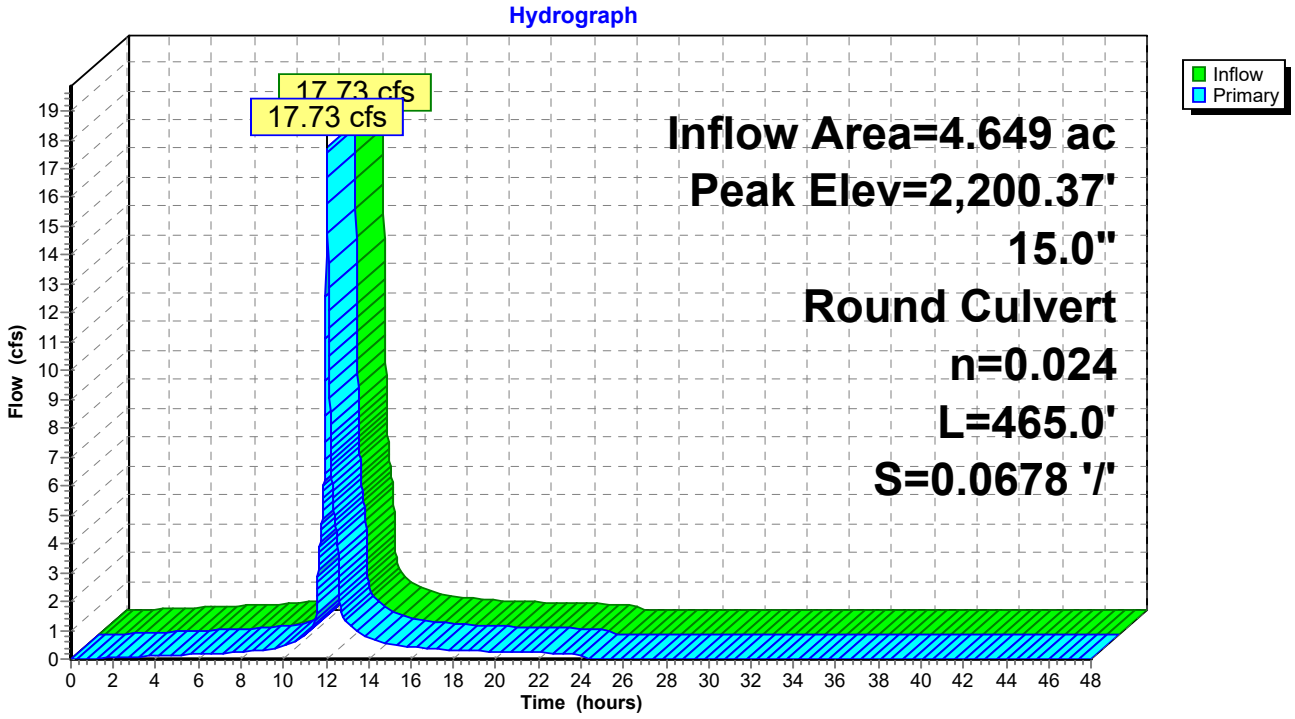
Inflow Area =	4.649 ac,	Inflow Depth =	3.12"	for	10-yr event
Inflow =	17.73 cfs @	12.04 hrs,	Volume=	1.210 af	
Outflow =	17.73 cfs @	12.05 hrs,	Volume=	1.210 af,	Atten= 0%, Lag= 0.6 min
Primary =	17.73 cfs @	12.05 hrs,	Volume=	1.210 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,200.37' @ 12.05 hrs
Flood Elev= 2,108.82'

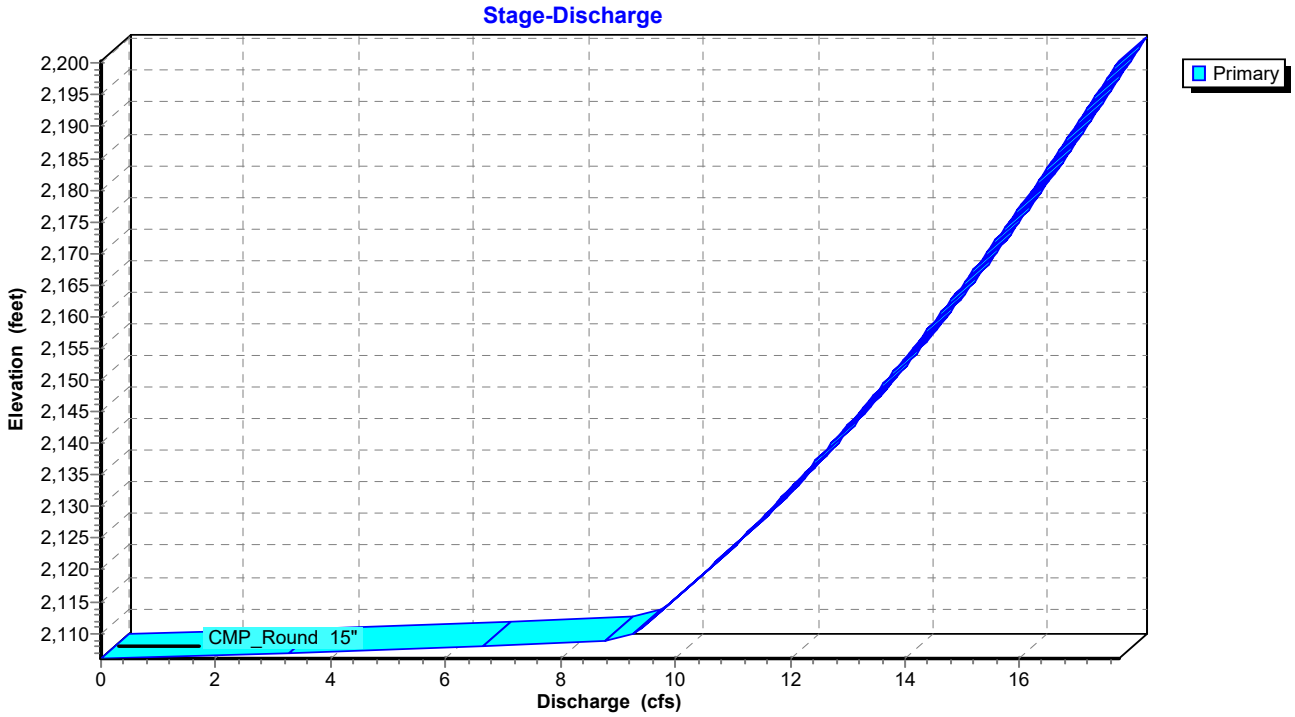
Device	Routing	Invert	Outlet Devices
#1	Primary	2,106.01'	**15.0" Round CMP_Round 15"** L= 465.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,106.01' / 2,074.50' S= 0.0678 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=17.69 cfs @ 12.05 hrs HW=2,199.83' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Round 15"** (Barrel Controls 17.69 cfs @ 14.41 fps)

Pond 3P: EX. MH "B"



Pond 3P: EX. MH "B"



Summary for Pond 8P: CARRIAGE COURT POND

Inflow Area = 2.839 ac, Inflow Depth = 2.55" for 10-yr event
Inflow = 7.85 cfs @ 12.10 hrs, Volume= 0.603 af
Outflow = 4.49 cfs @ 12.28 hrs, Volume= 0.603 af, Atten= 43%, Lag= 10.8 min
Primary = 4.49 cfs @ 12.28 hrs, Volume= 0.603 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,175.87' @ 12.28 hrs Surf.Area= 2,069 sf Storage= 3,505 cf

Plug-Flow detention time= 6.4 min calculated for 0.603 af (100% of inflow)
Center-of-Mass det. time= 6.3 min (826.2 - 819.9)

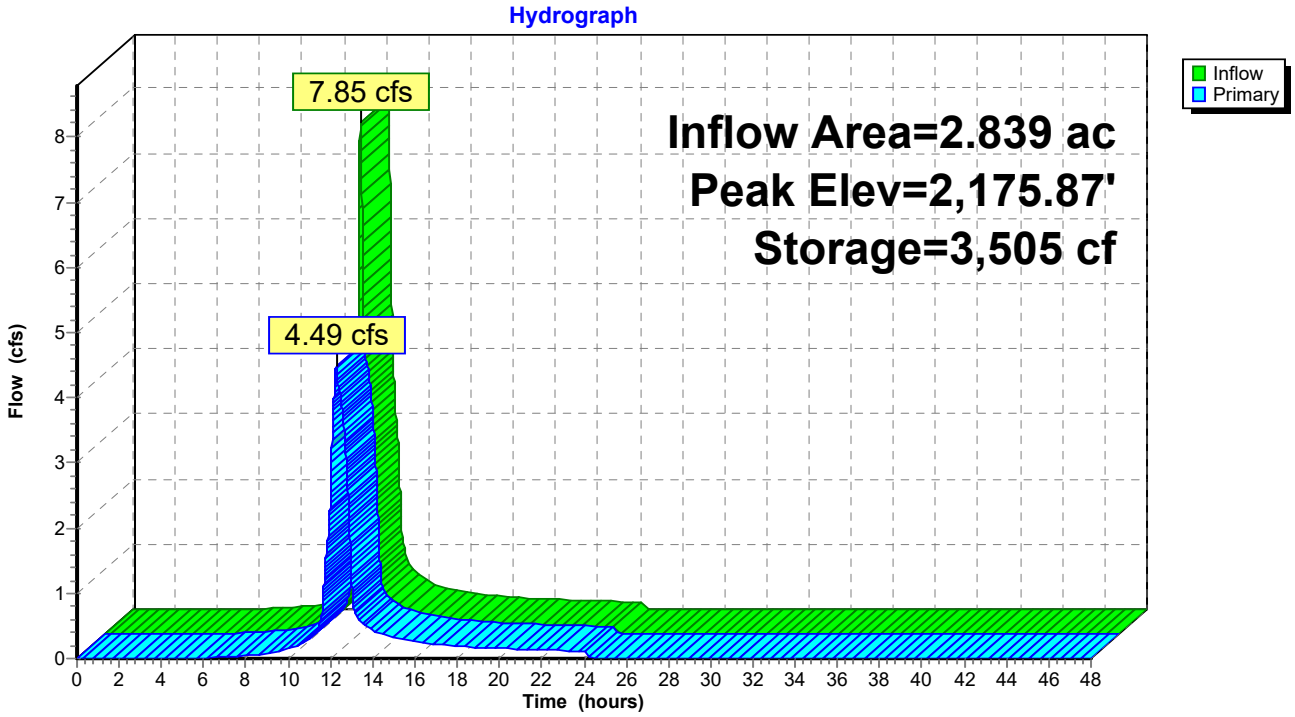
Volume	Invert	Avail.Storage	Storage Description
#1	2,173.00'	5,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,173.00	0	0	0
2,174.00	1,116	558	558
2,175.00	1,600	1,358	1,916
2,176.00	2,142	1,871	3,787
2,176.80	2,616	1,903	5,690

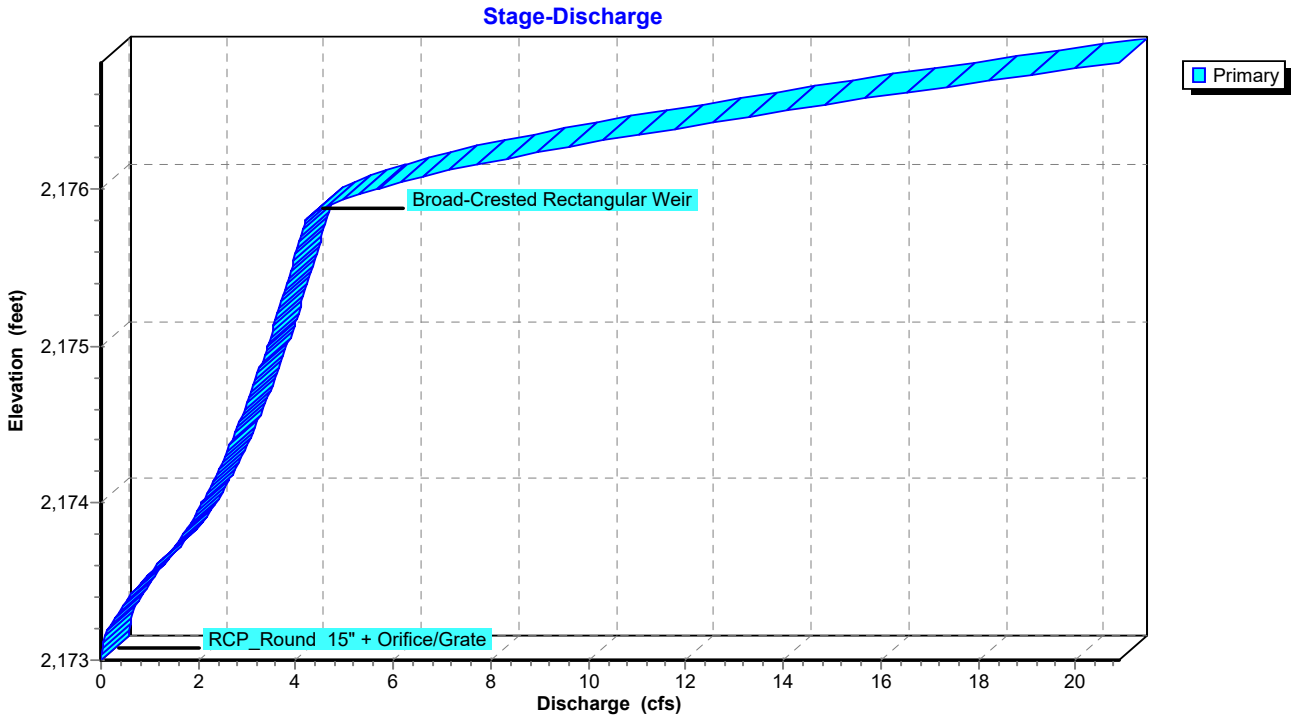
Device	Routing	Invert	Outlet Devices
#1	Primary	2,173.00'	**15.0" Round RCP_Round 15"** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 2,173.00' / 2,172.59' S= 0.0102 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,173.00'	**10.0" Vert. Orifice/Grate** C= 0.620
#3	Primary	2,175.80'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=4.49 cfs @ 12.28 hrs HW=2,175.87' TW=0.00' (Dynamic Tailwater)
- **1=RCP_Round 15"** (Passes 4.25 cfs of 8.84 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.25 cfs @ 7.79 fps)
- **3=Broad-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.62 fps)

Pond 8P: CARRIAGE COURT POND



Pond 8P: CARRIAGE COURT POND



Summary for Pond 10P: FIDDLERS GREEN MAIN POND

Inflow	=	99.43 cfs @	12.47 hrs,	Volume=	14.586 af
Outflow	=	95.35 cfs @	12.53 hrs,	Volume=	15.202 af, Atten= 4%, Lag= 3.3 min
Primary	=	94.97 cfs @	12.56 hrs,	Volume=	15.129 af
Secondary	=	2.85 cfs @	12.26 hrs,	Volume=	0.073 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 2,153.35' Surf.Area= 10,860 sf Storage= 28,479 cf
Peak Elev= 2,157.07' @ 12.56 hrs Surf.Area= 16,257 sf Storage= 76,675 cf (48,196 cf above start)

Plug-Flow detention time= 83.1 min calculated for 14.545 af (100% of inflow)
Center-of-Mass det. time= 61.8 min (910.2 - 848.4)

Volume	Invert	Avail.Storage	Storage Description
#1	2,149.70'	113,149 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,149.70	0	0	0
2,150.00	1,312	197	197
2,151.00	8,894	5,103	5,300
2,152.00	9,707	9,301	14,600
2,153.00	10,555	10,131	24,731
2,153.35	10,860	3,748	28,479
2,154.00	11,438	7,247	35,726
2,155.00	12,358	11,898	47,624
2,156.00	13,777	13,068	60,691
2,157.00	16,078	14,928	75,619
2,158.00	18,823	17,451	93,069
2,159.00	21,337	20,080	113,149

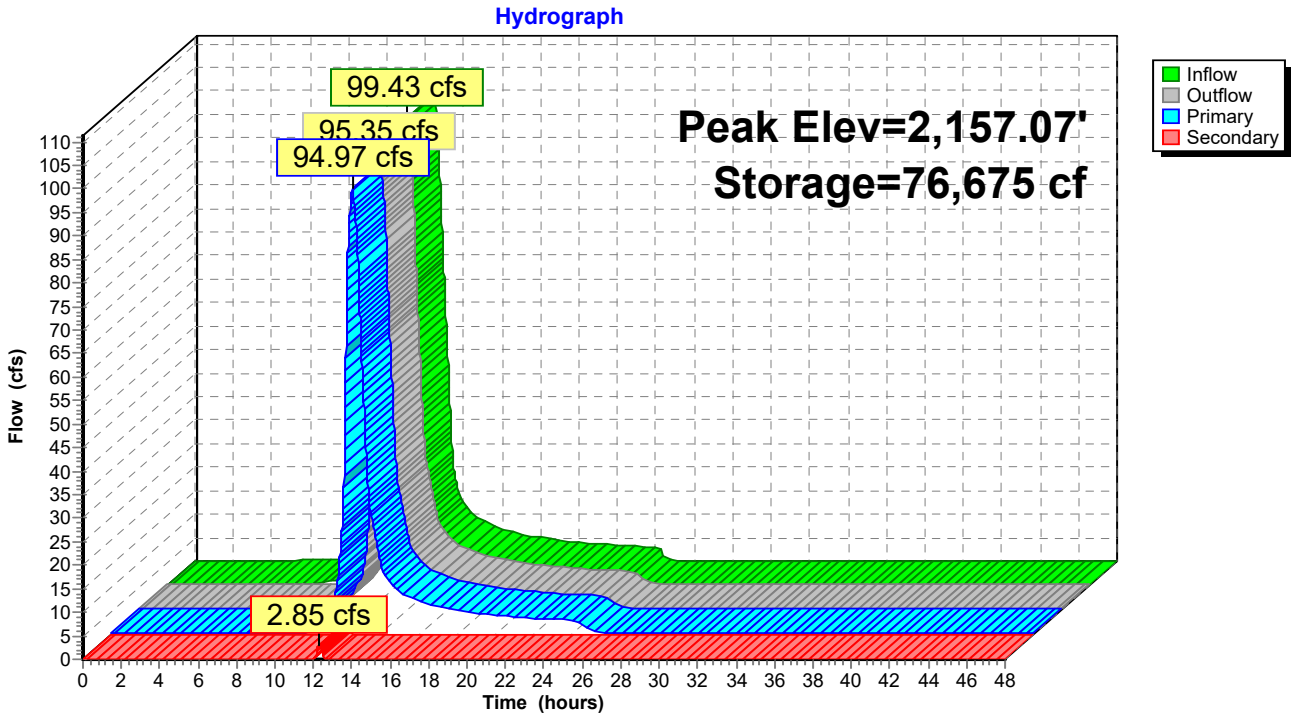
Device	Routing	Invert	Outlet Devices
#1	Primary	2,149.70'	**36.0" Round Culvert** L= 34.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,149.70' / 2,149.53' S= 0.0049 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Device 1	2,149.70'	**3.0" Vert. Orifice/Grate** C= 0.620
#3	Device 1	2,153.35'	**20.0" Vert. Orifice/Grate X 2.00** C= 0.620
#4	Device 1	2,155.63'	**48.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#5	Primary	2,156.63'	**17.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#6	Secondary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf
#7	Secondary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900
n= 0.011, Flow Area= 3.14 sf

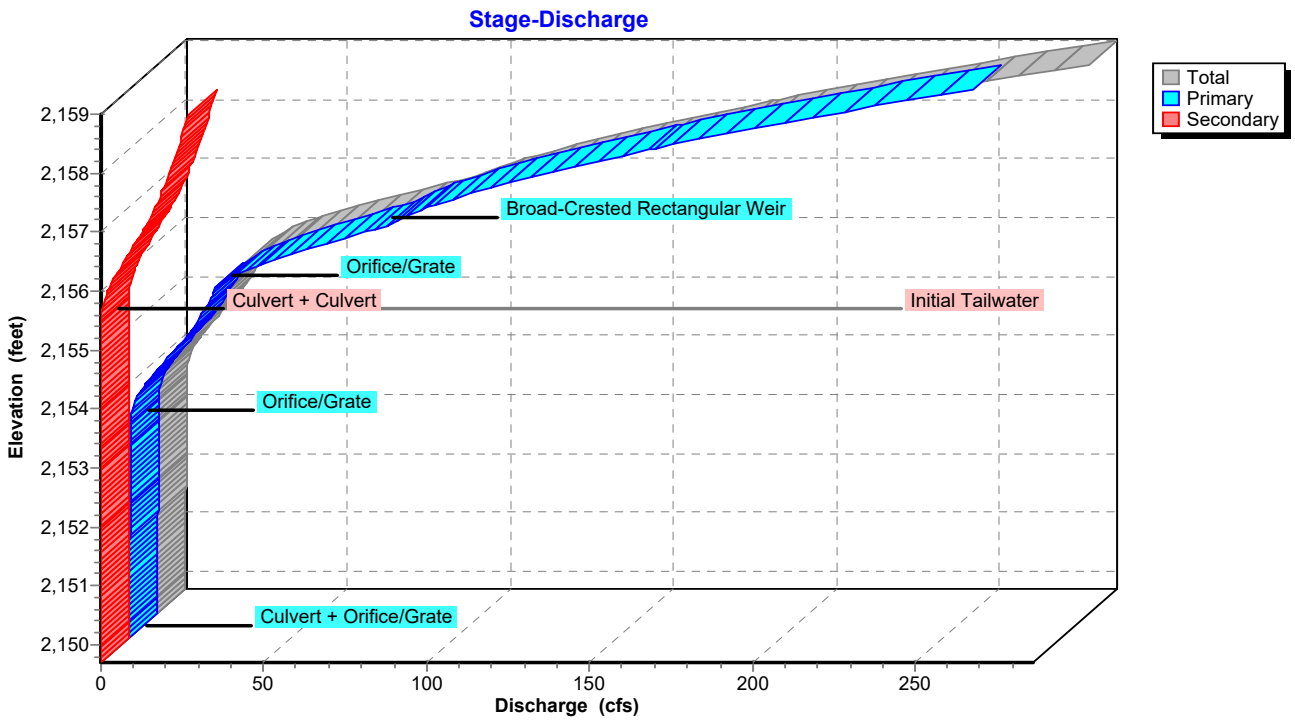
Primary OutFlow Max=94.95 cfs @ 12.56 hrs HW=2,157.06' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 82.43 cfs @ 11.66 fps)
  - **2=Orifice/Grate** (Passes < 0.66 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 36.85 cfs potential flow)
  - **4=Orifice/Grate** (Passes < 70.64 cfs potential flow)
- **5=Broad-Crested Rectangular Weir** (Weir Controls 12.52 cfs @ 1.69 fps)

Secondary OutFlow Max=1.97 cfs @ 12.26 hrs HW=2,156.49' TW=2,156.45' (Dynamic Tailwater)
- **6=Culvert** (Inlet Controls 0.79 cfs @ 0.76 fps)
- **7=Culvert** (Inlet Controls 1.18 cfs @ 0.76 fps)

Pond 10P: FIDDLERS GREEN MAIN POND



Pond 10P: FIDDLERS GREEN MAIN POND



Summary for Pond 11P: KNOB HILL POND

Inflow Area = 47.793 ac, Inflow Depth = 2.05" for 10-yr event
Inflow = 76.40 cfs @ 12.27 hrs, Volume= 8.170 af
Outflow = 52.29 cfs @ 12.52 hrs, Volume= 8.170 af, Atten= 32%, Lag= 15.4 min
Primary = 52.29 cfs @ 12.52 hrs, Volume= 8.170 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,175.21' @ 12.52 hrs Surf.Area= 0 sf Storage= 46,408 cf

Plug-Flow detention time= 7.1 min calculated for 8.168 af (100% of inflow)
Center-of-Mass det. time= 7.1 min (852.1 - 844.9)

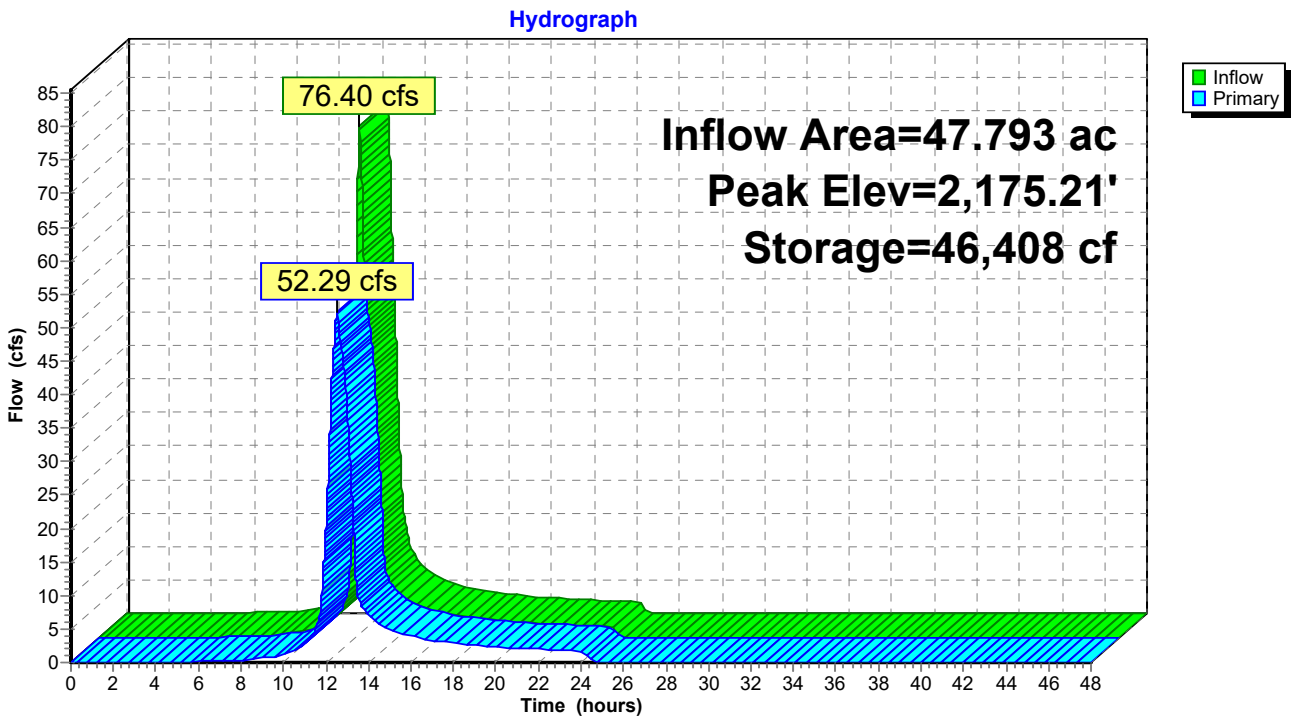
Volume	Invert	Avail.Storage	Storage Description
#1	2,169.00'	56,234 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
2,169.00	0
2,170.00	401
2,171.00	4,203
2,172.00	11,900
2,174.00	31,514
2,176.00	56,234

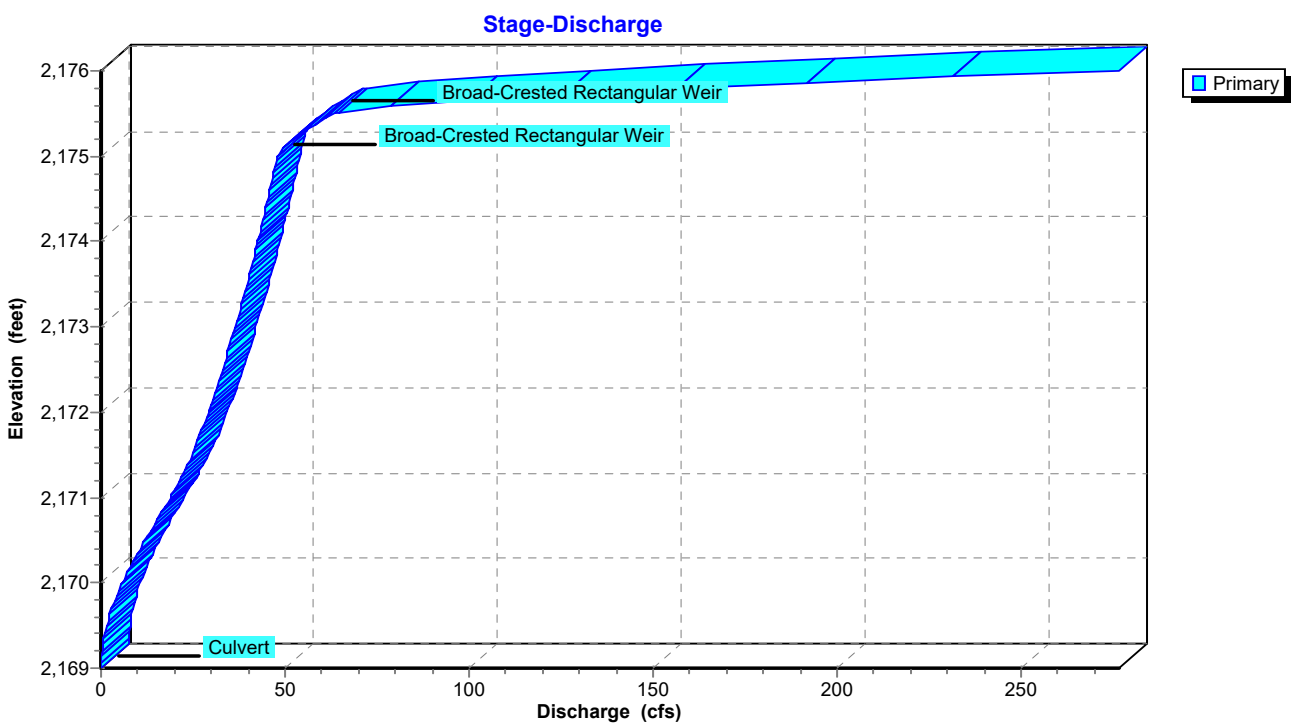
Device	Routing	Invert	Outlet Devices
#1	Primary	2,169.00'	**30.0" Round Culvert** L= 35.0' Ke= 0.610 Inlet / Outlet Invert= 2,169.00' / 2,168.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 HDPE, Flow Area= 4.91 sf
#2	Primary	2,175.00'	**14.5' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	2,175.50'	**200.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=52.28 cfs @ 12.52 hrs HW=2,175.20' TW=2,157.05' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 49.02 cfs @ 9.99 fps)
- **2=Broad-Crested Rectangular Weir** (Weir Controls 3.27 cfs @ 1.10 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 11P: KNOB HILL POND



Pond 11P: KNOB HILL POND



Summary for Pond 14P: FIDDLERS GREEN AUX POND

[86] Warning: Oscillations may require smaller dt (severity=2)

Inflow	=	5.51 cfs @ 12.25 hrs, Volume=	0.338 af	
Outflow	=	3.42 cfs @ 12.89 hrs, Volume=	0.338 af, Atten= 38%, Lag= 38.4 min	
Primary	=	3.42 cfs @ 12.89 hrs, Volume=	0.338 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,157.07' @ 12.59 hrs Surf.Area= 6,567 sf Storage= 6,016 cf

Plug-Flow detention time= 20.8 min calculated for 0.338 af (100% of inflow)
Center-of-Mass det. time= 20.7 min (840.3 - 819.7)

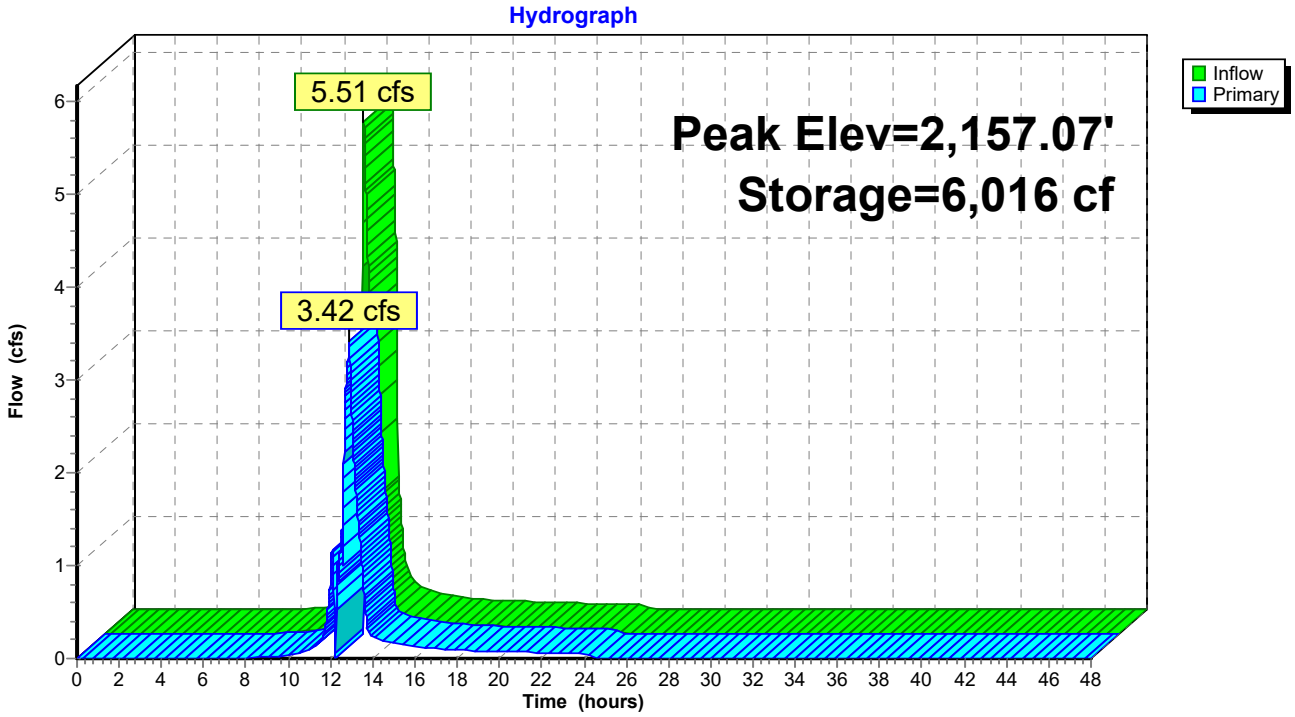
Volume	Invert	Avail.Storage	Storage Description
#1	2,155.50'	27,923 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,155.50	0	0	0
2,156.00	3,036	759	759
2,157.00	6,522	4,779	5,538
2,158.00	7,134	6,828	12,366
2,159.00	7,772	7,453	19,819
2,160.00	8,436	8,104	27,923

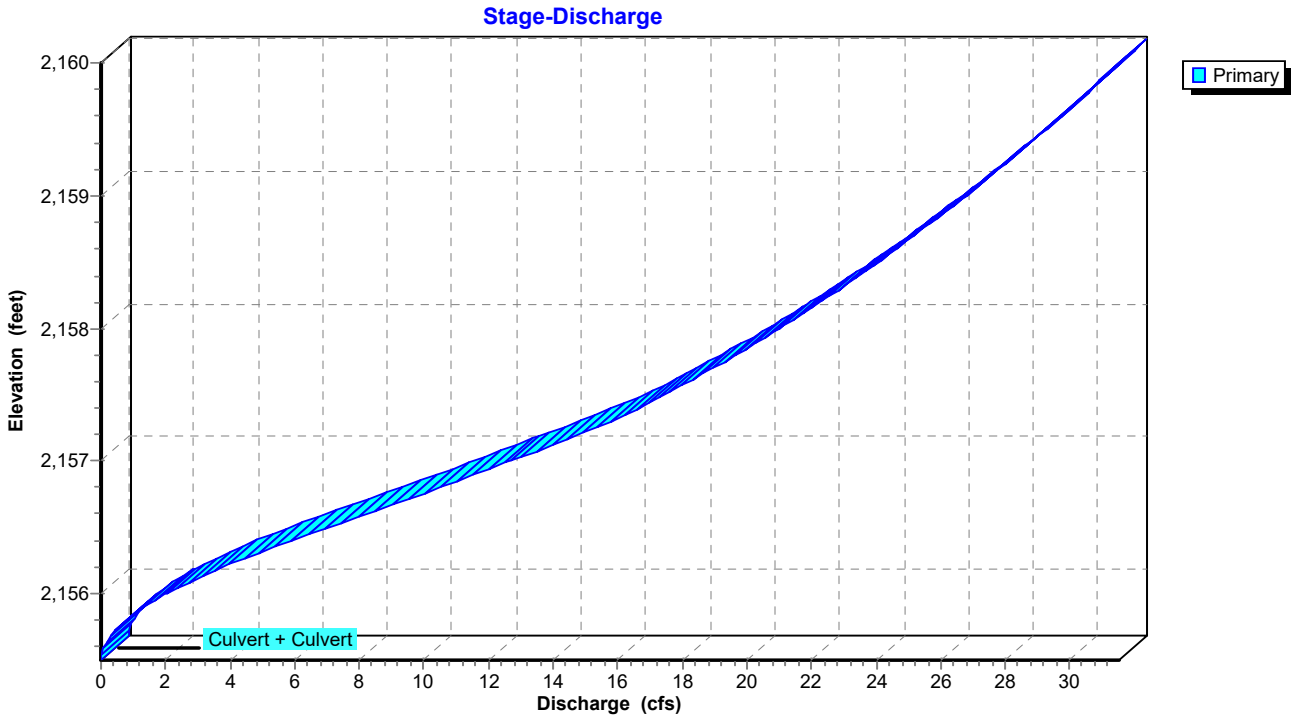
Device	Routing	Invert	Outlet Devices
#1	Primary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Primary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

Primary OutFlow Max=3.79 cfs @ 12.89 hrs HW=2,156.76' TW=2,156.65' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.31 cfs @ 1.59 fps)
└─**2=Culvert** (Outlet Controls 1.49 cfs @ 1.50 fps)

Pond 14P: FIDDLERS GREEN AUX POND



Pond 14P: FIDDLERS GREEN AUX POND



Summary for Pond 19P: EX 50"x31" CMP

[58] Hint: Peaked 0.68' above defined flood level

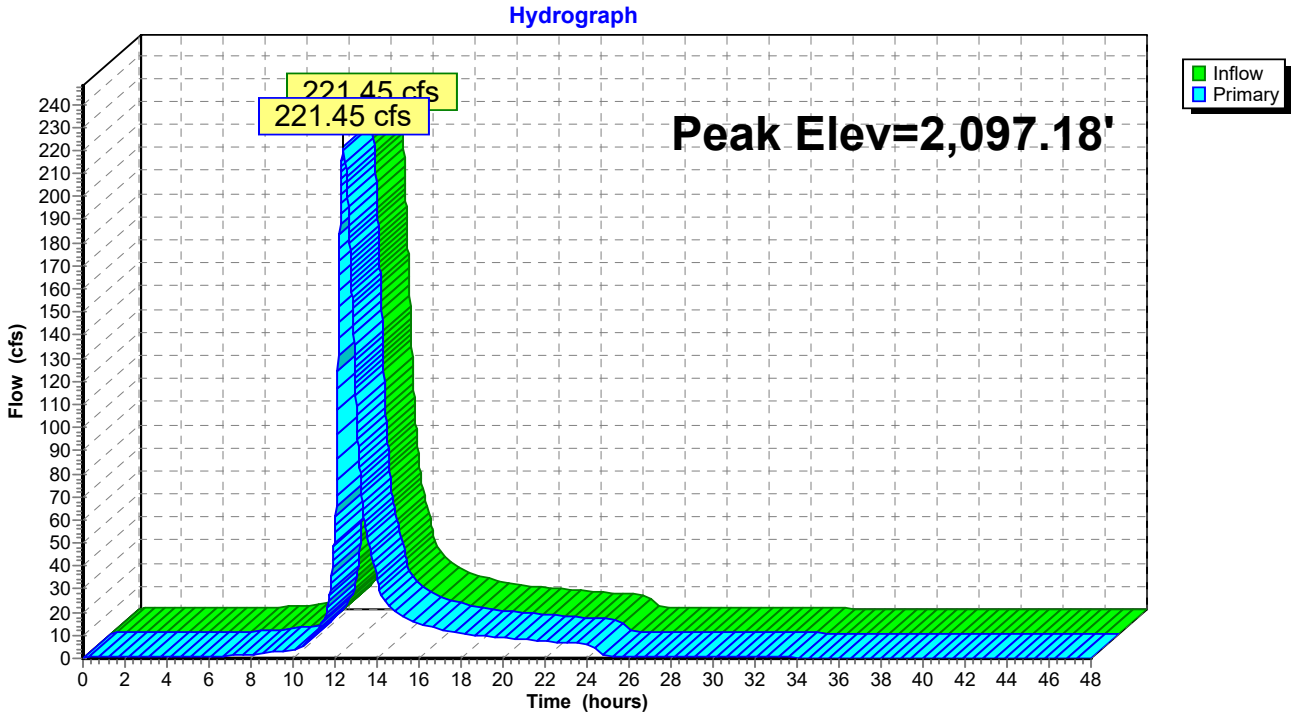
Inflow	=	221.45 cfs @	12.35 hrs,	Volume=	32.711 af
Outflow	=	221.45 cfs @	12.36 hrs,	Volume=	32.711 af, Atten= 0%, Lag= 0.6 min
Primary	=	221.45 cfs @	12.36 hrs,	Volume=	32.711 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.18' @ 12.36 hrs
Flood Elev= 2,096.50'

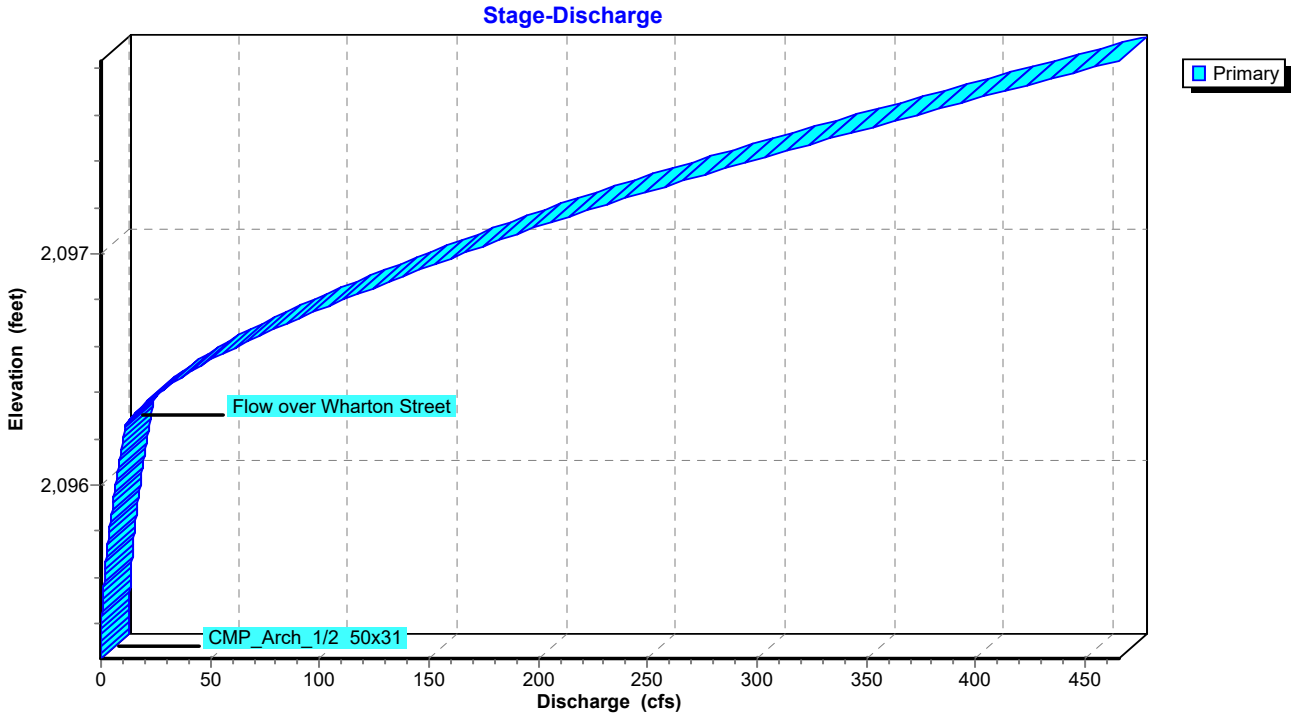
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=221.38 cfs @ 12.36 hrs HW=2,097.18' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 31.38 cfs @ 4.45 fps)
└─**2=Flow over Wharton Street** (Weir Controls 190.01 cfs @ 2.54 fps)

Pond 19P: EX 50"x31" CMP



Pond 19P: EX 50"x31" CMP



Summary for Subcatchment 3S: BERRYFIELD POND DA

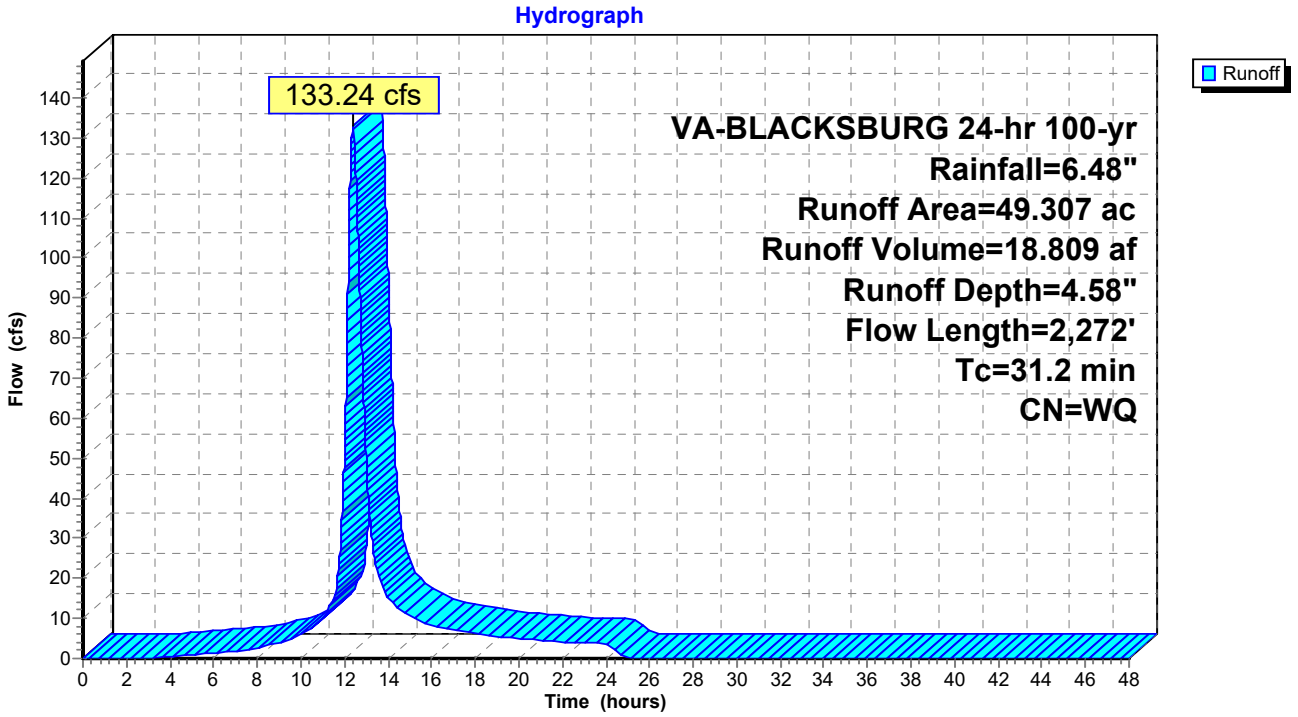
Runoff = 133.24 cfs @ 12.38 hrs, Volume= 18.809 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	3.627	70	Woods, Good, HSG C
	1.722	77	Woods, Good, HSG D
	11.203	74	>75% Grass cover, Good, HSG C
	0.649	80	>75% Grass cover, Good, HSG D
	0.017	82	2 acre lots, 12% imp, HSG D
	0.988	79	1 acre lots, 20% imp, HSG C
	1.522	80	1/2 acre lots, 25% imp, HSG C
	2.739	81	1/3 acre lots, 30% imp, HSG C
	0.020	86	1/3 acre lots, 30% imp, HSG D
	3.233	83	1/4 acre lots, 38% imp, HSG C
	0.390	87	1/4 acre lots, 38% imp, HSG D
	13.958	90	1/8 acre lots, 65% imp, HSG C
	1.013	92	1/8 acre lots, 65% imp, HSG D
	6.184	92	Paved roads w/open ditches, 50% imp, HSG C
	0.599	93	Paved roads w/open ditches, 50% imp, HSG D
	0.780	98	Paved parking, HSG C
*	0.663	83	25% Carry Over from Prospect Street Infiltration Pits
	49.307		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.0633	0.12		**Sheet Flow, Tc4** Woods: Light underbrush n= 0.400 P2= 2.76"
3.6	1,024	0.0869	4.75		**Shallow Concentrated Flow, Tc5** Unpaved Kv= 16.1 fps
2.2	284	0.0176	2.14		**Shallow Concentrated Flow, Tc6** Unpaved Kv= 16.1 fps
5.2	814	0.0307	2.63		**Shallow Concentrated Flow, Tc7** Grassed Waterway Kv= 15.0 fps
31.2	2,272	Total			

Subcatchment 3S: BERRYFIELD POND DA



Summary for Subcatchment 4S: 5'x3' CONC. BOX DA

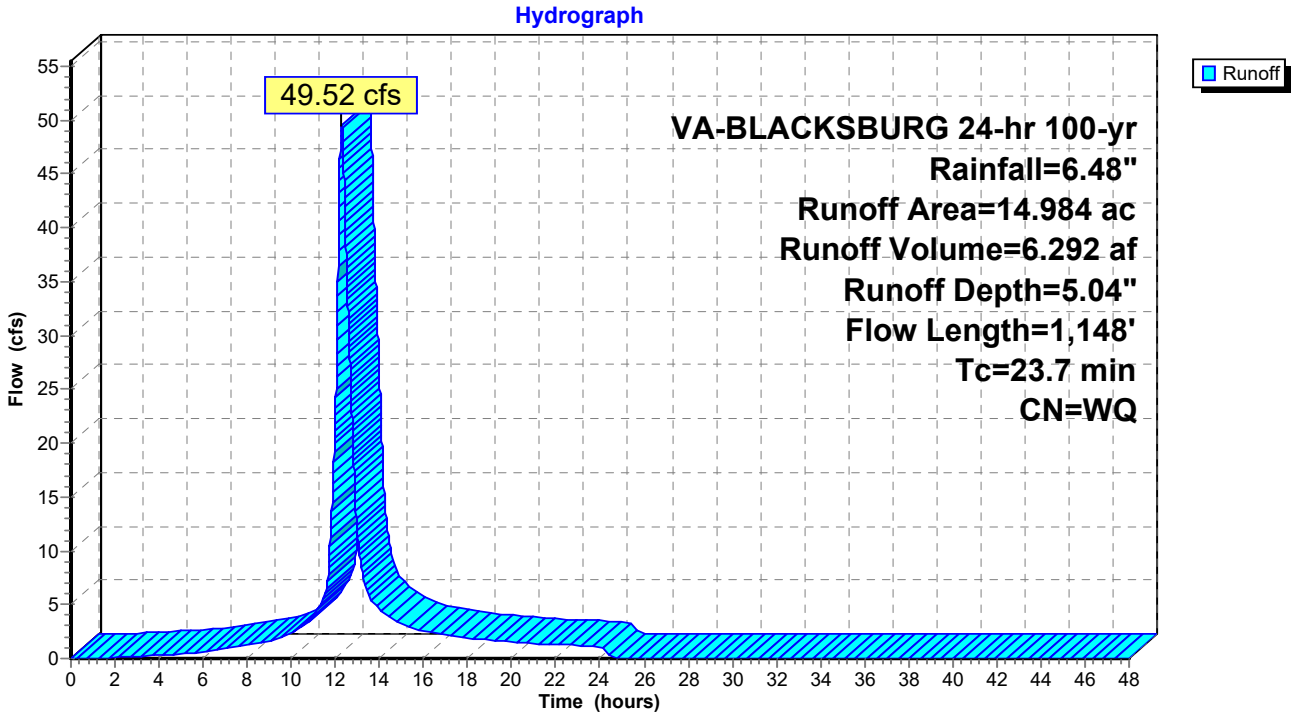
Runoff = 49.52 cfs @ 12.28 hrs, Volume= 6.292 af, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.444	74	>75% Grass cover, Good, HSG C
3.534	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.202	95	Urban commercial, 85% imp, HSG D
0.593	92	Paved roads w/open ditches, 50% imp, HSG C
1.697	93	Paved roads w/open ditches, 50% imp, HSG D
0.147	98	Paved parking, HSG C
1.587	98	Paved parking, HSG D
14.984		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 4S: 5'x3' CONC. BOX DA



Summary for Subcatchment 5S: CLAY ST. DA

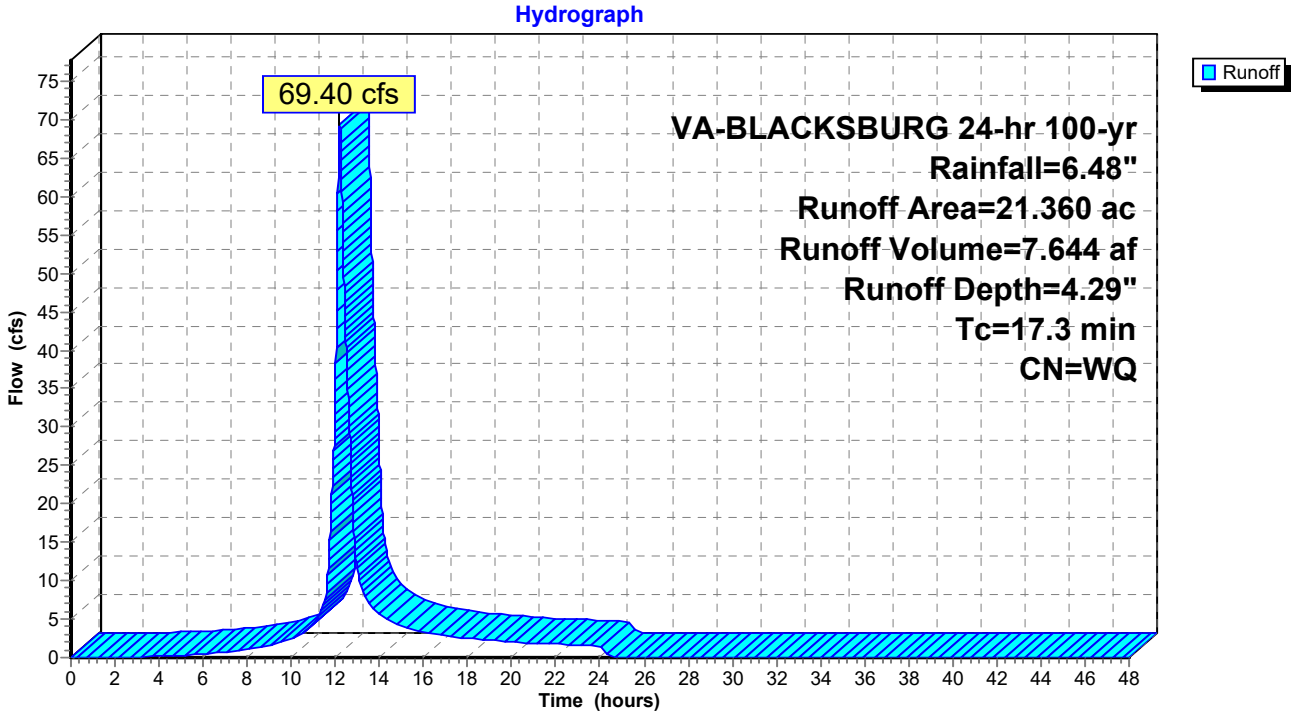
Runoff = 69.40 cfs @ 12.19 hrs, Volume= 7.644 af, Depth= 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
5.332	70	Woods, Good, HSG C
4.382	74	>75% Grass cover, Good, HSG C
2.136	81	1/3 acre lots, 30% imp, HSG C
2.246	83	1/4 acre lots, 38% imp, HSG C
3.153	90	1/8 acre lots, 65% imp, HSG C
4.111	92	Paved roads w/open ditches, 50% imp, HSG C
21.360		Weighted Average

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

Subcatchment 5S: CLAY ST. DA



Summary for Subcatchment 6S: EX. MH "B" DA

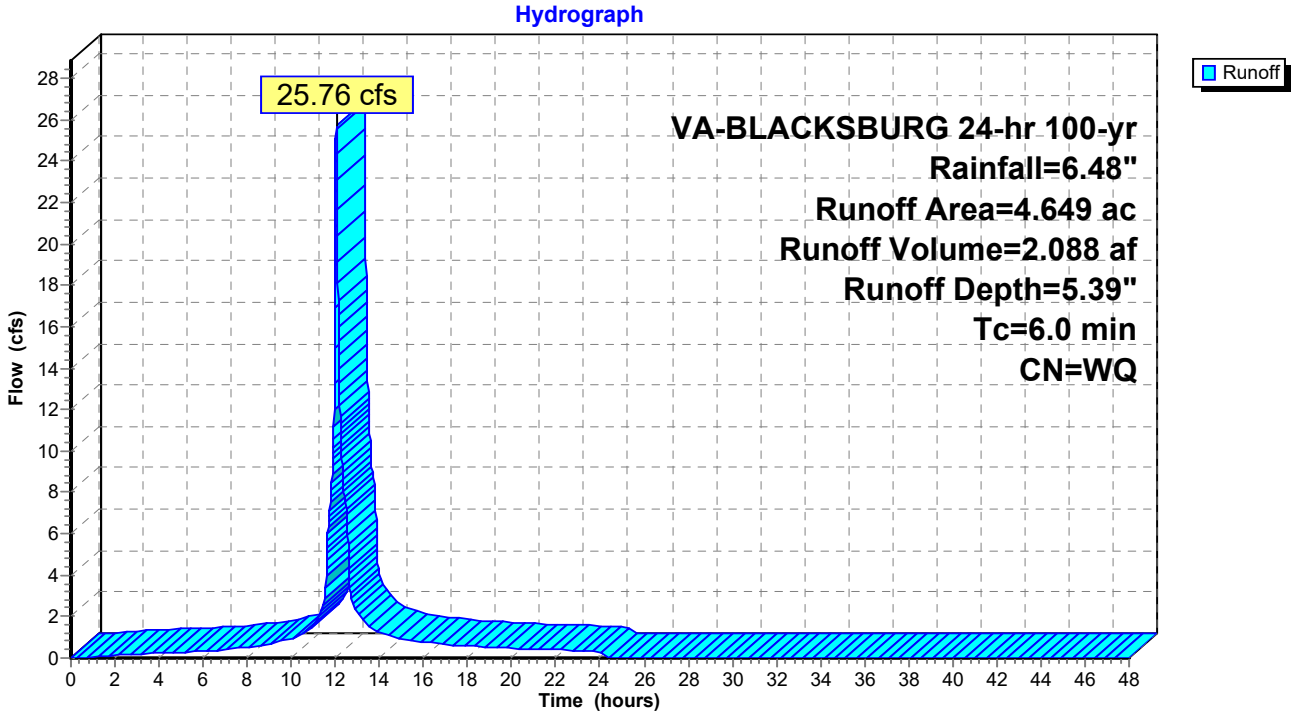
Runoff = 25.76 cfs @ 12.04 hrs, Volume= 2.088 af, Depth= 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
1.958	80	>75% Grass cover, Good, HSG D
2.685	98	Paved parking, HSG D
0.006	98	Paved parking, HSG C
4.649		Weighted Average

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

Subcatchment 6S: EX. MH "B" DA



Summary for Subcatchment 7S: EX. MH "A" DA

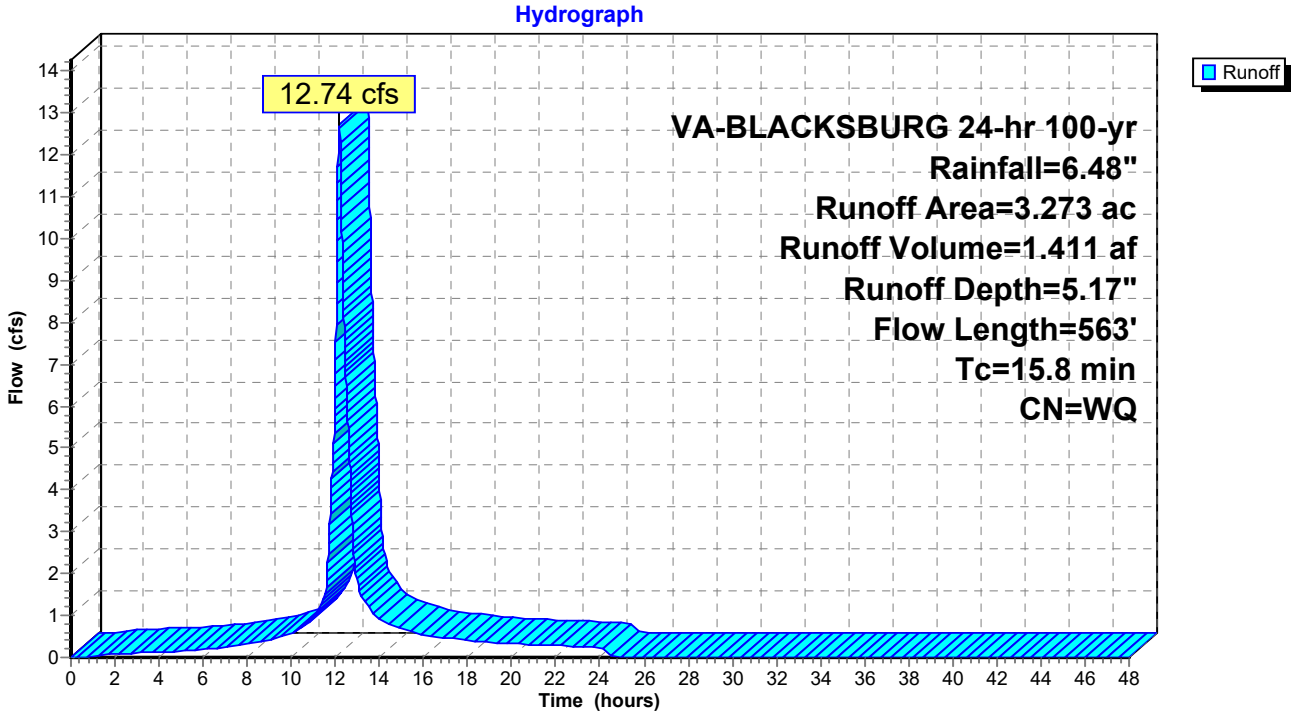
Runoff = 12.74 cfs @ 12.17 hrs, Volume= 1.411 af, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.830	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
1.727	80	>75% Grass cover, Good, HSG D
3.273		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0600	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	74	0.0598	3.94		**Shallow Concentrated Flow, Tc2** Unpaved Kv= 16.1 fps
1.8	339	0.0229	3.07		**Shallow Concentrated Flow, Tc3** Paved Kv= 20.3 fps
15.8	563	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 9S: CARRIAGE COURT DA

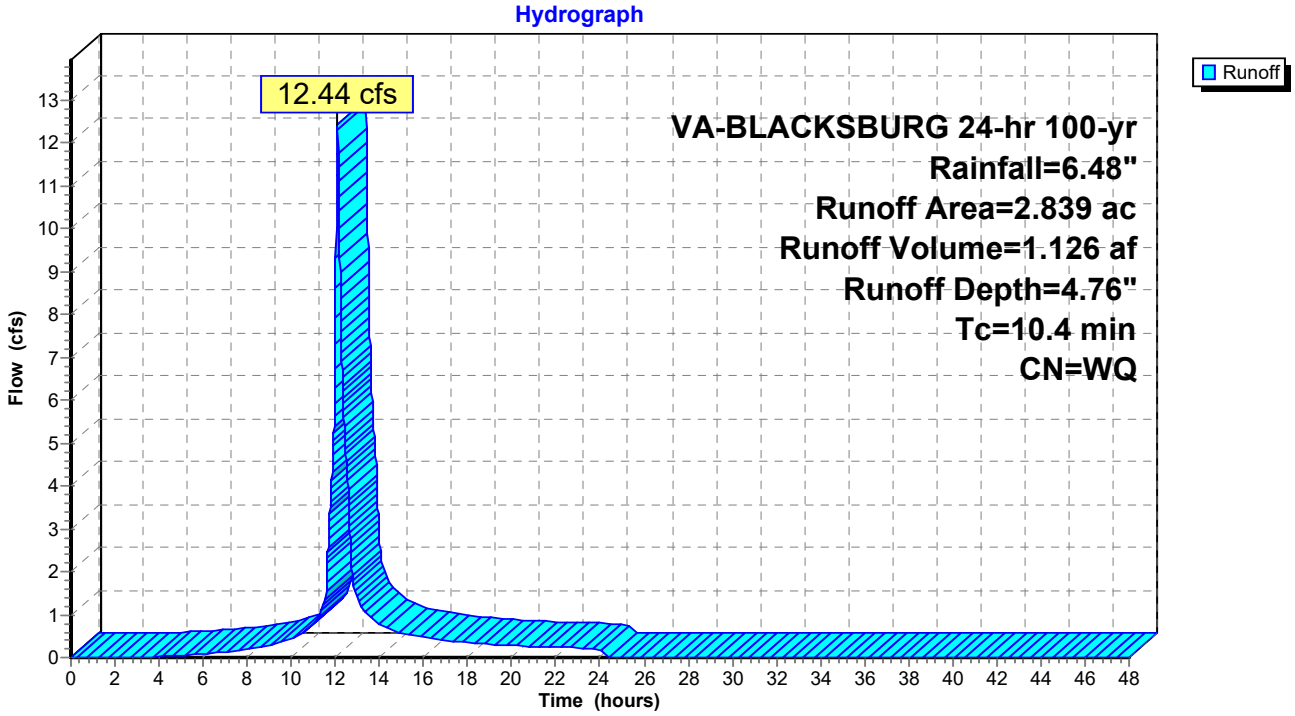
Runoff = 12.44 cfs @ 12.09 hrs, Volume= 1.126 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
2.217	83	1/4 acre lots, 38% imp, HSG C
0.622	92	Paved roads w/open ditches, 50% imp, HSG C
2.839		Weighted Average

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

Subcatchment 9S: CARRIAGE COURT DA



Summary for Subcatchment 12S: FIDDLERS GREEN MAIN DA

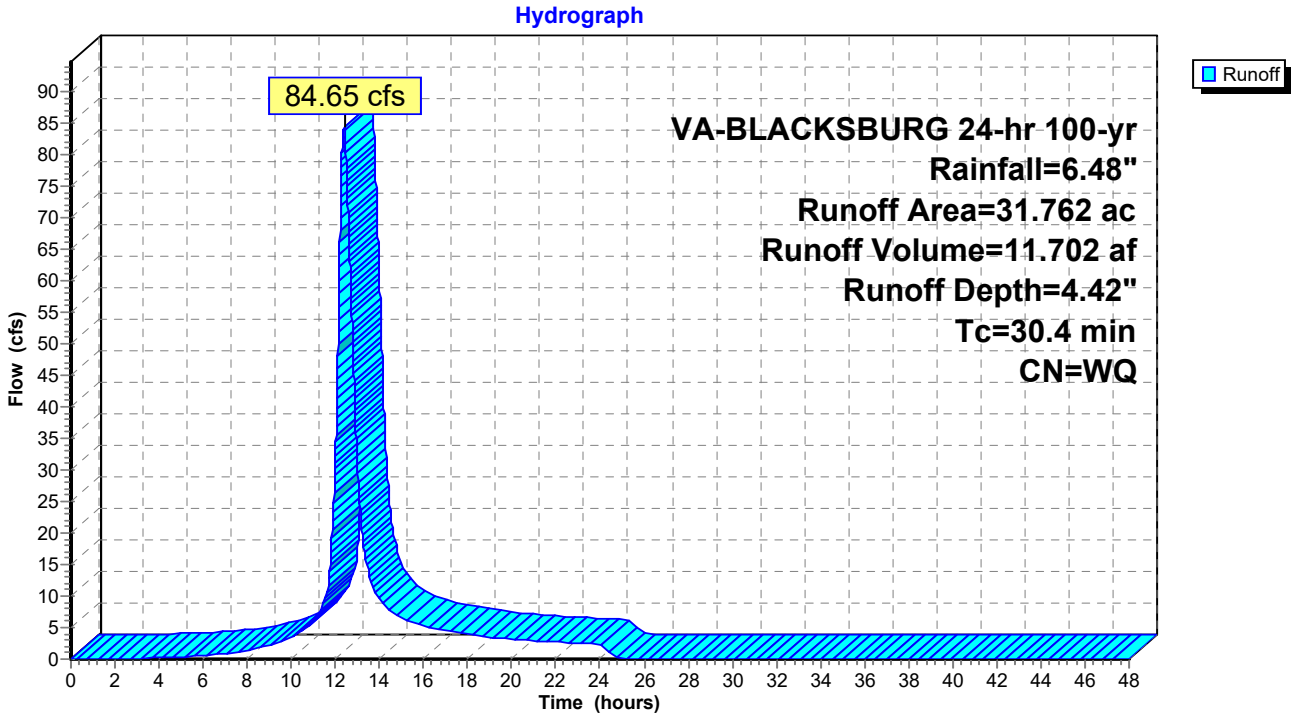
Runoff = 84.65 cfs @ 12.39 hrs, Volume= 11.702 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.116	70	Woods, Good, HSG C
8.691	74	>75% Grass cover, Good, HSG C
2.424	80	1/2 acre lots, 25% imp, HSG C
4.428	81	1/3 acre lots, 30% imp, HSG C
10.306	83	1/4 acre lots, 38% imp, HSG C
4.998	92	Paved roads w/open ditches, 50% imp, HSG C
0.799	98	Paved parking, HSG C
31.762		Weighted Average

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

Subcatchment 12S: FIDDLERS GREEN MAIN DA



Summary for Subcatchment 13S: KNOB HILL DA

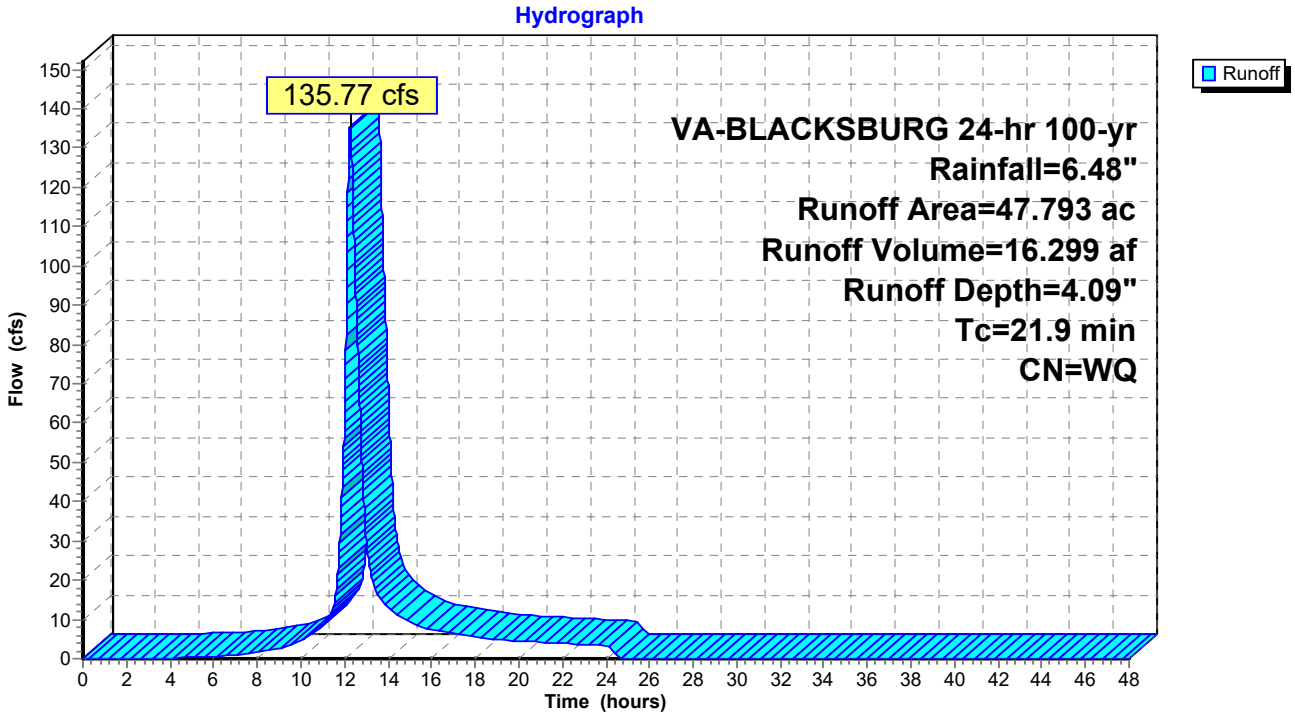
Runoff = 135.77 cfs @ 12.26 hrs, Volume= 16.299 af, Depth= 4.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	0.103	55	Woods, Good, HSG B
	10.773	70	Woods, Good, HSG C
	1.435	74	>75% Grass cover, Good, HSG C
	1.128	79	1 acre lots, 20% imp, HSG C
	5.039	80	1/2 acre lots, 25% imp, HSG C
	5.519	72	1/3 acre lots, 30% imp, HSG B
	15.477	81	1/3 acre lots, 30% imp, HSG C
	1.091	83	1/4 acre lots, 38% imp, HSG C
	1.823	94	Urban commercial, 85% imp, HSG C
	0.485	89	Paved roads w/open ditches, 50% imp, HSG B
	4.240	92	Paved roads w/open ditches, 50% imp, HSG C
*	0.680	80	25% Carry Over from Jefferson Street Infiltration Pits
	47.793		Weighted Average

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

Subcatchment 13S: KNOB HILL DA



Summary for Subcatchment 15S: FIDDLERS GREEN AUX DA

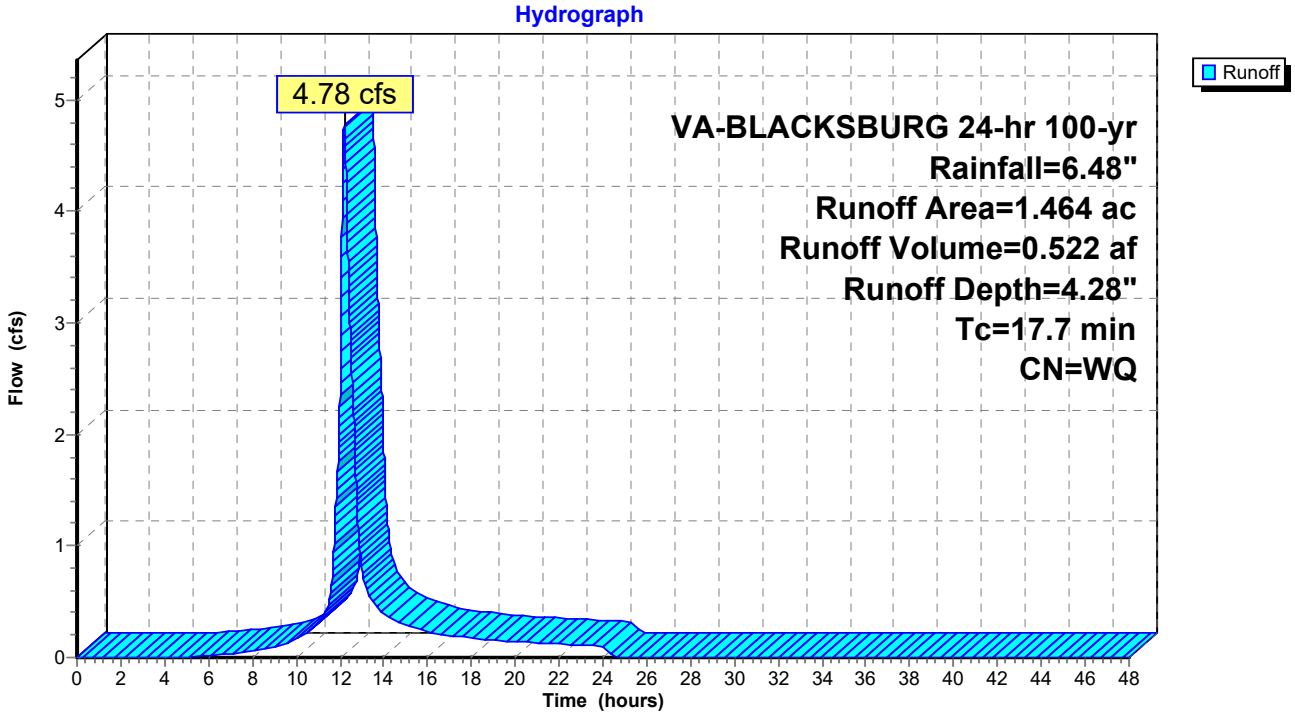
Runoff = 4.78 cfs @ 12.20 hrs, Volume= 0.522 af, Depth= 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.398	74	>75% Grass cover, Good, HSG C
1.066	83	1/4 acre lots, 38% imp, HSG C
1.464		Weighted Average

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

Subcatchment 15S: FIDDLERS GREEN AUX DA



Summary for Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)

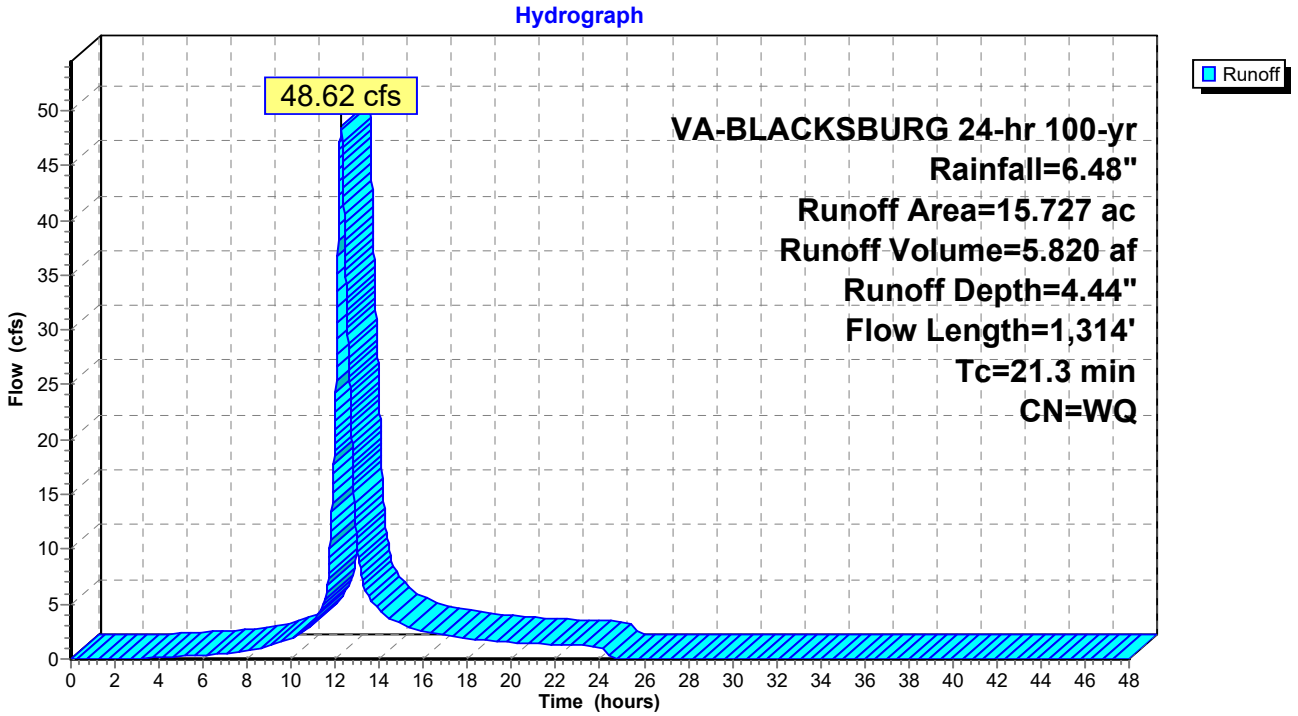
Runoff = 48.62 cfs @ 12.24 hrs, Volume= 5.820 af, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	0.584	70	Woods, Good, HSG C
	4.980	74	>75% Grass cover, Good, HSG C
	4.010	80	>75% Grass cover, Good, HSG D
	0.330	81	1/3 acre lots, 30% imp, HSG C
	1.247	92	Paved roads w/open ditches, 50% imp, HSG C
	0.435	98	Paved parking, HSG C
	0.126	98	Paved parking, HSG D
*	4.015	90	25% Carry Over from Villas Infiltration Pits
	15.727		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 20S: 50"x31" CMP DA (INCL. EX. 24" RCP)



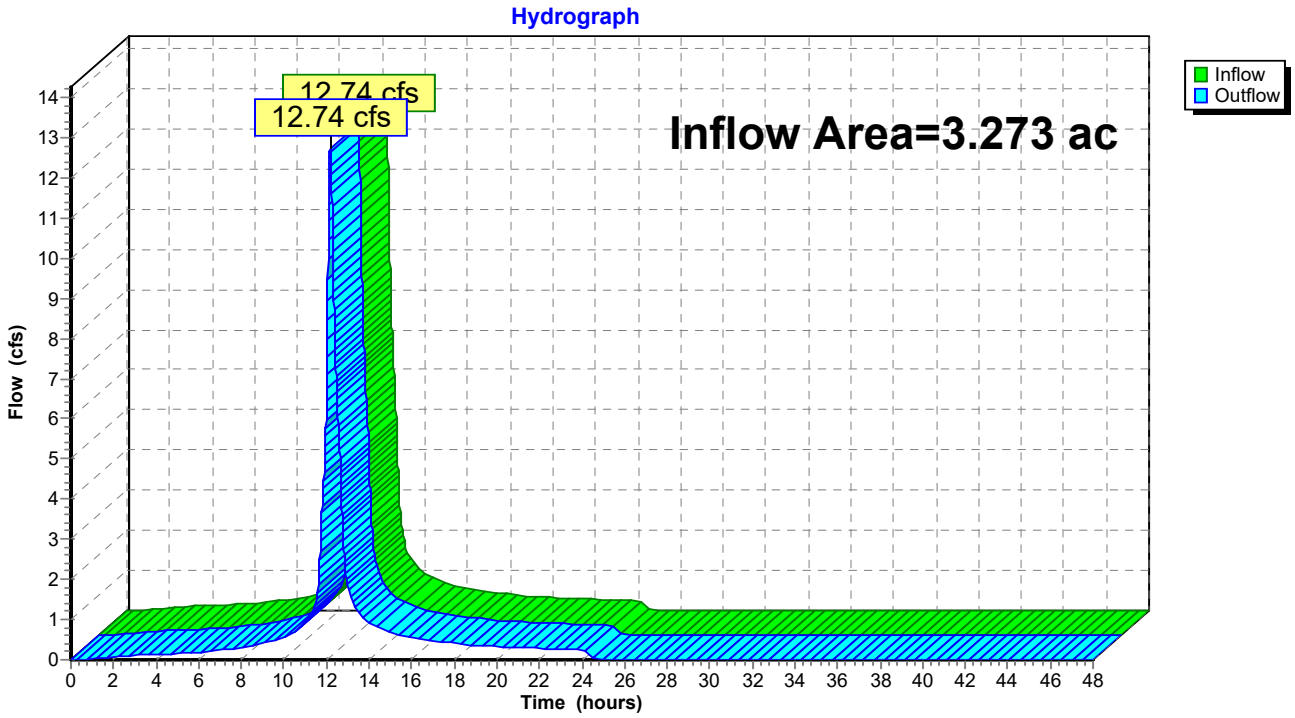
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.273 ac, Inflow Depth = 5.17" for 100-yr event
Inflow = 12.74 cfs @ 12.17 hrs, Volume= 1.411 af
Outflow = 12.74 cfs @ 12.18 hrs, Volume= 1.411 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



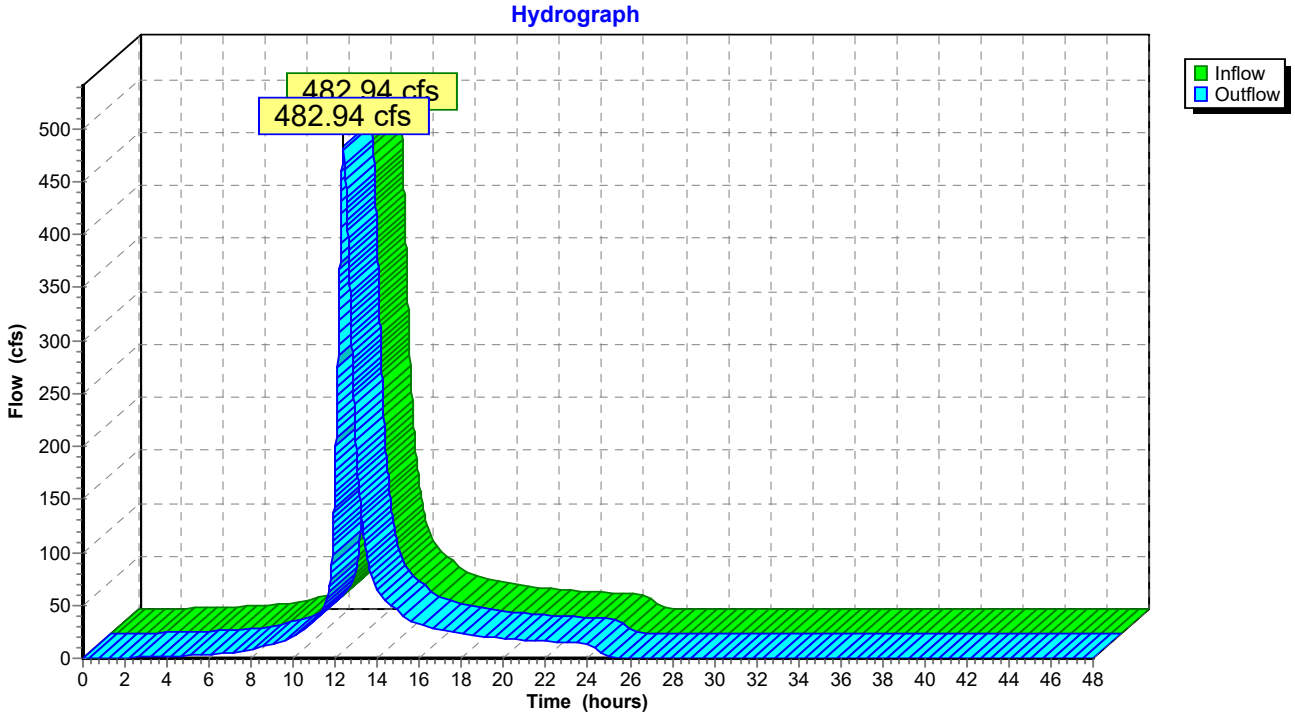
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	482.94 cfs @	12.36 hrs,	Volume=	70.913 af
Outflow	=	482.94 cfs @	12.37 hrs,	Volume=	70.913 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT



Summary for Pond 1P: BERRYFIELD POND

Inflow	=	387.36 cfs @	12.37 hrs,	Volume=	56.715 af
Outflow	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af, Atten= 0%, Lag= 0.6 min
Primary	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,100.82' @ 12.38 hrs Surf.Area= 21,539 sf Storage= 36,897 cf
Flood Elev= 2,101.00' Surf.Area= 23,595 sf Storage= 41,004 cf

Plug-Flow detention time= 2.7 min calculated for 56.702 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (853.5 - 850.8)

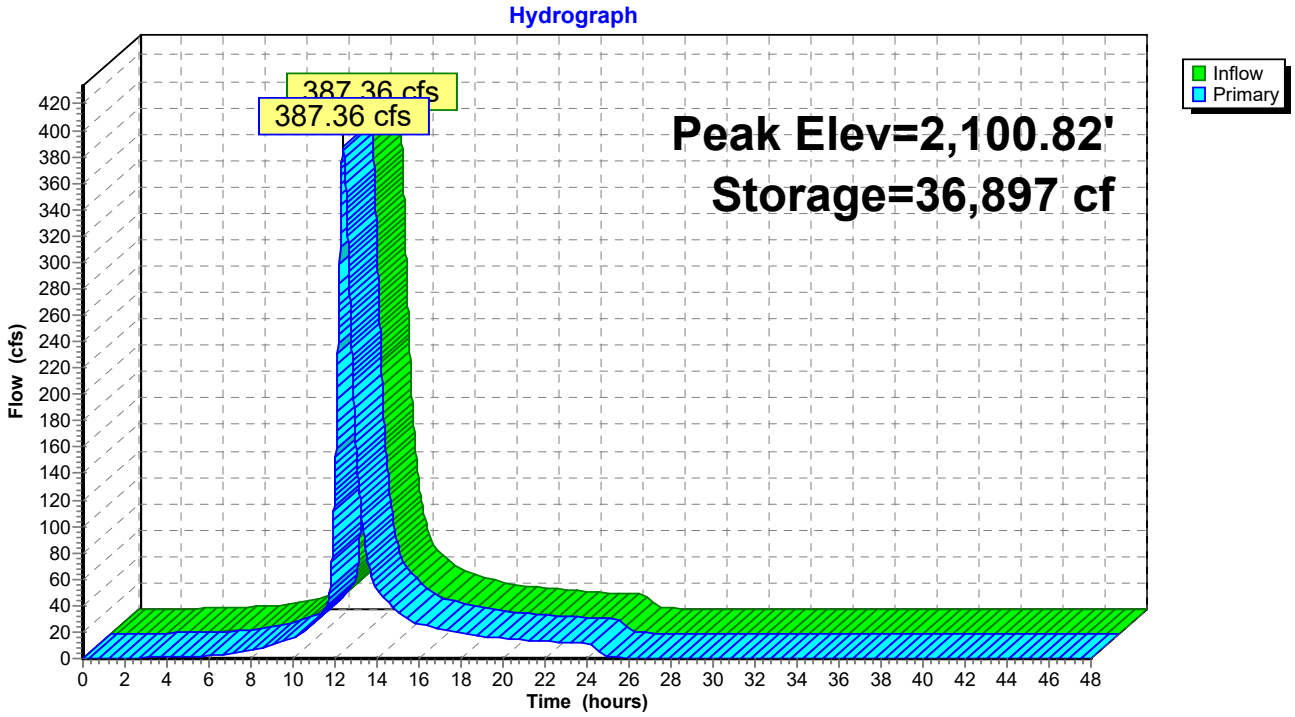
Volume	Invert	Avail.Storage	Storage Description
#1	2,096.00'	41,004 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,096.00	0	0	0
2,098.00	5,379	5,379	5,379
2,100.00	12,299	17,678	23,057
2,101.00	23,595	17,947	41,004

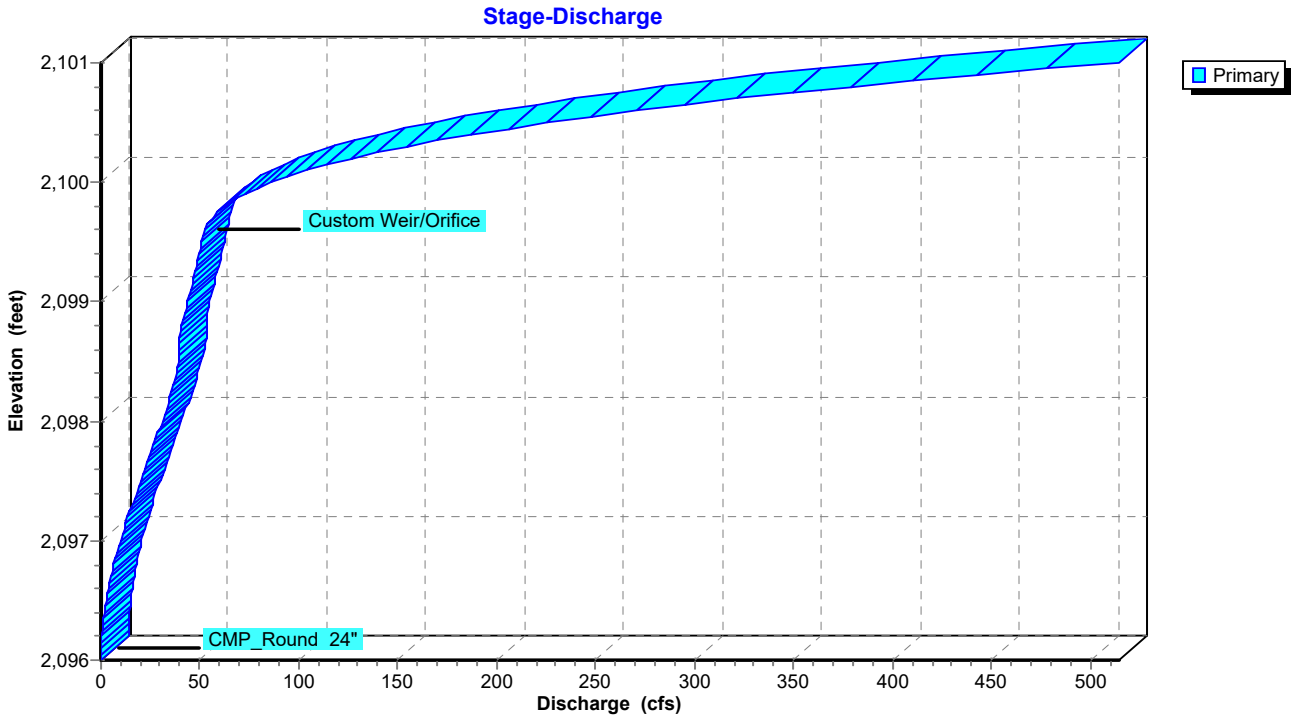
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.00'	**24.0" Round CMP_Round 24" X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,096.00' / 2,095.50' S= 0.0083 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 3.14 sf
#2	Primary	2,099.50'	**Custom Weir/Orifice, Cv= 3.00 (C= 3.75)** Head (feet) 0.00 0.50 1.50 Width (feet) 0.00 55.00 160.00

Primary OutFlow Max=387.27 cfs @ 12.38 hrs HW=2,100.82' TW=2,097.74' (Dynamic Tailwater)
└─**1=CMP_Round 24"** (Inlet Controls 62.83 cfs @ 6.67 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 324.45 cfs @ 3.46 fps)

Pond 1P: BERRYFIELD POND



Pond 1P: BERRYFIELD POND



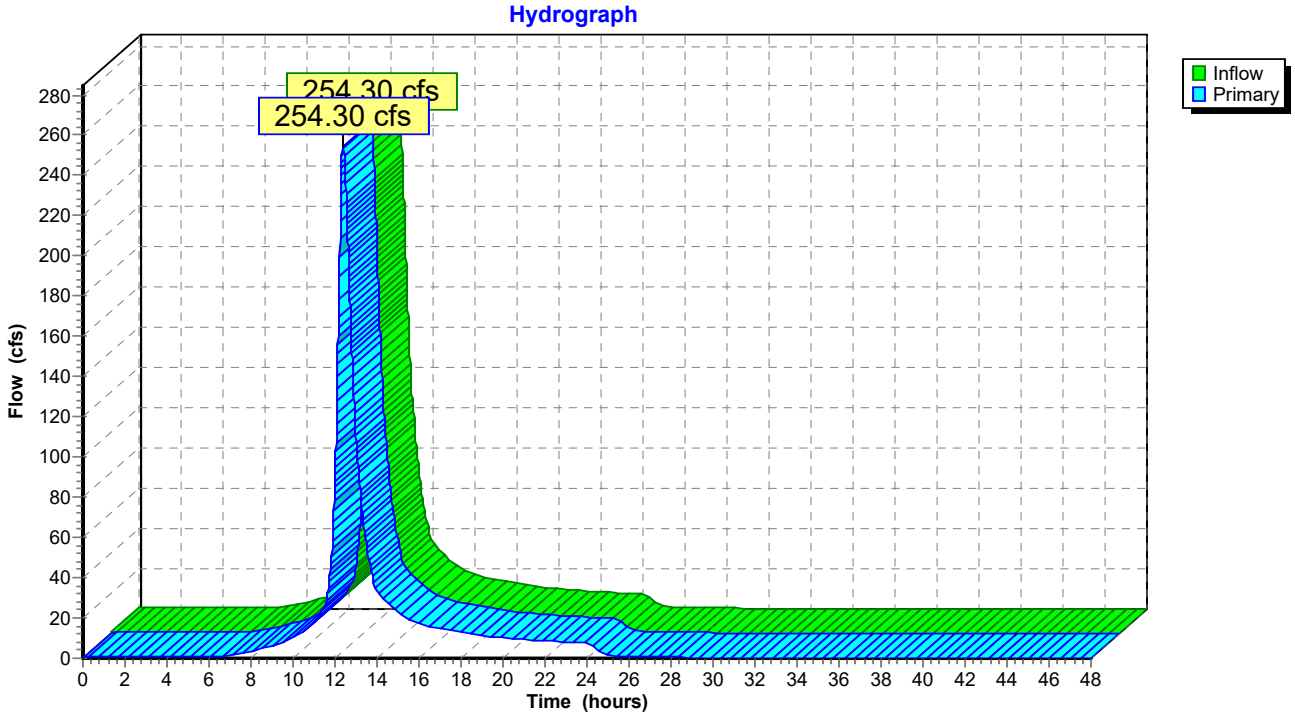
Summary for Pond 2P: CLAY ST. UNDERGROUND BOX

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	254.30 cfs @	12.36 hrs,	Volume=	37.906 af
Primary	=	254.30 cfs @	12.37 hrs,	Volume=	37.906 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 2P: CLAY ST. UNDERGROUND BOX



Summary for Pond 3P: EX. MH "B"

[58] Hint: Peaked 229.98' above defined flood level

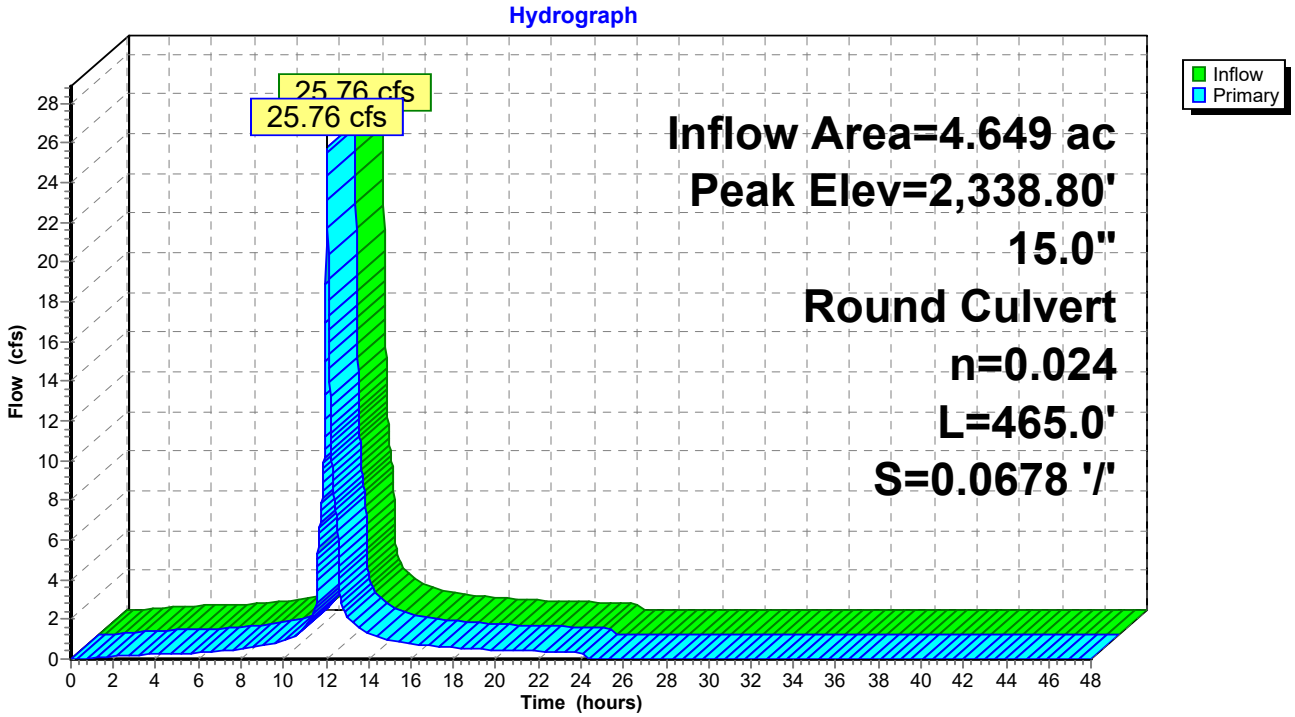
Inflow Area =	4.649 ac,	Inflow Depth =	5.39"	for	100-yr event
Inflow =	25.76 cfs @	12.04 hrs,	Volume=	2.088 af	
Outflow =	25.76 cfs @	12.05 hrs,	Volume=	2.088 af,	Atten= 0%, Lag= 0.6 min
Primary =	25.76 cfs @	12.05 hrs,	Volume=	2.088 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,338.80' @ 12.05 hrs
Flood Elev= 2,108.82'

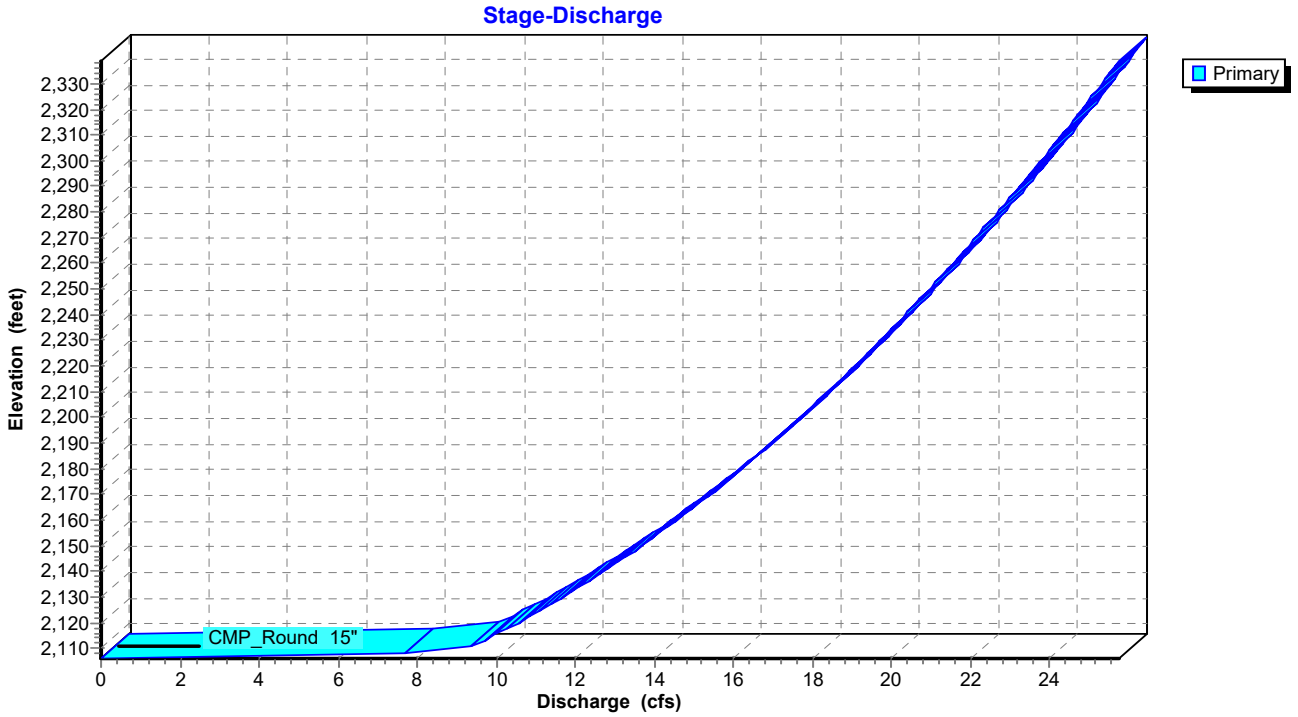
Device	Routing	Invert	Outlet Devices
#1	Primary	2,106.01'	**15.0" Round CMP_Round 15"** L= 465.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,106.01' / 2,074.50' S= 0.0678 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=25.70 cfs @ 12.05 hrs HW=2,337.63' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Round 15"** (Barrel Controls 25.70 cfs @ 20.94 fps)

Pond 3P: EX. MH "B"



Pond 3P: EX. MH "B"



Summary for Pond 8P: CARRIAGE COURT POND

Inflow Area = 2.839 ac, Inflow Depth = 4.76" for 100-yr event
Inflow = 12.44 cfs @ 12.09 hrs, Volume= 1.126 af
Outflow = 11.43 cfs @ 12.15 hrs, Volume= 1.126 af, Atten= 8%, Lag= 3.1 min
Primary = 11.43 cfs @ 12.15 hrs, Volume= 1.126 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,176.36' @ 12.15 hrs Surf.Area= 2,358 sf Storage= 4,607 cf

Plug-Flow detention time= 5.9 min calculated for 1.126 af (100% of inflow)
Center-of-Mass det. time= 5.9 min (812.6 - 806.7)

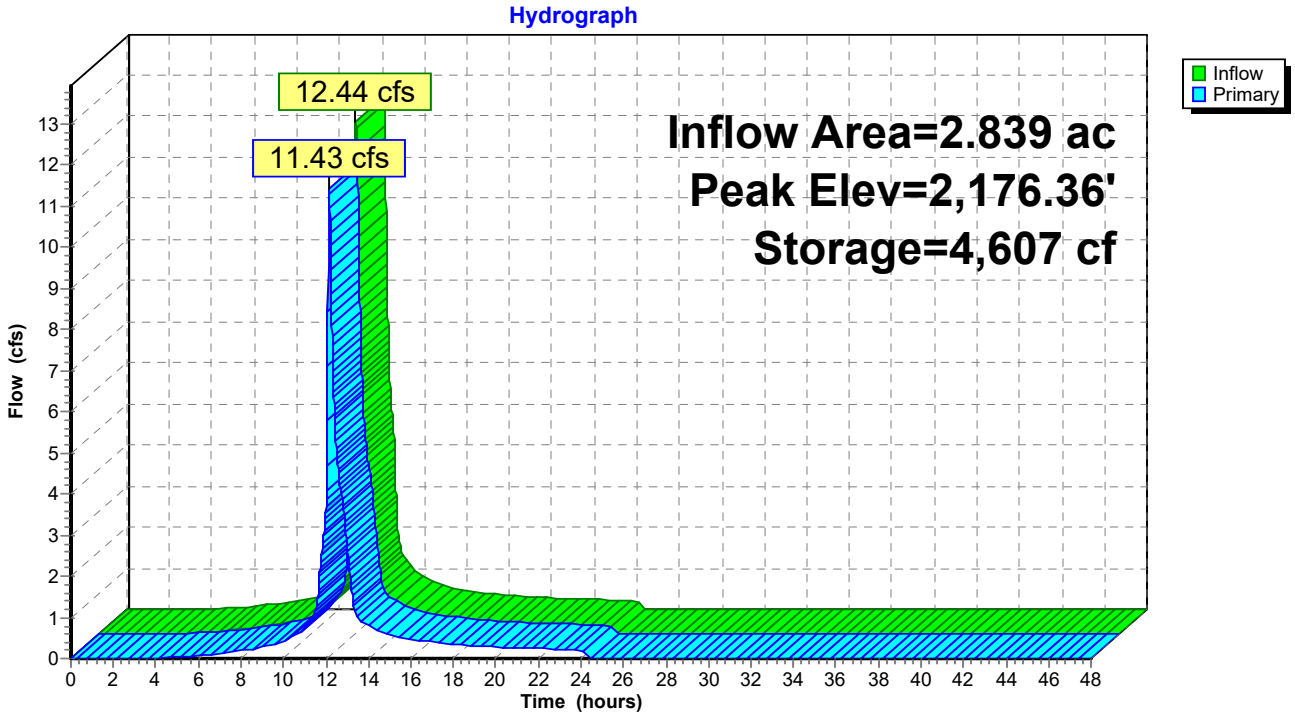
Volume	Invert	Avail.Storage	Storage Description
#1	2,173.00'	5,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,173.00	0	0	0
2,174.00	1,116	558	558
2,175.00	1,600	1,358	1,916
2,176.00	2,142	1,871	3,787
2,176.80	2,616	1,903	5,690

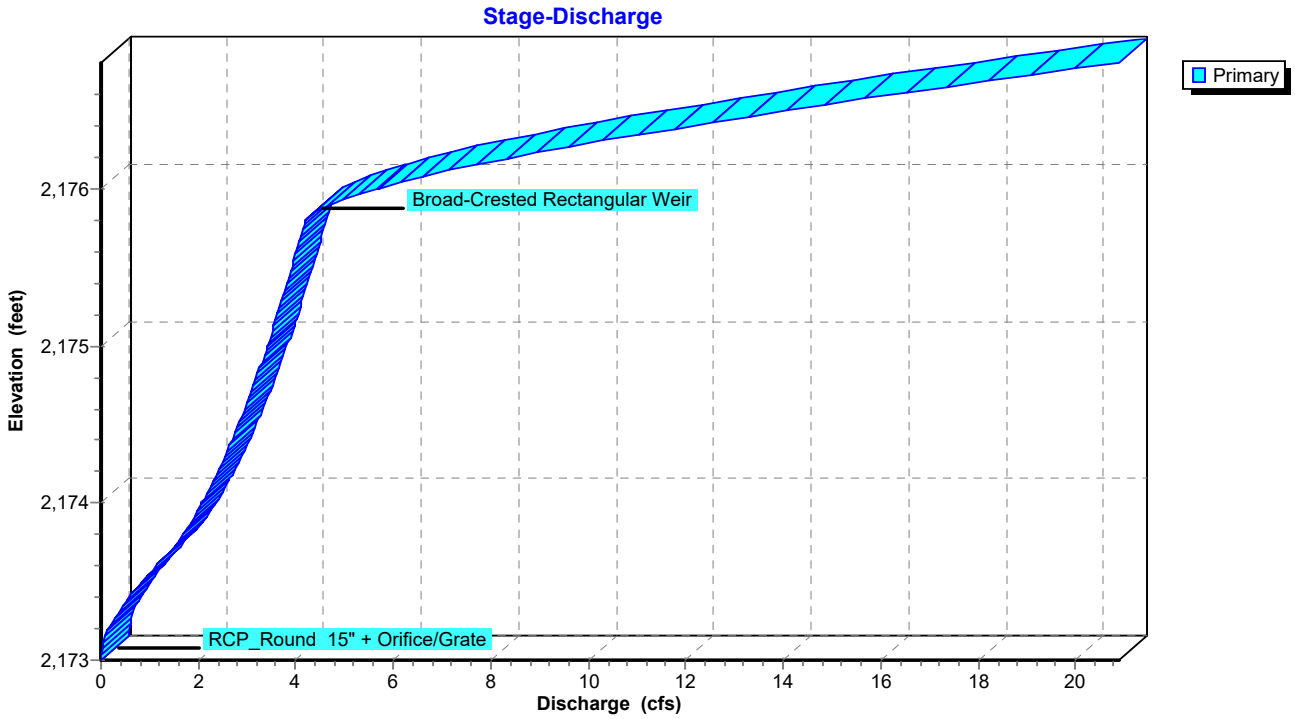
Device	Routing	Invert	Outlet Devices
#1	Primary	2,173.00'	**15.0" Round RCP_Round 15"** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 2,173.00' / 2,172.59' S= 0.0102 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,173.00'	**10.0" Vert. Orifice/Grate** C= 0.620
#3	Primary	2,175.80'	**6.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=11.42 cfs @ 12.15 hrs HW=2,176.36' TW=0.00' (Dynamic Tailwater)
- **1=RCP_Round 15"** (Passes 4.66 cfs of 9.78 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.66 cfs @ 8.54 fps)
- **3=Broad-Crested Rectangular Weir** (Weir Controls 6.76 cfs @ 2.00 fps)

Pond 8P: CARRIAGE COURT POND



Pond 8P: CARRIAGE COURT POND



Summary for Pond 10P: FIDDLERS GREEN MAIN POND

Inflow	=	215.84 cfs @	12.30 hrs,	Volume=	28.741 af
Outflow	=	203.76 cfs @	12.37 hrs,	Volume=	29.354 af, Atten= 6%, Lag= 4.0 min
Primary	=	199.35 cfs @	12.42 hrs,	Volume=	29.136 af
Secondary	=	12.55 cfs @	12.26 hrs,	Volume=	0.218 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 2,153.35' Surf.Area= 10,860 sf Storage= 28,479 cf
Peak Elev= 2,158.42' @ 12.42 hrs Surf.Area= 19,890 sf Storage= 101,283 cf (72,804 cf above start)

Plug-Flow detention time= 50.9 min calculated for 28.700 af (100% of inflow)
Center-of-Mass det. time= 38.8 min (874.4 - 835.6)

Volume	Invert	Avail.Storage	Storage Description
#1	2,149.70'	113,149 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,149.70	0	0	0
2,150.00	1,312	197	197
2,151.00	8,894	5,103	5,300
2,152.00	9,707	9,301	14,600
2,153.00	10,555	10,131	24,731
2,153.35	10,860	3,748	28,479
2,154.00	11,438	7,247	35,726
2,155.00	12,358	11,898	47,624
2,156.00	13,777	13,068	60,691
2,157.00	16,078	14,928	75,619
2,158.00	18,823	17,451	93,069
2,159.00	21,337	20,080	113,149

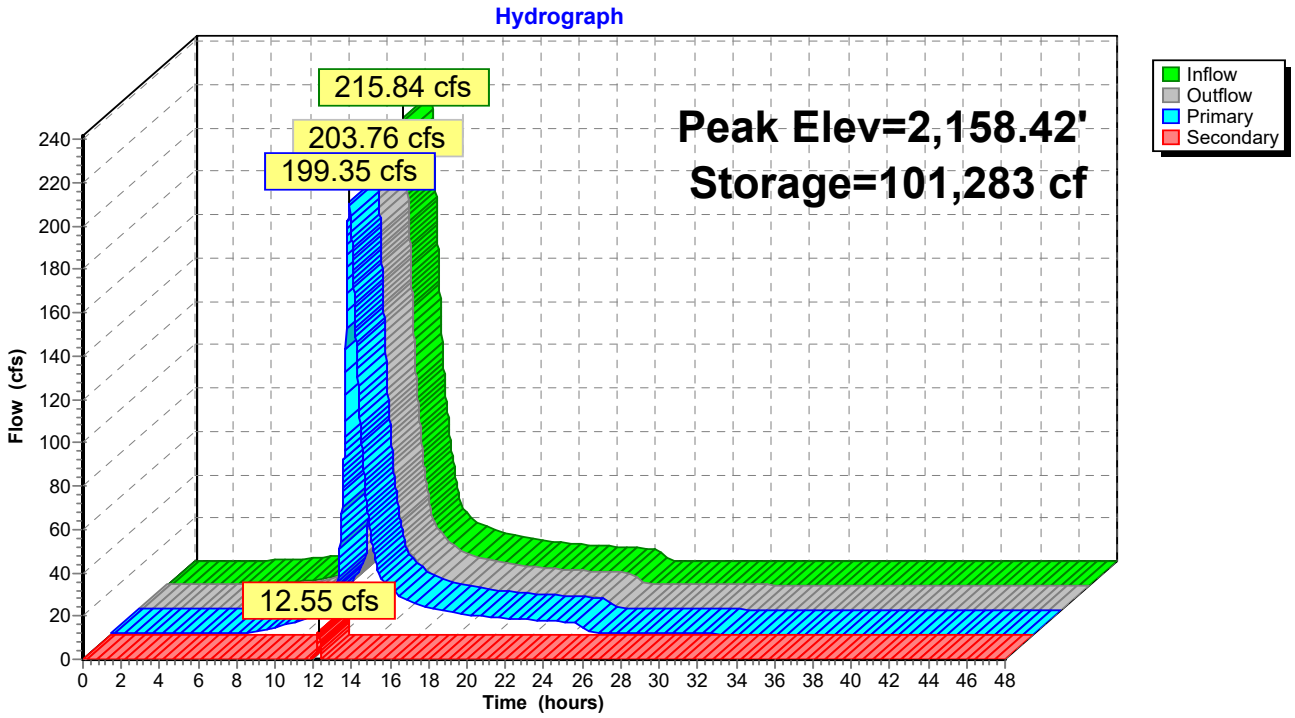
Device	Routing	Invert	Outlet Devices
#1	Primary	2,149.70'	**36.0" Round Culvert** L= 34.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,149.70' / 2,149.53' S= 0.0049 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Device 1	2,149.70'	**3.0" Vert. Orifice/Grate** C= 0.620
#3	Device 1	2,153.35'	**20.0" Vert. Orifice/Grate X 2.00** C= 0.620
#4	Device 1	2,155.63'	**48.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#5	Primary	2,156.63'	**17.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#6	Secondary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf
#7	Secondary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 2,155.00' / 2,155.50' S= -0.0055 '/' Cc= 0.900
n= 0.011, Flow Area= 3.14 sf

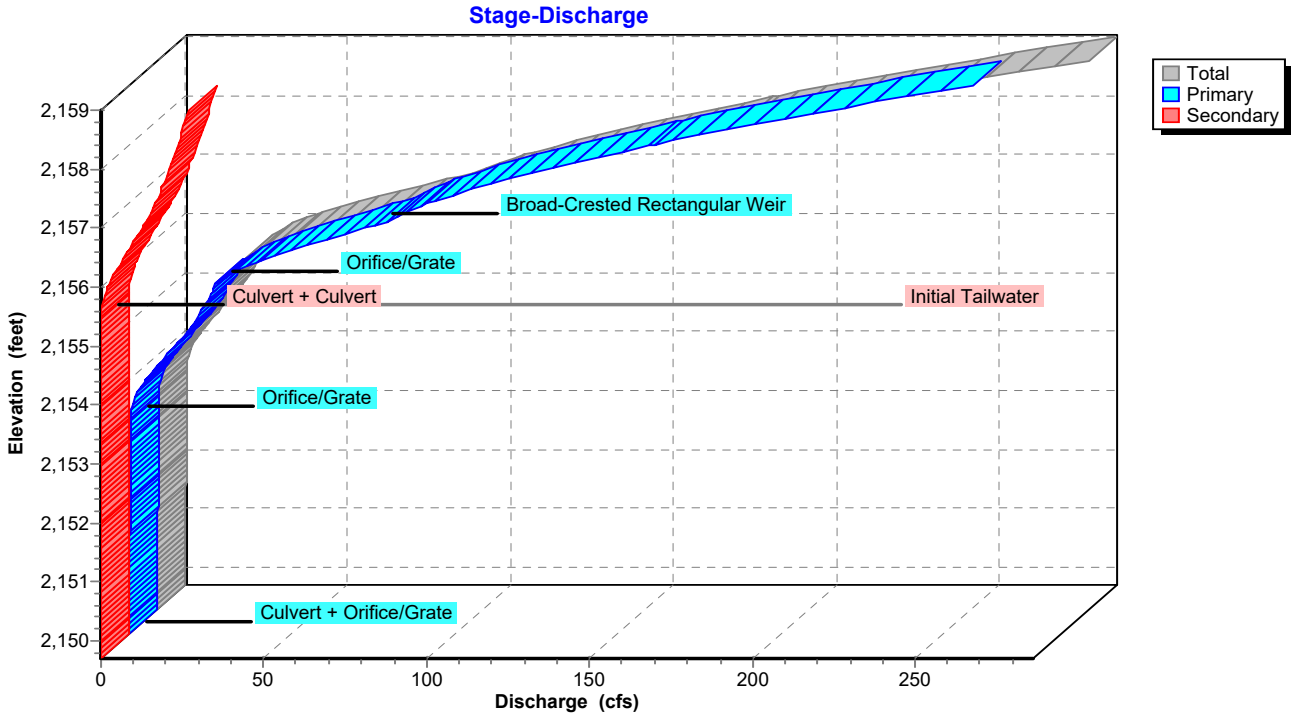
Primary OutFlow Max=199.28 cfs @ 12.42 hrs HW=2,158.42' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 91.48 cfs @ 12.94 fps)
  - **2=Orifice/Grate** (Passes < 0.72 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 44.70 cfs potential flow)
  - **4=Orifice/Grate** (Passes < 104.50 cfs potential flow)
- **5=Broad-Crested Rectangular Weir** (Weir Controls 107.81 cfs @ 3.54 fps)

Secondary OutFlow Max=11.49 cfs @ 12.26 hrs HW=2,157.93' TW=2,157.45' (Dynamic Tailwater)
- **6=Culvert** (Inlet Controls 3.23 cfs @ 2.63 fps)
- **7=Culvert** (Inlet Controls 8.26 cfs @ 2.63 fps)

Pond 10P: FIDDLERS GREEN MAIN POND



Pond 10P: FIDDLERS GREEN MAIN POND



Summary for Pond 11P: KNOB HILL POND

[89] Warning: Qout>Qin may require smaller dt

Inflow Area = 47.793 ac, Inflow Depth = 4.09" for 100-yr event
Inflow = 135.77 cfs @ 12.26 hrs, Volume= 16.299 af
Outflow = 135.80 cfs @ 12.27 hrs, Volume= 16.299 af, Atten= 0%, Lag= 0.6 min
Primary = 135.80 cfs @ 12.27 hrs, Volume= 16.299 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,175.74' @ 12.27 hrs Surf.Area= 0 sf Storage= 53,069 cf

Plug-Flow detention time= 6.4 min calculated for 16.299 af (100% of inflow)
Center-of-Mass det. time= 6.3 min (838.7 - 832.4)

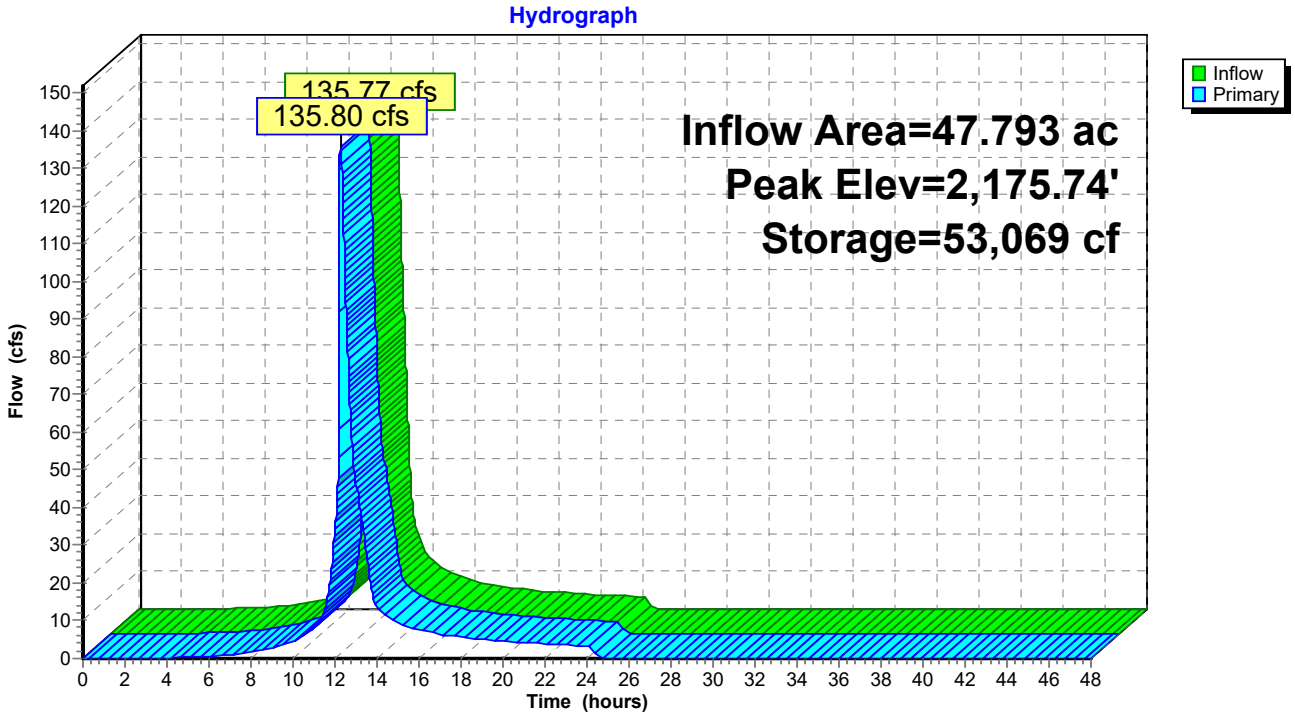
Volume	Invert	Avail.Storage	Storage Description
#1	2,169.00'	56,234 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
2,169.00	0
2,170.00	401
2,171.00	4,203
2,172.00	11,900
2,174.00	31,514
2,176.00	56,234

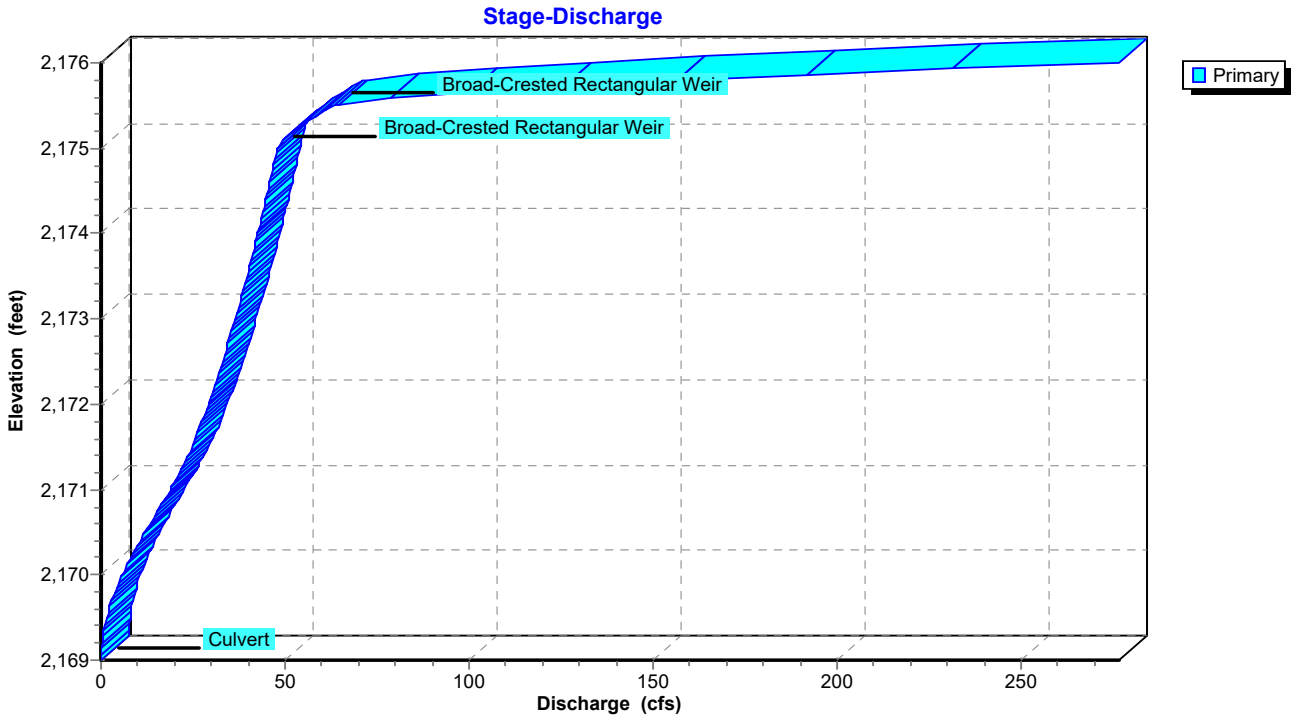
Device	Routing	Invert	Outlet Devices
#1	Primary	2,169.00'	**30.0" Round Culvert** L= 35.0' Ke= 0.610 Inlet / Outlet Invert= 2,169.00' / 2,168.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 HDPE, Flow Area= 4.91 sf
#2	Primary	2,175.00'	**14.5' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	2,175.50'	**200.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=135.77 cfs @ 12.27 hrs HW=2,175.74' TW=2,158.02' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 51.61 cfs @ 10.51 fps)
- **2=Broad-Crested Rectangular Weir** (Weir Controls 25.05 cfs @ 2.32 fps)
- **3=Broad-Crested Rectangular Weir** (Weir Controls 59.10 cfs @ 1.21 fps)

Pond 11P: KNOB HILL POND



Pond 11P: KNOB HILL POND



Summary for Pond 14P: FIDDLERS GREEN AUX POND

[86] Warning: Oscillations may require smaller dt (severity=1)

Inflow	=	17.11 cfs @	12.25 hrs,	Volume=	0.740 af
Outflow	=	7.12 cfs @	12.75 hrs,	Volume=	0.740 af, Atten= 58%, Lag= 29.8 min
Primary	=	7.12 cfs @	12.75 hrs,	Volume=	0.740 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,158.45' @ 12.45 hrs Surf.Area= 7,423 sf Storage= 15,664 cf

Plug-Flow detention time= 25.3 min calculated for 0.740 af (100% of inflow)
Center-of-Mass det. time= 25.3 min (825.3 - 800.0)

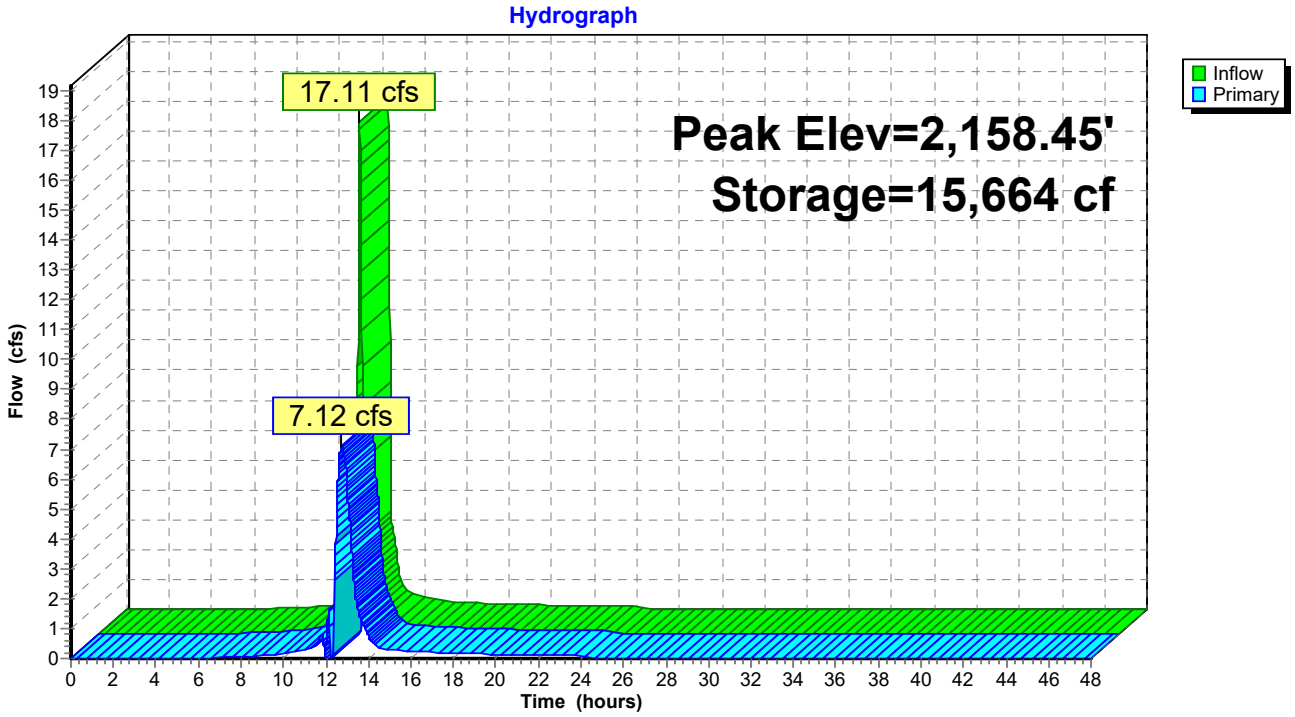
Volume	Invert	Avail.Storage	Storage Description
#1	2,155.50'	27,923 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,155.50	0	0	0
2,156.00	3,036	759	759
2,157.00	6,522	4,779	5,538
2,158.00	7,134	6,828	12,366
2,159.00	7,772	7,453	19,819
2,160.00	8,436	8,104	27,923

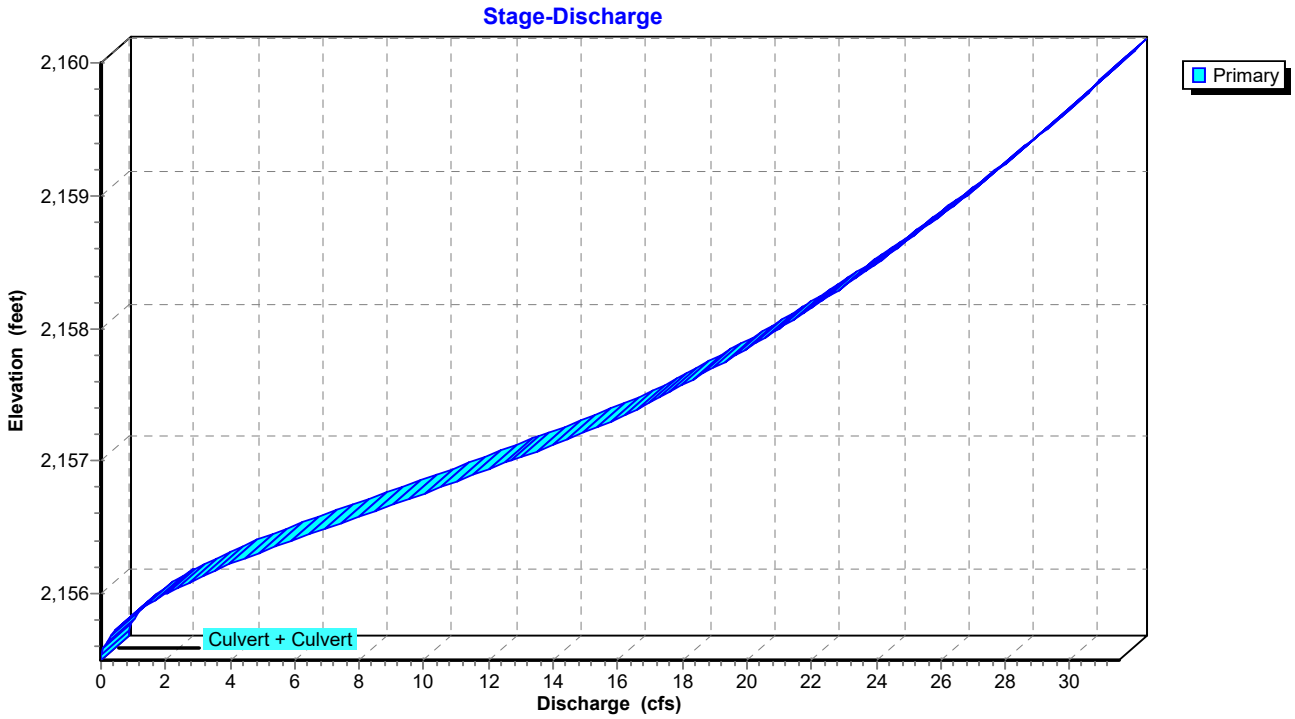
Device	Routing	Invert	Outlet Devices
#1	Primary	2,155.50'	**24.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Primary	2,155.50'	**15.0" Round Culvert** L= 91.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,155.50' / 2,155.00' S= 0.0055 '/' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

Primary OutFlow Max=7.64 cfs @ 12.75 hrs HW=2,157.91' TW=2,157.70' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.49 cfs @ 1.75 fps)
└─**2=Culvert** (Inlet Controls 2.15 cfs @ 1.75 fps)

Pond 14P: FIDDLERS GREEN AUX POND



Pond 14P: FIDDLERS GREEN AUX POND



Summary for Pond 19P: EX 50"x31" CMP

[58] Hint: Peaked 1.24' above defined flood level

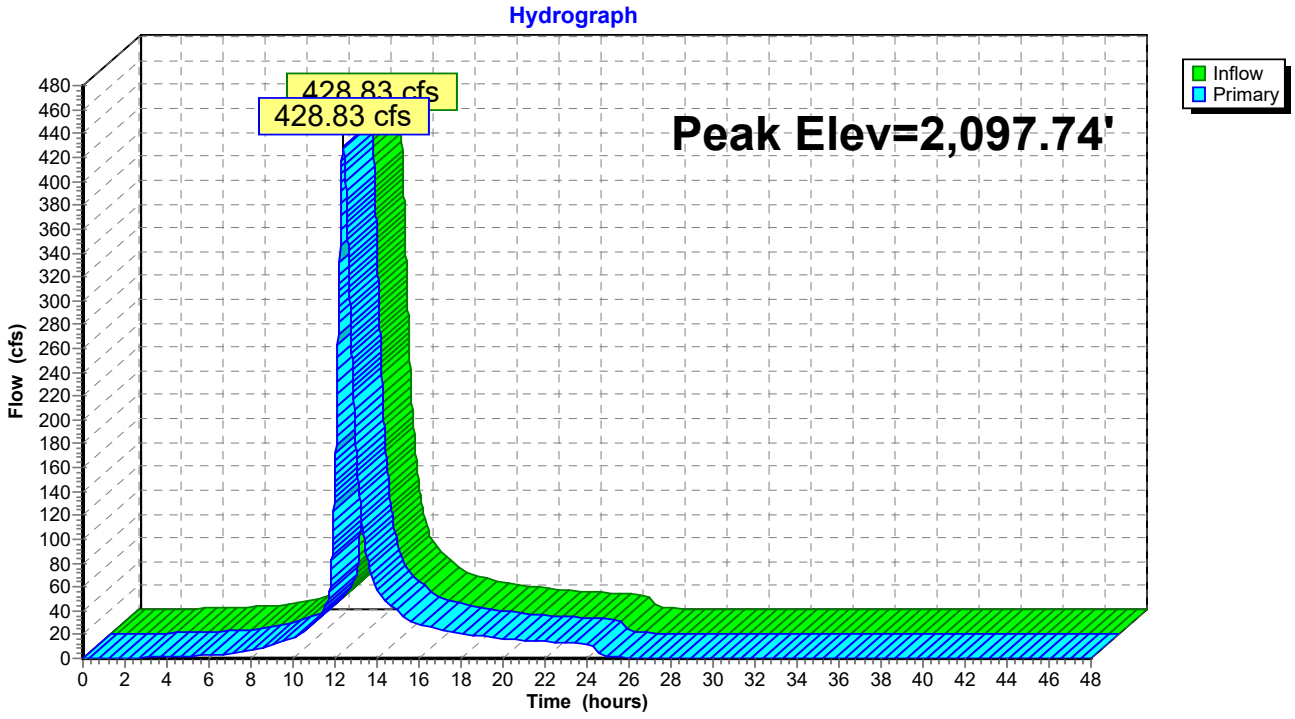
Inflow	=	428.83 cfs @	12.37 hrs,	Volume=	62.534 af
Outflow	=	428.83 cfs @	12.38 hrs,	Volume=	62.534 af, Atten= 0%, Lag= 0.6 min
Primary	=	428.83 cfs @	12.38 hrs,	Volume=	62.534 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.74' @ 12.38 hrs
Flood Elev= 2,096.50'

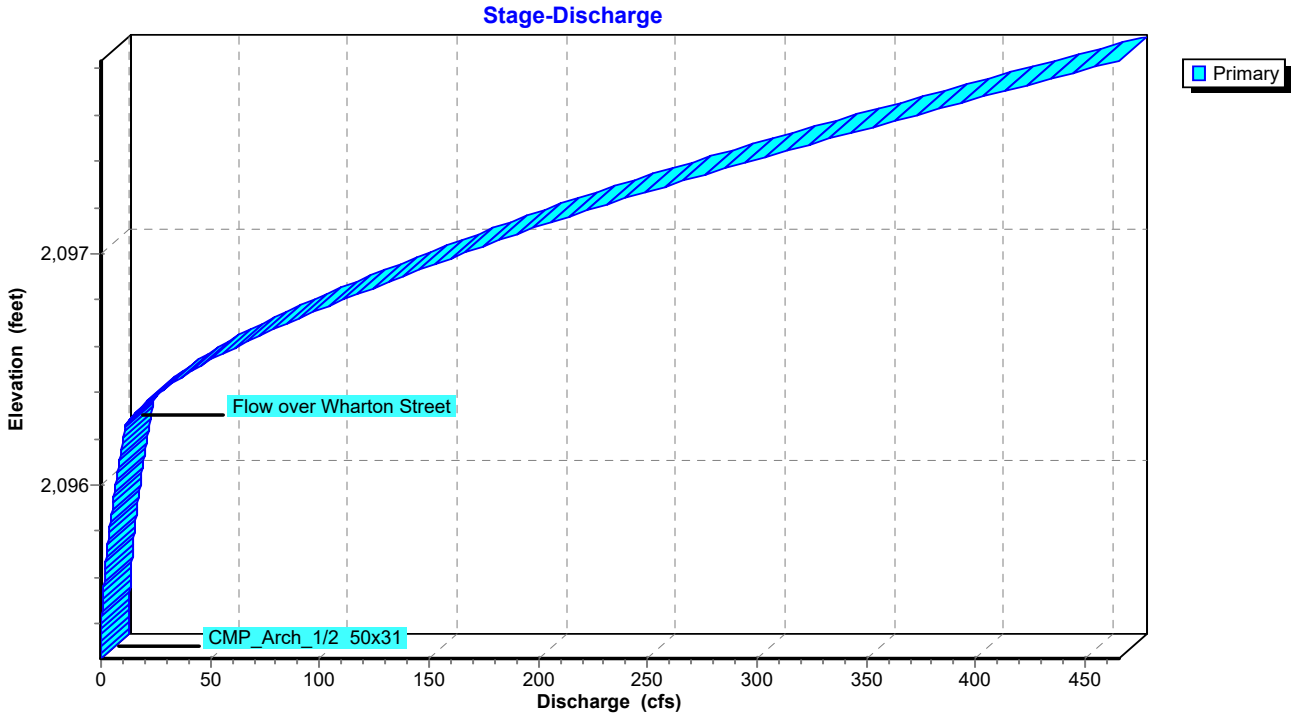
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

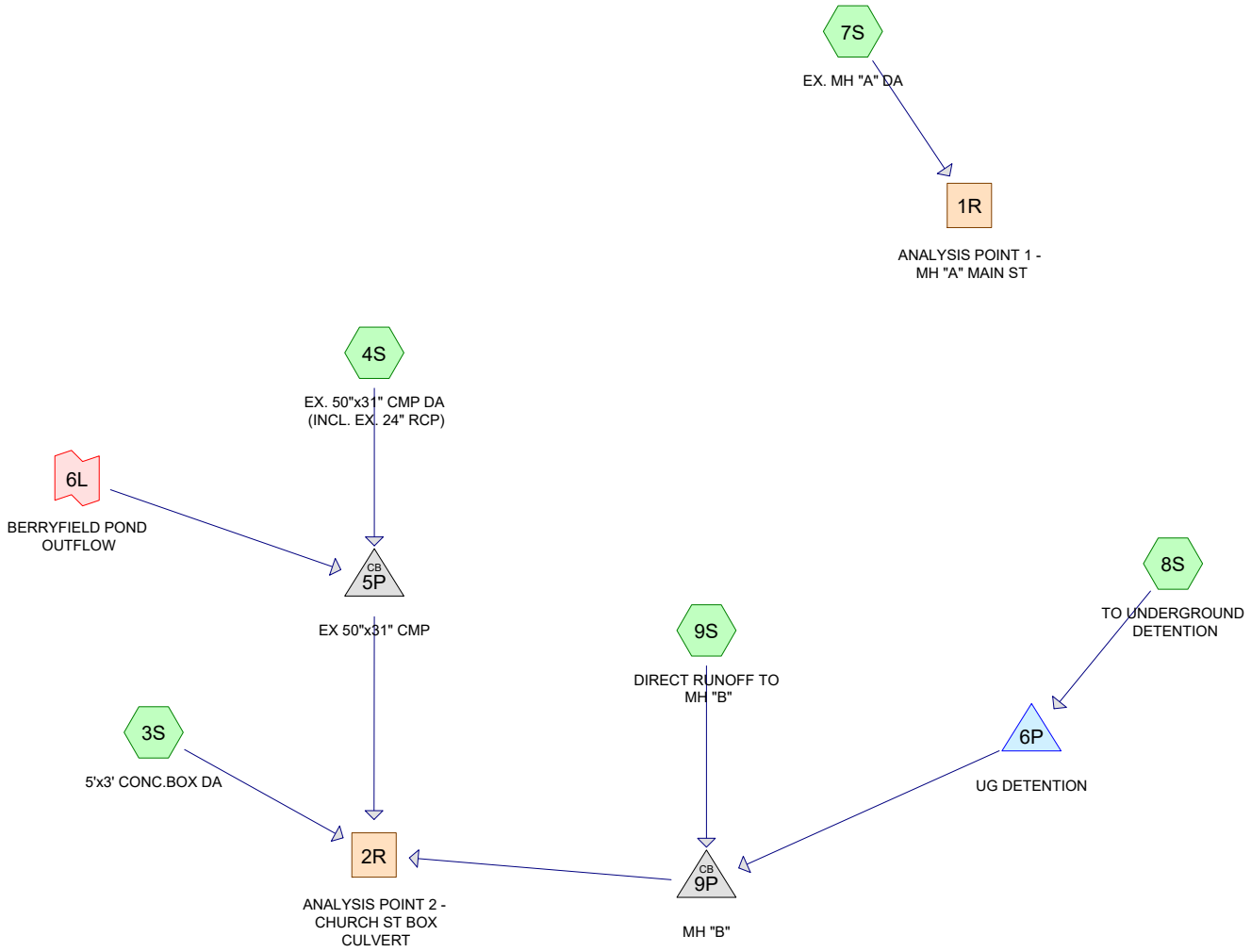
Primary OutFlow Max=428.80 cfs @ 12.38 hrs HW=2,097.74' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 44.33 cfs @ 5.32 fps)
└─**2=Flow over Wharton Street** (Weir Controls 384.47 cfs @ 3.22 fps)

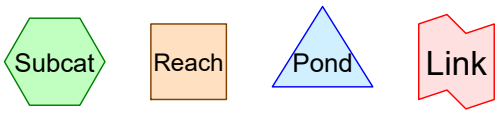
Pond 19P: EX 50"x31" CMP



Pond 19P: EX 50"x31" CMP







Routing Diagram for OBMS-POST
Prepared by Balzer & Associates, Inc., Printed 10/5/2017
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.094	80	1/2 acre lots, 25% imp, HSG C (3S)
0.122	85	1/2 acre lots, 25% imp, HSG D (3S)
0.330	81	1/3 acre lots, 30% imp, HSG C (8S)
1.676	83	1/4 acre lots, 38% imp, HSG C (3S)
2.736	87	1/4 acre lots, 38% imp, HSG D (3S)
0.287	90	1/8 acre lots, 65% imp, HSG C (3S)
1.682	92	1/8 acre lots, 65% imp, HSG D (3S)
2.404	74	>75% Grass cover, Good, HSG C (3S, 4S, 8S)
4.087	80	>75% Grass cover, Good, HSG D (3S, 4S, 7S, 8S, 9S)
4.015	90	Carry Over from Villas Infiltration Pits (8S)
0.846	91	PRD Parcel #3 (8S)
1.965	92	PRD Parcel #4 (8S)
2.079	93	PRD Parcel #5 (8S)
1.692	92	PRD Parcel #6 (8S)
1.616	98	Paved parking, HSG C (4S, 7S, 8S)
10.069	98	Paved parking, HSG D (3S, 7S, 8S, 9S)
0.593	98	Paved roads w/curbs & sewers, HSG C (3S)
2.408	98	Paved roads w/curbs & sewers, HSG D (3S, 7S)
1.096	92	Paved roads w/open ditches, 50% imp, HSG C (4S)
0.005	93	Paved roads w/open ditches, 50% imp, HSG D (4S)
0.183	94	Urban commercial, 85% imp, HSG C (3S)
0.201	95	Urban commercial, 85% imp, HSG D (3S)
0.584	70	Woods, Good, HSG C (4S)
40.770	**91**	**TOTAL AREA**

Summary for Subcatchment 3S: 5'x3' CONC.BOX DA

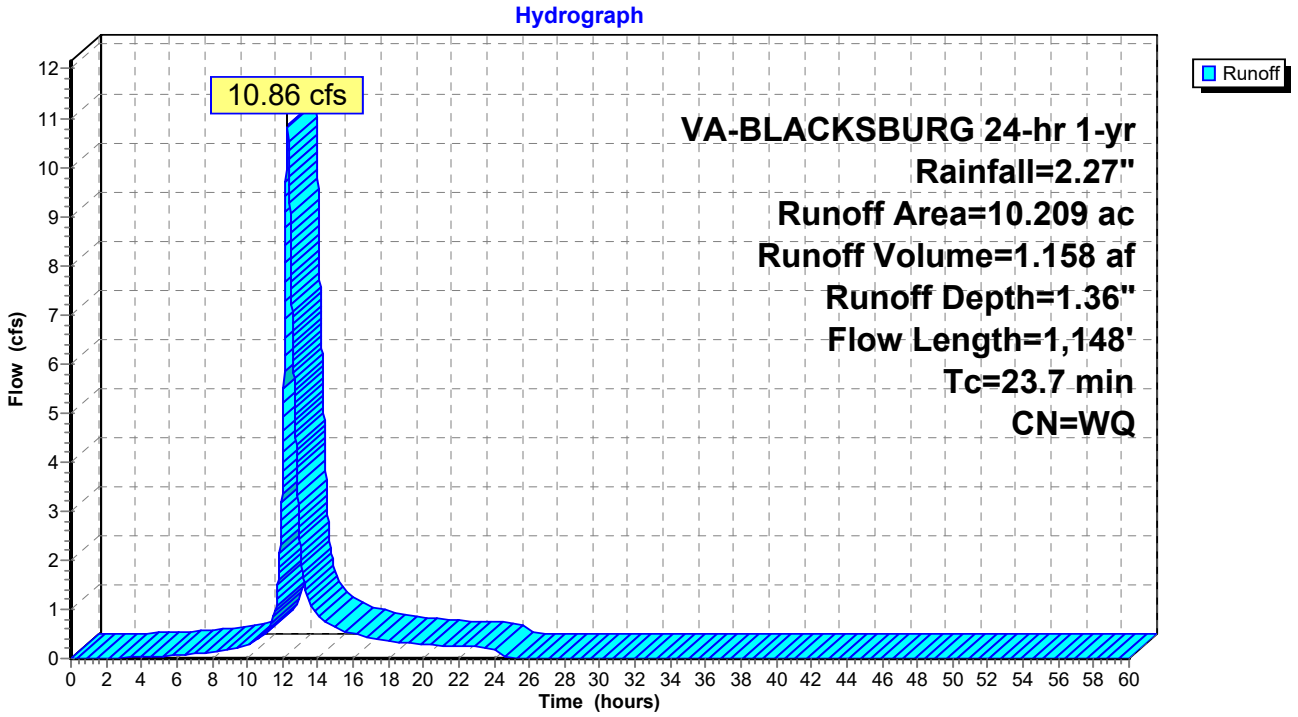
Runoff = 10.86 cfs @ 12.29 hrs, Volume= 1.158 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.101	74	>75% Grass cover, Good, HSG C
0.620	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.201	95	Urban commercial, 85% imp, HSG D
0.593	98	Paved roads w/curbs & sewers, HSG C
1.692	98	Paved roads w/curbs & sewers, HSG D
0.222	98	Paved parking, HSG D
10.209		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 3S: 5'x3' CONC.BOX DA



Summary for Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)

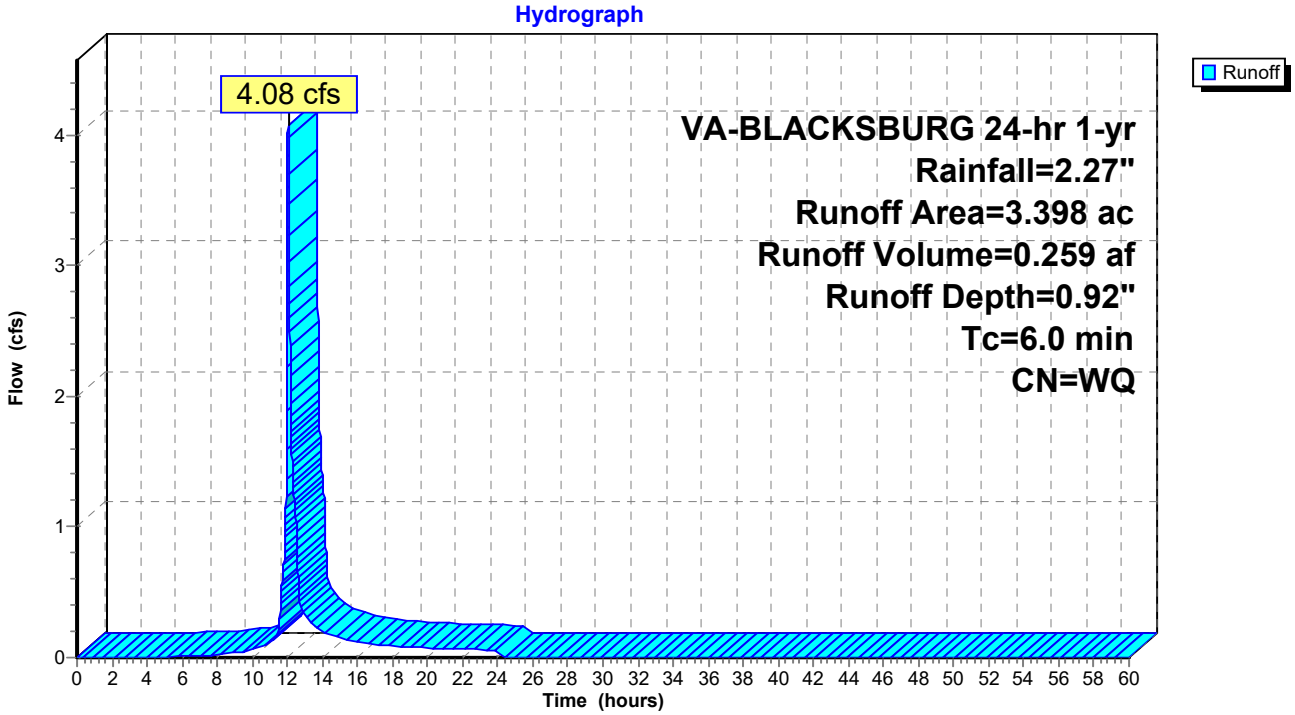
Runoff = 4.08 cfs @ 12.04 hrs, Volume= 0.259 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
1.371	74	>75% Grass cover, Good, HSG C
0.067	80	>75% Grass cover, Good, HSG D
0.584	70	Woods, Good, HSG C
1.096	92	Paved roads w/open ditches, 50% imp, HSG C
0.005	93	Paved roads w/open ditches, 50% imp, HSG D
0.275	98	Paved parking, HSG C
3.398		Weighted Average

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

Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)



Summary for Subcatchment 7S: EX. MH "A" DA

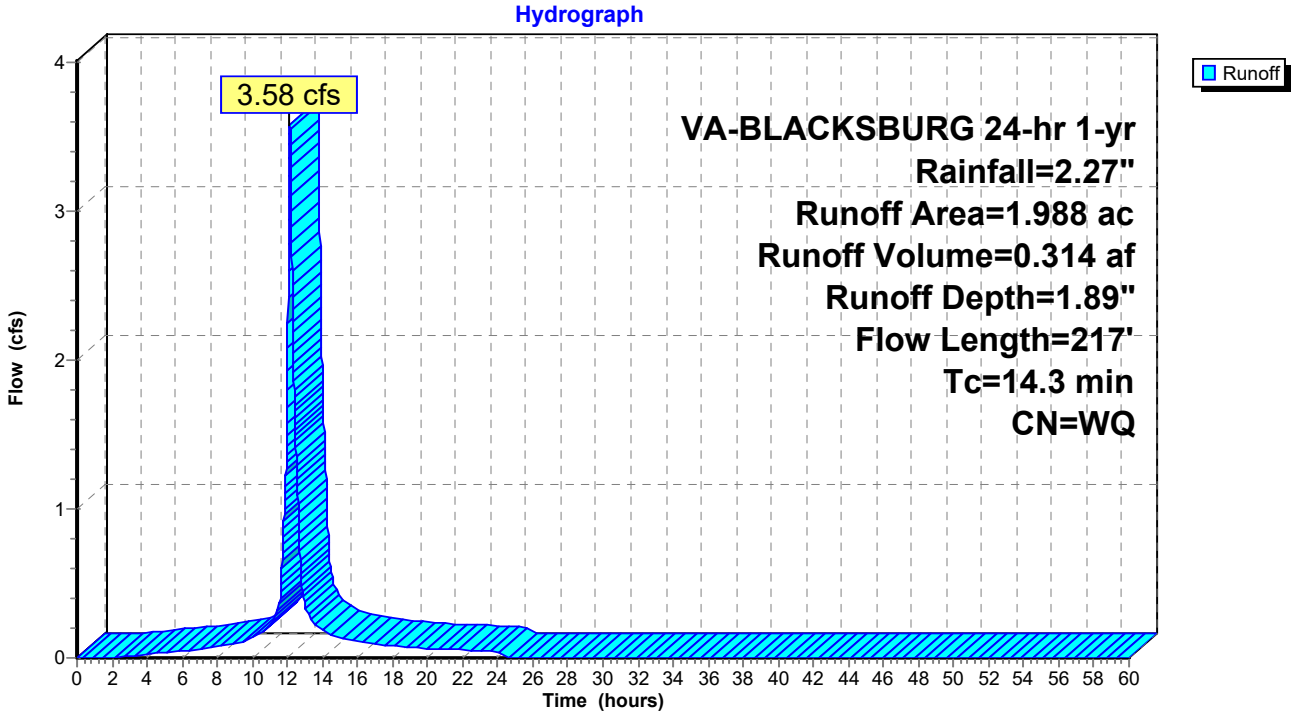
Runoff = 3.58 cfs @ 12.15 hrs, Volume= 0.314 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.011	98	Paved parking, HSG C
1.037	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
0.224	80	>75% Grass cover, Good, HSG D
1.988		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	150	0.0567	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	67	0.0820	4.30		**Shallow Concentrated Flow, Tc2** Grassed Waterway Kv= 15.0 fps
14.3	217	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 8S: TO UNDERGROUND DETENTION

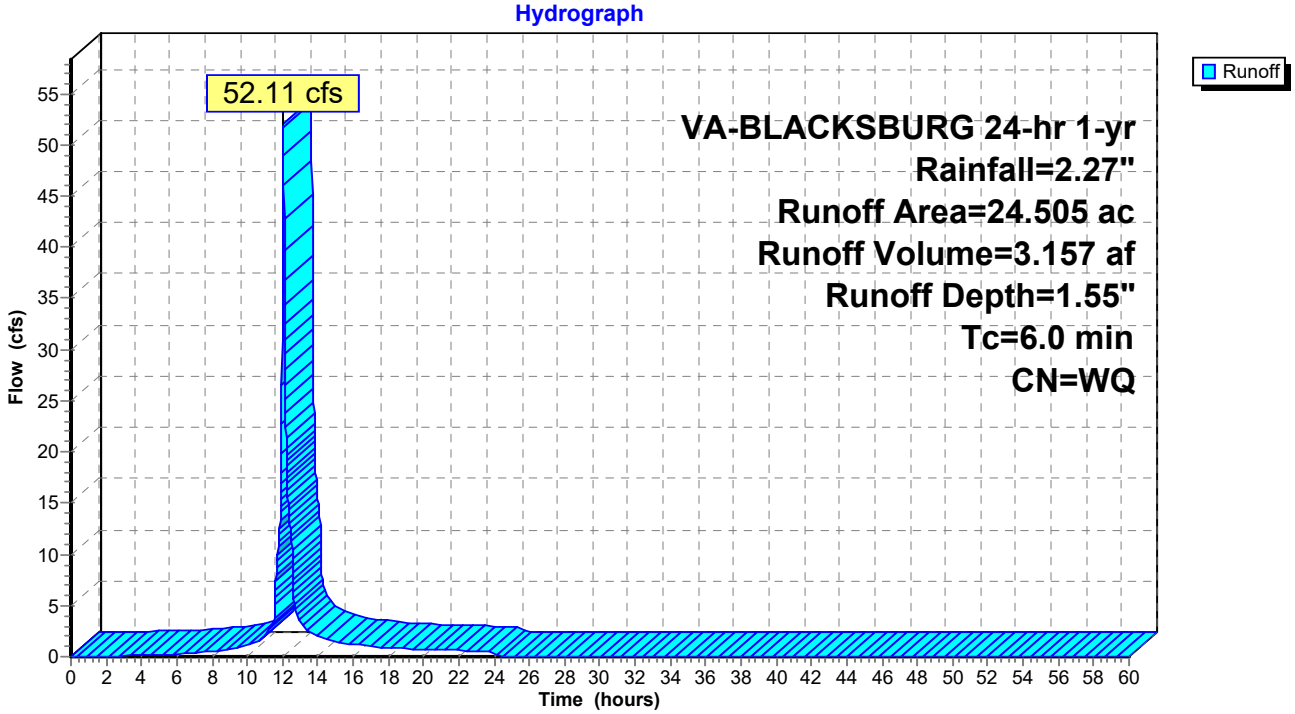
Runoff = 52.11 cfs @ 12.04 hrs, Volume= 3.157 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	1.330	98	Paved parking, HSG C
	8.380	98	Paved parking, HSG D
	0.932	74	>75% Grass cover, Good, HSG C
	2.936	80	>75% Grass cover, Good, HSG D
*	0.846	91	PRD Parcel #3
*	1.965	92	PRD Parcel #4
*	2.079	93	PRD Parcel #5
*	1.692	92	PRD Parcel #6
	0.330	81	1/3 acre lots, 30% imp, HSG C
*	4.015	90	Carry Over from Villas Infiltration Pits
	24.505		Weighted Average

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

Subcatchment 8S: TO UNDERGROUND DETENTION



Summary for Subcatchment 9S: DIRECT RUNOFF TO MH "B"

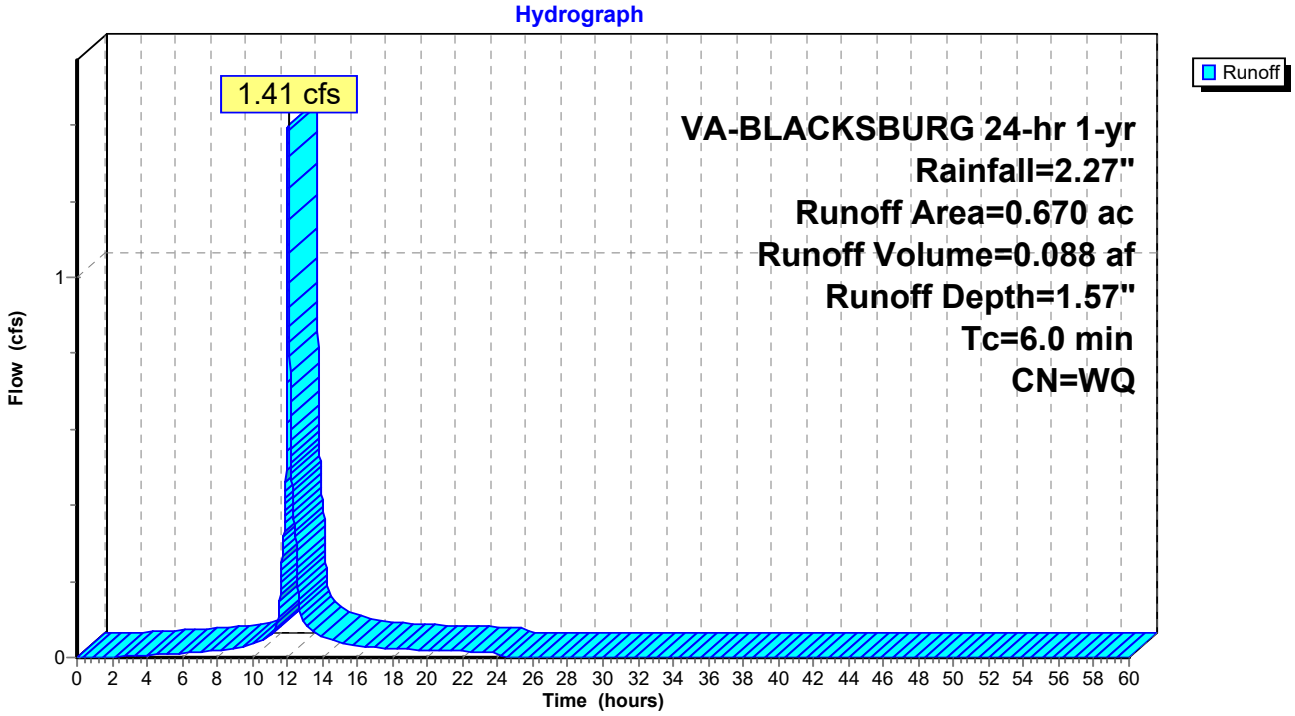
Runoff = 1.41 cfs @ 12.04 hrs, Volume= 0.088 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.430	98	Paved parking, HSG D
0.240	80	>75% Grass cover, Good, HSG D
0.670		Weighted Average

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

Subcatchment 9S: DIRECT RUNOFF TO MH "B"



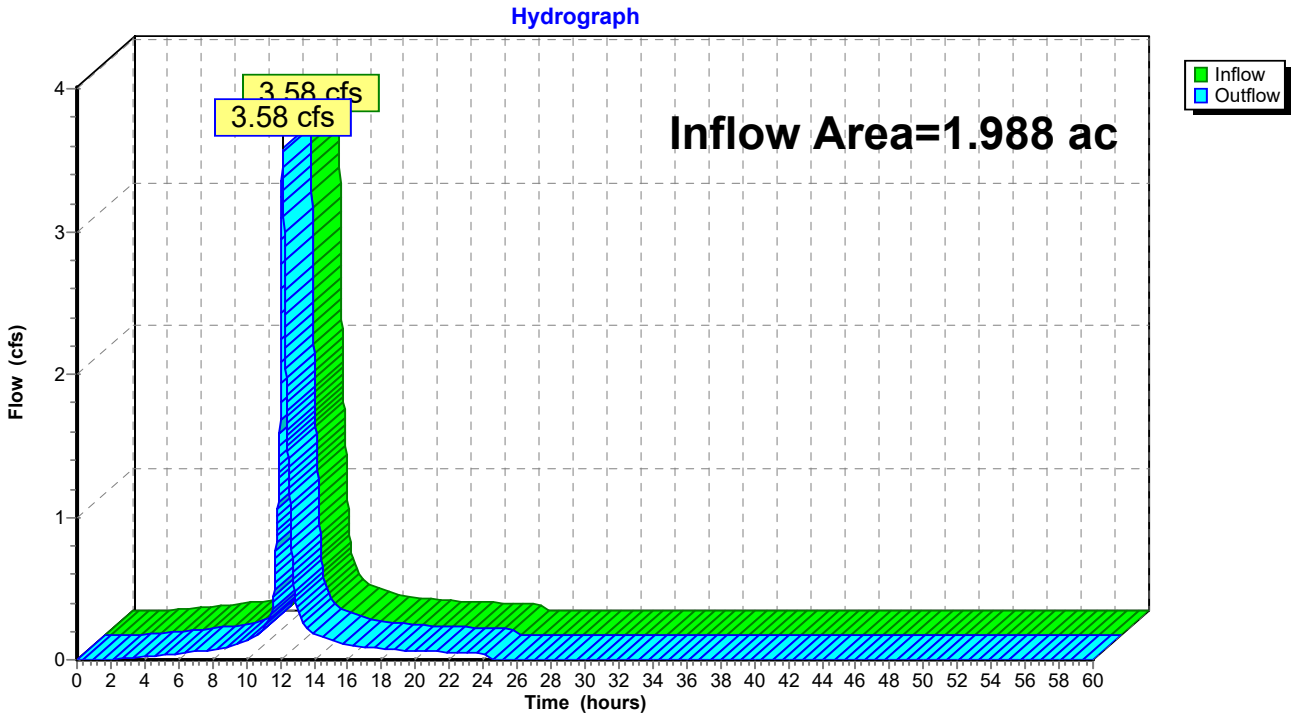
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.988 ac, Inflow Depth = 1.89" for 1-yr event
Inflow = 3.58 cfs @ 12.15 hrs, Volume= 0.314 af
Outflow = 3.58 cfs @ 12.15 hrs, Volume= 0.314 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



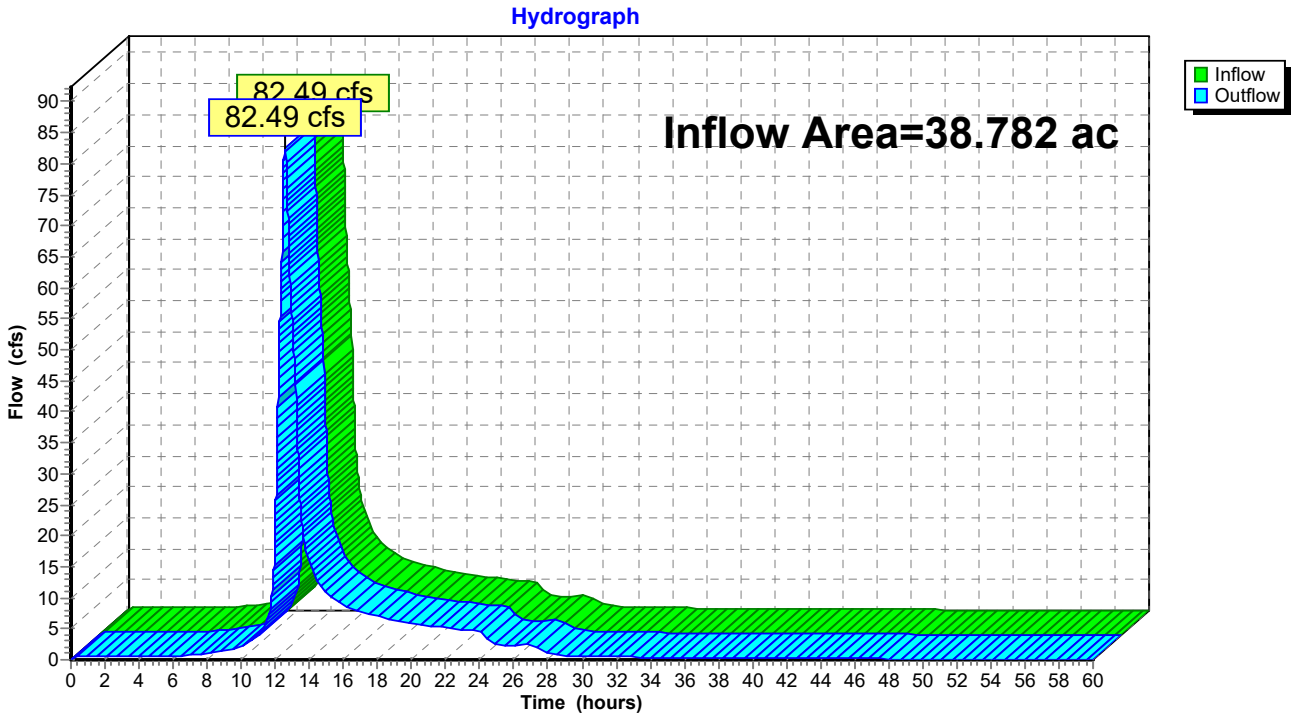
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 38.782 ac, Inflow Depth = 5.04" for 1-yr event
Inflow = 82.49 cfs @ 12.55 hrs, Volume= 16.279 af
Outflow = 82.49 cfs @ 12.55 hrs, Volume= 16.279 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT



Summary for Pond 5P: EX 50"x31" CMP

[58] Hint: Peaked 0.14' above defined flood level

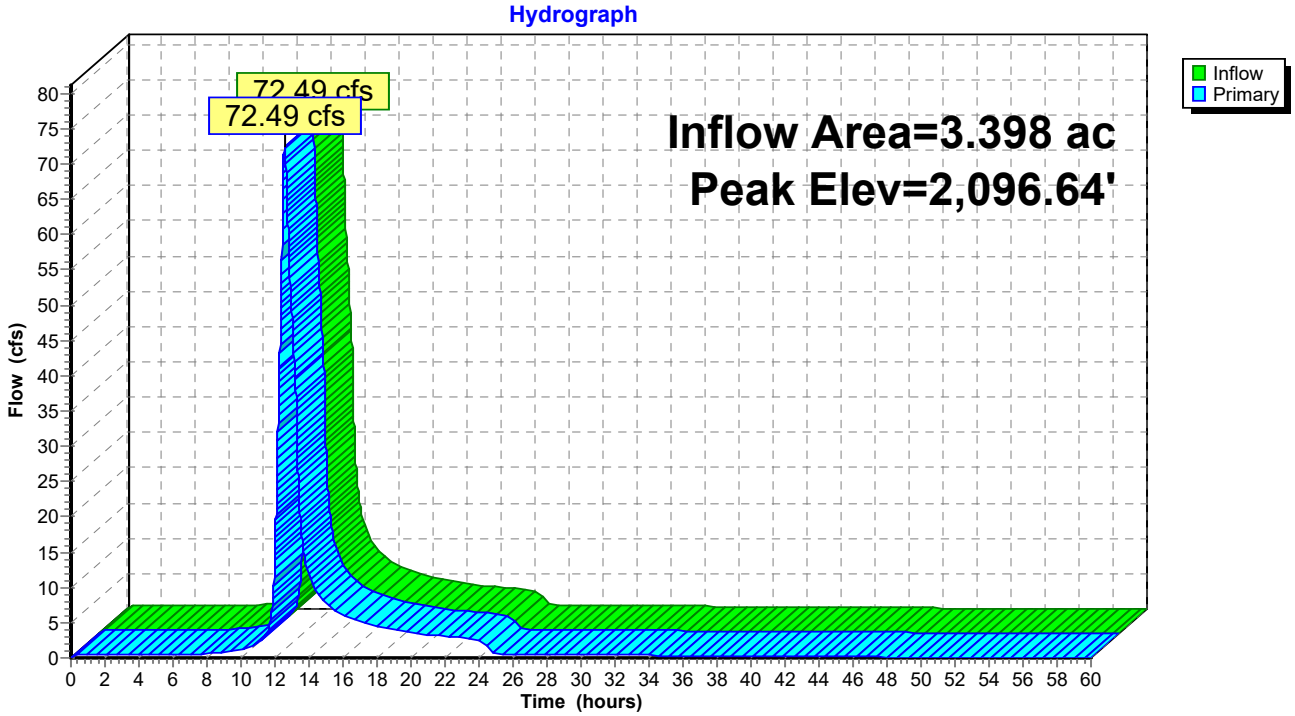
Inflow Area =	3.398 ac,	Inflow Depth = 41.97"	for 1-yr event		
Inflow =	72.49 cfs @	12.56 hrs,	Volume=	11.885 af	
Outflow =	72.49 cfs @	12.56 hrs,	Volume=	11.885 af,	Atten= 0%, Lag= 0.0 min
Primary =	72.49 cfs @	12.56 hrs,	Volume=	11.885 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.64' @ 12.56 hrs
Flood Elev= 2,096.50'

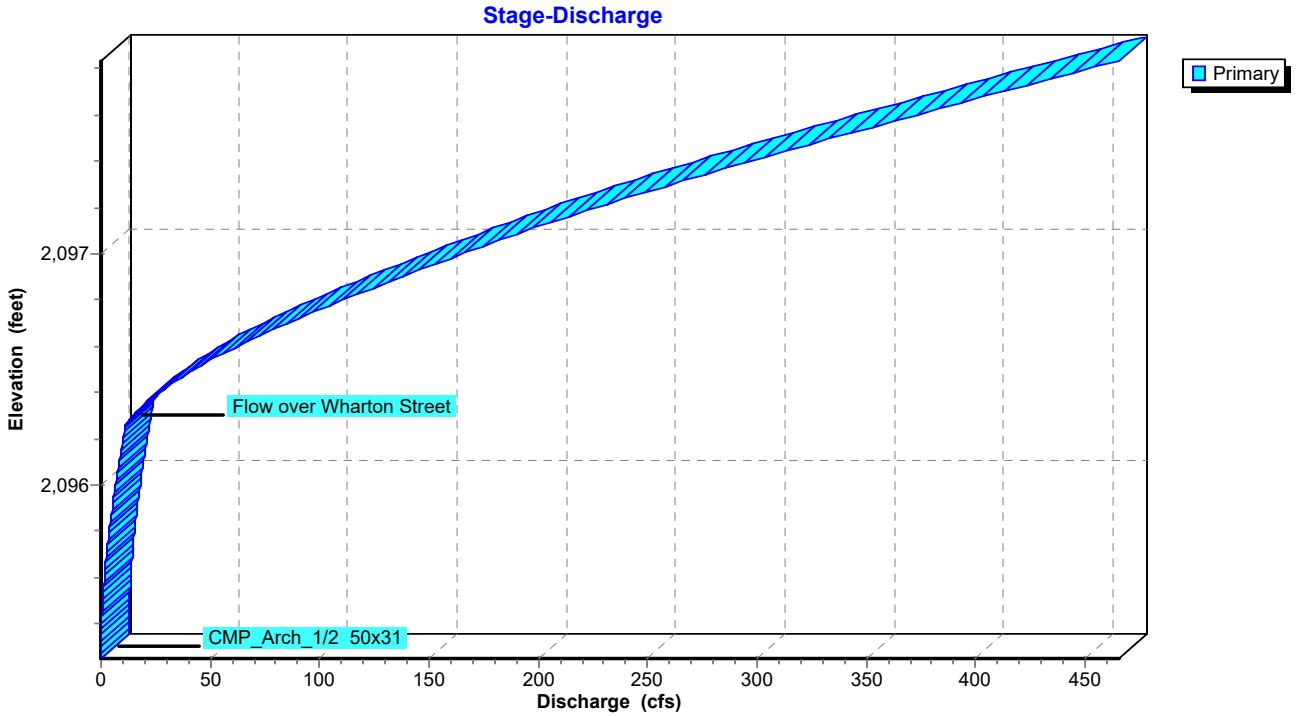
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=72.48 cfs @ 12.56 hrs HW=2,096.64' (Free Discharge)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 19.03 cfs @ 3.67 fps)
└─**2=Flow over Wharton Street** (Weir Controls 53.45 cfs @ 1.69 fps)

Pond 5P: EX 50"x31" CMP



Pond 5P: EX 50"x31" CMP



Summary for Pond 6P: UG DETENTION

Inflow Area = 24.505 ac, Inflow Depth = 1.55" for 1-yr event
Inflow = 52.11 cfs @ 12.04 hrs, Volume= 3.157 af
Outflow = 3.39 cfs @ 13.00 hrs, Volume= 3.148 af, Atten= 93%, Lag= 57.8 min
Primary = 3.39 cfs @ 13.00 hrs, Volume= 3.148 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,114.11' @ 13.00 hrs Surf.Area= 0.412 ac Storage= 1.635 af

Plug-Flow detention time= 324.8 min calculated for 3.148 af (100% of inflow)
Center-of-Mass det. time= 323.0 min (1,116.0 - 792.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,107.50'	1.103 af	**83.00'W x 216.42'L x 9.50'H Field A** 3.917 af Overall - 1.159 af Embedded = 2.759 af x 40.0% Voids
#2A	2,111.00'	1.159 af	**ADS_StormTech MC-4500 +Cap** x 468 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 9 Rows of 52 Chambers Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf
		2.262 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,107.50'	**30.0" Round 30" HDPE Culvert** L= 474.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,107.50' / 2,104.10' S= 0.0072 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.91 sf
#2	Device 1	2,107.50'	**Reg-U-Flo CX 9.5-in**
#3	Device 1	2,113.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	2,114.75'	**8.0' 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=3.39 cfs @ 13.00 hrs HW=2,114.11' (Free Discharge)
└─**1=30" HDPE Culvert** (Passes 3.39 cfs of 50.07 cfs potential flow)
  ├─**2=Reg-U-Flo CX 9.5-in** (Custom Controls 2.27 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 1.13 cfs @ 2.65 fps)
  └─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: UG DETENTION - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

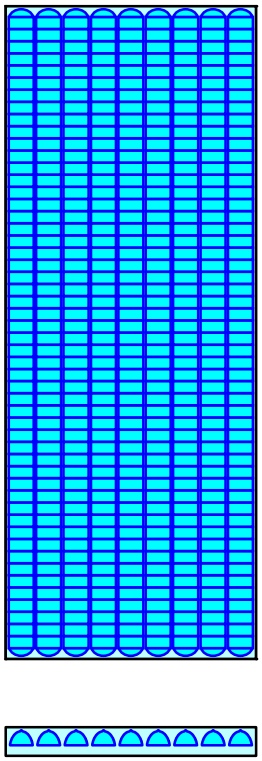
52 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 214.42' Row Length +12.0" End Stone x 2 = 216.42' Base Length
9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width
42.0" Base + 60.0" Chamber Height + 12.0" Cover = 9.50' Field Height

468 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 9 Rows = 50,480.1 cf Chamber Storage

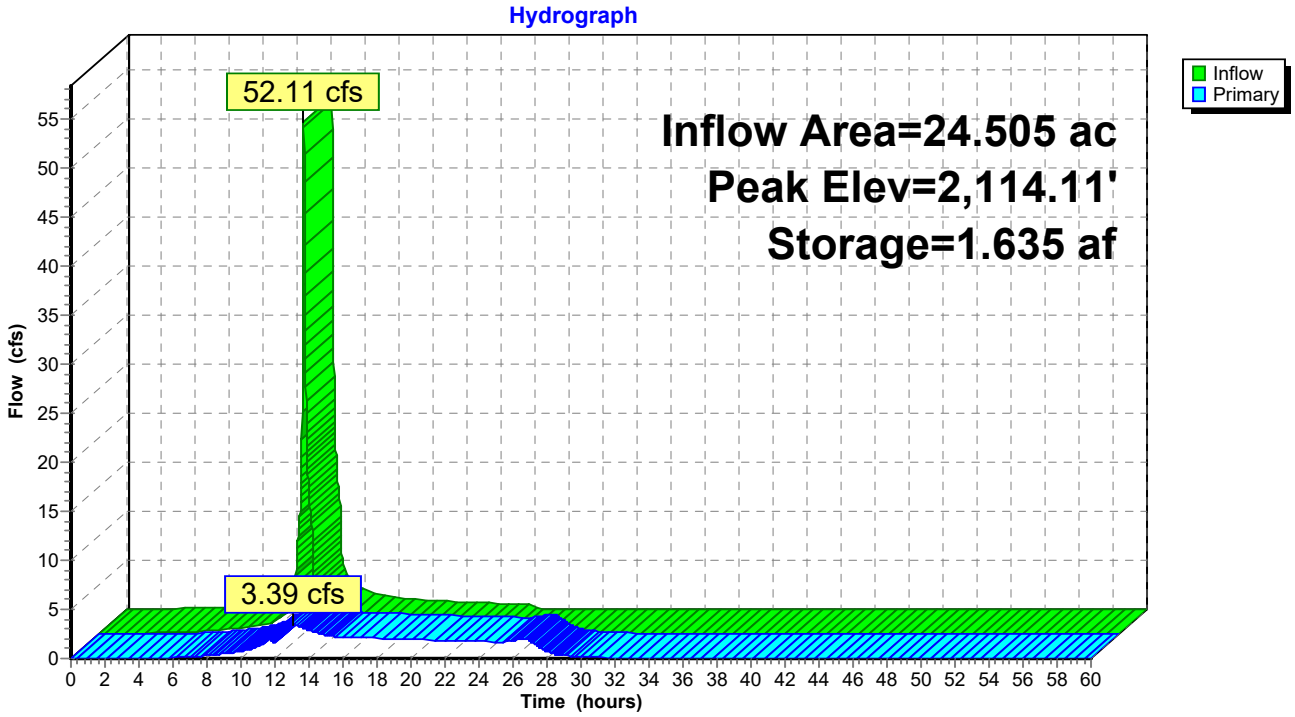
170,644.5 cf Field - 50,480.1 cf Chambers = 120,164.4 cf Stone x 40.0% Voids = 48,065.8 cf Stone Storage

Chamber Storage + Stone Storage = 98,545.9 cf = 2.262 af
Overall Storage Efficiency = 57.7%
Overall System Size = 216.42' x 83.00' x 9.50'

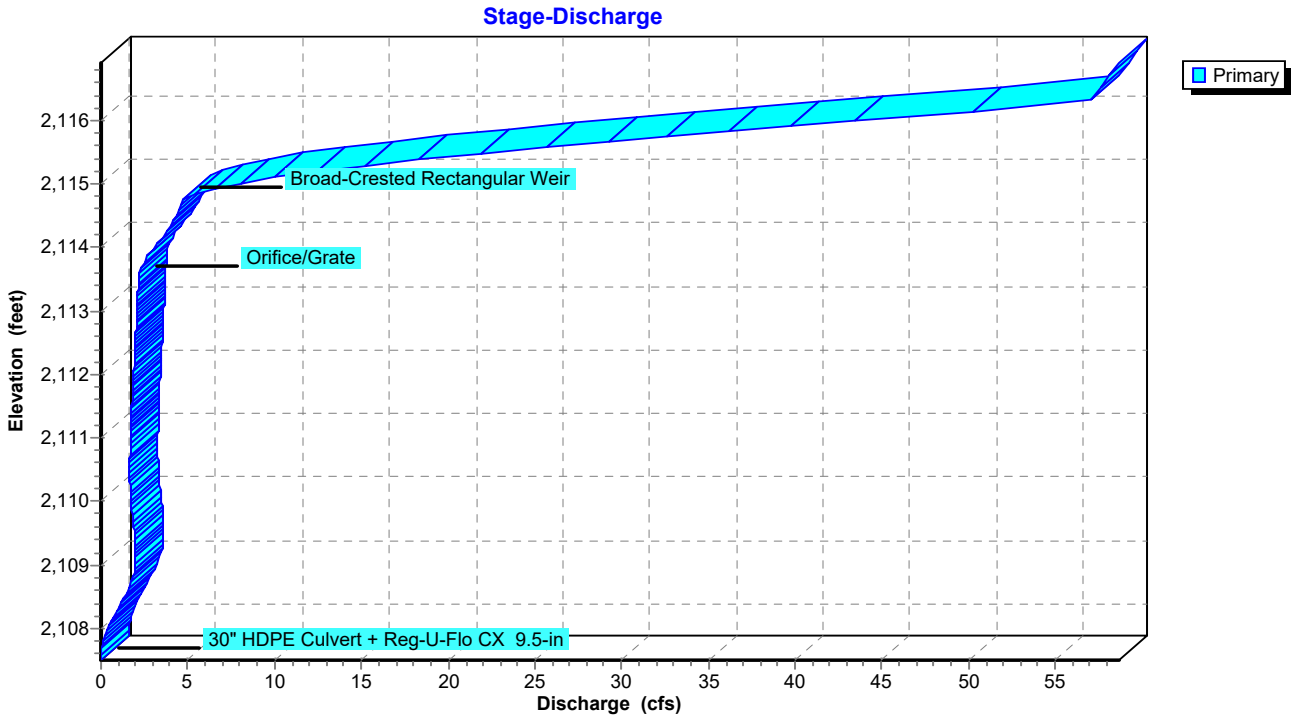
468 Chambers
6,320.2 cy Field
4,450.5 cy Stone



Pond 6P: UG DETENTION



Pond 6P: UG DETENTION



Summary for Pond 9P: MH "B"

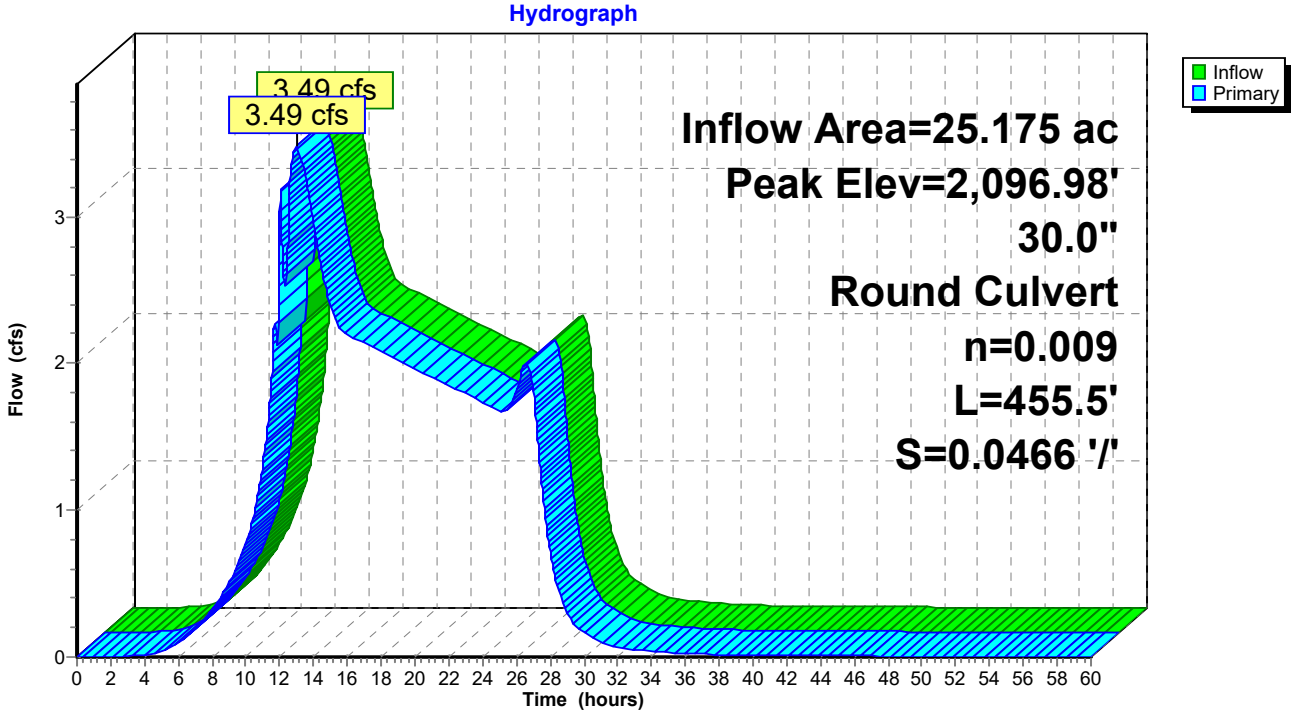
Inflow Area =	25.175 ac,	Inflow Depth >	1.54"	for	1-yr event
Inflow =	3.49 cfs @	12.97 hrs,	Volume=	3.236 af	
Outflow =	3.49 cfs @	12.97 hrs,	Volume=	3.236 af,	Atten= 0%, Lag= 0.0 min
Primary =	3.49 cfs @	12.97 hrs,	Volume=	3.236 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.98' @ 12.97 hrs
Flood Elev= 2,108.82'

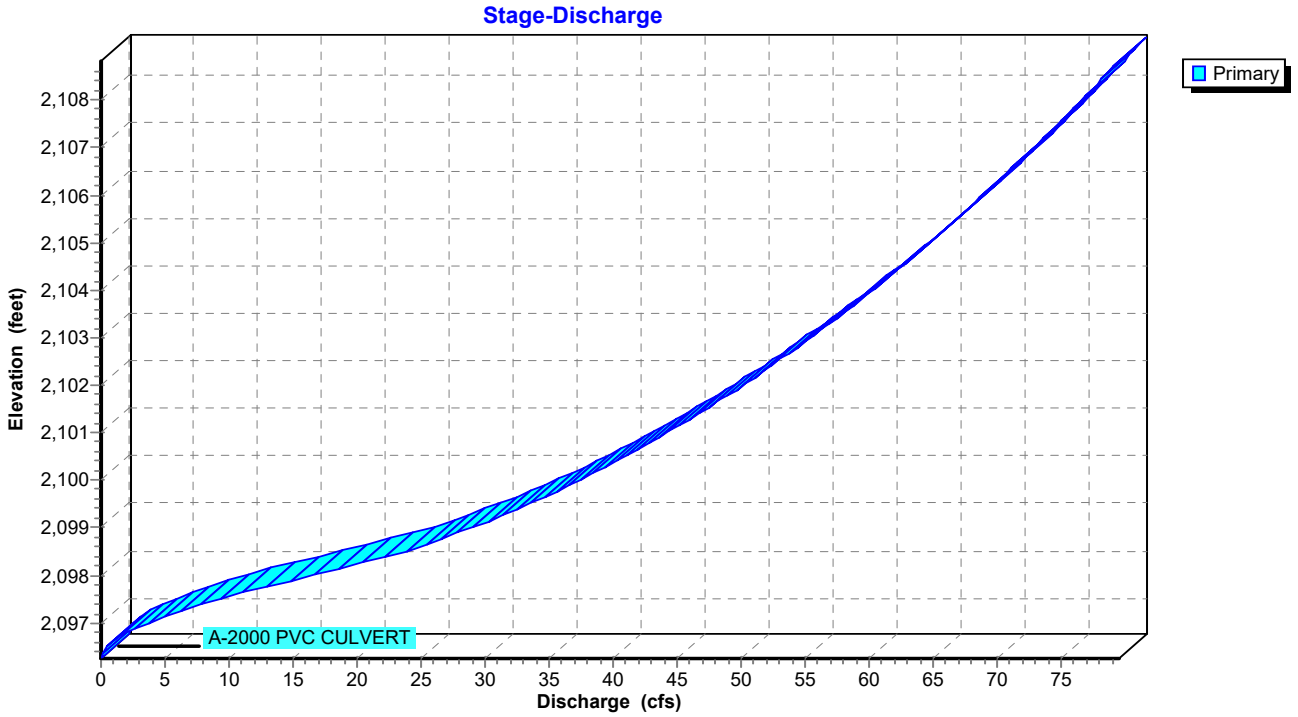
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.25'	**30.0" Round A-2000 PVC CULVERT** L= 455.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,096.25' / 2,075.02' S= 0.0466 '/' Cc= 0.900 n= 0.009, Flow Area= 4.91 sf

Primary OutFlow Max=3.47 cfs @ 12.97 hrs HW=2,096.98' (Free Discharge)
└─**1=A-2000 PVC CULVERT** (Inlet Controls 3.47 cfs @ 2.91 fps)

Pond 9P: MH "B"



Pond 9P: MH "B"


Stage-Discharge
Primary
Elevation (feet)
2,108
2,107
2,106
2,105
2,104
2,103
2,102
2,101
2,100
2,099
2,098
2,097
A-2000 PVC CULVERT
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Discharge (cfs)

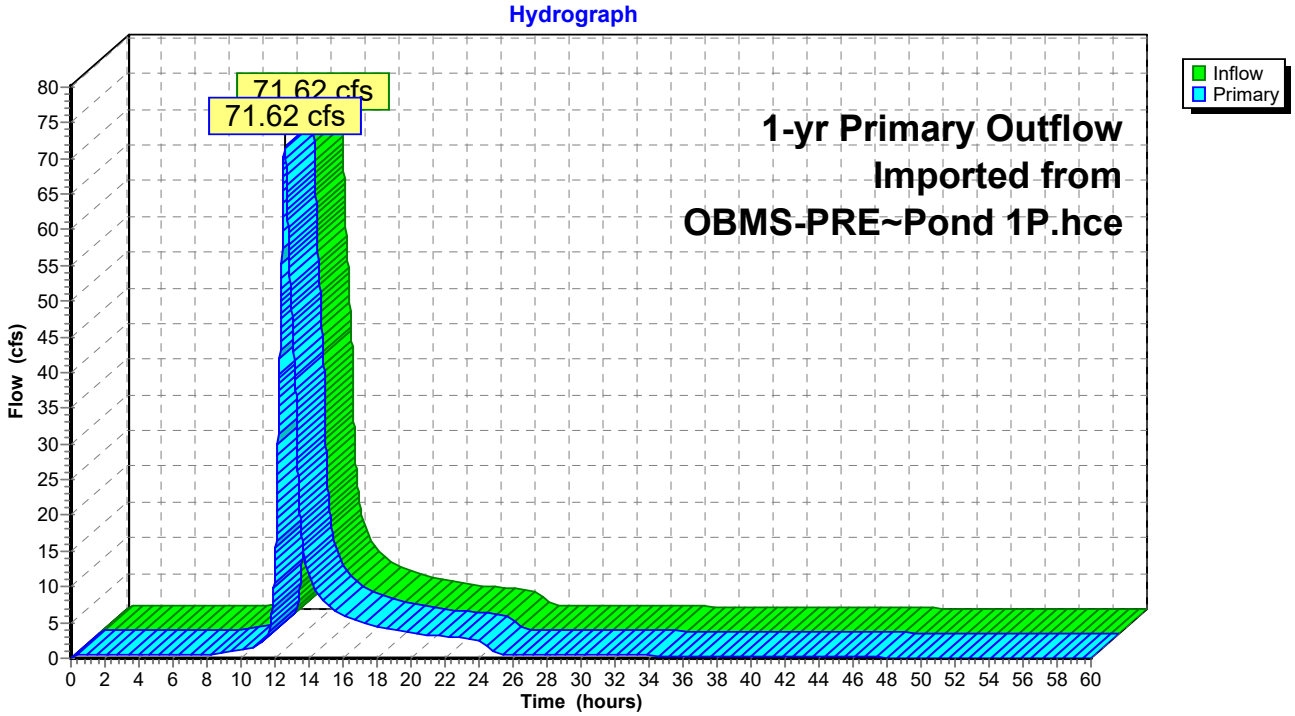
Summary for Link 6L: BERRYFIELD POND OUTFLOW

Inflow	=	71.62 cfs @	12.57 hrs,	Volume=	11.626 af
Primary	=	71.62 cfs @	12.57 hrs,	Volume=	11.626 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

1-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 6L: BERRYFIELD POND OUTFLOW



Summary for Subcatchment 3S: 5'x3' CONC.BOX DA

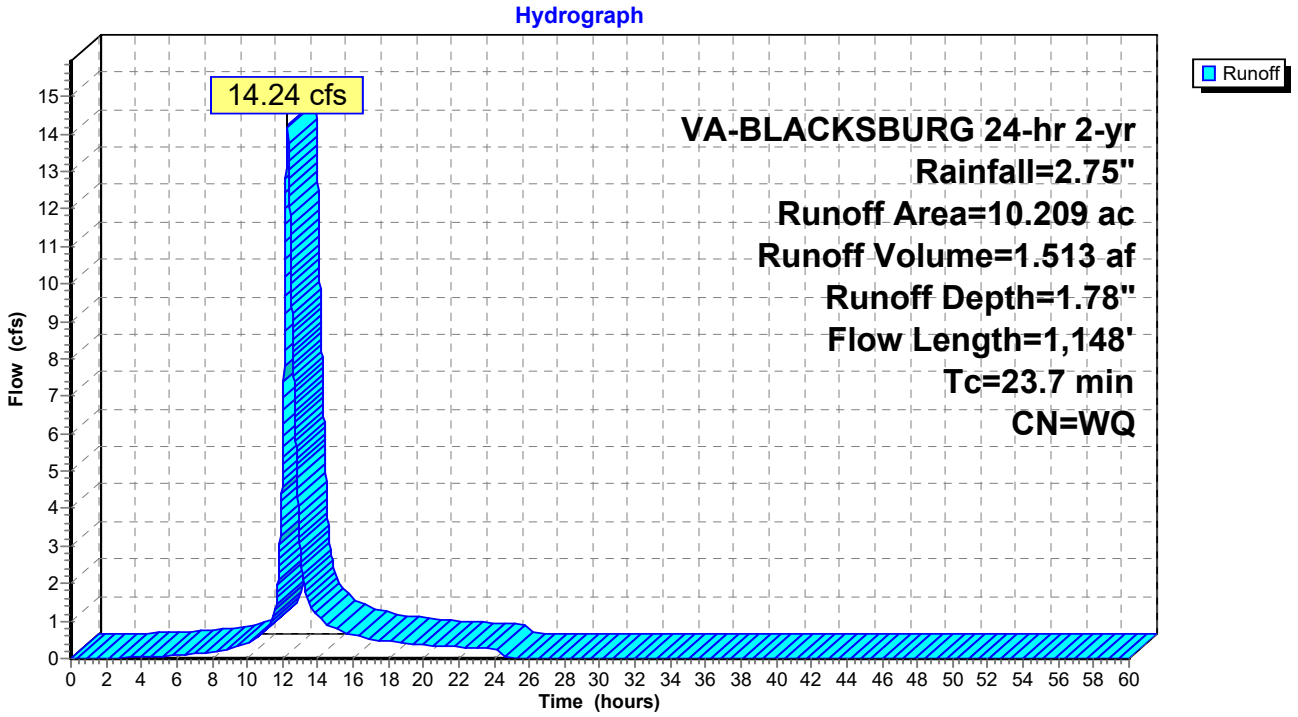
Runoff = 14.24 cfs @ 12.28 hrs, Volume= 1.513 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.101	74	>75% Grass cover, Good, HSG C
0.620	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.201	95	Urban commercial, 85% imp, HSG D
0.593	98	Paved roads w/curbs & sewers, HSG C
1.692	98	Paved roads w/curbs & sewers, HSG D
0.222	98	Paved parking, HSG D
10.209		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 3S: 5'x3' CONC.BOX DA



Summary for Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)

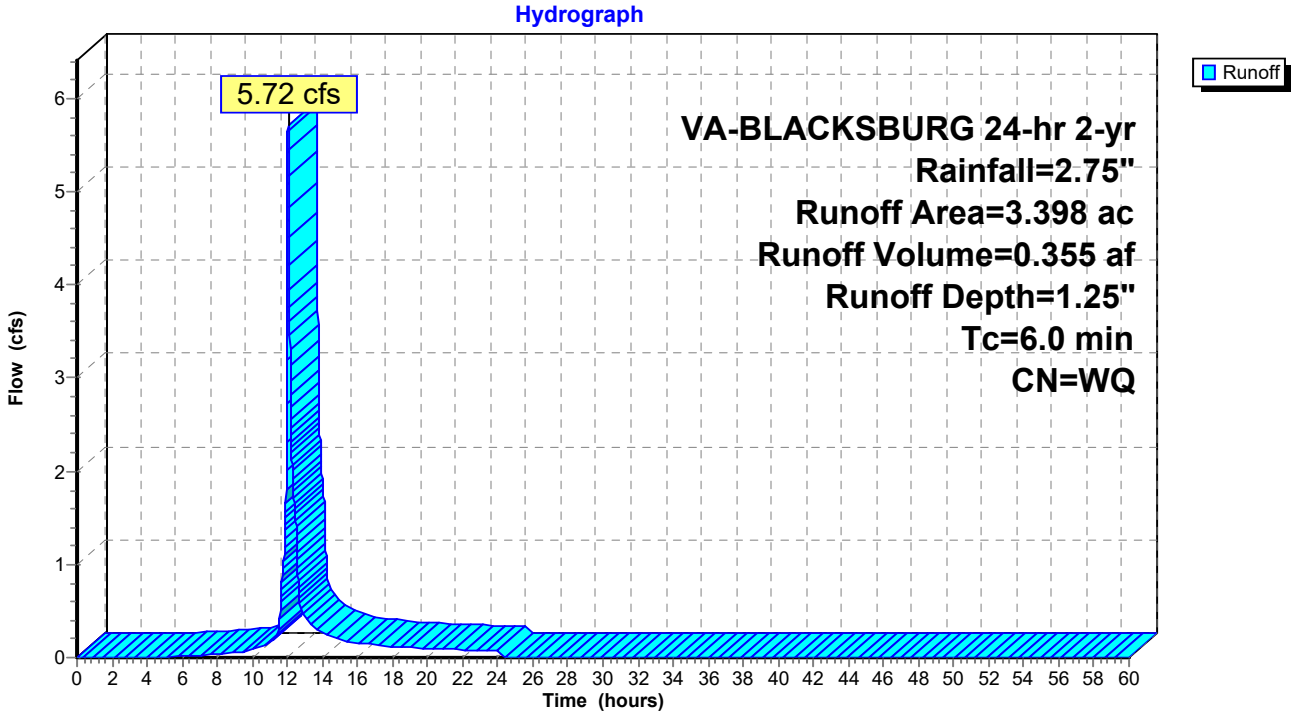
Runoff = 5.72 cfs @ 12.04 hrs, Volume= 0.355 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
1.371	74	>75% Grass cover, Good, HSG C
0.067	80	>75% Grass cover, Good, HSG D
0.584	70	Woods, Good, HSG C
1.096	92	Paved roads w/open ditches, 50% imp, HSG C
0.005	93	Paved roads w/open ditches, 50% imp, HSG D
0.275	98	Paved parking, HSG C
3.398		Weighted Average

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

Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)



Summary for Subcatchment 7S: EX. MH "A" DA

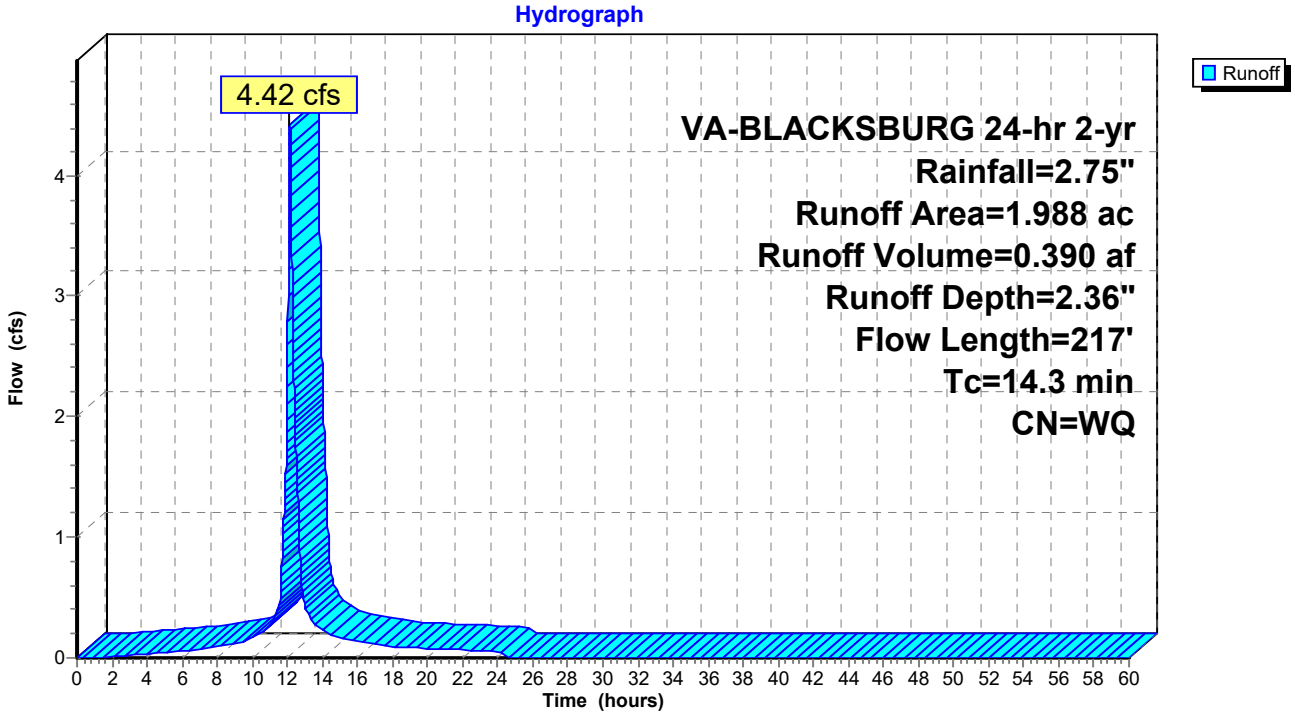
Runoff = 4.42 cfs @ 12.14 hrs, Volume= 0.390 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.011	98	Paved parking, HSG C
1.037	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
0.224	80	>75% Grass cover, Good, HSG D
1.988		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	150	0.0567	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	67	0.0820	4.30		**Shallow Concentrated Flow, Tc2** Grassed Waterway Kv= 15.0 fps
14.3	217	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 8S: TO UNDERGROUND DETENTION

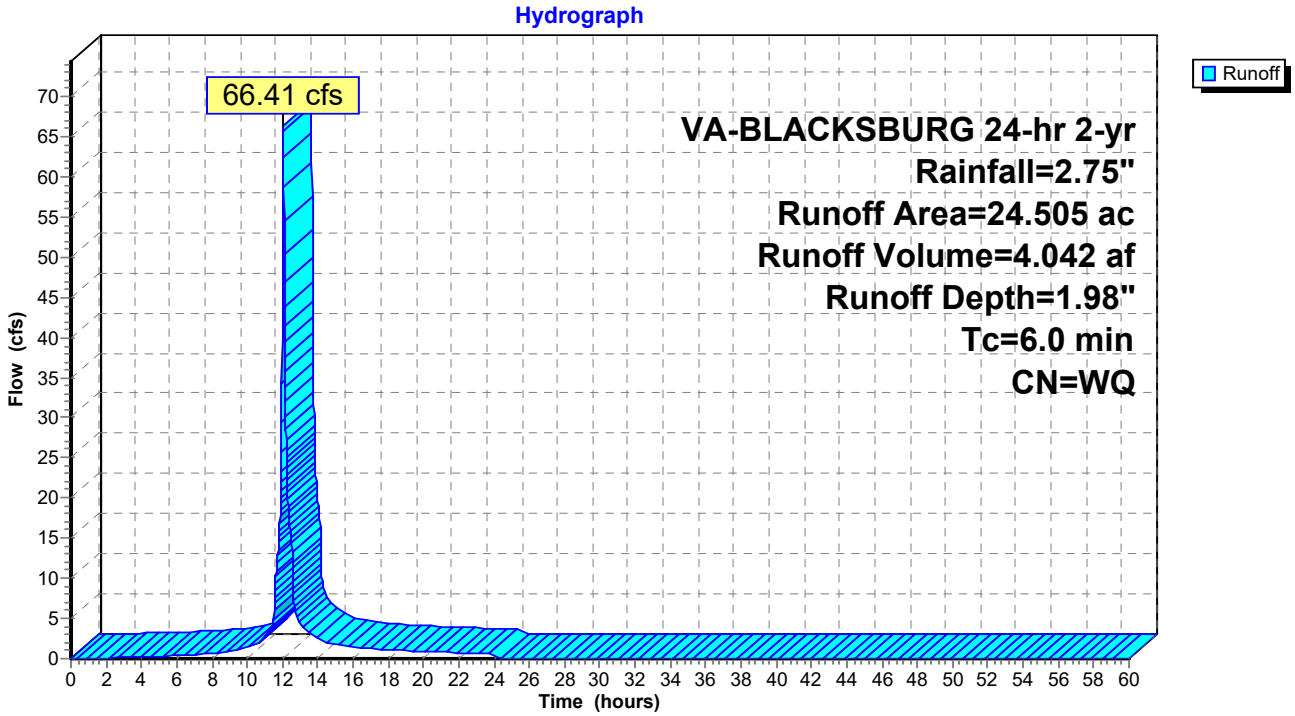
Runoff = 66.41 cfs @ 12.04 hrs, Volume= 4.042 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

	Area (ac)	CN	Description
	1.330	98	Paved parking, HSG C
	8.380	98	Paved parking, HSG D
	0.932	74	>75% Grass cover, Good, HSG C
	2.936	80	>75% Grass cover, Good, HSG D
*	0.846	91	PRD Parcel #3
*	1.965	92	PRD Parcel #4
*	2.079	93	PRD Parcel #5
*	1.692	92	PRD Parcel #6
	0.330	81	1/3 acre lots, 30% imp, HSG C
*	4.015	90	Carry Over from Villas Infiltration Pits
	24.505		Weighted Average

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

Subcatchment 8S: TO UNDERGROUND DETENTION



Summary for Subcatchment 9S: DIRECT RUNOFF TO MH "B"

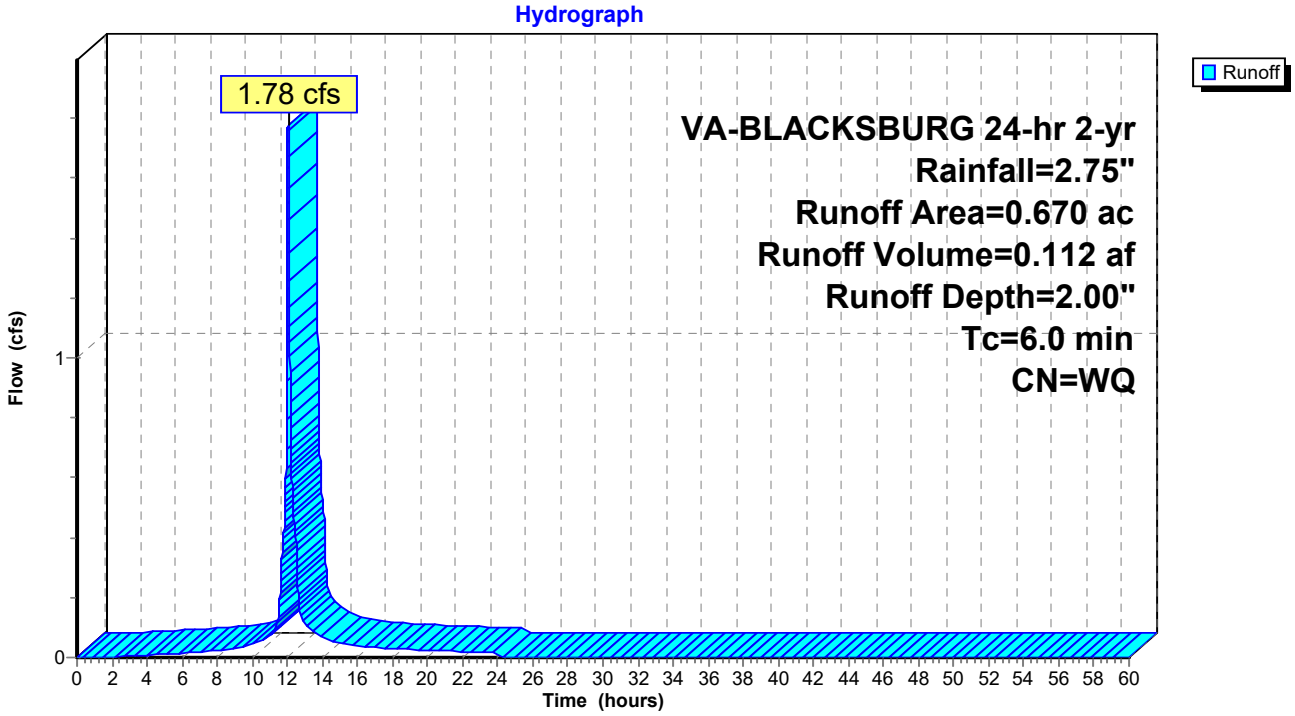
Runoff = 1.78 cfs @ 12.04 hrs, Volume= 0.112 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.430	98	Paved parking, HSG D
0.240	80	>75% Grass cover, Good, HSG D
0.670		Weighted Average

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

Subcatchment 9S: DIRECT RUNOFF TO MH "B"



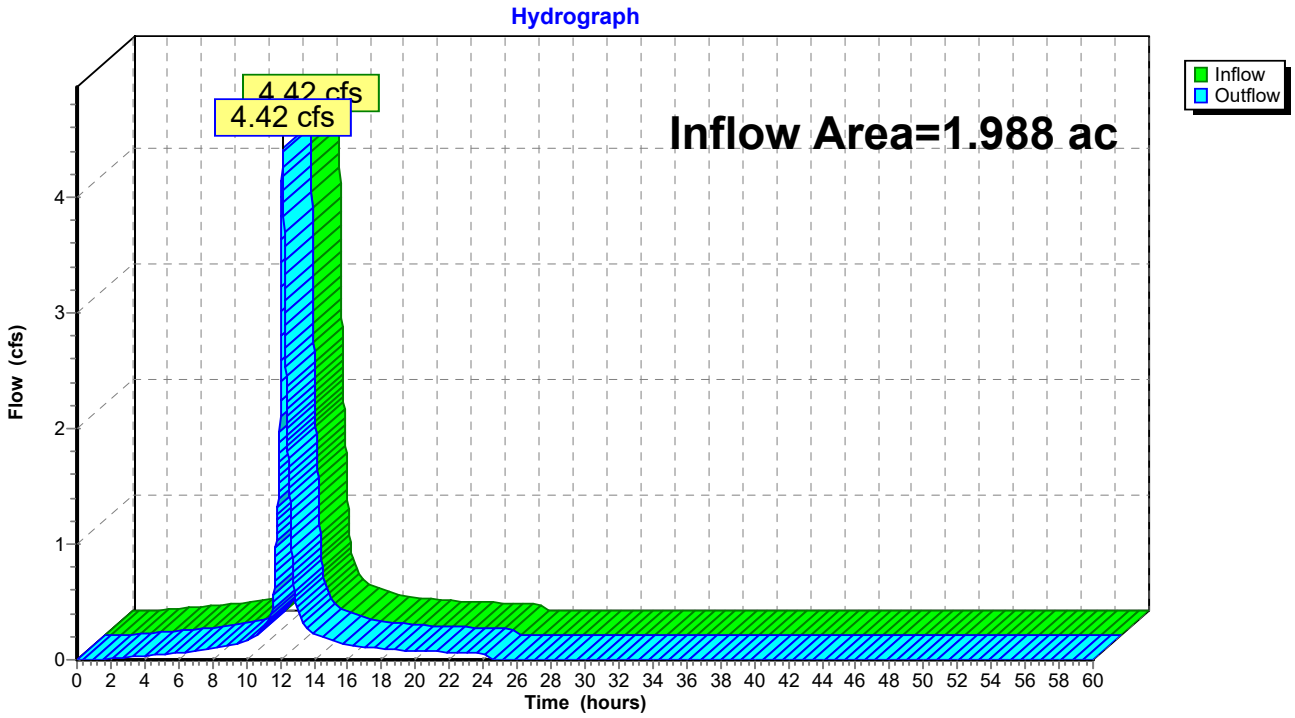
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.988 ac, Inflow Depth = 2.36" for 2-yr event
Inflow = 4.42 cfs @ 12.14 hrs, Volume= 0.390 af
Outflow = 4.42 cfs @ 12.14 hrs, Volume= 0.390 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



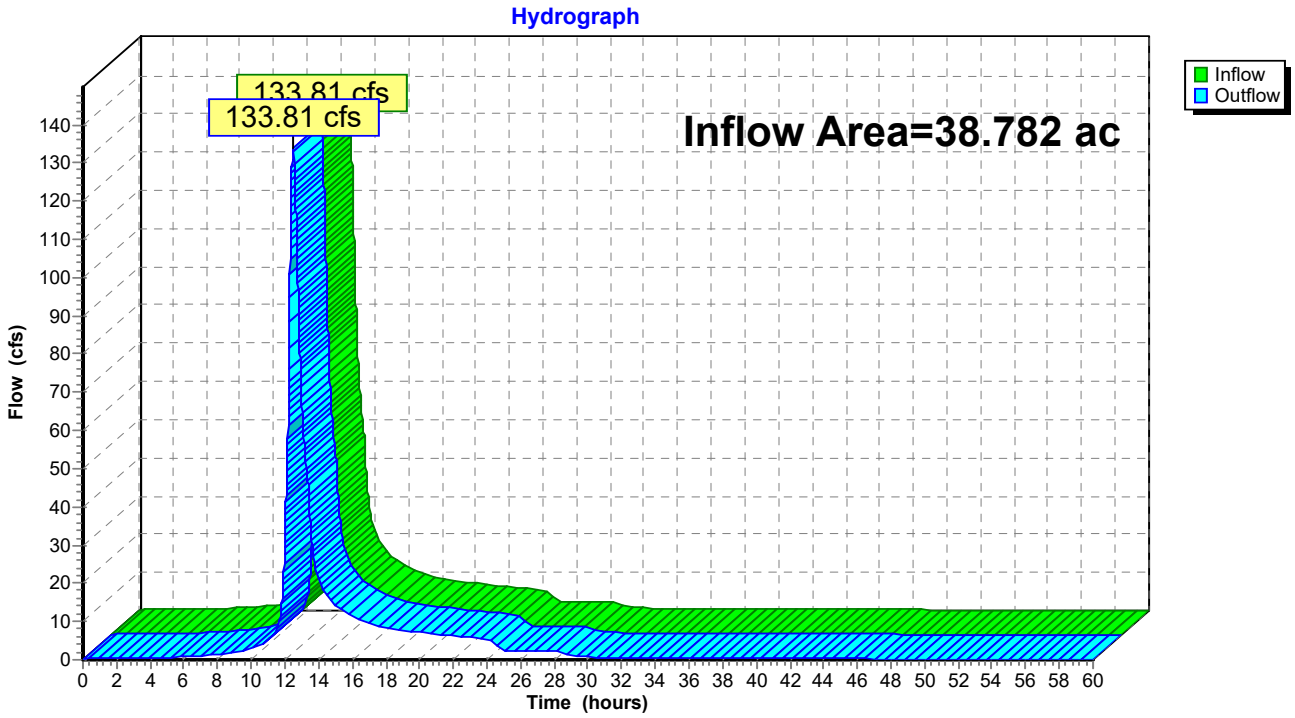
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 38.782 ac, Inflow Depth = 6.81" for 2-yr event
Inflow = 133.81 cfs @ 12.49 hrs, Volume= 22.023 af
Outflow = 133.81 cfs @ 12.49 hrs, Volume= 22.023 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT



Summary for Pond 5P: EX 50"x31" CMP

[58] Hint: Peaked 0.31' above defined flood level

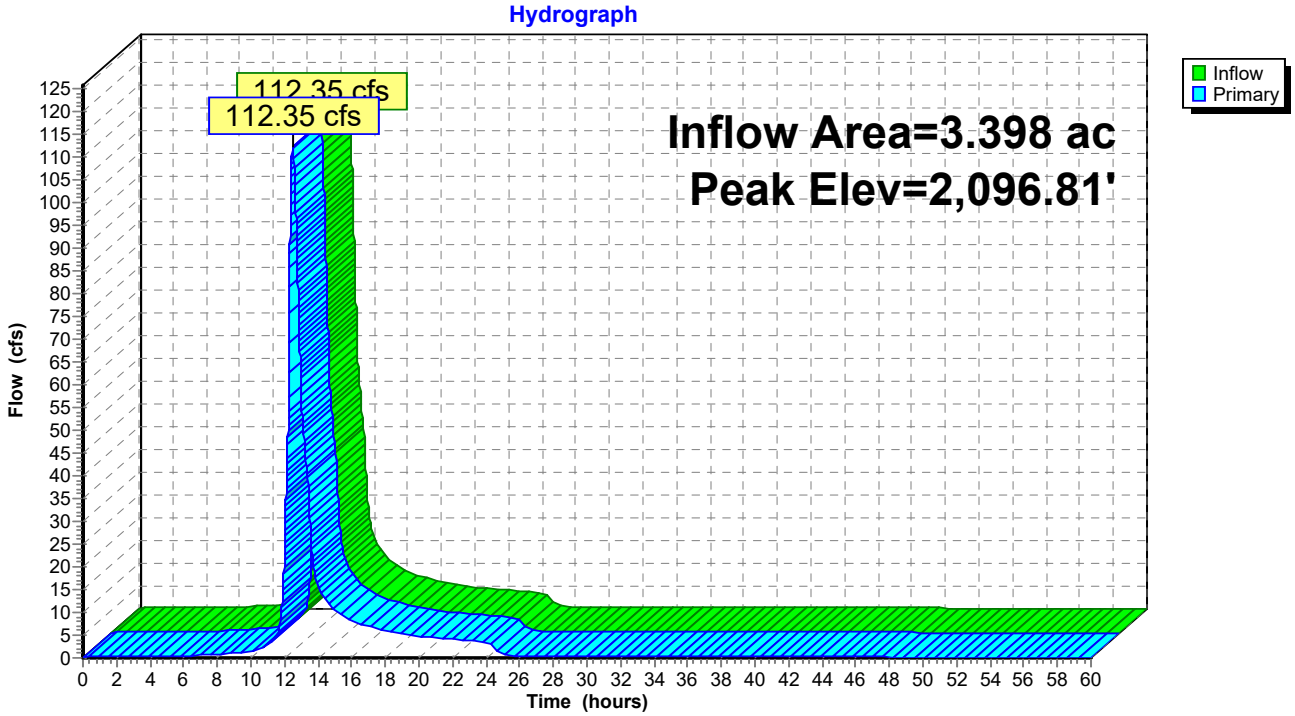
Inflow Area =	3.398 ac,	Inflow Depth = 57.79"	for 2-yr event			
Inflow =	112.35 cfs @	12.48 hrs,	Volume=	16.365 af		
Outflow =	112.35 cfs @	12.48 hrs,	Volume=	16.365 af,	Atten= 0%,	Lag= 0.0 min
Primary =	112.35 cfs @	12.48 hrs,	Volume=	16.365 af		

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.81' @ 12.48 hrs
Flood Elev= 2,096.50'

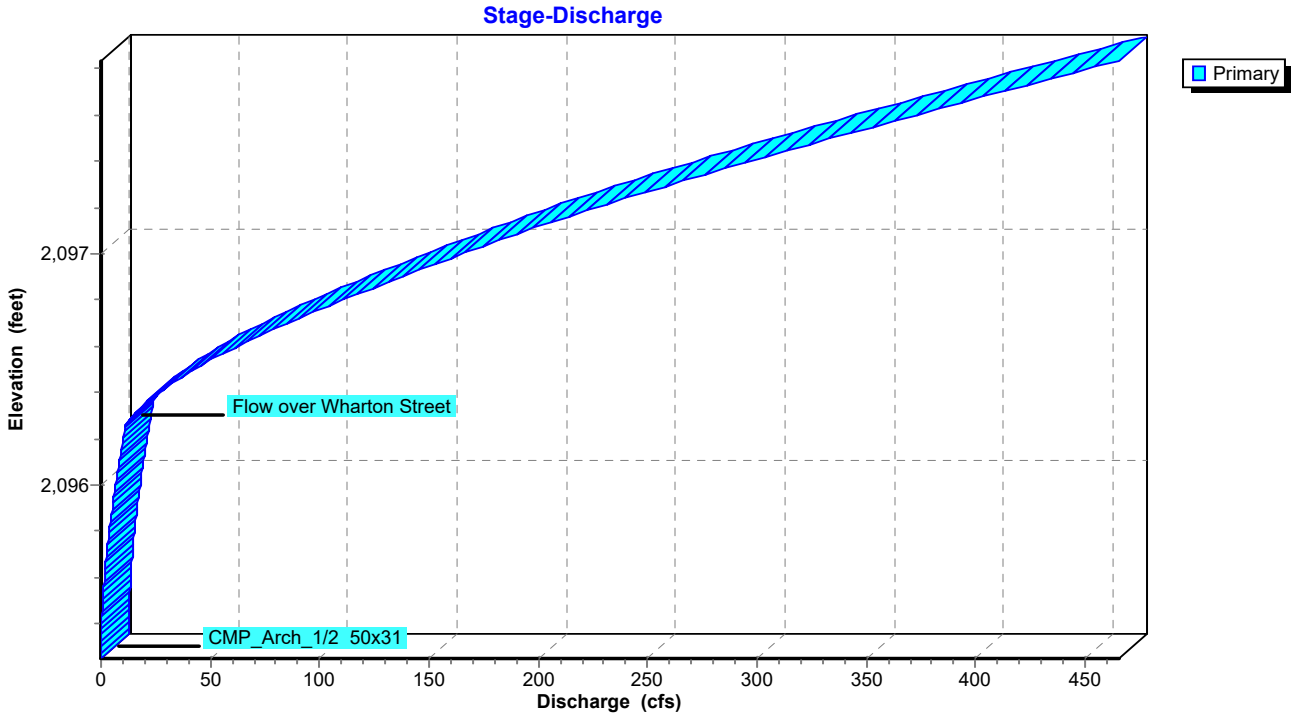
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=112.32 cfs @ 12.48 hrs HW=2,096.81' (Free Discharge)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 22.62 cfs @ 3.91 fps)
└─**2=Flow over Wharton Street** (Weir Controls 89.70 cfs @ 2.01 fps)

Pond 5P: EX 50"x31" CMP



Pond 5P: EX 50"x31" CMP



Summary for Pond 6P: UG DETENTION

Inflow Area = 24.505 ac, Inflow Depth = 1.98" for 2-yr event
Inflow = 66.41 cfs @ 12.04 hrs, Volume= 4.042 af
Outflow = 12.13 cfs @ 12.56 hrs, Volume= 4.034 af, Atten= 82%, Lag= 31.3 min
Primary = 12.13 cfs @ 12.56 hrs, Volume= 4.034 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,115.18' @ 12.56 hrs Surf.Area= 0.412 ac Storage= 1.934 af

Plug-Flow detention time= 292.6 min calculated for 4.033 af (100% of inflow)
Center-of-Mass det. time= 291.5 min (1,079.2 - 787.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,107.50'	1.103 af	**83.00'W x 216.42'L x 9.50'H Field A** 3.917 af Overall - 1.159 af Embedded = 2.759 af x 40.0% Voids
#2A	2,111.00'	1.159 af	**ADS_StormTech MC-4500 +Cap** x 468 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 9 Rows of 52 Chambers Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf
		2.262 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,107.50'	**30.0" Round 30" HDPE Culvert** L= 474.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,107.50' / 2,104.10' S= 0.0072 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.91 sf
#2	Device 1	2,107.50'	**Reg-U-Flo CX 9.5-in**
#3	Device 1	2,113.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	2,114.75'	**8.0' 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=12.12 cfs @ 12.56 hrs HW=2,115.18' (Free Discharge)
└─**1=30" HDPE Culvert** (Passes 12.12 cfs of 53.54 cfs potential flow)
  ├─**2=Reg-U-Flo CX 9.5-in** (Custom Controls 2.45 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 2.96 cfs @ 5.42 fps)
  └─**4=Broad-Crested Rectangular Weir** (Weir Controls 6.72 cfs @ 1.94 fps)

Pond 6P: UG DETENTION - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

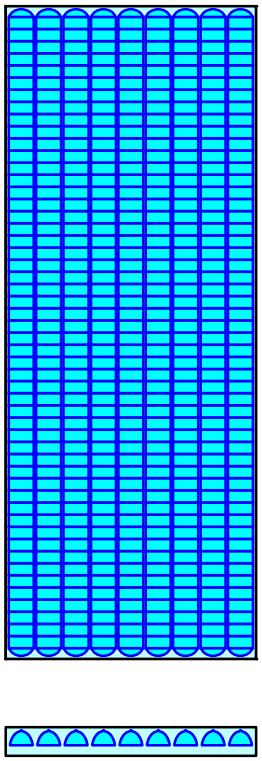
52 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 214.42' Row Length +12.0" End Stone x 2 = 216.42' Base Length
9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width
42.0" Base + 60.0" Chamber Height + 12.0" Cover = 9.50' Field Height

468 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 9 Rows = 50,480.1 cf Chamber Storage

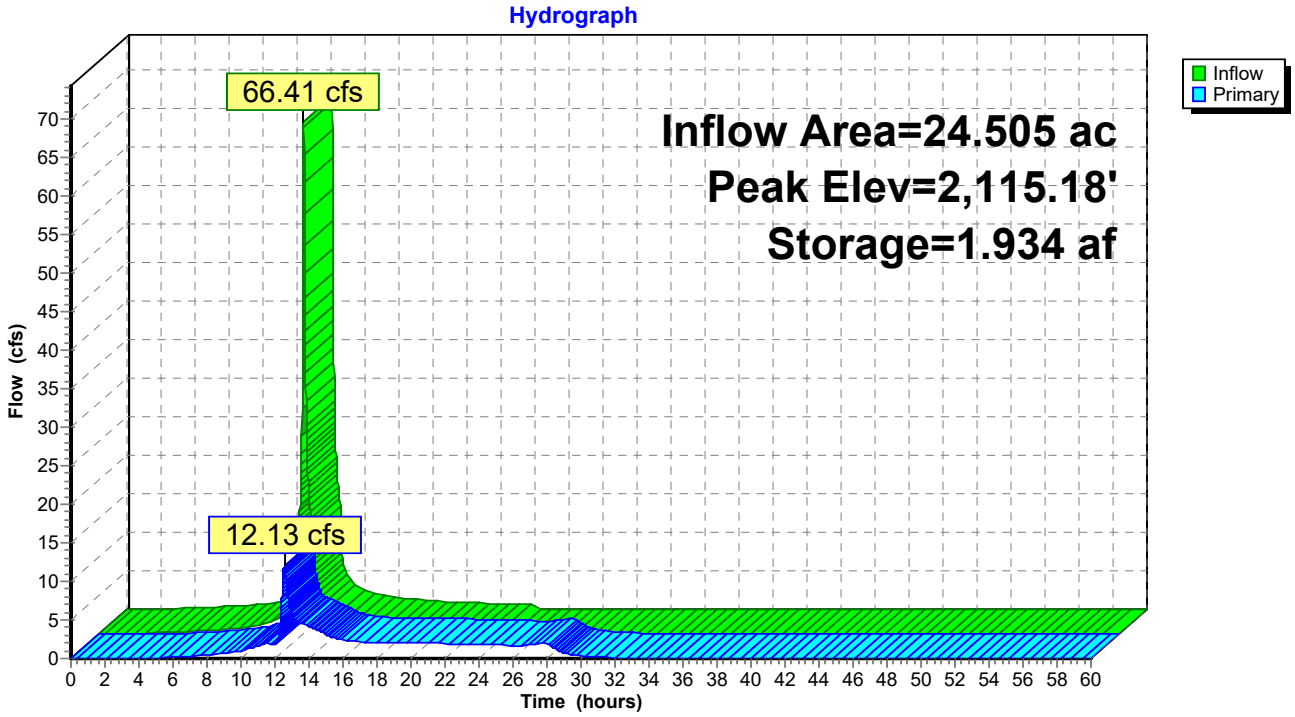
170,644.5 cf Field - 50,480.1 cf Chambers = 120,164.4 cf Stone x 40.0% Voids = 48,065.8 cf Stone Storage

Chamber Storage + Stone Storage = 98,545.9 cf = 2.262 af
Overall Storage Efficiency = 57.7%
Overall System Size = 216.42' x 83.00' x 9.50'

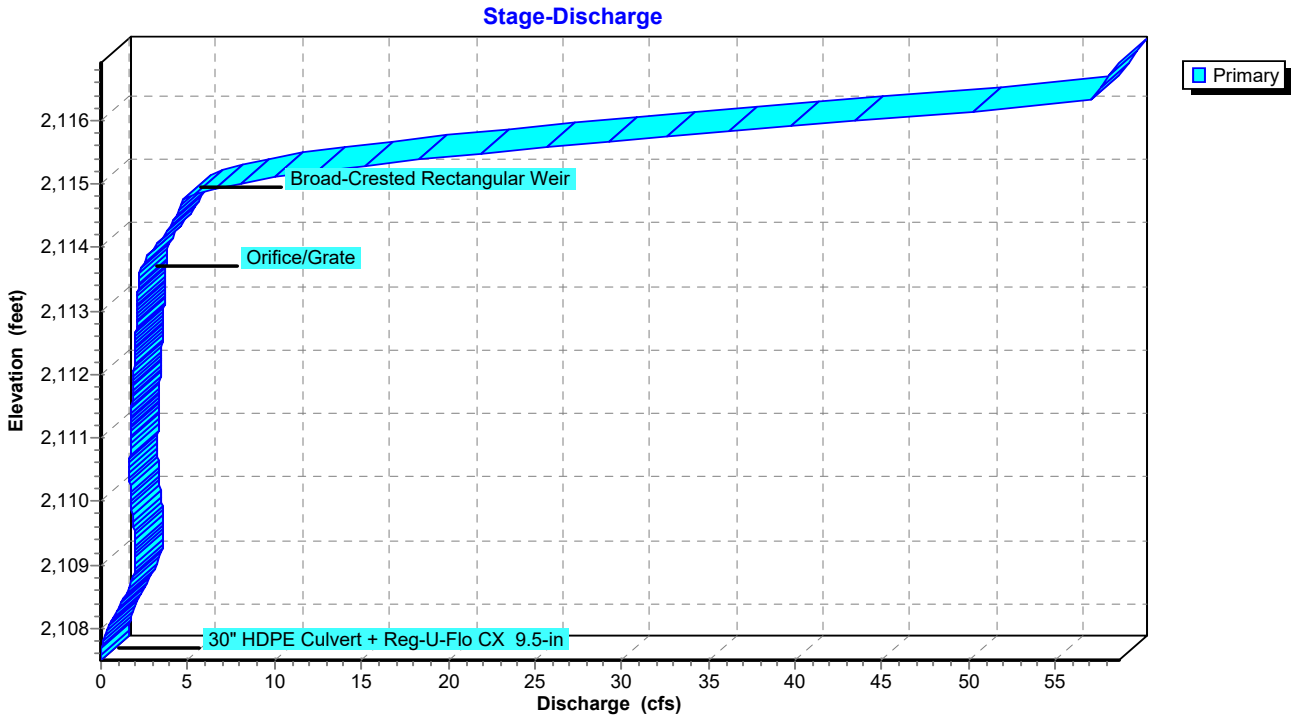
468 Chambers
6,320.2 cy Field
4,450.5 cy Stone



Pond 6P: UG DETENTION



Pond 6P: UG DETENTION



Summary for Pond 9P: MH "B"

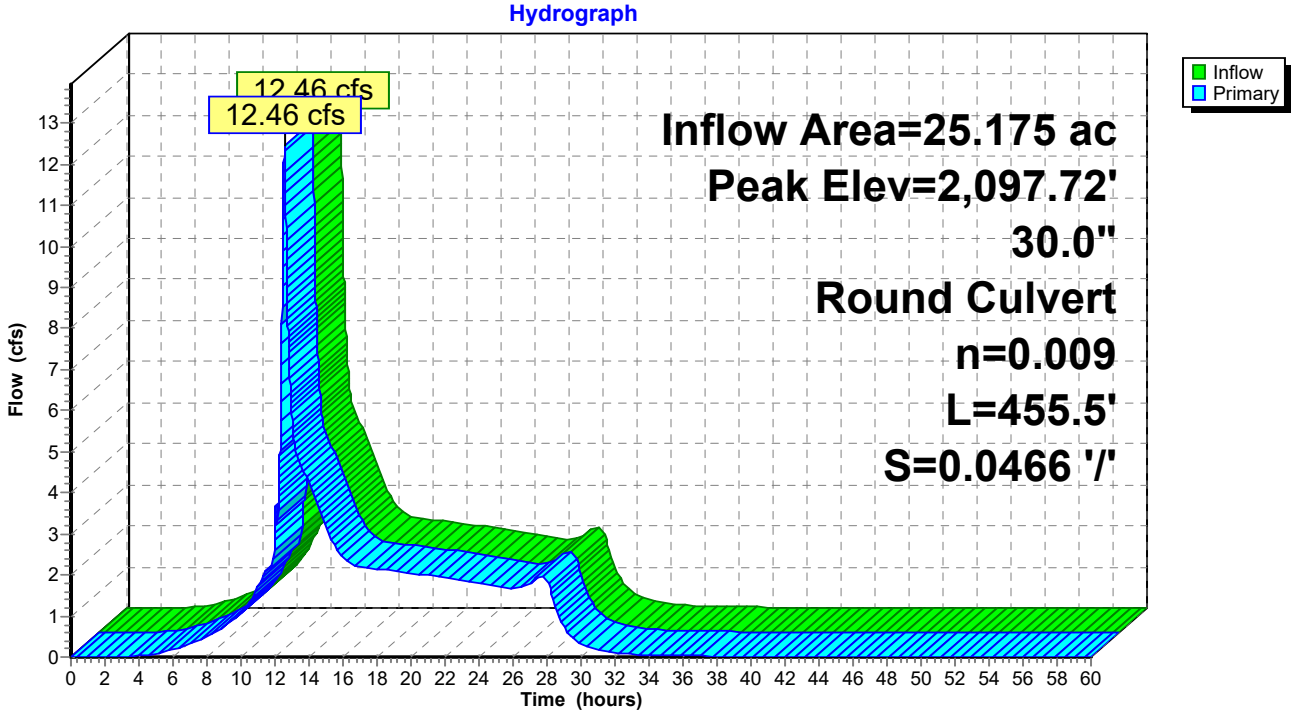
Inflow Area = 25.175 ac, Inflow Depth > 1.98" for 2-yr event
Inflow = 12.46 cfs @ 12.56 hrs, Volume= 4.145 af
Outflow = 12.46 cfs @ 12.56 hrs, Volume= 4.145 af, Atten= 0%, Lag= 0.0 min
Primary = 12.46 cfs @ 12.56 hrs, Volume= 4.145 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.72' @ 12.56 hrs
Flood Elev= 2,108.82'

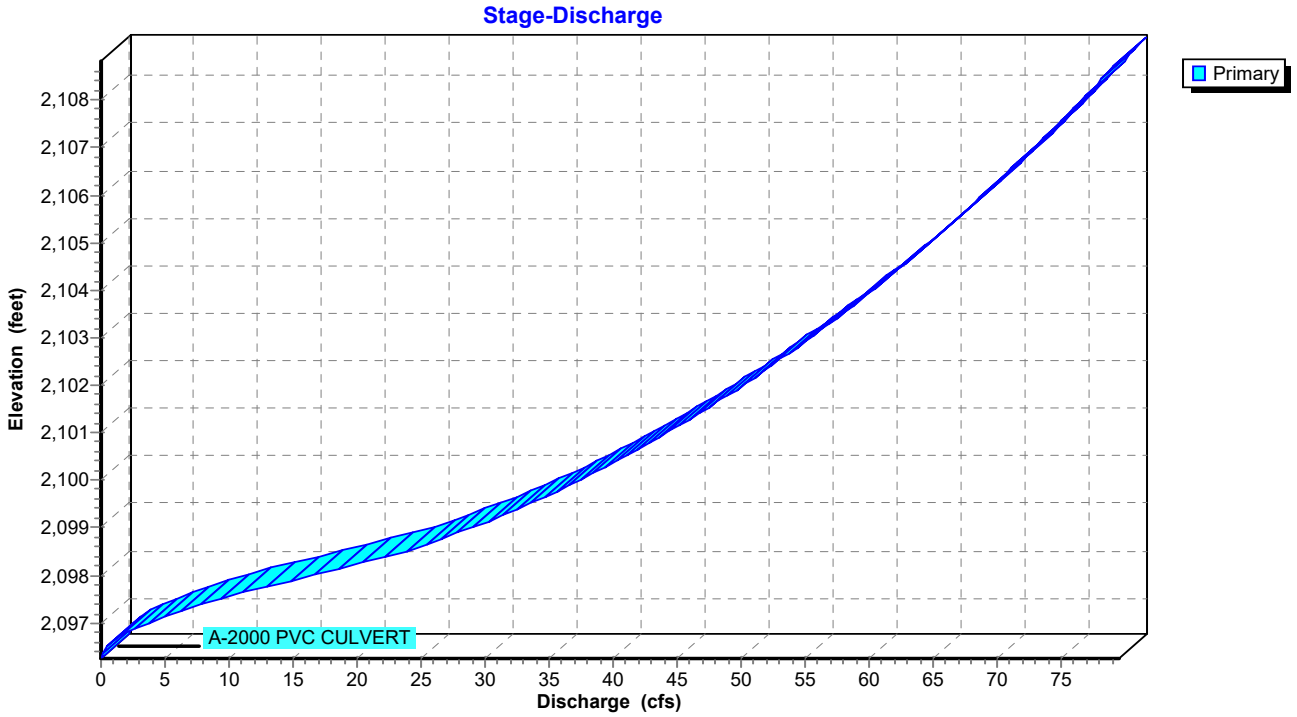
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.25'	**30.0" Round A-2000 PVC CULVERT** L= 455.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,096.25' / 2,075.02' S= 0.0466 '/' Cc= 0.900 n= 0.009, Flow Area= 4.91 sf

Primary OutFlow Max=12.44 cfs @ 12.56 hrs HW=2,097.72' (Free Discharge)
└**1=A-2000 PVC CULVERT** (Inlet Controls 12.44 cfs @ 4.13 fps)

Pond 9P: MH "B"



Pond 9P: MH "B"


Stage-Discharge
Primary
Elevation (feet)
2,108
2,107
2,106
2,105
2,104
2,103
2,102
2,101
2,100
2,099
2,098
2,097
A-2000 PVC CULVERT
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Discharge (cfs)

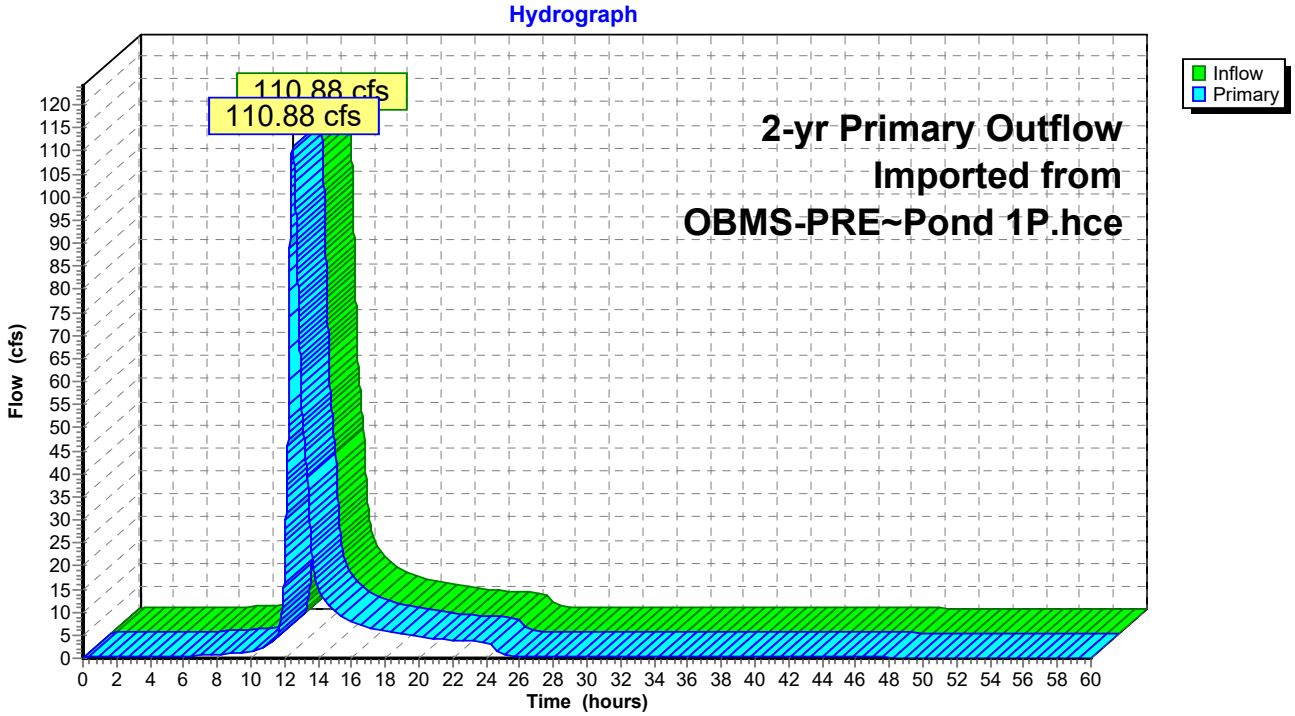
Summary for Link 6L: BERRYFIELD POND OUTFLOW

Inflow	=	110.88 cfs @	12.48 hrs,	Volume=	16.010 af
Primary	=	110.88 cfs @	12.48 hrs,	Volume=	16.010 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

2-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 6L: BERRYFIELD POND OUTFLOW



Summary for Subcatchment 3S: 5'x3' CONC.BOX DA

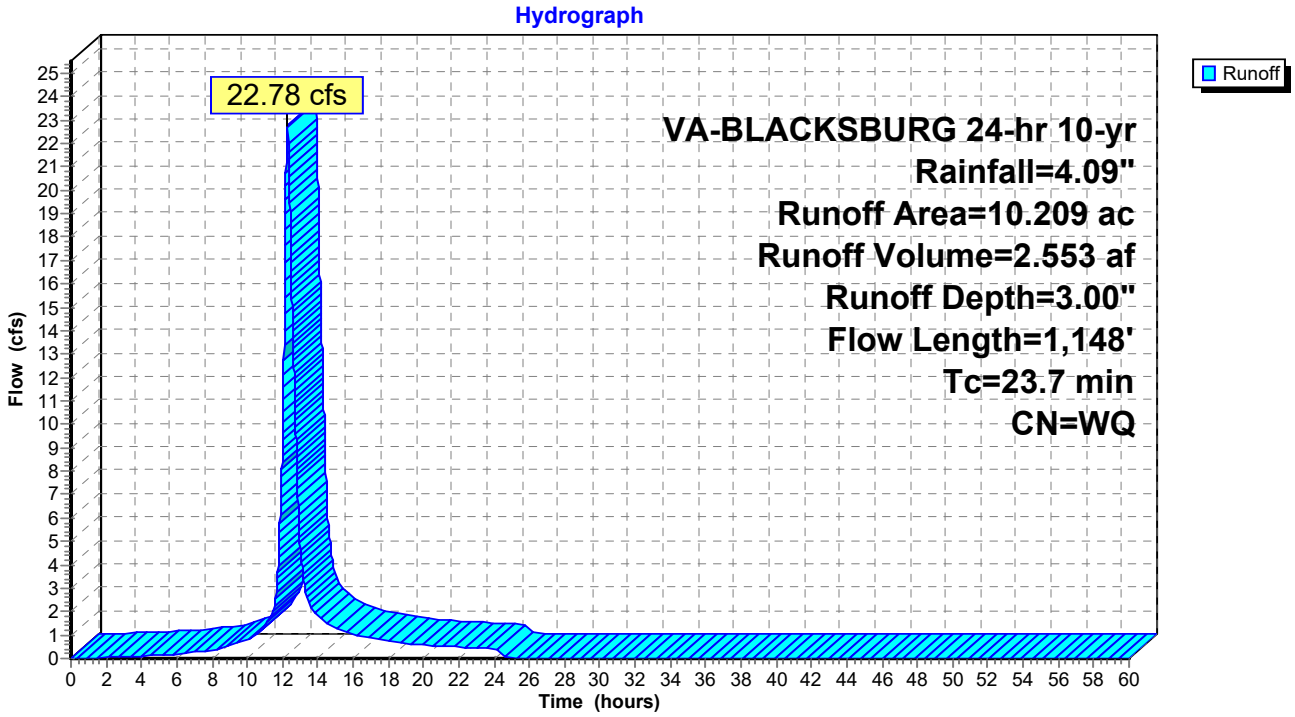
Runoff = 22.78 cfs @ 12.28 hrs, Volume= 2.553 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.101	74	>75% Grass cover, Good, HSG C
0.620	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.201	95	Urban commercial, 85% imp, HSG D
0.593	98	Paved roads w/curbs & sewers, HSG C
1.692	98	Paved roads w/curbs & sewers, HSG D
0.222	98	Paved parking, HSG D
10.209		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 3S: 5'x3' CONC.BOX DA



Summary for Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)

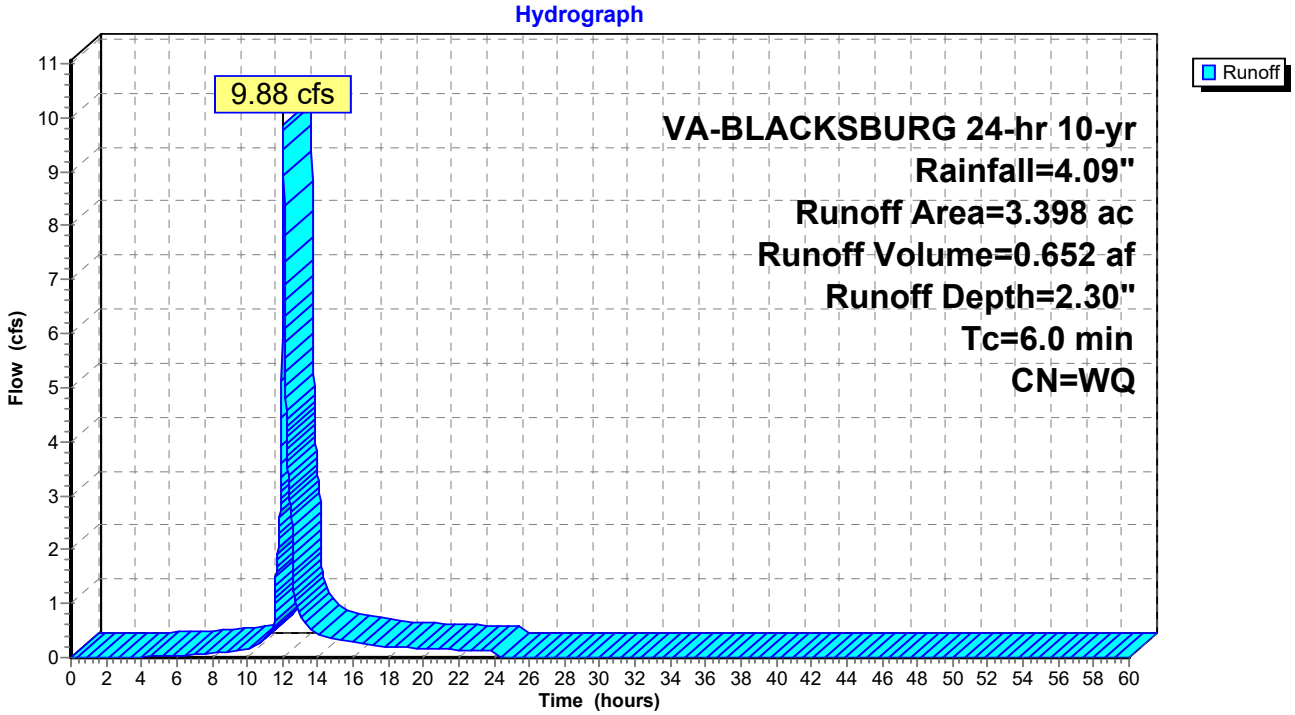
Runoff = 9.88 cfs @ 12.04 hrs, Volume= 0.652 af, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
1.371	74	>75% Grass cover, Good, HSG C
0.067	80	>75% Grass cover, Good, HSG D
0.584	70	Woods, Good, HSG C
1.096	92	Paved roads w/open ditches, 50% imp, HSG C
0.005	93	Paved roads w/open ditches, 50% imp, HSG D
0.275	98	Paved parking, HSG C
3.398		Weighted Average

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

Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)



Summary for Subcatchment 7S: EX. MH "A" DA

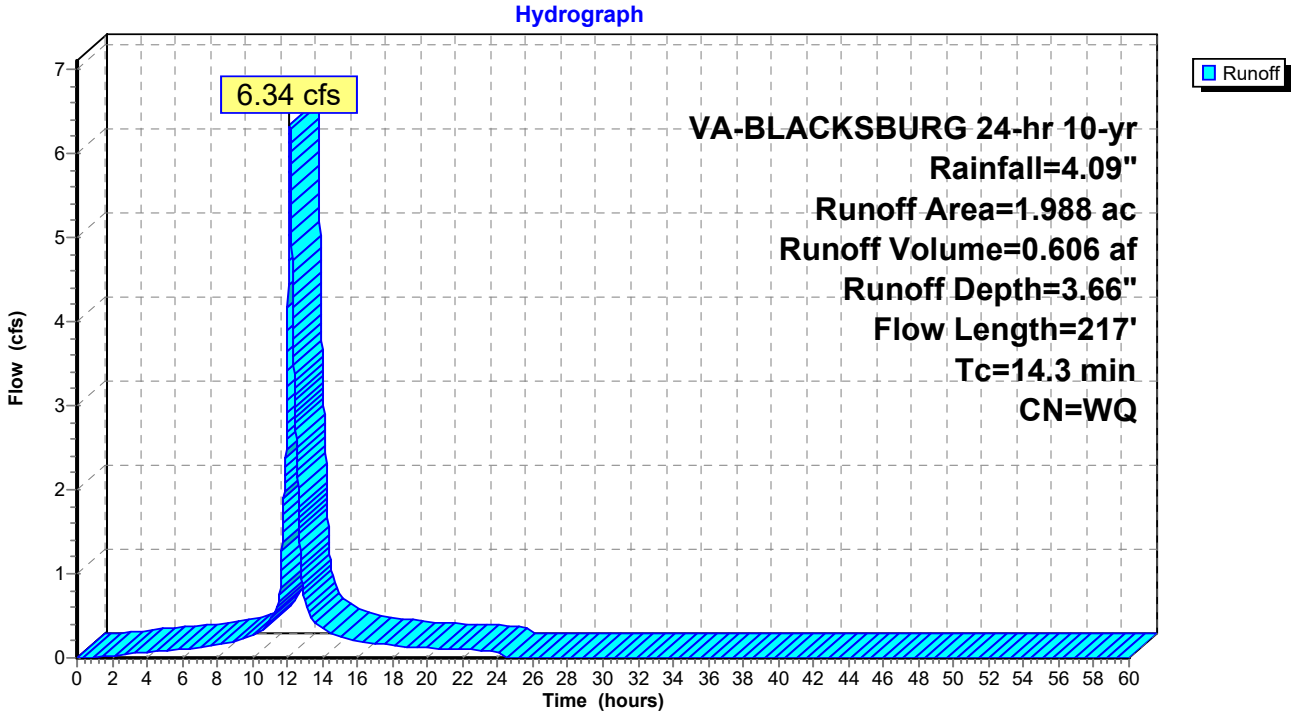
Runoff = 6.34 cfs @ 12.15 hrs, Volume= 0.606 af, Depth= 3.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.011	98	Paved parking, HSG C
1.037	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
0.224	80	>75% Grass cover, Good, HSG D
1.988		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	150	0.0567	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	67	0.0820	4.30		**Shallow Concentrated Flow, Tc2** Grassed Waterway Kv= 15.0 fps
14.3	217	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 8S: TO UNDERGROUND DETENTION

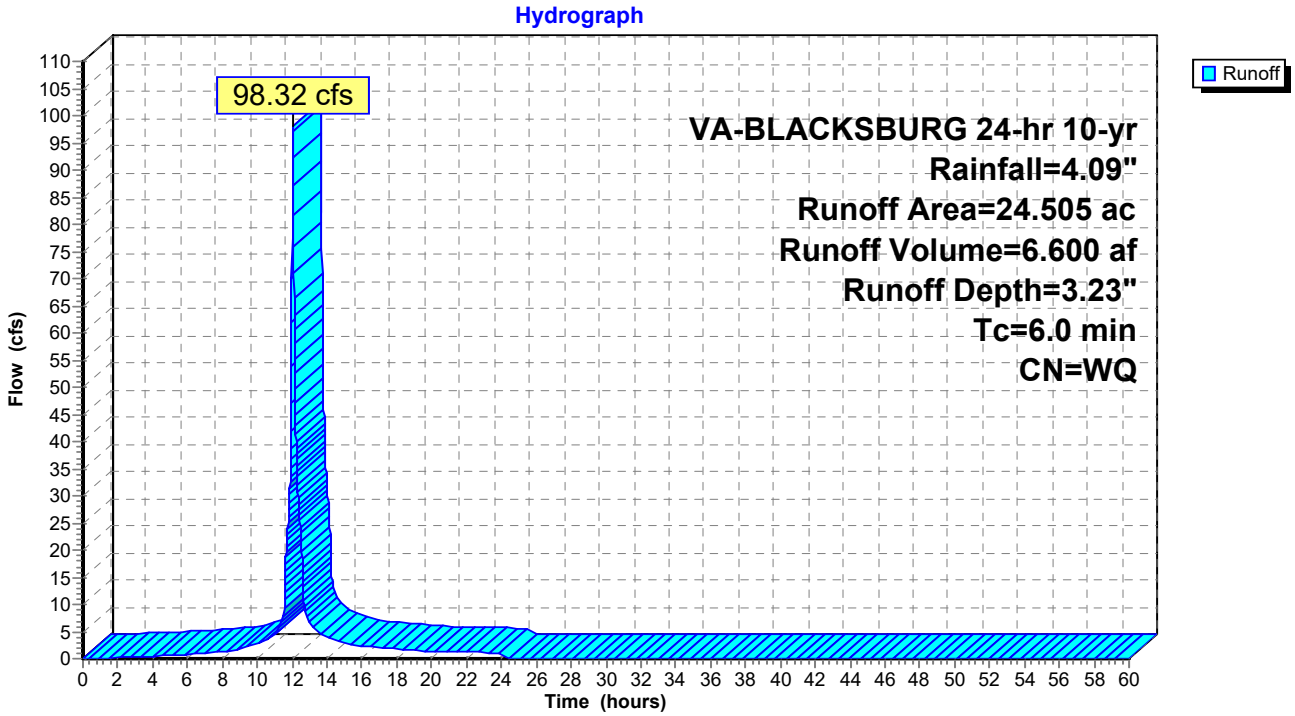
Runoff = 98.32 cfs @ 12.04 hrs, Volume= 6.600 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

	Area (ac)	CN	Description
	1.330	98	Paved parking, HSG C
	8.380	98	Paved parking, HSG D
	0.932	74	>75% Grass cover, Good, HSG C
	2.936	80	>75% Grass cover, Good, HSG D
*	0.846	91	PRD Parcel #3
*	1.965	92	PRD Parcel #4
*	2.079	93	PRD Parcel #5
*	1.692	92	PRD Parcel #6
	0.330	81	1/3 acre lots, 30% imp, HSG C
*	4.015	90	Carry Over from Villas Infiltration Pits
	24.505		Weighted Average

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

Subcatchment 8S: TO UNDERGROUND DETENTION



Summary for Subcatchment 9S: DIRECT RUNOFF TO MH "B"

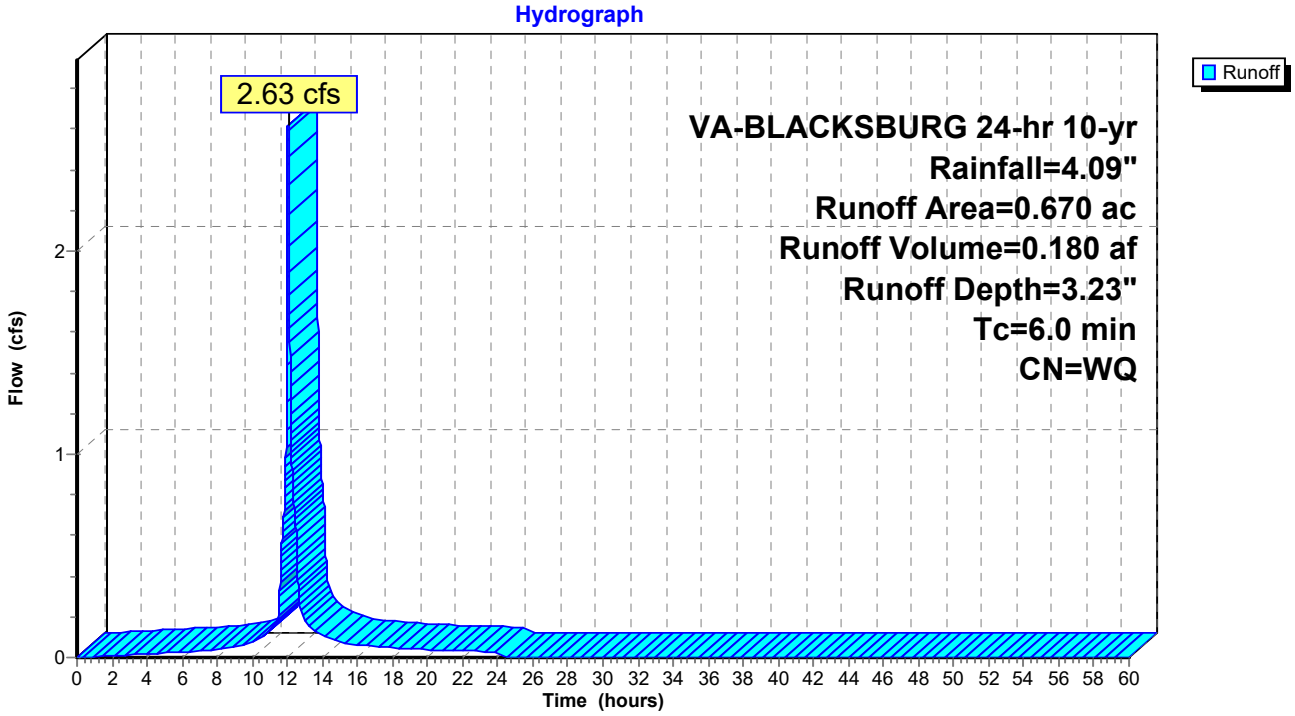
Runoff = 2.63 cfs @ 12.04 hrs, Volume= 0.180 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.430	98	Paved parking, HSG D
0.240	80	>75% Grass cover, Good, HSG D
0.670		Weighted Average

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

Subcatchment 9S: DIRECT RUNOFF TO MH "B"



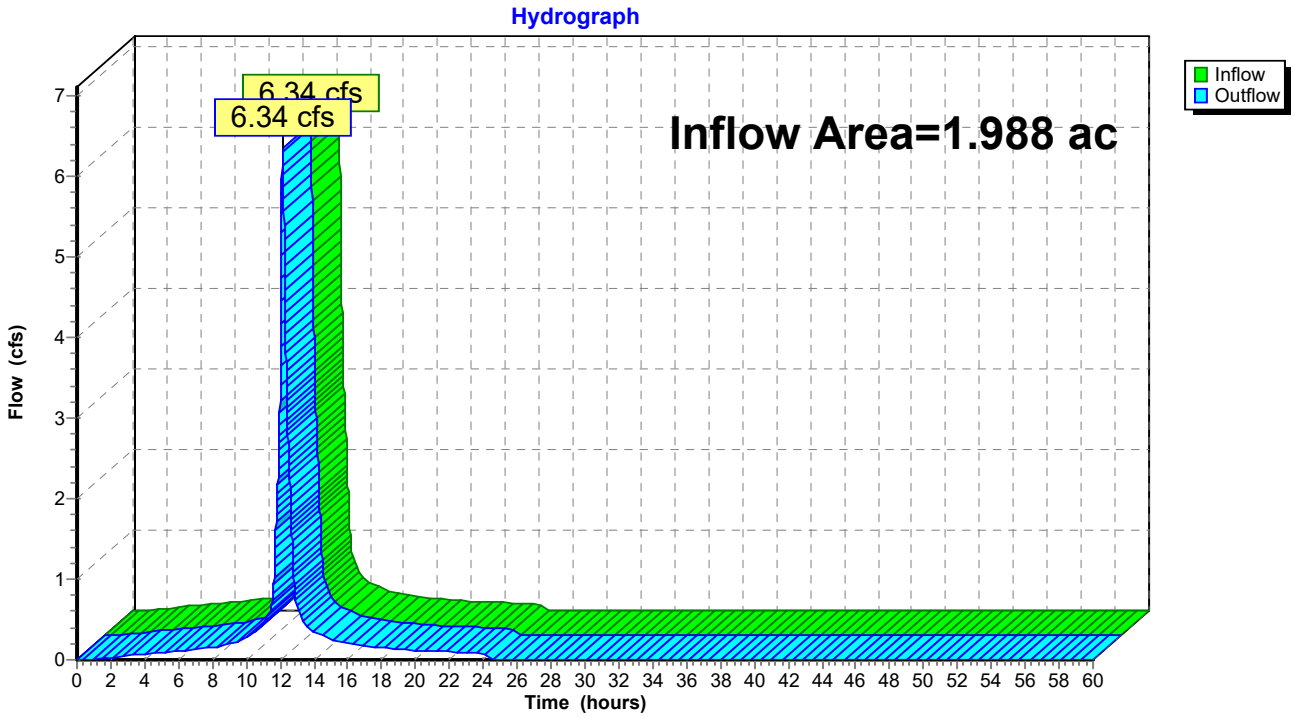
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.988 ac, Inflow Depth = 3.66" for 10-yr event
Inflow = 6.34 cfs @ 12.15 hrs, Volume= 0.606 af
Outflow = 6.34 cfs @ 12.15 hrs, Volume= 0.606 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



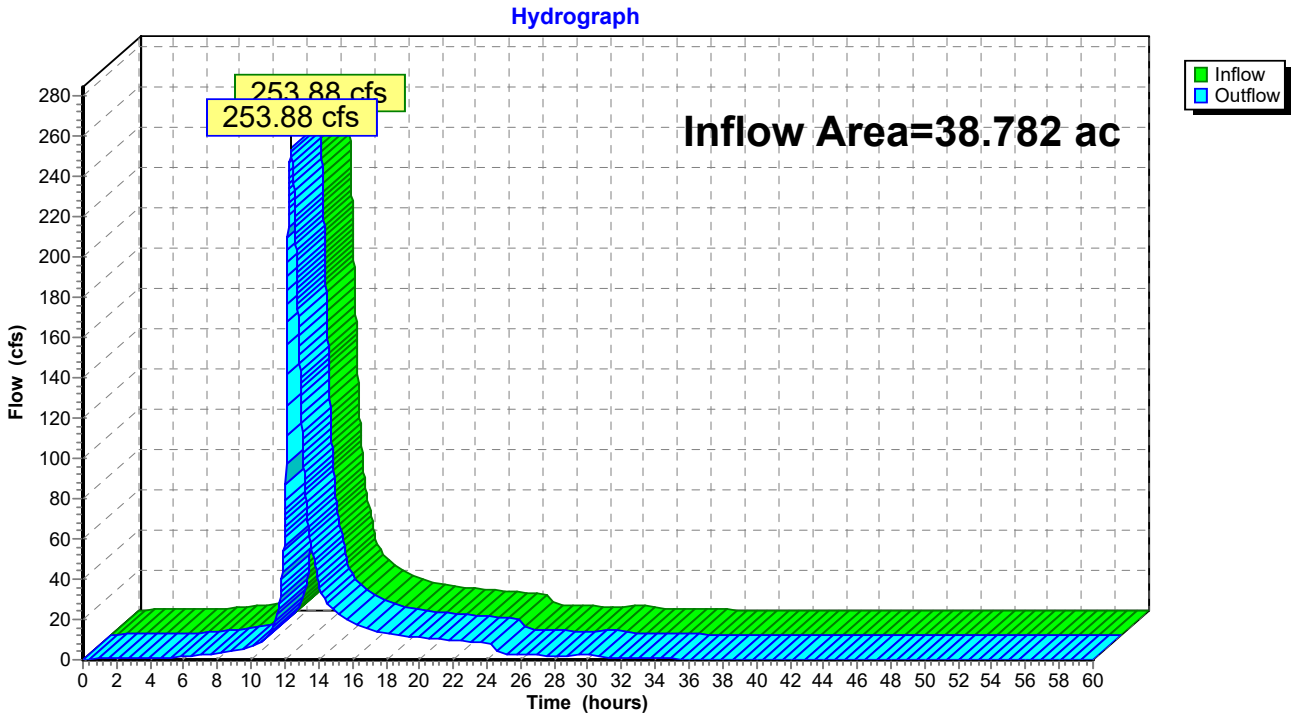
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 38.782 ac, Inflow Depth = 12.27" for 10-yr event
Inflow = 253.88 cfs @ 12.34 hrs, Volume= 39.644 af
Outflow = 253.88 cfs @ 12.34 hrs, Volume= 39.644 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT



Summary for Pond 5P: EX 50"x31" CMP

[58] Hint: Peaked 0.62' above defined flood level

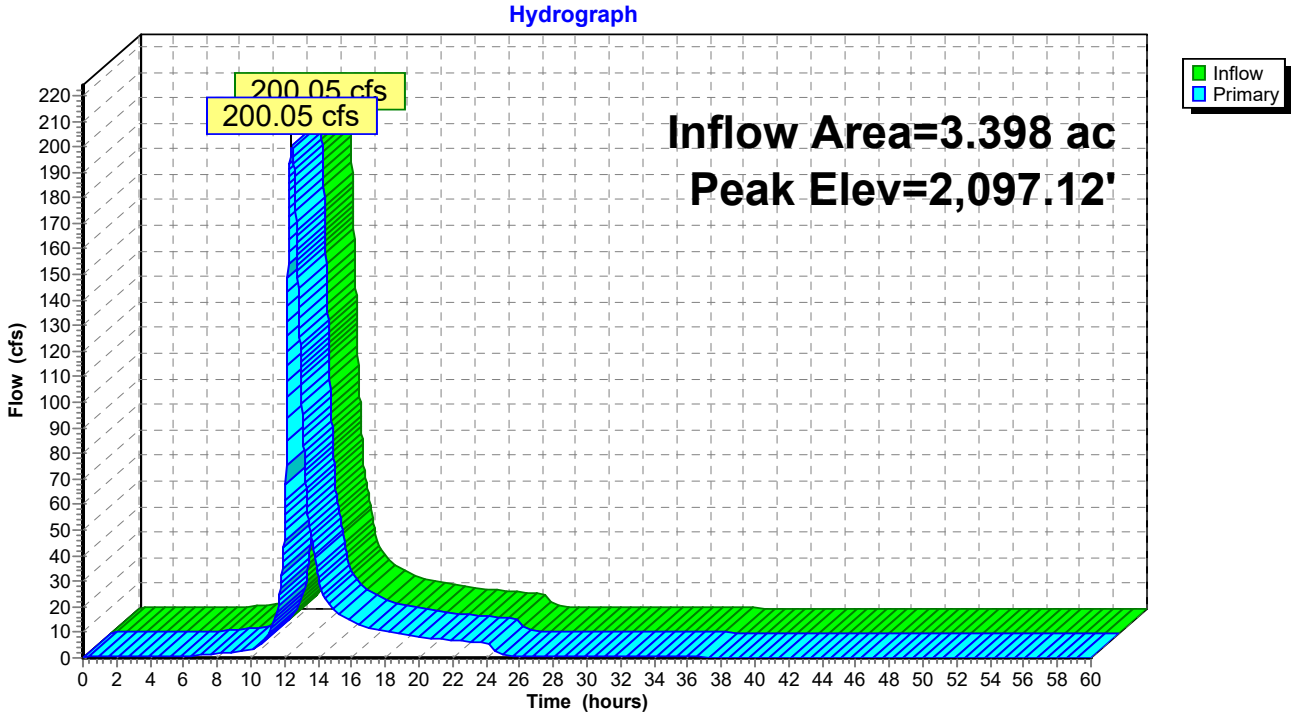
Inflow Area =	3.398 ac,	Inflow Depth =	107.07"	for	10-yr event	
Inflow =	200.05 cfs @	12.42 hrs,	Volume=		30.319 af	
Outflow =	200.05 cfs @	12.42 hrs,	Volume=		30.319 af,	Atten= 0%, Lag= 0.0 min
Primary =	200.05 cfs @	12.42 hrs,	Volume=		30.319 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.12' @ 12.42 hrs
Flood Elev= 2,096.50'

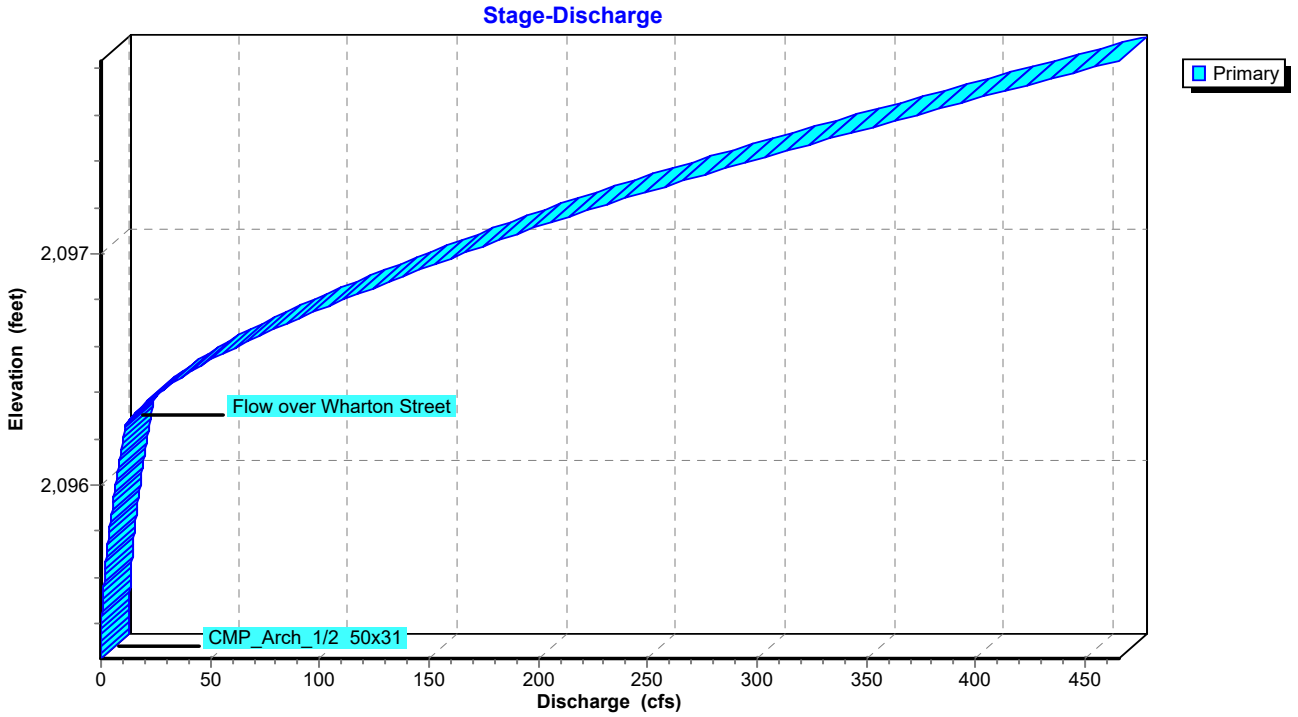
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=200.03 cfs @ 12.42 hrs HW=2,097.12' (Free Discharge)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 29.80 cfs @ 4.36 fps)
└─**2=Flow over Wharton Street** (Weir Controls 170.23 cfs @ 2.45 fps)

Pond 5P: EX 50"x31" CMP



Pond 5P: EX 50"x31" CMP



Summary for Pond 6P: UG DETENTION

Inflow Area = 24.505 ac, Inflow Depth = 3.23" for 10-yr event
Inflow = 98.32 cfs @ 12.04 hrs, Volume= 6.600 af
Outflow = 57.17 cfs @ 12.14 hrs, Volume= 6.591 af, Atten= 42%, Lag= 6.4 min
Primary = 57.17 cfs @ 12.14 hrs, Volume= 6.591 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,116.39' @ 12.14 hrs Surf.Area= 0.412 ac Storage= 2.161 af

Plug-Flow detention time= 222.9 min calculated for 6.590 af (100% of inflow)
Center-of-Mass det. time= 222.3 min (1,000.7 - 778.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,107.50'	1.103 af	**83.00'W x 216.42'L x 9.50'H Field A** 3.917 af Overall - 1.159 af Embedded = 2.759 af x 40.0% Voids
#2A	2,111.00'	1.159 af	**ADS_StormTech MC-4500 +Cap** x 468 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 9 Rows of 52 Chambers Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf
		2.262 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,107.50'	**30.0" Round 30" HDPE Culvert** L= 474.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,107.50' / 2,104.10' S= 0.0072 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.91 sf
#2	Device 1	2,107.50'	**Reg-U-Flo CX 9.5-in**
#3	Device 1	2,113.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	2,114.75'	**8.0' 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=57.17 cfs @ 12.14 hrs HW=2,116.39' (Free Discharge)
└─**1=30" HDPE Culvert** (Barrel Controls 57.17 cfs @ 11.65 fps)
  ├─**2=Reg-U-Flo CX 9.5-in** (Passes < 2.65 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 4.13 cfs potential flow)
  └─**4=Broad-Crested Rectangular Weir** (Passes < 55.59 cfs potential flow)

Pond 6P: UG DETENTION - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

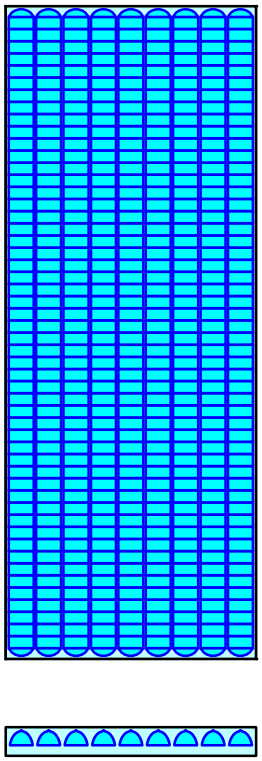
52 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 214.42' Row Length +12.0" End Stone x 2 = 216.42' Base Length
9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width
42.0" Base + 60.0" Chamber Height + 12.0" Cover = 9.50' Field Height

468 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 9 Rows = 50,480.1 cf Chamber Storage

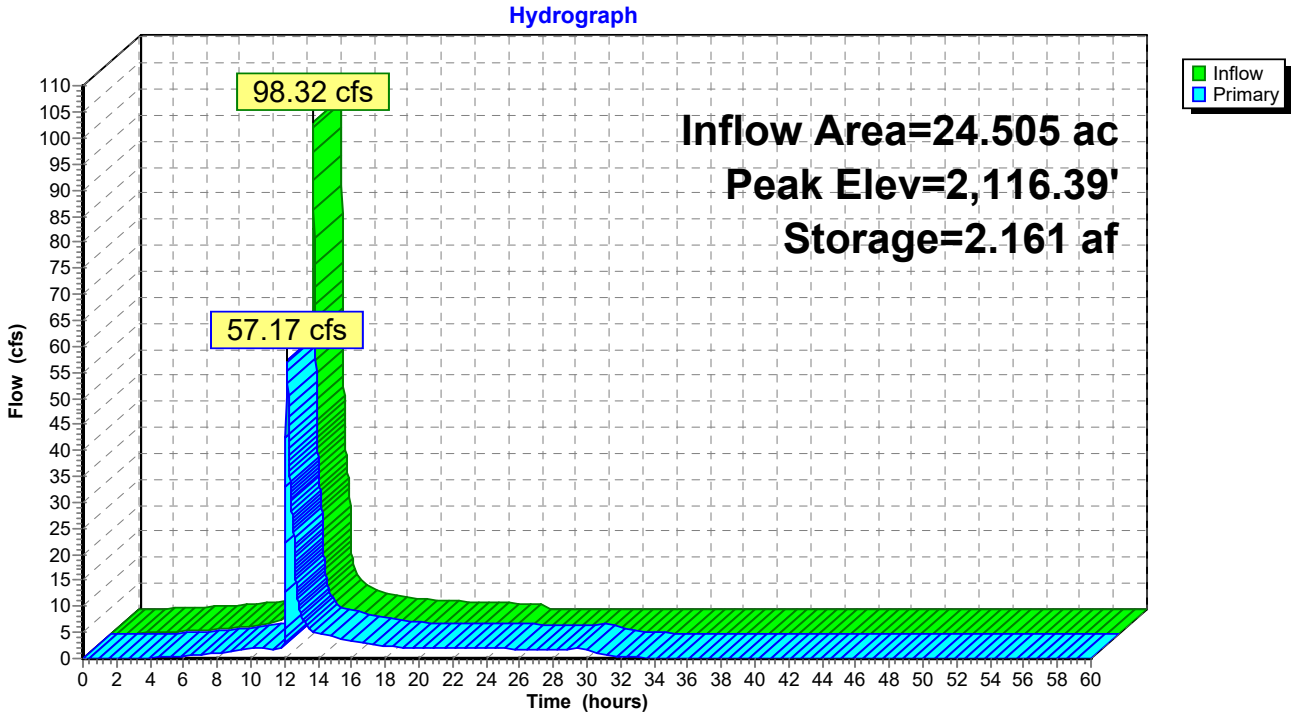
170,644.5 cf Field - 50,480.1 cf Chambers = 120,164.4 cf Stone x 40.0% Voids = 48,065.8 cf Stone Storage

Chamber Storage + Stone Storage = 98,545.9 cf = 2.262 af
Overall Storage Efficiency = 57.7%
Overall System Size = 216.42' x 83.00' x 9.50'

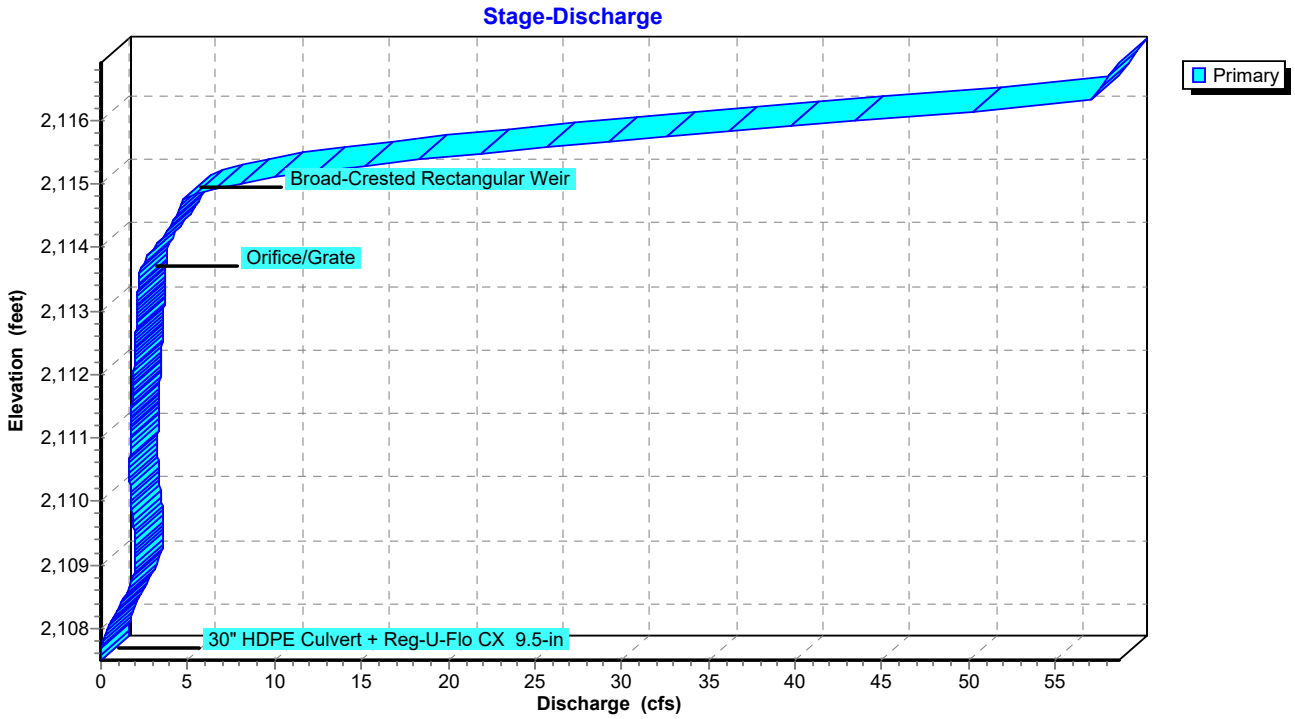
468 Chambers
6,320.2 cy Field
4,450.5 cy Stone



Pond 6P: UG DETENTION



Pond 6P: UG DETENTION



Summary for Pond 9P: MH "B"

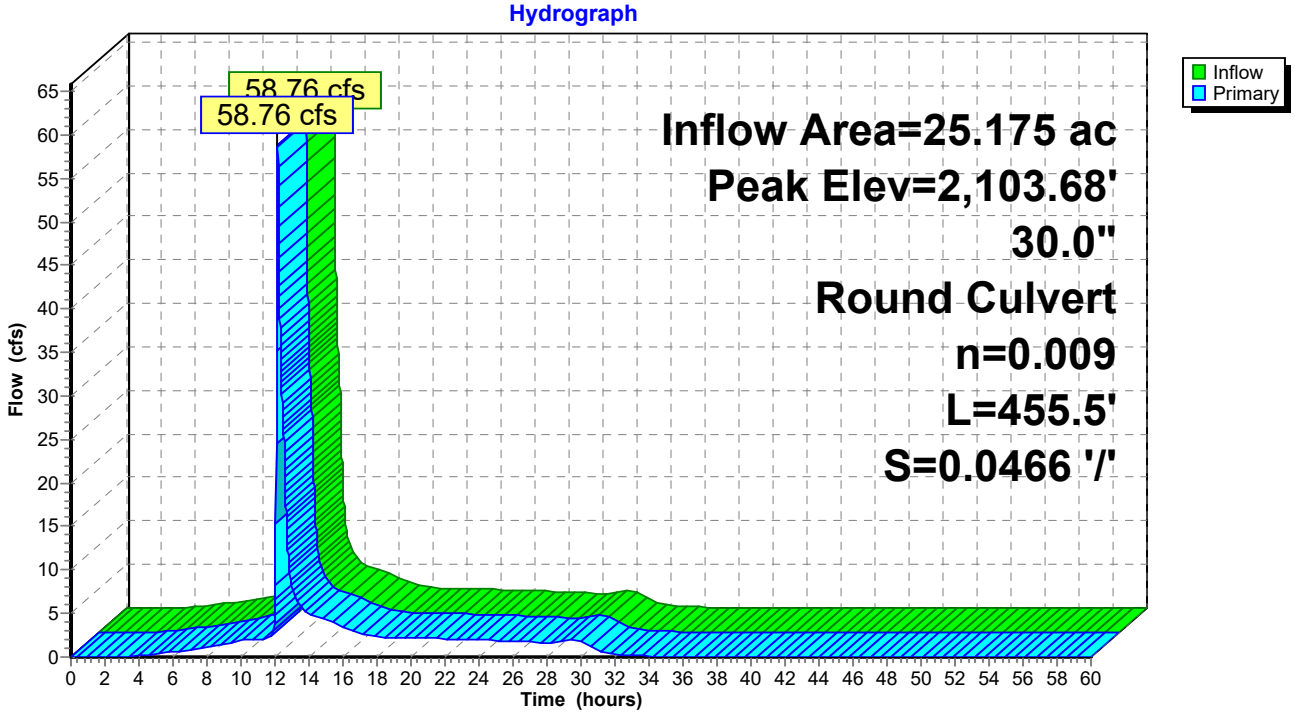
Inflow Area =	25.175 ac,	Inflow Depth =	3.23"	for	10-yr event
Inflow =	58.76 cfs @	12.12 hrs,	Volume=	6.772 af	
Outflow =	58.76 cfs @	12.12 hrs,	Volume=	6.772 af,	Atten= 0%, Lag= 0.0 min
Primary =	58.76 cfs @	12.12 hrs,	Volume=	6.772 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,103.68' @ 12.12 hrs
Flood Elev= 2,108.82'

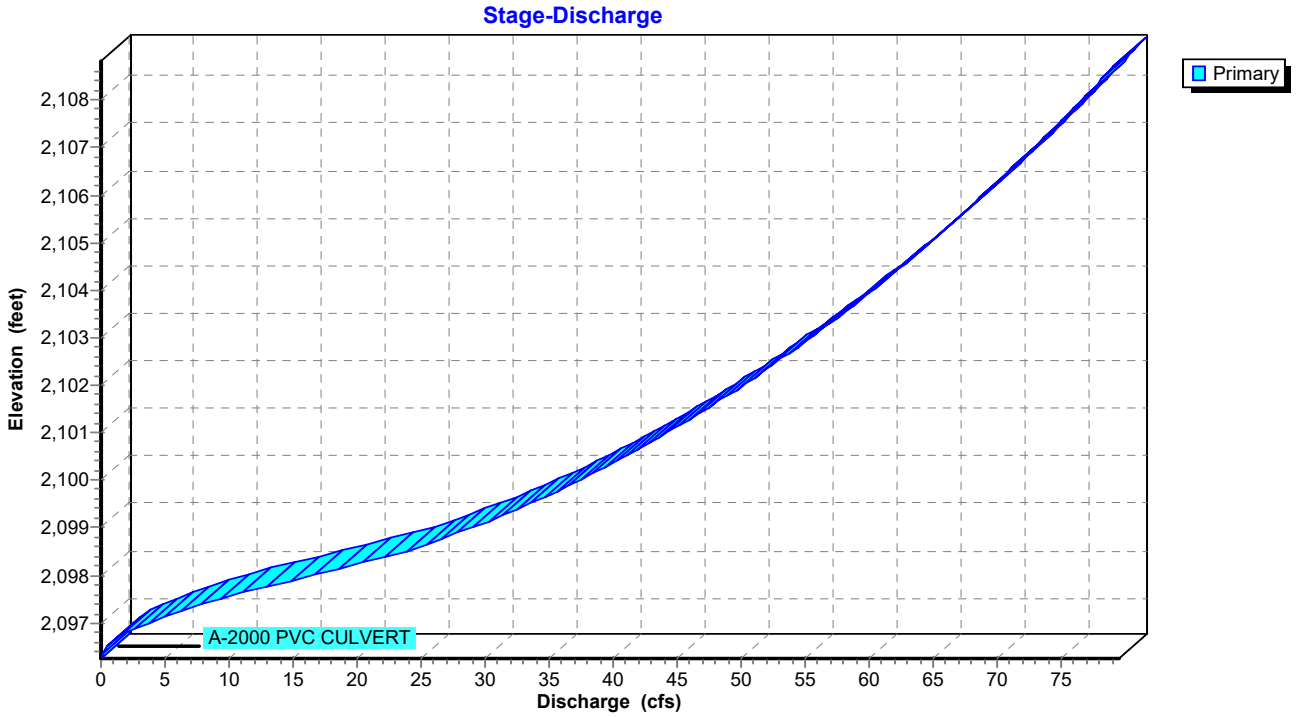
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.25'	**30.0" Round A-2000 PVC CULVERT** L= 455.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,096.25' / 2,075.02' S= 0.0466 '/' Cc= 0.900 n= 0.009, Flow Area= 4.91 sf

Primary OutFlow Max=58.76 cfs @ 12.12 hrs HW=2,103.68' (Free Discharge)
└**1=A-2000 PVC CULVERT** (Inlet Controls 58.76 cfs @ 11.97 fps)

Pond 9P: MH "B"



Pond 9P: MH "B"


Stage-Discharge
Primary
Elevation (feet)
2,108
2,107
2,106
2,105
2,104
2,103
2,102
2,101
2,100
2,099
2,098
2,097
A-2000 PVC CULVERT
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Discharge (cfs)

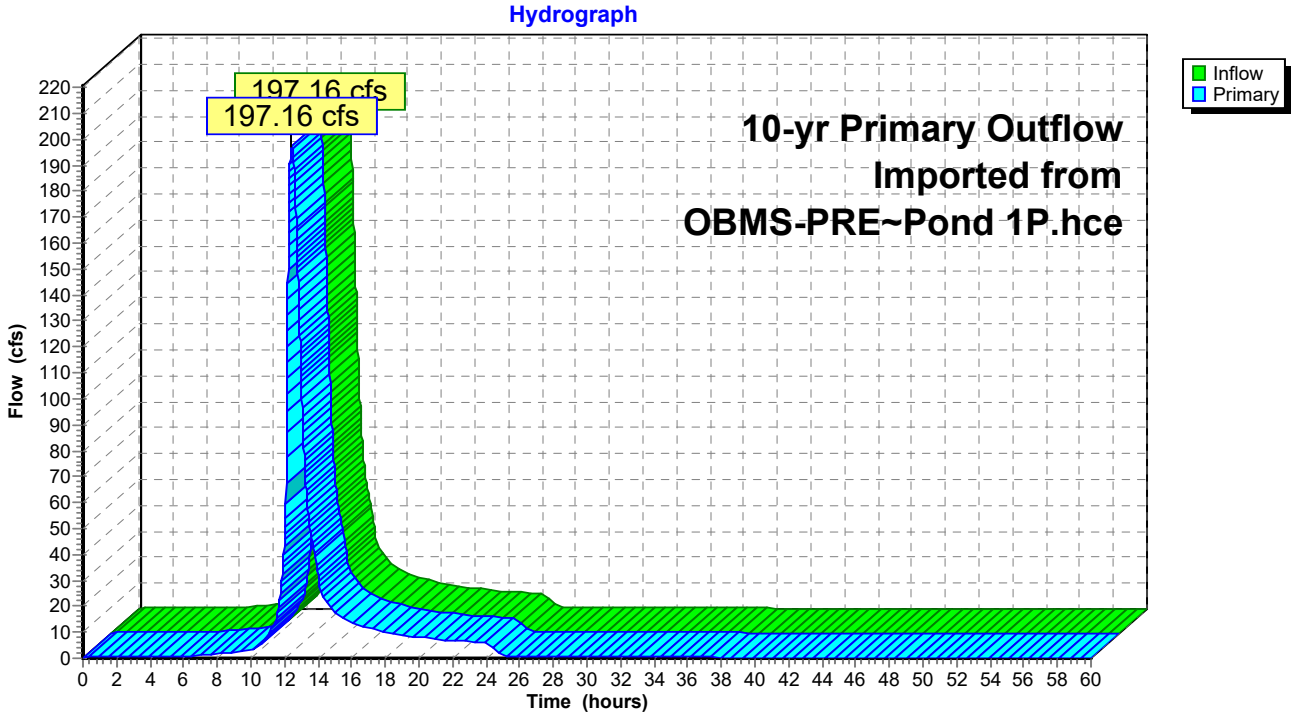
Summary for Link 6L: BERRYFIELD POND OUTFLOW

Inflow	=	197.16 cfs @	12.42 hrs,	Volume=	29.667 af
Primary	=	197.16 cfs @	12.42 hrs,	Volume=	29.667 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

10-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 6L: BERRYFIELD POND OUTFLOW



Summary for Subcatchment 3S: 5'x3' CONC.BOX DA

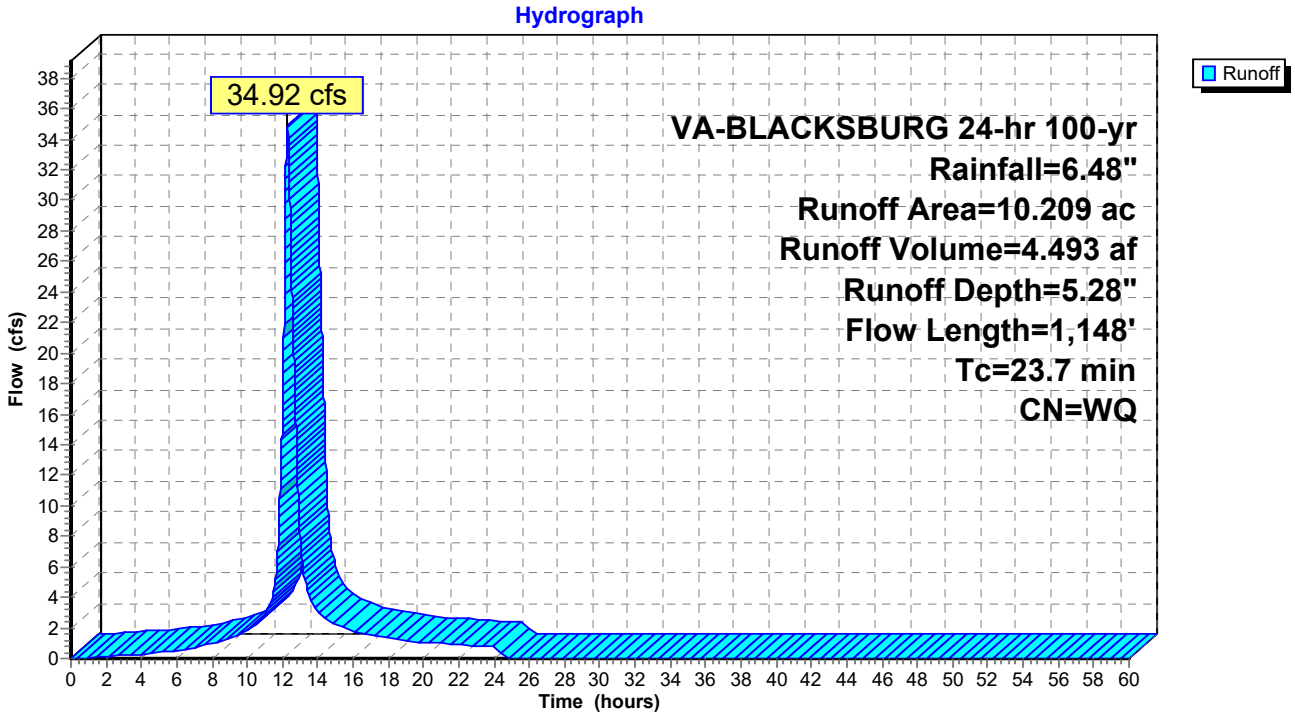
Runoff = 34.92 cfs @ 12.27 hrs, Volume= 4.493 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.101	74	>75% Grass cover, Good, HSG C
0.620	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.201	95	Urban commercial, 85% imp, HSG D
0.593	98	Paved roads w/curbs & sewers, HSG C
1.692	98	Paved roads w/curbs & sewers, HSG D
0.222	98	Paved parking, HSG D
10.209		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 3S: 5'x3' CONC.BOX DA



Summary for Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)

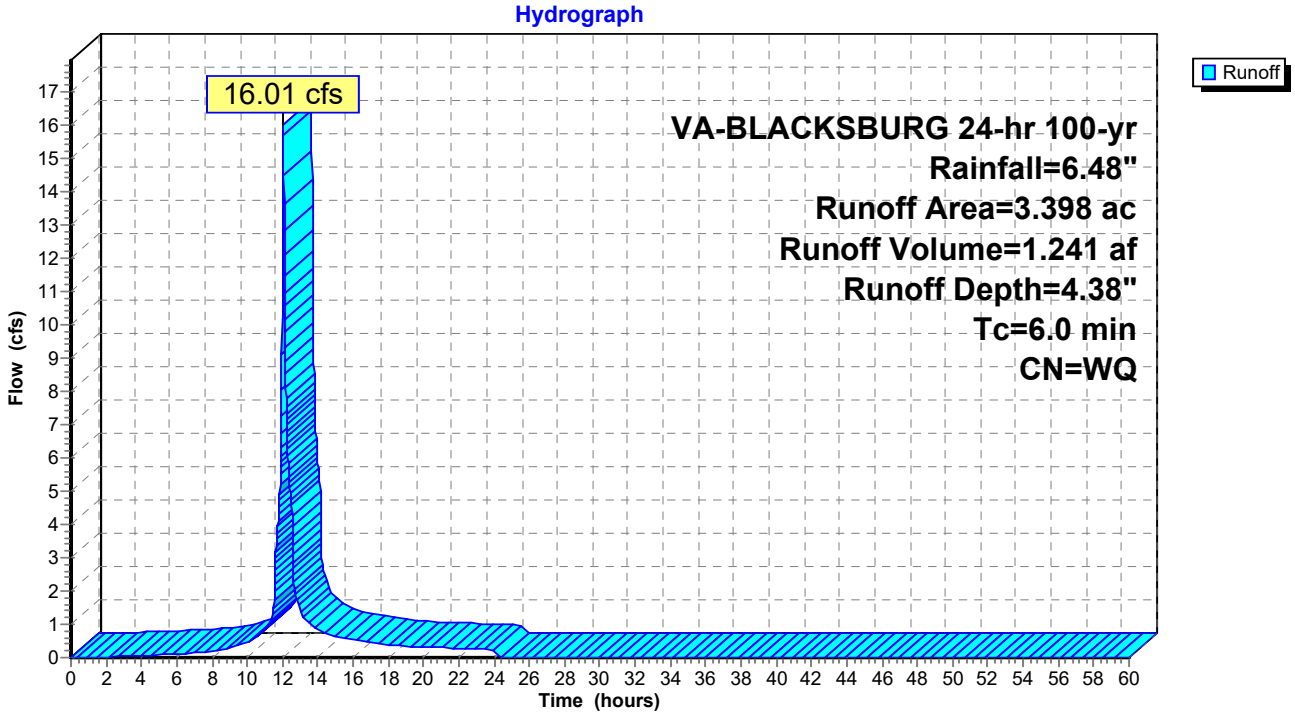
Runoff = 16.01 cfs @ 12.04 hrs, Volume= 1.241 af, Depth= 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
1.371	74	>75% Grass cover, Good, HSG C
0.067	80	>75% Grass cover, Good, HSG D
0.584	70	Woods, Good, HSG C
1.096	92	Paved roads w/open ditches, 50% imp, HSG C
0.005	93	Paved roads w/open ditches, 50% imp, HSG D
0.275	98	Paved parking, HSG C
3.398		Weighted Average

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

Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)



Summary for Subcatchment 7S: EX. MH "A" DA

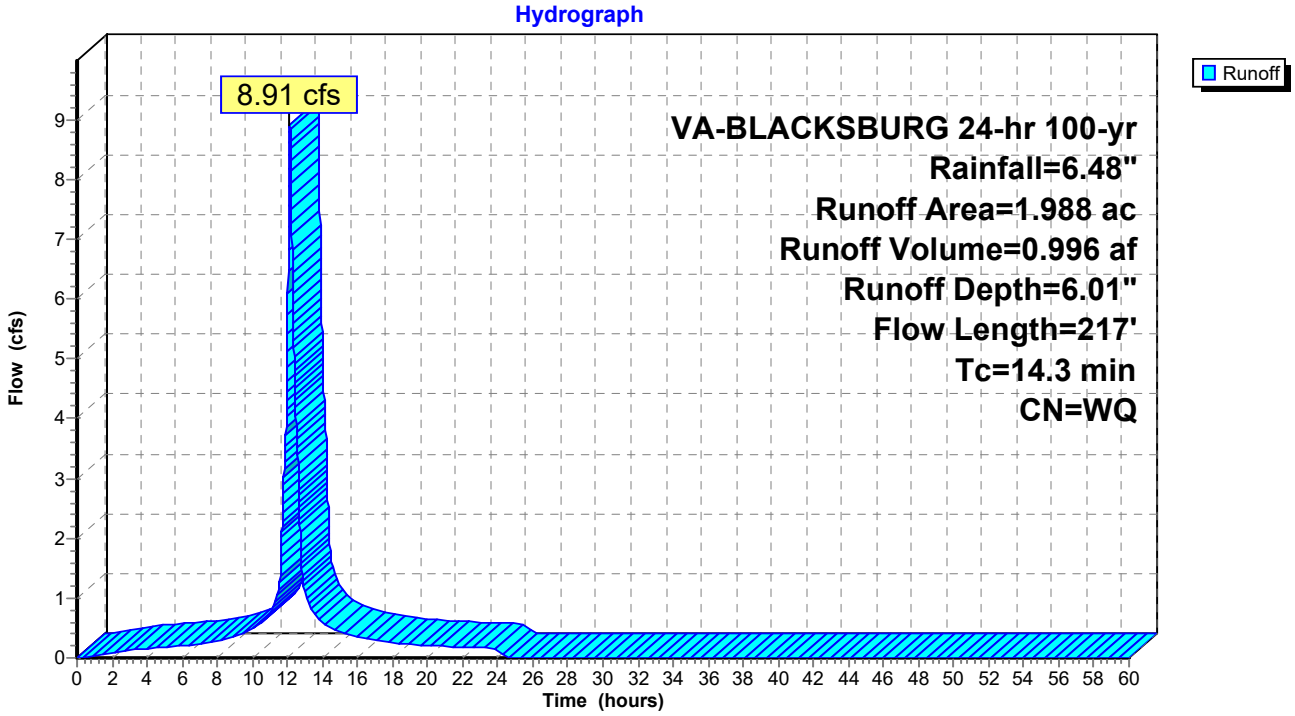
Runoff = 8.91 cfs @ 12.15 hrs, Volume= 0.996 af, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.011	98	Paved parking, HSG C
1.037	98	Paved parking, HSG D
0.716	98	Paved roads w/curbs & sewers, HSG D
0.224	80	>75% Grass cover, Good, HSG D
1.988		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	150	0.0567	0.18		**Sheet Flow, Tc1** Grass: Dense n= 0.240 P2= 2.76"
0.3	67	0.0820	4.30		**Shallow Concentrated Flow, Tc2** Grassed Waterway Kv= 15.0 fps
14.3	217	Total			

Subcatchment 7S: EX. MH "A" DA



Summary for Subcatchment 8S: TO UNDERGROUND DETENTION

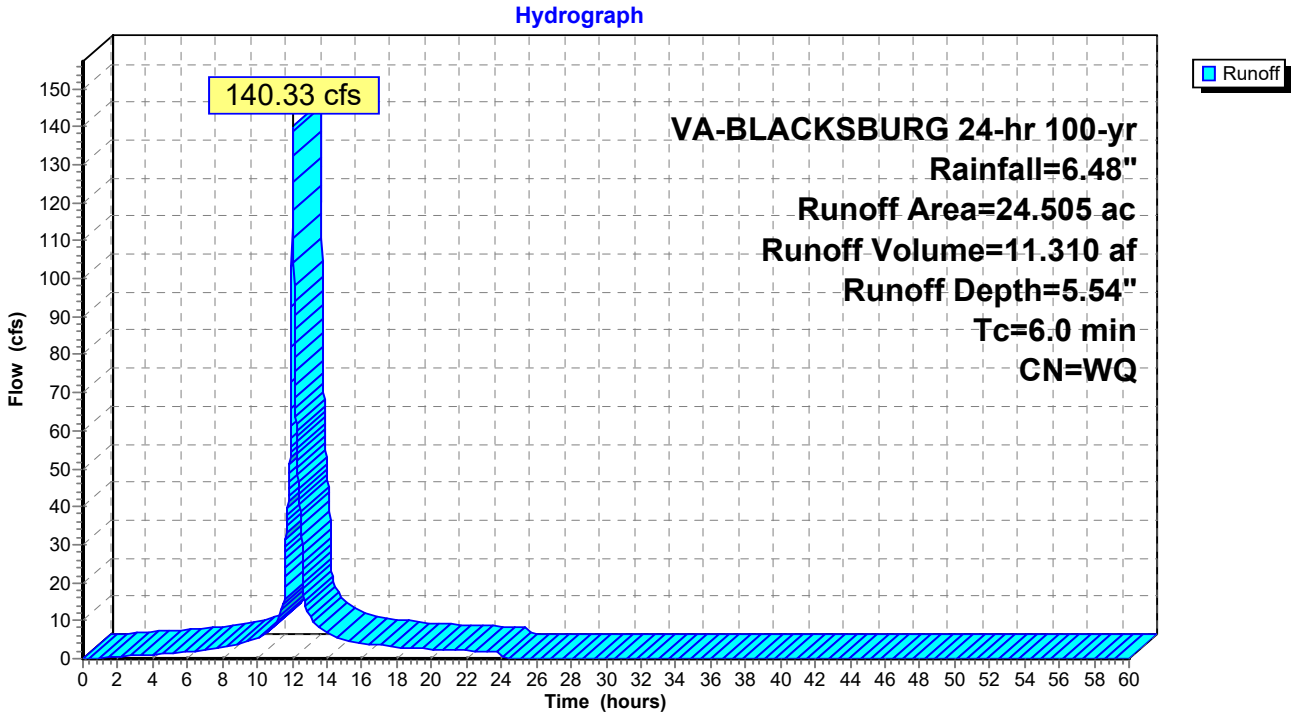
Runoff = 140.33 cfs @ 12.04 hrs, Volume= 11.310 af, Depth= 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	1.330	98	Paved parking, HSG C
	8.380	98	Paved parking, HSG D
	0.932	74	>75% Grass cover, Good, HSG C
	2.936	80	>75% Grass cover, Good, HSG D
*	0.846	91	PRD Parcel #3
*	1.965	92	PRD Parcel #4
*	2.079	93	PRD Parcel #5
*	1.692	92	PRD Parcel #6
	0.330	81	1/3 acre lots, 30% imp, HSG C
*	4.015	90	Carry Over from Villas Infiltration Pits
	24.505		Weighted Average

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

Subcatchment 8S: TO UNDERGROUND DETENTION



Summary for Subcatchment 9S: DIRECT RUNOFF TO MH "B"

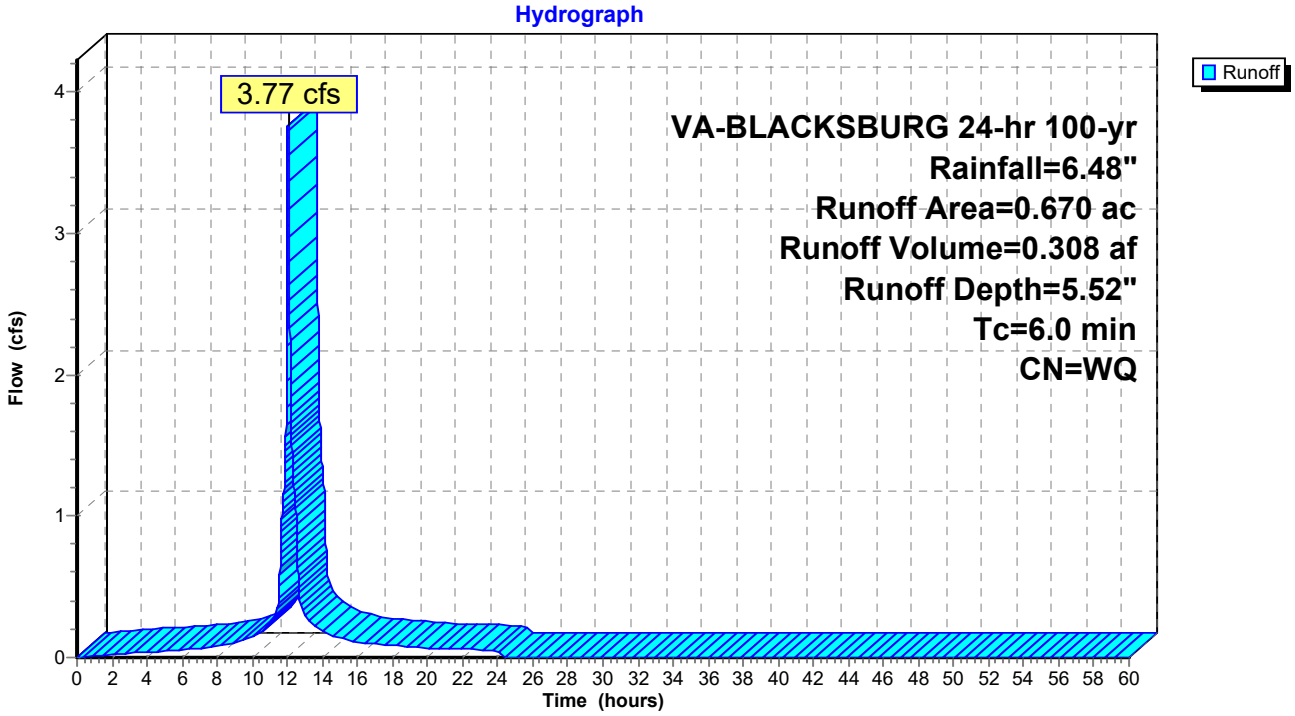
Runoff = 3.77 cfs @ 12.04 hrs, Volume= 0.308 af, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.430	98	Paved parking, HSG D
0.240	80	>75% Grass cover, Good, HSG D
0.670		Weighted Average

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

Subcatchment 9S: DIRECT RUNOFF TO MH "B"



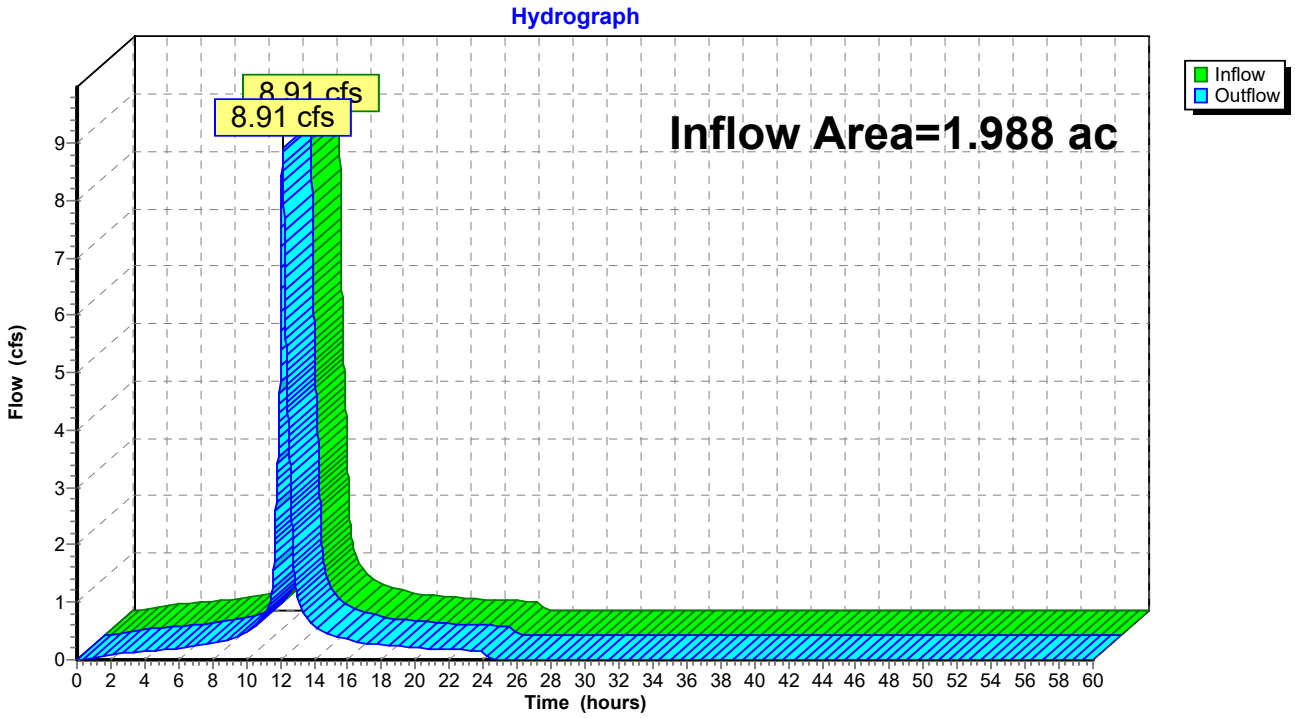
Summary for Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.988 ac, Inflow Depth = 6.01" for 100-yr event
Inflow = 8.91 cfs @ 12.15 hrs, Volume= 0.996 af
Outflow = 8.91 cfs @ 12.15 hrs, Volume= 0.996 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 1R: ANALYSIS POINT 1 - MH "A" MAIN ST



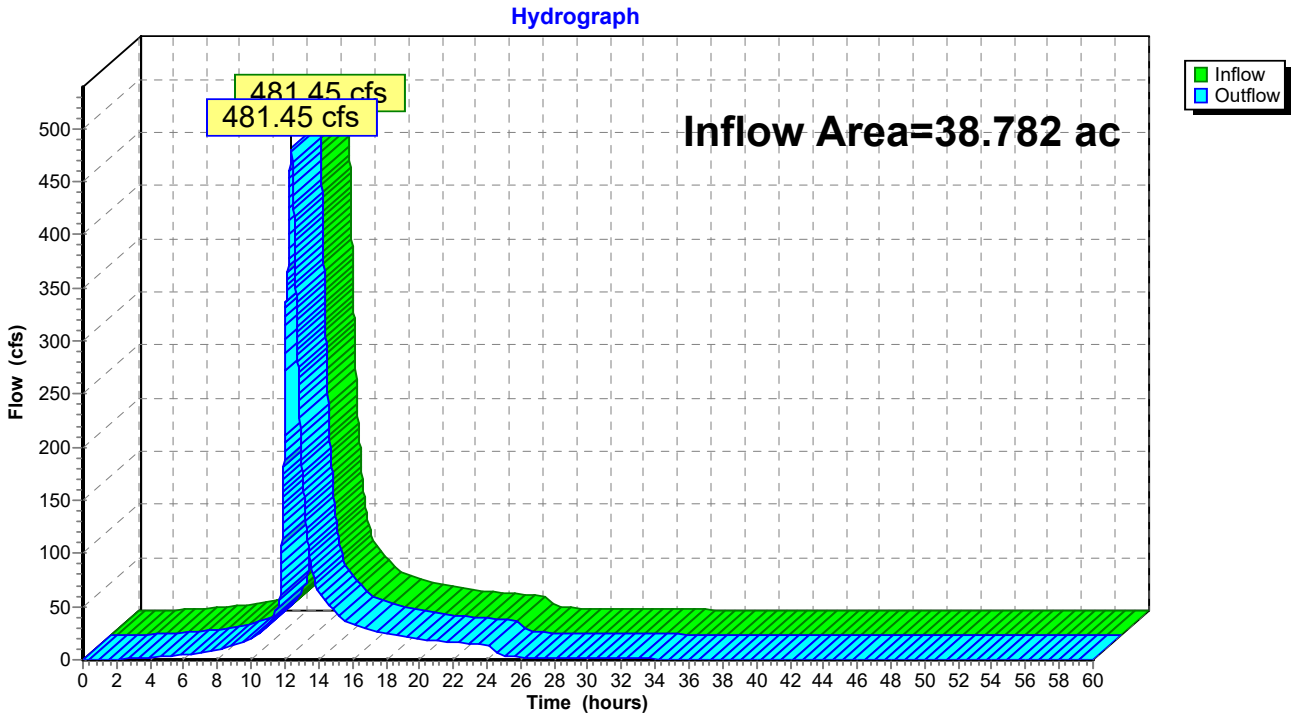
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 38.782 ac, Inflow Depth = 22.91" for 100-yr event
Inflow = 481.45 cfs @ 12.35 hrs, Volume= 74.056 af
Outflow = 481.45 cfs @ 12.35 hrs, Volume= 74.056 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT



Summary for Pond 5P: EX 50"x31" CMP

[58] Hint: Peaked 1.15' above defined flood level

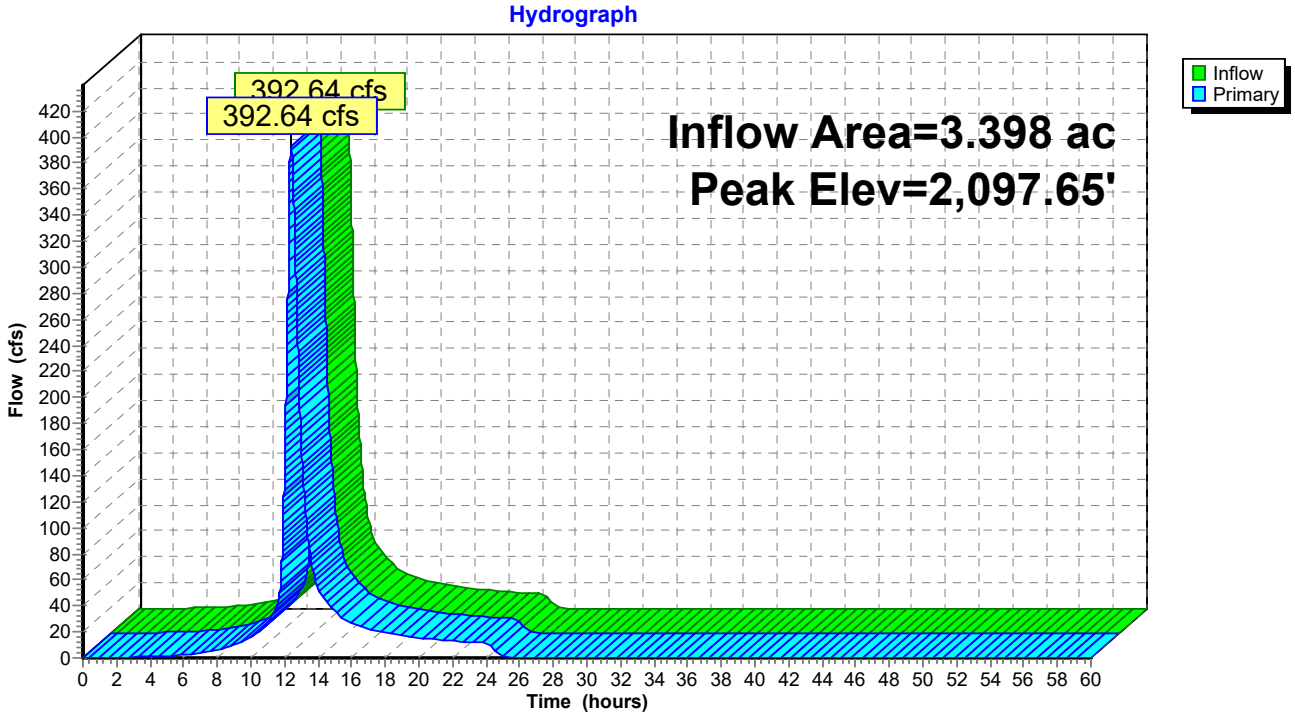
Inflow Area =	3.398 ac,	Inflow Depth =	204.67"	for	100-yr event
Inflow =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af	
Outflow =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af,	Atten= 0%, Lag= 0.0 min
Primary =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.65' @ 12.38 hrs
Flood Elev= 2,096.50'

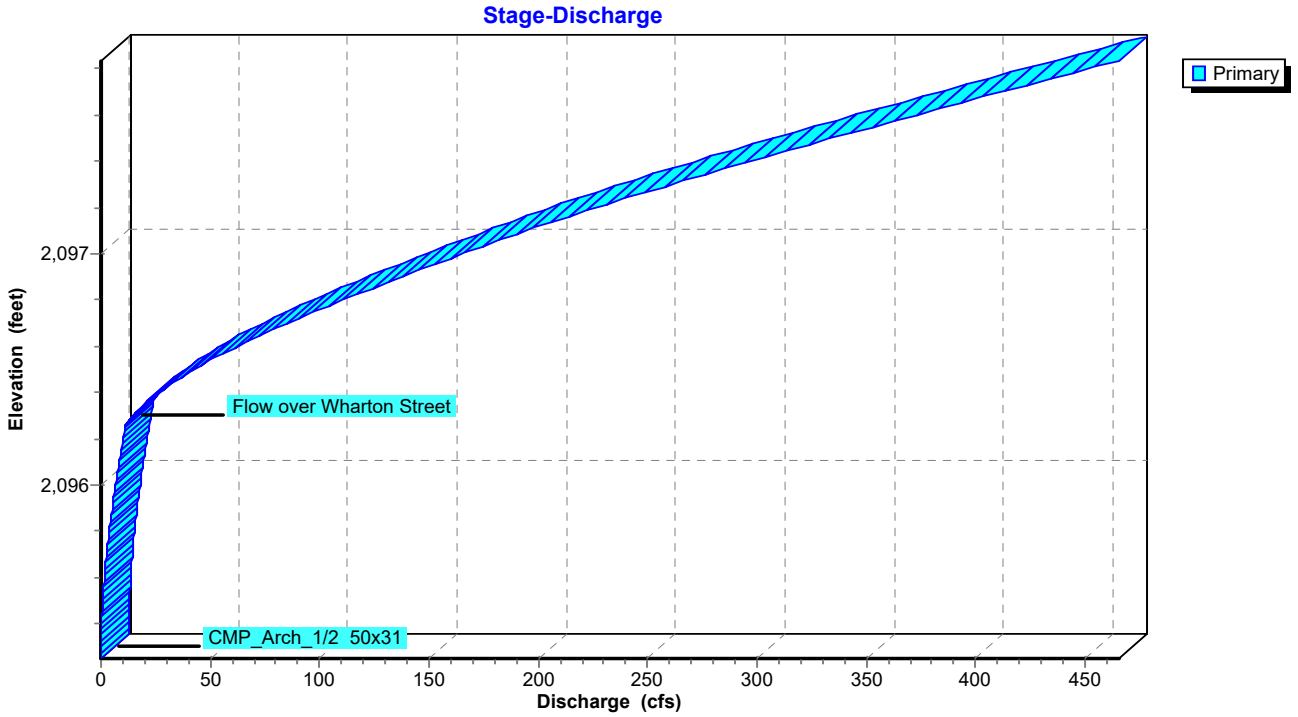
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=392.57 cfs @ 12.38 hrs HW=2,097.65' (Free Discharge)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 42.31 cfs @ 5.16 fps)
└─**2=Flow over Wharton Street** (Weir Controls 350.27 cfs @ 3.12 fps)

Pond 5P: EX 50"x31" CMP



Pond 5P: EX 50"x31" CMP



Summary for Pond 6P: UG DETENTION

[93] Warning: Storage range exceeded by 48.80'
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 24.505 ac, Inflow Depth = 5.54" for 100-yr event
Inflow = 140.33 cfs @ 12.04 hrs, Volume= 11.310 af
Outflow = 140.61 cfs @ 12.04 hrs, Volume= 11.300 af, Atten= 0%, Lag= 0.1 min
Primary = 140.61 cfs @ 12.04 hrs, Volume= 11.300 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,165.80' @ 12.04 hrs Surf.Area= 0.412 ac Storage= 2.262 af

Plug-Flow detention time= 168.1 min calculated for 11.298 af (100% of inflow)
Center-of-Mass det. time= 167.8 min (937.6 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,107.50'	1.103 af	**83.00'W x 216.42'L x 9.50'H Field A** 3.917 af Overall - 1.159 af Embedded = 2.759 af x 40.0% Voids
#2A	2,111.00'	1.159 af	**ADS_StormTech MC-4500 +Cap** x 468 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 9 Rows of 52 Chambers Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf
		2.262 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,107.50'	**30.0" Round 30" HDPE Culvert** L= 474.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,107.50' / 2,104.10' S= 0.0072 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.91 sf
#2	Device 1	2,107.50'	**Reg-U-Flo CX 9.5-in**
#3	Device 1	2,113.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	2,114.75'	**8.0' 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=140.23 cfs @ 12.04 hrs HW=2,165.49' (Free Discharge)
└─**1=30" HDPE Culvert** (Barrel Controls 140.23 cfs @ 28.57 fps)
  ├─**2=Reg-U-Flo CX 9.5-in** (Passes < 10.83 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 18.86 cfs potential flow)
  └─**4=Broad-Crested Rectangular Weir** (Passes < 9,598.69 cfs potential flow)

Pond 6P: UG DETENTION - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 9 rows = 642.6 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

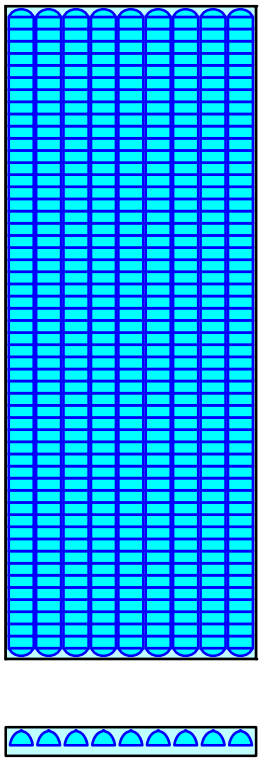
52 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 214.42' Row Length +12.0" End Stone x 2 = 216.42' Base Length
9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width
42.0" Base + 60.0" Chamber Height + 12.0" Cover = 9.50' Field Height

468 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 9 Rows = 50,480.1 cf Chamber Storage

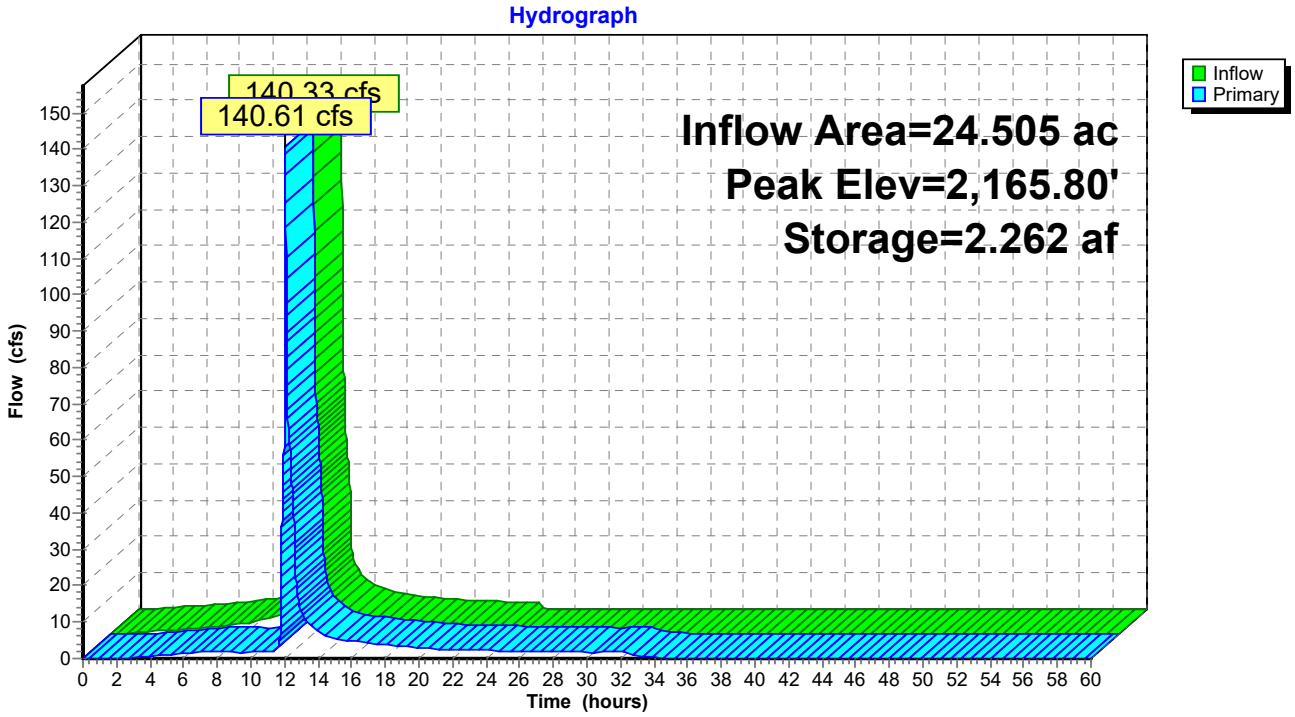
170,644.5 cf Field - 50,480.1 cf Chambers = 120,164.4 cf Stone x 40.0% Voids = 48,065.8 cf Stone Storage

Chamber Storage + Stone Storage = 98,545.9 cf = 2.262 af
Overall Storage Efficiency = 57.7%
Overall System Size = 216.42' x 83.00' x 9.50'

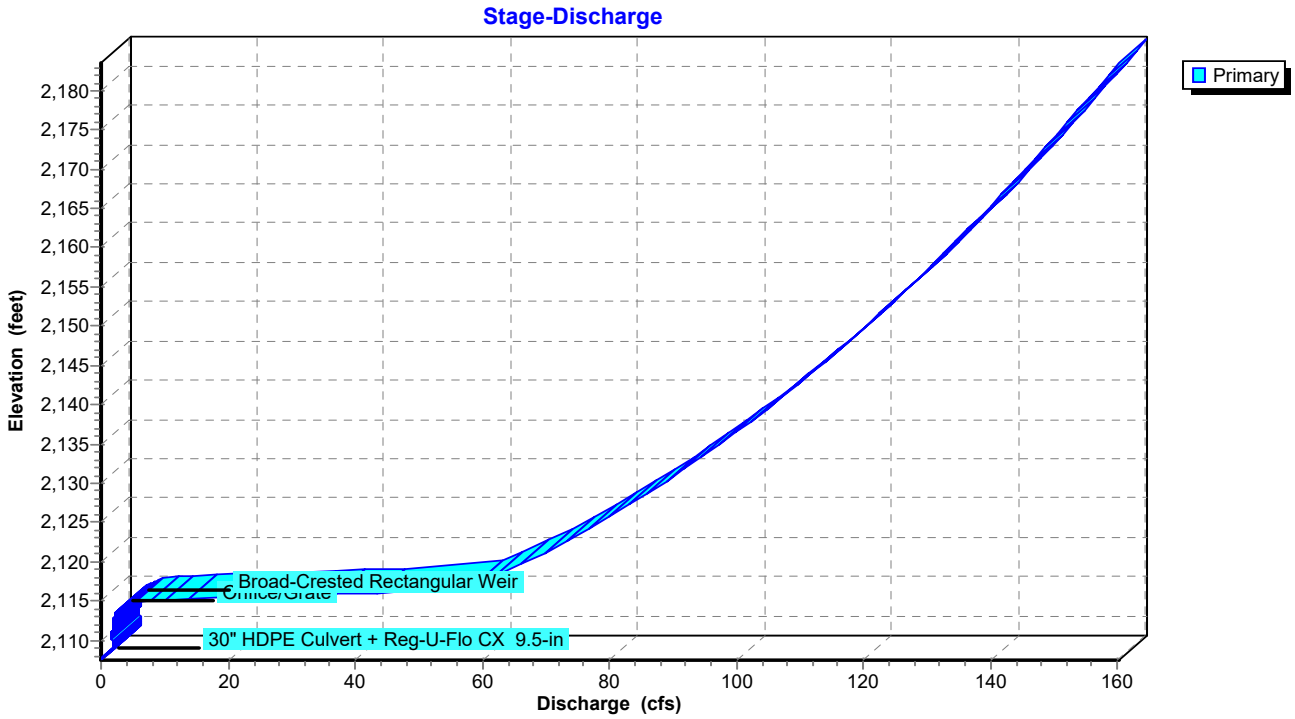
468 Chambers
6,320.2 cy Field
4,450.5 cy Stone



Pond 6P: UG DETENTION



Pond 6P: UG DETENTION



Summary for Pond 9P: MH "B"

[58] Hint: Peaked 25.99' above defined flood level
[79] Warning: Submerged Pond 6P Primary device # 1 INLET by 27.26'

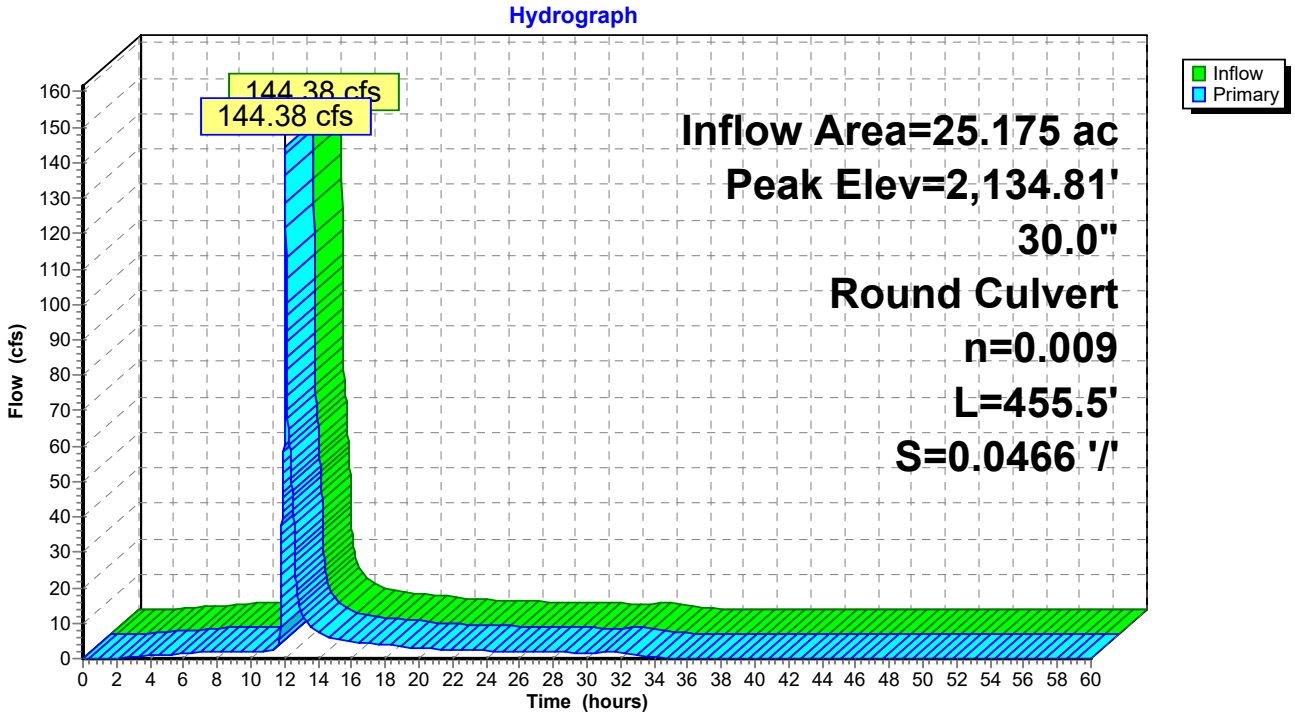
Inflow Area =	25.175 ac,	Inflow Depth =	5.53"	for	100-yr event
Inflow =	144.38 cfs @	12.04 hrs,	Volume=	11.608 af	
Outflow =	144.38 cfs @	12.04 hrs,	Volume=	11.608 af,	Atten= 0%, Lag= 0.0 min
Primary =	144.38 cfs @	12.04 hrs,	Volume=	11.608 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,134.81' @ 12.04 hrs
Flood Elev= 2,108.82'

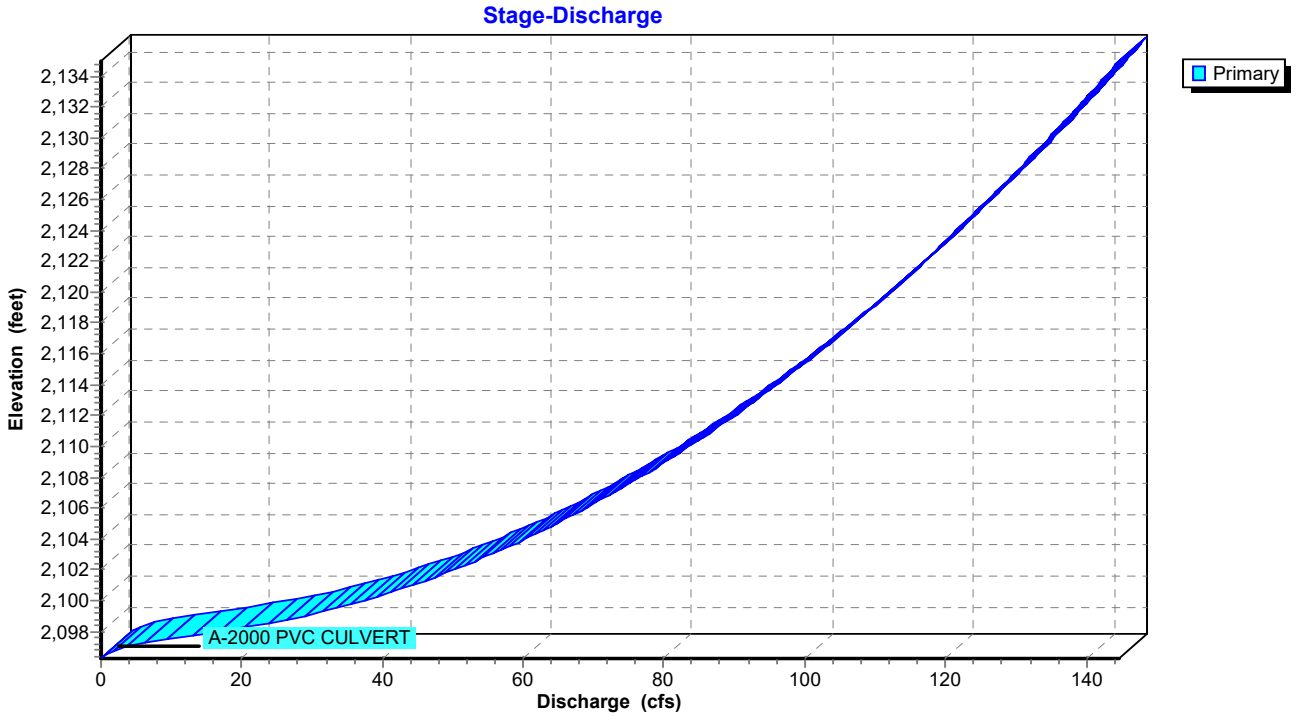
Device	Routing	Invert	Outlet Devices
#1	Primary	2,096.25'	**30.0" Round A-2000 PVC CULVERT** L= 455.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,096.25' / 2,075.02' S= 0.0466 '/' Cc= 0.900 n= 0.009, Flow Area= 4.91 sf

Primary OutFlow Max=144.00 cfs @ 12.04 hrs HW=2,134.62' (Free Discharge)
└─**1=A-2000 PVC CULVERT** (Inlet Controls 144.00 cfs @ 29.33 fps)

Pond 9P: MH "B"



Pond 9P: MH "B"


Stage-Discharge
Primary
Elevation (feet)
2,134
2,132
2,130
2,128
2,126
2,124
2,122
2,120
2,118
2,116
2,114
2,112
2,110
2,108
2,106
2,104
2,102
2,100
2,098
A-2000 PVC CULVERT
0
20
40
60
80
100
120
140
Discharge (cfs)

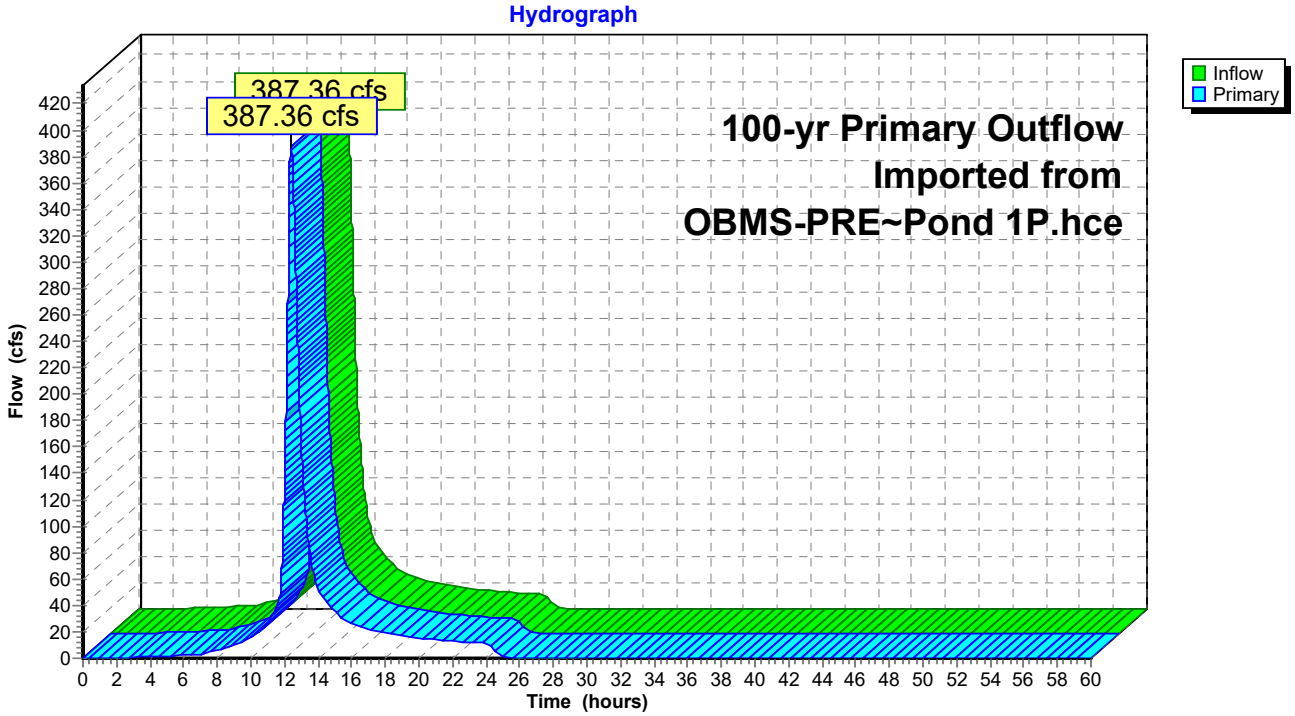
Summary for Link 6L: BERRYFIELD POND OUTFLOW

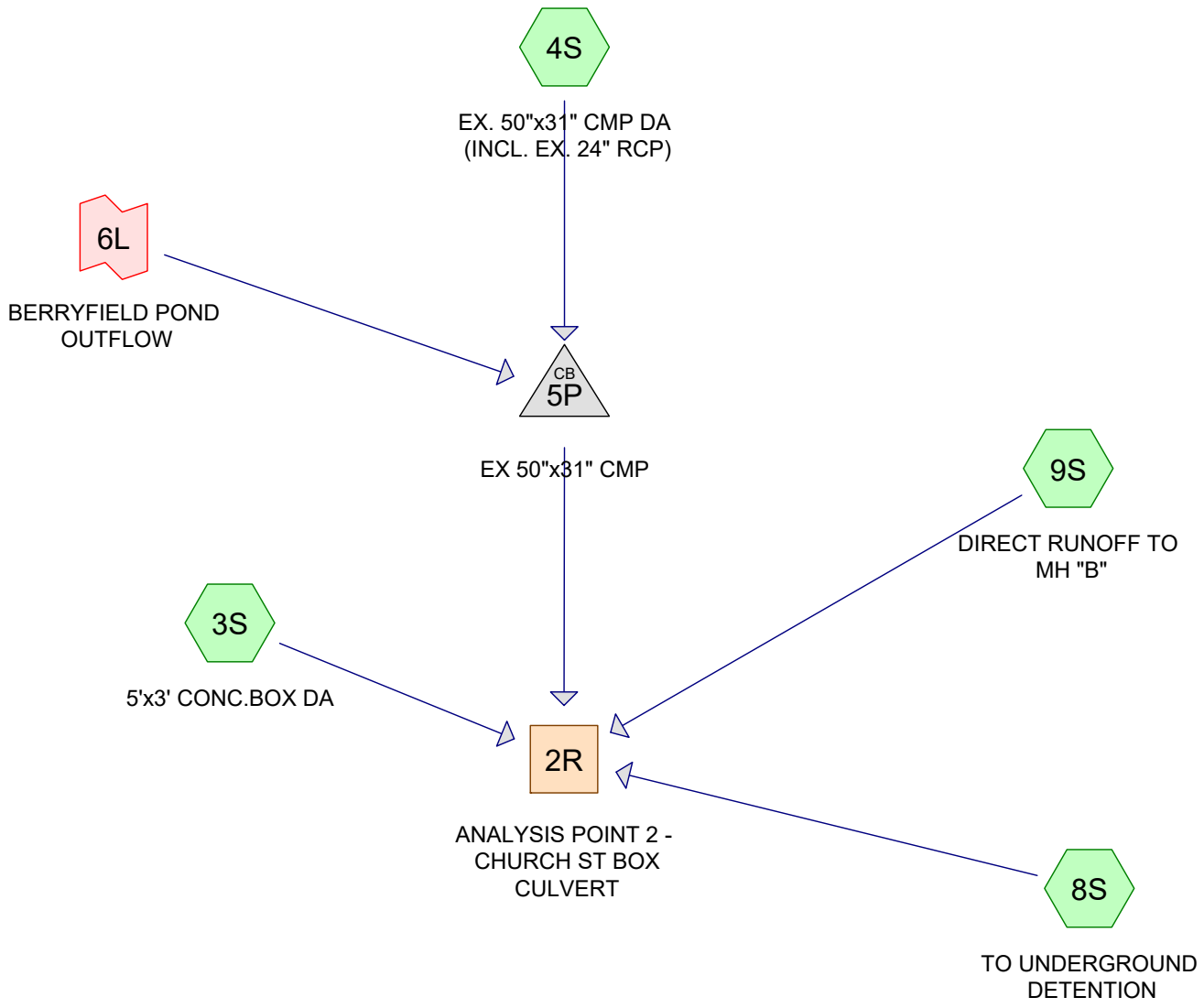
Inflow	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af
Primary	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af, Atten= 0%, Lag= 0.0 min

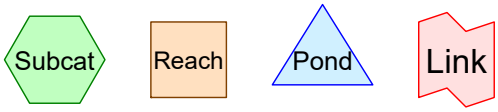
Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

100-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 6L: BERRYFIELD POND OUTFLOW







Routing Diagram for OBMS-POST 100 YEAR
Prepared by Balzer & Associates, Inc., Printed 10/6/2017
HydroCAD® 10.00-20 s/n 07713 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.094	80	1/2 acre lots, 25% imp, HSG C (3S)
0.122	85	1/2 acre lots, 25% imp, HSG D (3S)
0.330	81	1/3 acre lots, 30% imp, HSG C (8S)
1.676	83	1/4 acre lots, 38% imp, HSG C (3S)
2.736	87	1/4 acre lots, 38% imp, HSG D (3S)
0.287	90	1/8 acre lots, 65% imp, HSG C (3S)
1.682	92	1/8 acre lots, 65% imp, HSG D (3S)
2.404	74	>75% Grass cover, Good, HSG C (3S, 4S, 8S)
3.860	80	>75% Grass cover, Good, HSG D (3S, 4S, 8S, 9S)
4.015	90	Carry Over from Villas Infiltration Pits (8S)
0.846	91	PRD Parcel #3 (8S)
1.965	92	PRD Parcel #4 (8S)
2.079	93	PRD Parcel #5 (8S)
1.692	92	PRD Parcel #6 (8S)
1.608	98	Paved parking, HSG C (4S, 8S)
9.032	98	Paved parking, HSG D (3S, 8S, 9S)
0.593	98	Paved roads w/curbs & sewers, HSG C (3S)
1.692	98	Paved roads w/curbs & sewers, HSG D (3S)
1.096	92	Paved roads w/open ditches, 50% imp, HSG C (4S)
0.005	93	Paved roads w/open ditches, 50% imp, HSG D (4S)
0.183	94	Urban commercial, 85% imp, HSG C (3S)
0.201	95	Urban commercial, 85% imp, HSG D (3S)
0.584	70	Woods, Good, HSG C (4S)
38.782	**90**	**TOTAL AREA**

Summary for Subcatchment 3S: 5'x3' CONC.BOX DA

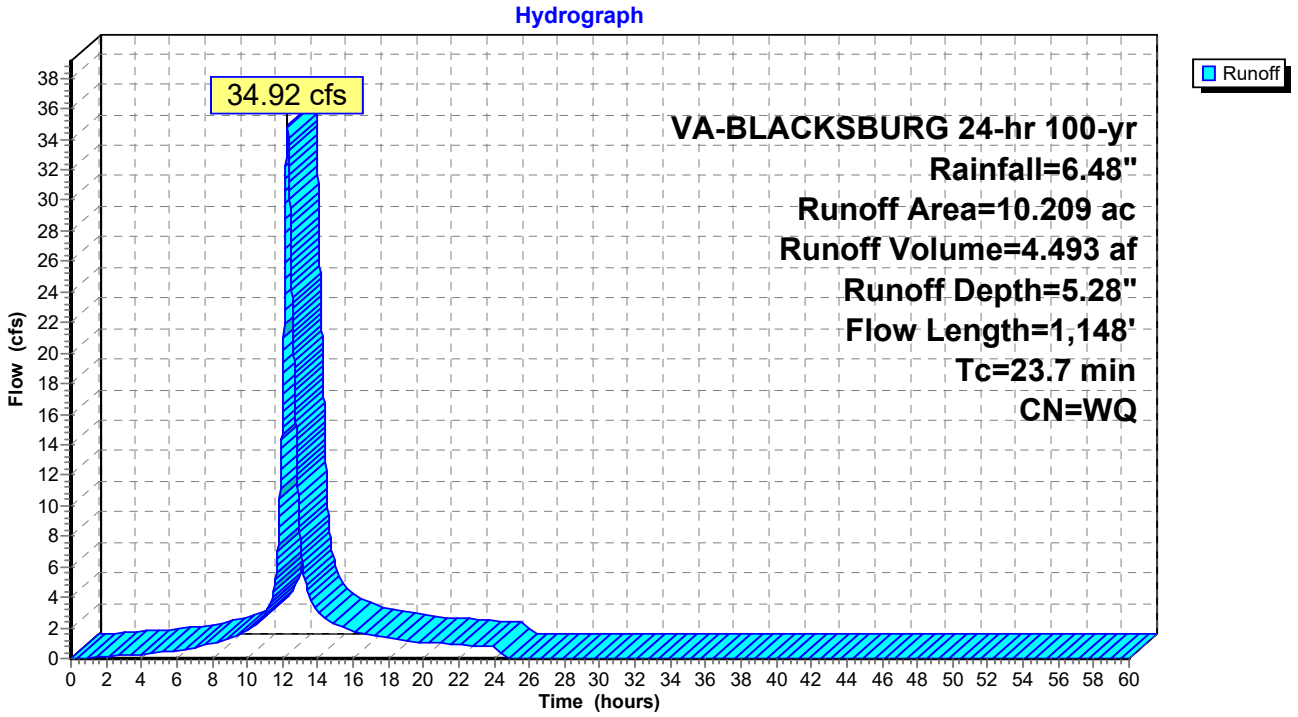
Runoff = 34.92 cfs @ 12.27 hrs, Volume= 4.493 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.101	74	>75% Grass cover, Good, HSG C
0.620	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.201	95	Urban commercial, 85% imp, HSG D
0.593	98	Paved roads w/curbs & sewers, HSG C
1.692	98	Paved roads w/curbs & sewers, HSG D
0.222	98	Paved parking, HSG D
10.209		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 3S: 5'x3' CONC.BOX DA



Summary for Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)

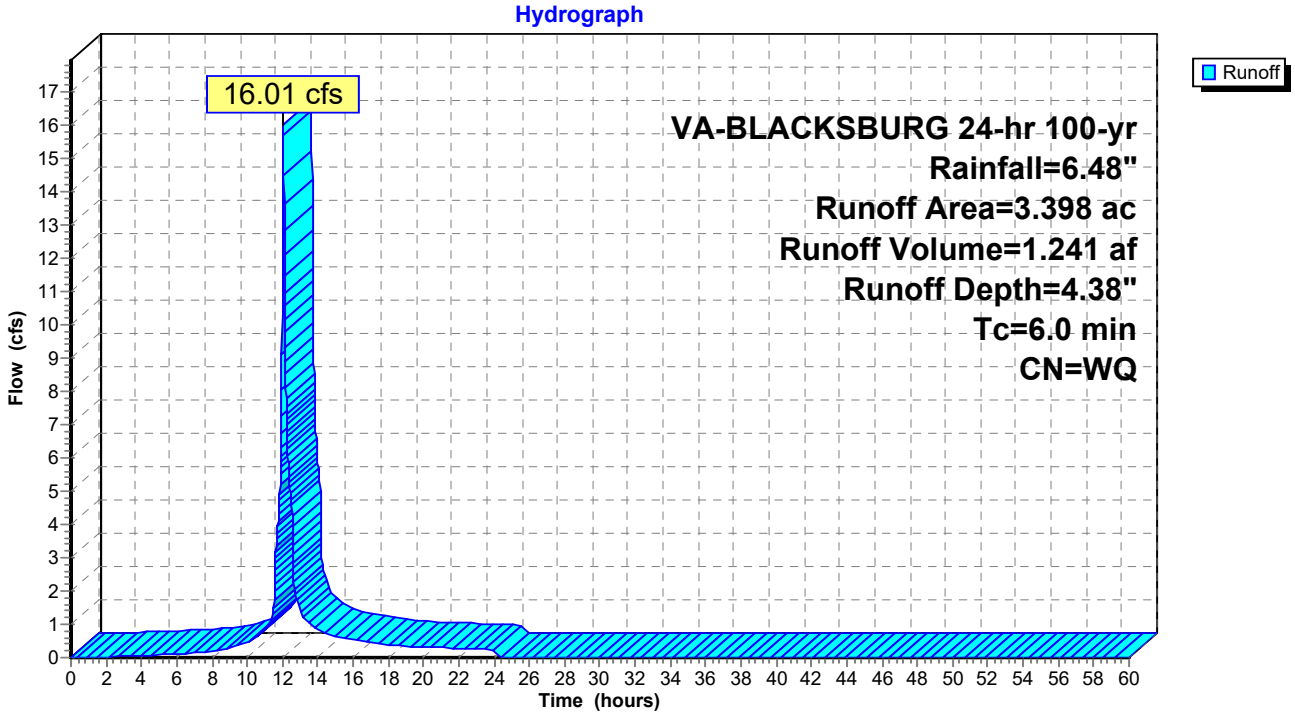
Runoff = 16.01 cfs @ 12.04 hrs, Volume= 1.241 af, Depth= 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
1.371	74	>75% Grass cover, Good, HSG C
0.067	80	>75% Grass cover, Good, HSG D
0.584	70	Woods, Good, HSG C
1.096	92	Paved roads w/open ditches, 50% imp, HSG C
0.005	93	Paved roads w/open ditches, 50% imp, HSG D
0.275	98	Paved parking, HSG C
3.398		Weighted Average

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

Subcatchment 4S: EX. 50"x31" CMP DA (INCL. EX. 24" RCP)



Summary for Subcatchment 8S: TO UNDERGROUND DETENTION

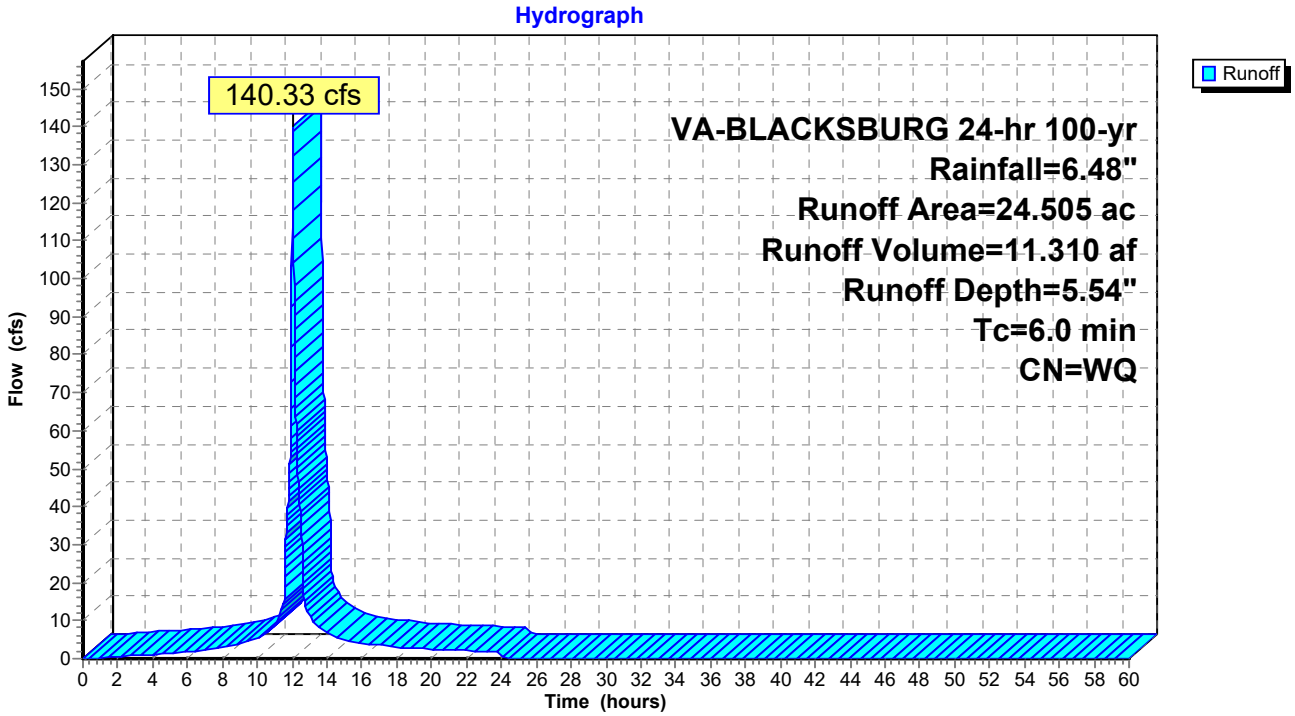
Runoff = 140.33 cfs @ 12.04 hrs, Volume= 11.310 af, Depth= 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

	Area (ac)	CN	Description
	1.333	98	Paved parking, HSG C
	8.380	98	Paved parking, HSG D
	0.932	74	>75% Grass cover, Good, HSG C
	2.933	80	>75% Grass cover, Good, HSG D
*	0.846	91	PRD Parcel #3
*	1.965	92	PRD Parcel #4
*	2.079	93	PRD Parcel #5
*	1.692	92	PRD Parcel #6
	0.330	81	1/3 acre lots, 30% imp, HSG C
*	4.015	90	Carry Over from Villas Infiltration Pits
	24.505		Weighted Average

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

Subcatchment 8S: TO UNDERGROUND DETENTION



Summary for Subcatchment 9S: DIRECT RUNOFF TO MH "B"

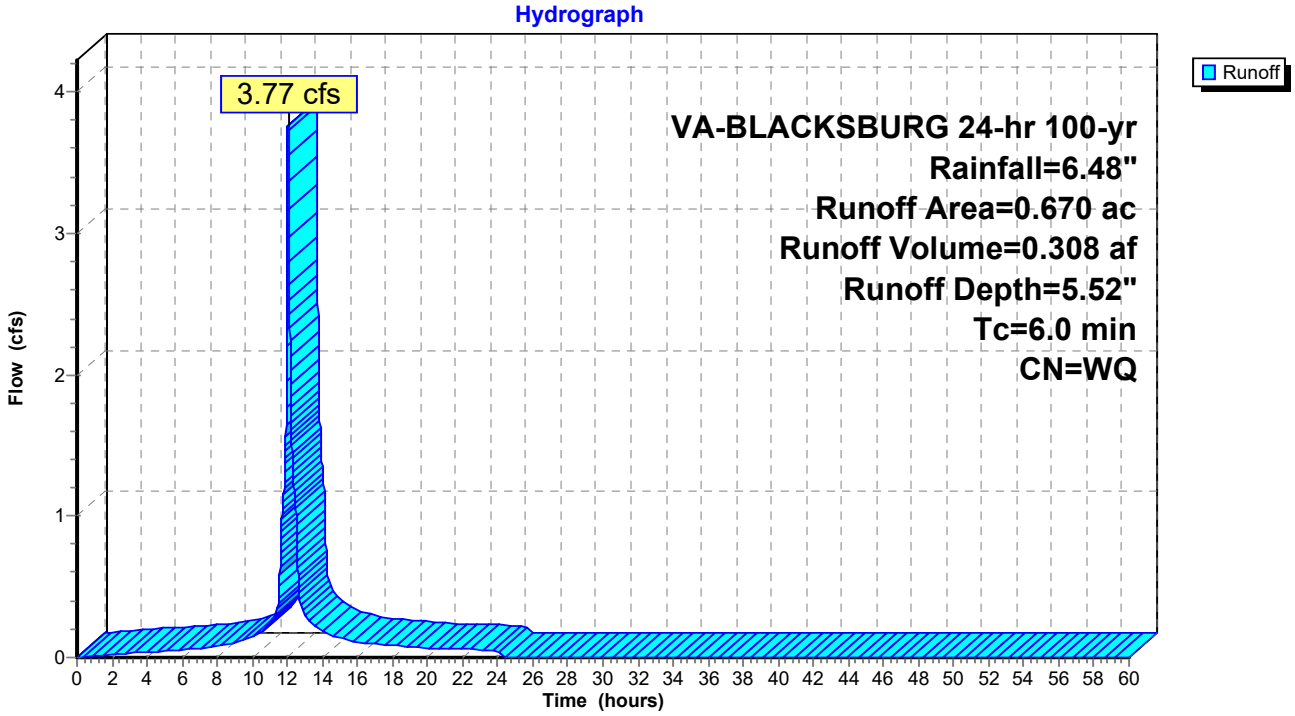
Runoff = 3.77 cfs @ 12.04 hrs, Volume= 0.308 af, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.430	98	Paved parking, HSG D
0.240	80	>75% Grass cover, Good, HSG D
0.670		Weighted Average

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

Subcatchment 9S: DIRECT RUNOFF TO MH "B"



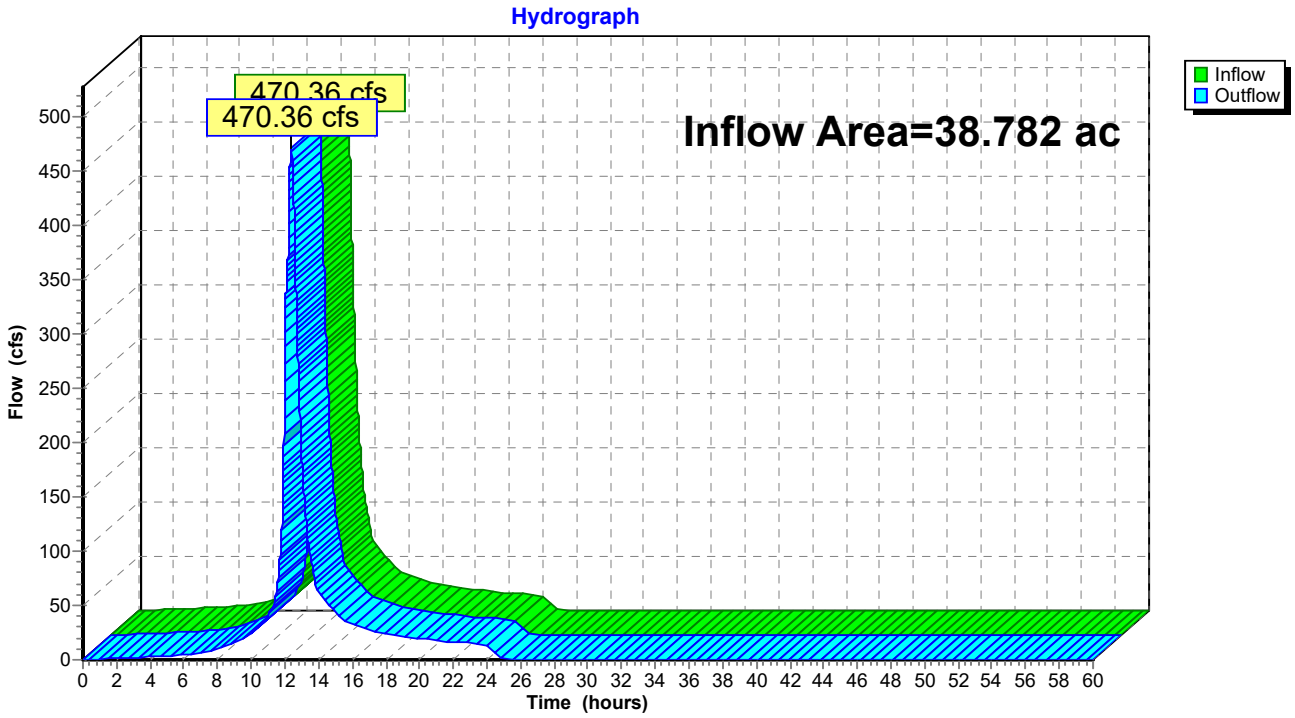
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 38.782 ac, Inflow Depth = 22.92" for 100-yr event
Inflow = 470.36 cfs @ 12.36 hrs, Volume= 74.066 af
Outflow = 470.36 cfs @ 12.36 hrs, Volume= 74.066 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST BOX CULVERT



Summary for Pond 5P: EX 50"x31" CMP

[58] Hint: Peaked 1.15' above defined flood level

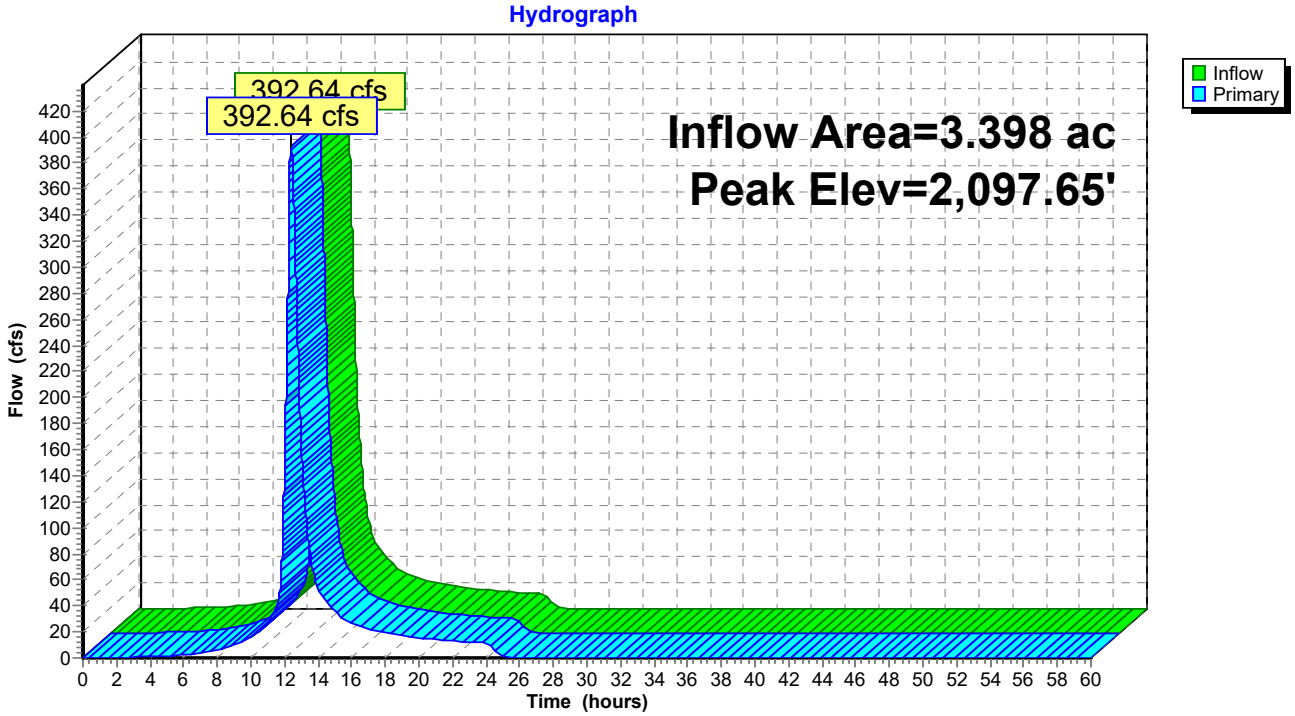
Inflow Area =	3.398 ac,	Inflow Depth =	204.67"	for	100-yr event
Inflow =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af	
Outflow =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af,	Atten= 0%, Lag= 0.0 min
Primary =	392.64 cfs @	12.38 hrs,	Volume=	57.955 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 2,097.65' @ 12.38 hrs
Flood Elev= 2,096.50'

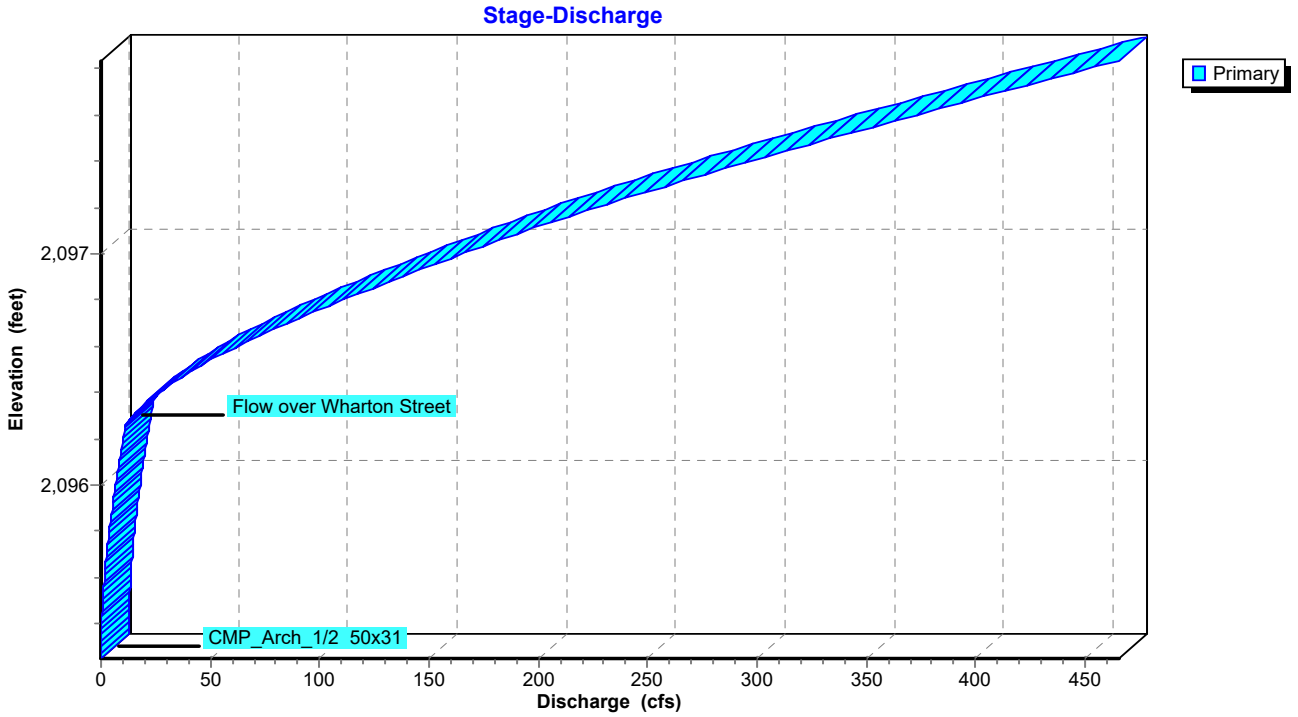
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=392.57 cfs @ 12.38 hrs HW=2,097.65' (Free Discharge)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 42.31 cfs @ 5.16 fps)
└─**2=Flow over Wharton Street** (Weir Controls 350.27 cfs @ 3.12 fps)

Pond 5P: EX 50"x31" CMP



Pond 5P: EX 50"x31" CMP



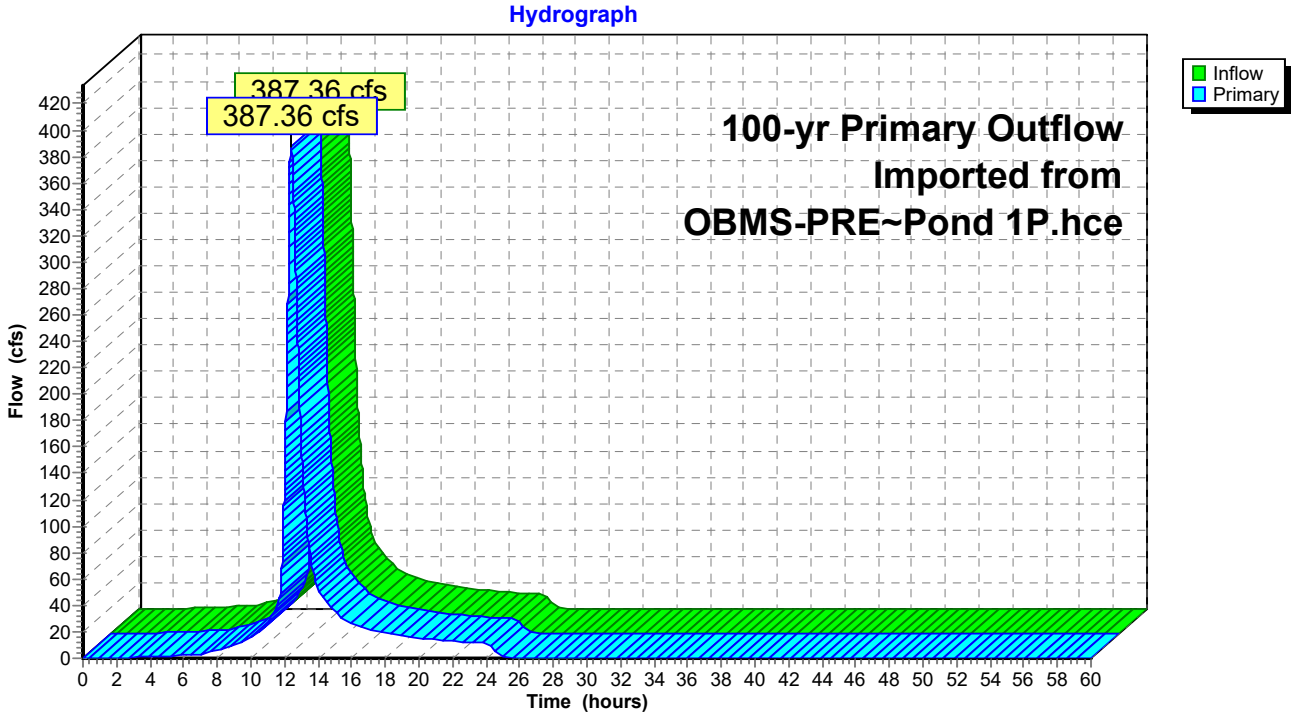
Summary for Link 6L: BERRYFIELD POND OUTFLOW

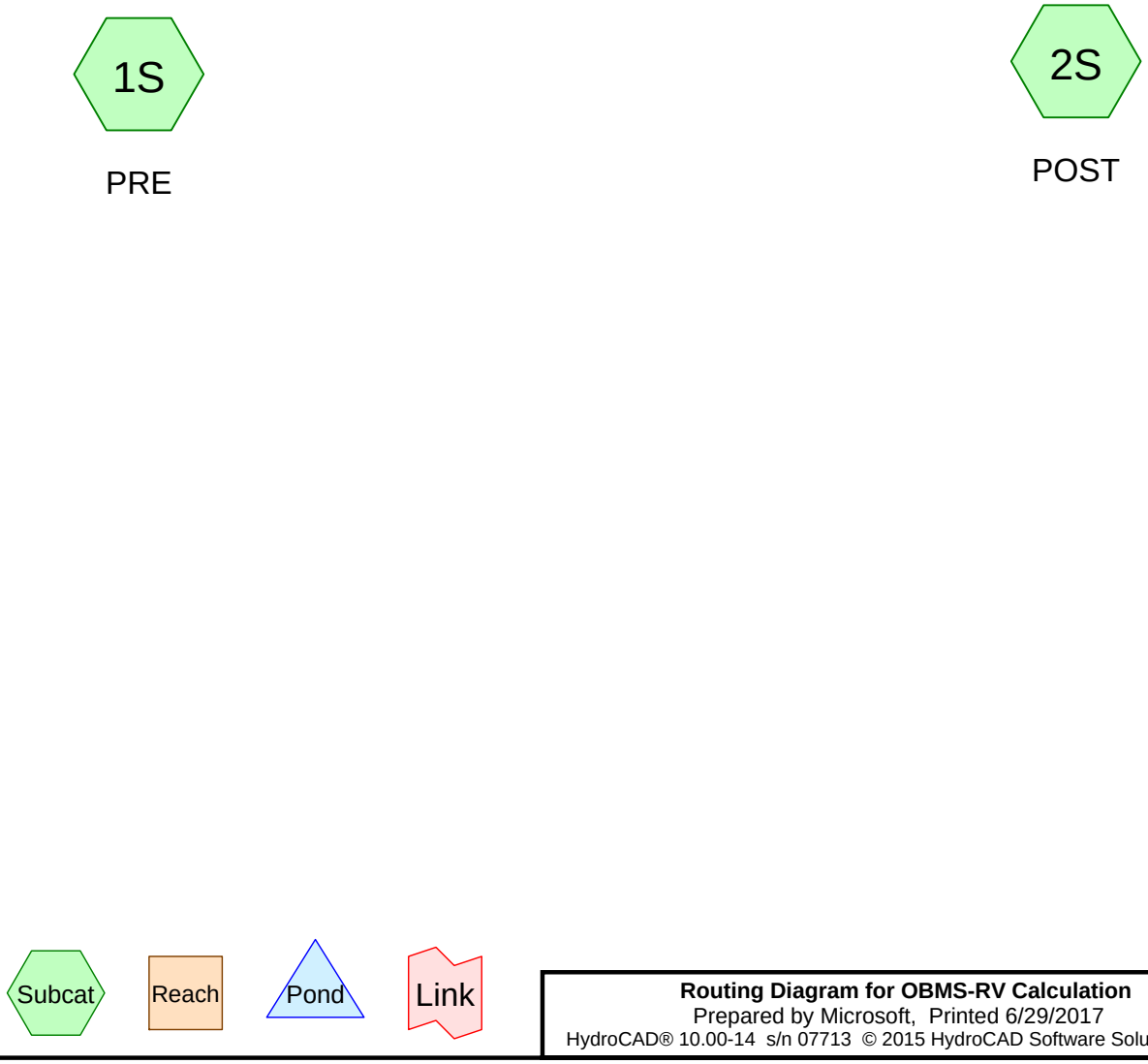
Inflow	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af
Primary	=	387.36 cfs @	12.38 hrs,	Volume=	56.714 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

100-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 6L: BERRYFIELD POND OUTFLOW





Routing Diagram for OBMS-RV Calculation
Prepared by Microsoft, Printed 6/29/2017
HydroCAD® 10.00-14 s/n 07713 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.783	74	>75% Grass cover, Good, HSG C (1S, 2S)
14.245	80	>75% Grass cover, Good, HSG D (1S, 2S)
6.876	98	Paved parking, HSG C (1S, 2S)
18.316	98	Paved parking, HSG D (1S, 2S)

Summary for Subcatchment 1S: PRE

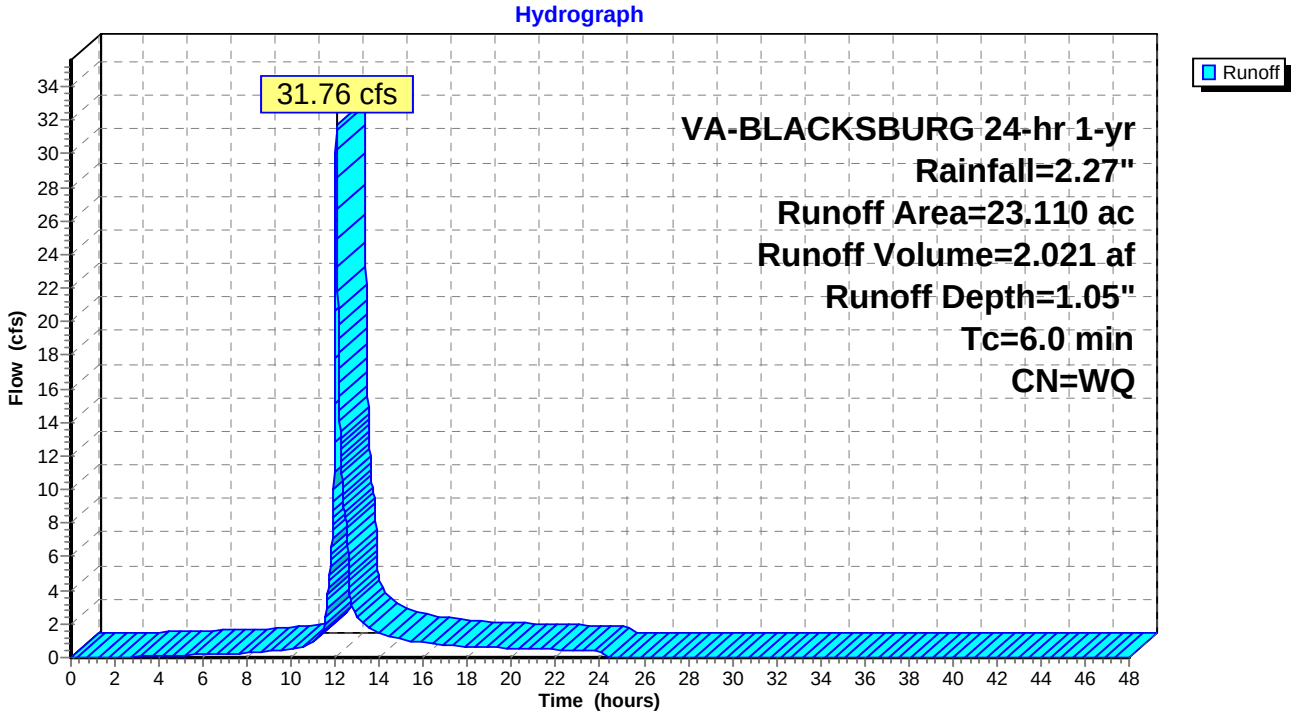
Runoff = 31.76 cfs @ 12.04 hrs, Volume= 2.021 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.443	74	>75% Grass cover, Good, HSG C
11.050	80	>75% Grass cover, Good, HSG D
1.387	98	Paved parking, HSG C
5.230	98	Paved parking, HSG D
23.110		Weighted Average

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

Subcatchment 1S: PRE



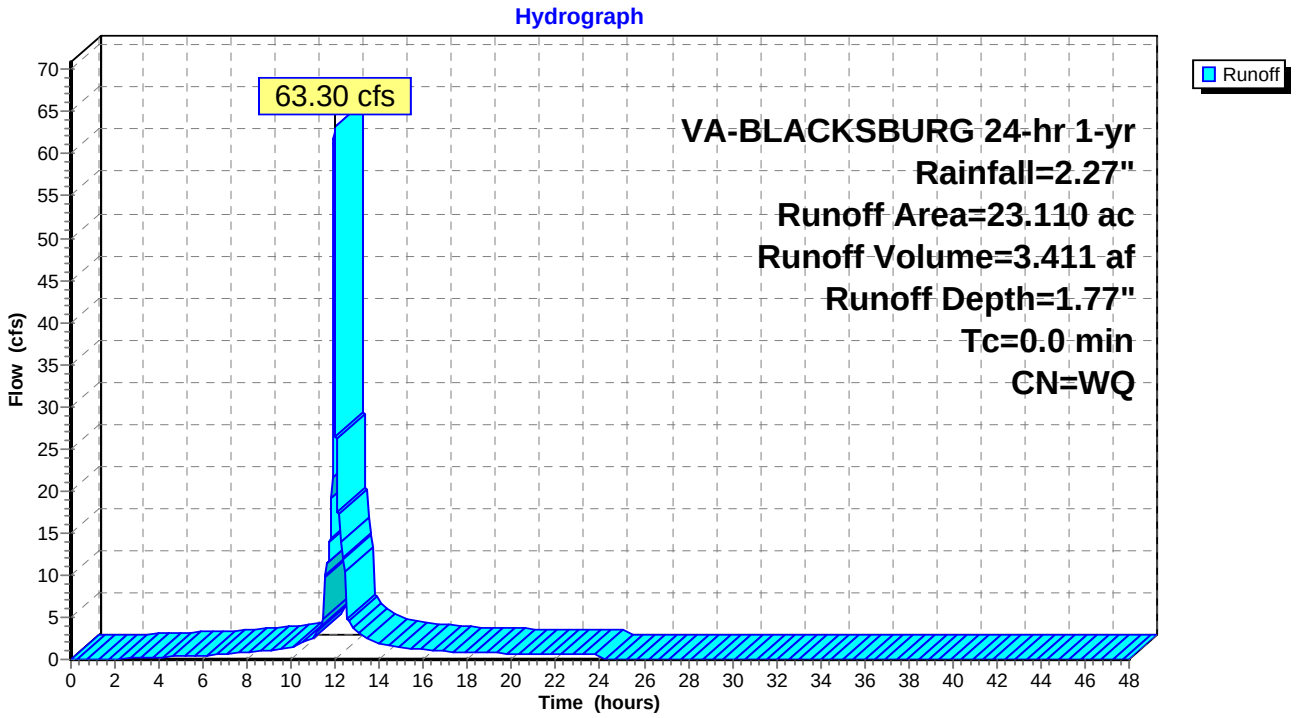
Summary for Subcatchment 2S: POST

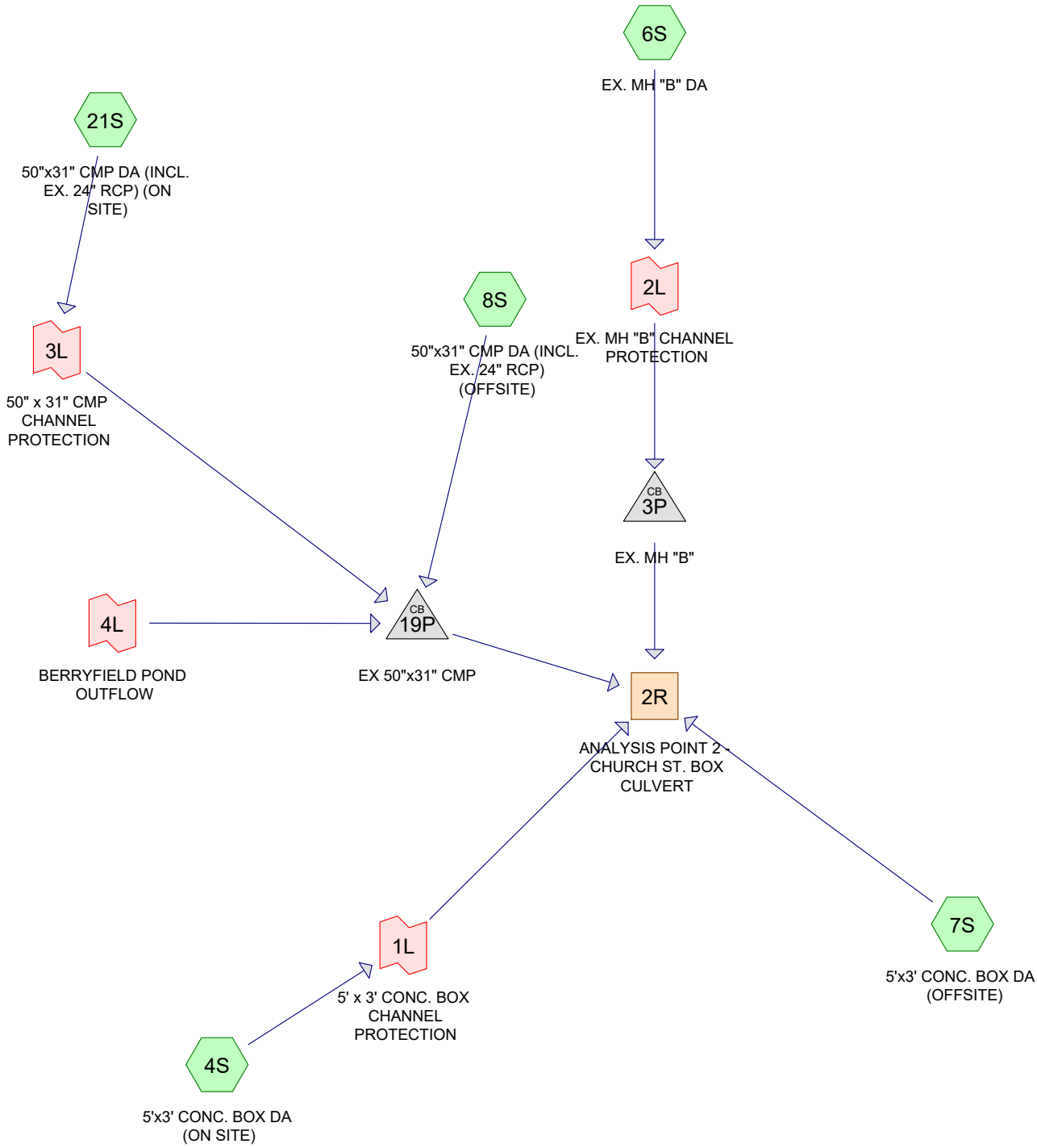
Runoff = 63.30 cfs @ 11.99 hrs, Volume= 3.411 af, Depth= 1.77"

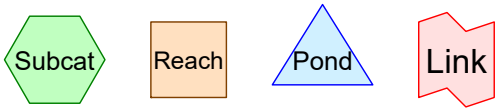
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
1.340	74	>75% Grass cover, Good, HSG C
3.195	80	>75% Grass cover, Good, HSG D
5.489	98	Paved parking, HSG C
13.086	98	Paved parking, HSG D
23.110		Weighted Average

Subcatchment 2S: POST







Routing Diagram for OBMS-Channel Protection
Prepared by Balzer & Associates, Inc., Printed 10/5/2017
HydroCAD® 10.00-20 s/n 07713 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.094	80	1/2 acre lots, 25% imp, HSG C (7S)
0.122	85	1/2 acre lots, 25% imp, HSG D (7S)
0.330	81	1/3 acre lots, 30% imp, HSG C (8S)
1.676	83	1/4 acre lots, 38% imp, HSG C (7S)
2.736	87	1/4 acre lots, 38% imp, HSG D (7S)
0.287	90	1/8 acre lots, 65% imp, HSG C (7S)
1.682	92	1/8 acre lots, 65% imp, HSG D (7S)
4.015	90	25% Carry Over from Villas Infiltration Pits (8S)
5.582	74	>75% Grass cover, Good, HSG C (4S, 7S, 21S)
9.502	80	>75% Grass cover, Good, HSG D (4S, 6S, 7S, 8S, 21S)
0.576	98	Paved parking, HSG C (4S, 6S, 21S)
4.398	98	Paved parking, HSG D (4S, 6S, 7S, 21S)
1.840	92	Paved roads w/open ditches, 50% imp, HSG C (7S, 8S)
1.697	93	Paved roads w/open ditches, 50% imp, HSG D (7S)
0.183	94	Urban commercial, 85% imp, HSG C (7S)
0.202	95	Urban commercial, 85% imp, HSG D (7S)
0.584	70	Woods, Good, HSG C (8S)
35.506	**85**	**TOTAL AREA**

Summary for Subcatchment 4S: 5'x3' CONC. BOX DA (ON SITE)

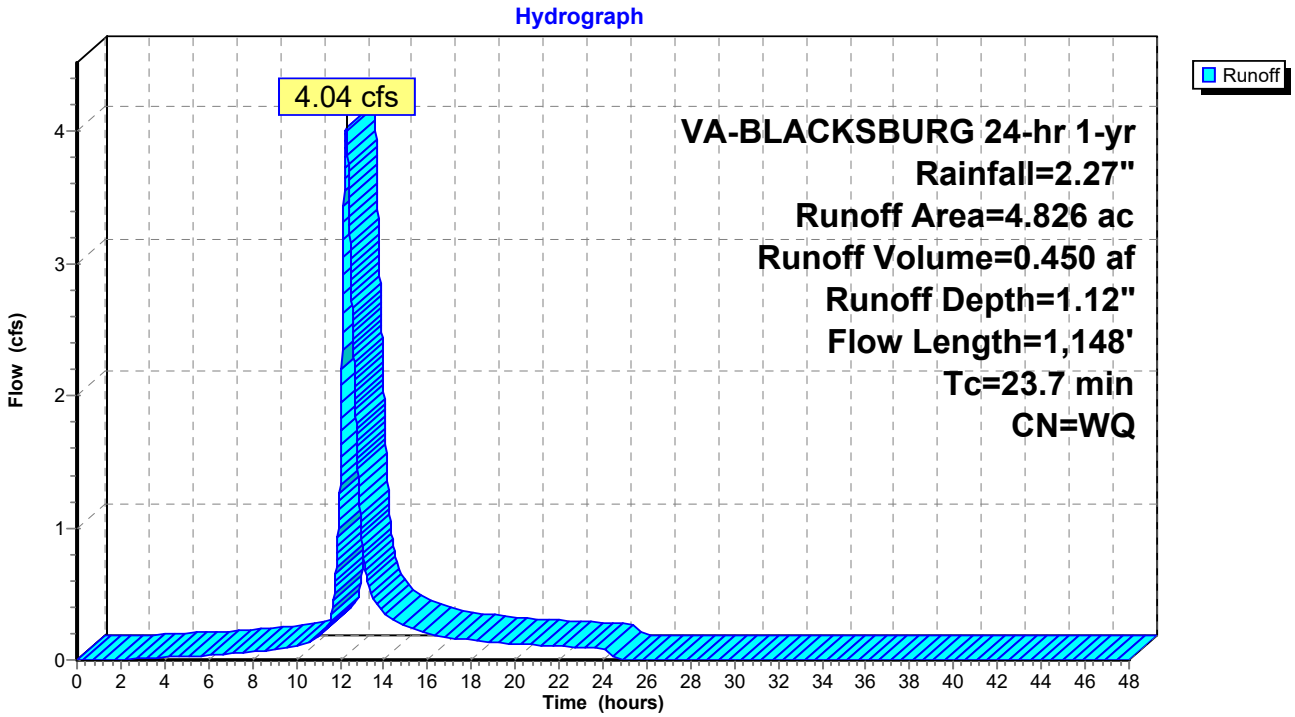
Runoff = 4.04 cfs @ 12.29 hrs, Volume= 0.450 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.328	74	>75% Grass cover, Good, HSG C
3.013	80	>75% Grass cover, Good, HSG D
0.147	98	Paved parking, HSG C
1.338	98	Paved parking, HSG D
4.826		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 4S: 5'x3' CONC. BOX DA (ON SITE)



Summary for Subcatchment 6S: EX. MH "B" DA

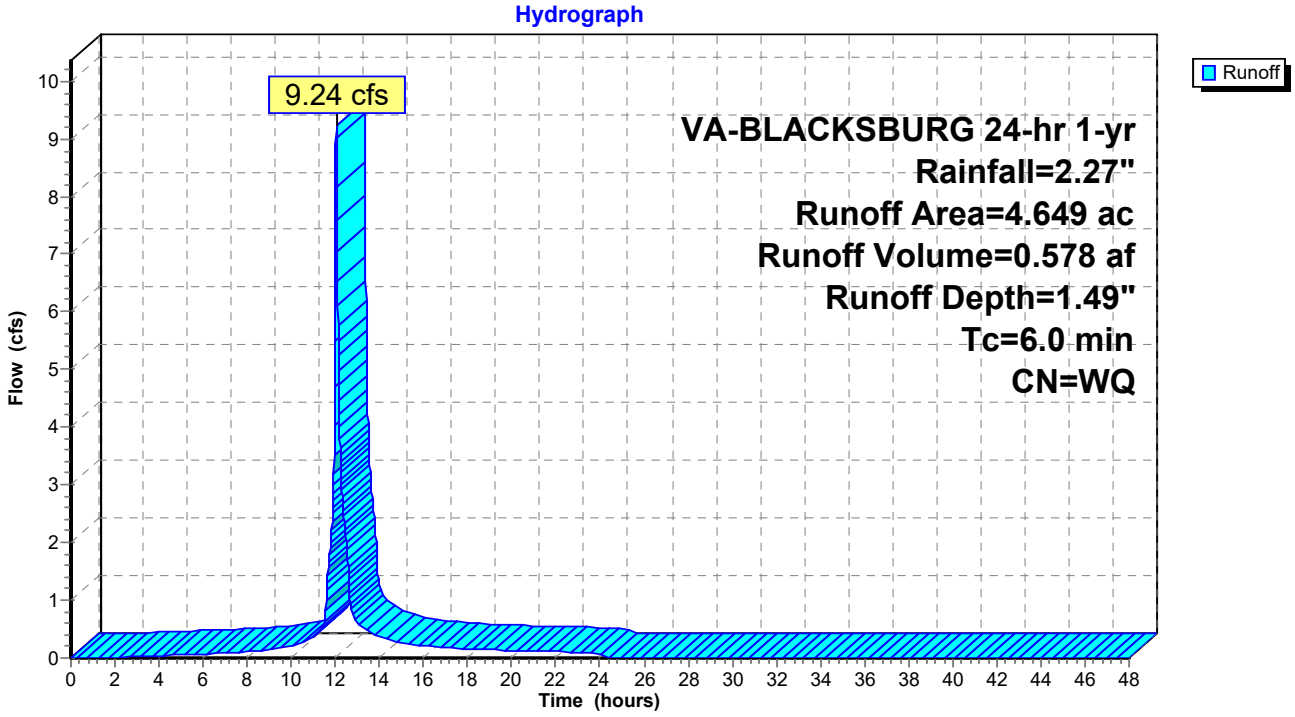
Runoff = 9.24 cfs @ 12.04 hrs, Volume= 0.578 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
1.958	80	>75% Grass cover, Good, HSG D
2.685	98	Paved parking, HSG D
0.006	98	Paved parking, HSG C
4.649		Weighted Average

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

Subcatchment 6S: EX. MH "B" DA



Summary for Subcatchment 7S: 5'x3' CONC. BOX DA (OFFSITE)

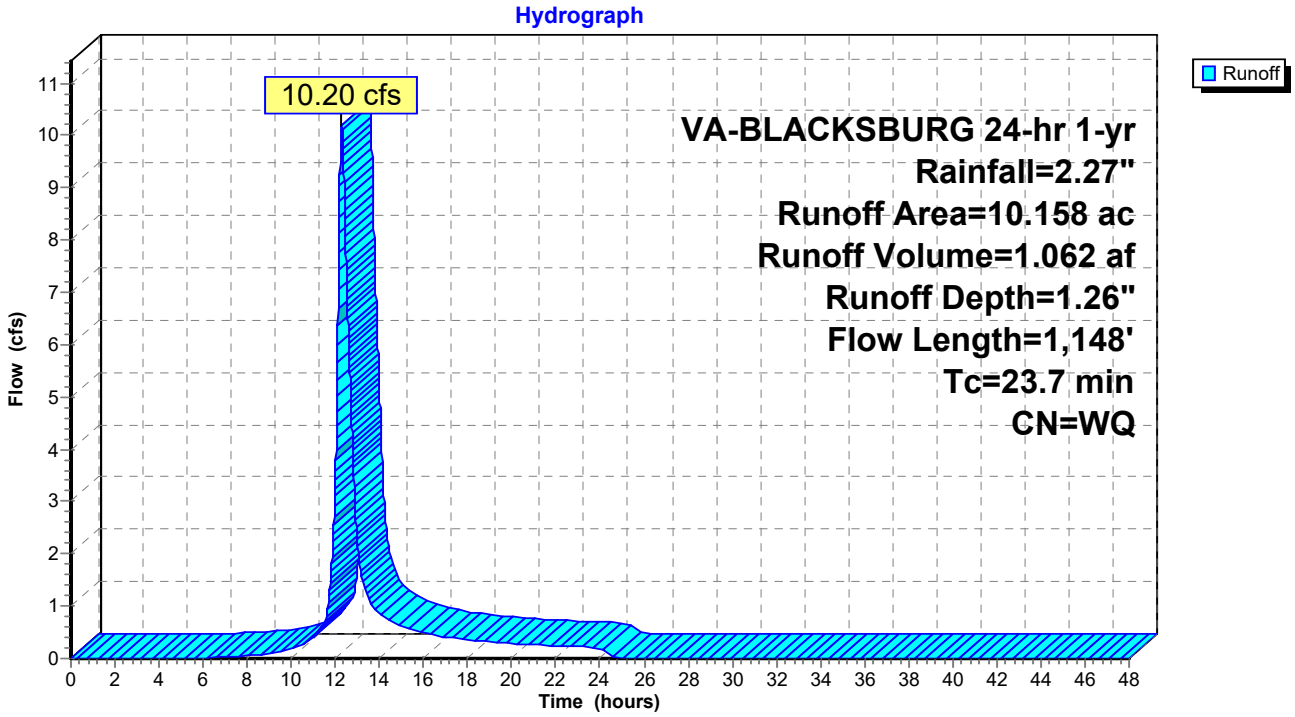
Runoff = 10.20 cfs @ 12.29 hrs, Volume= 1.062 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.116	74	>75% Grass cover, Good, HSG C
0.521	80	>75% Grass cover, Good, HSG D
0.094	80	1/2 acre lots, 25% imp, HSG C
0.122	85	1/2 acre lots, 25% imp, HSG D
1.676	83	1/4 acre lots, 38% imp, HSG C
2.736	87	1/4 acre lots, 38% imp, HSG D
0.287	90	1/8 acre lots, 65% imp, HSG C
1.682	92	1/8 acre lots, 65% imp, HSG D
0.183	94	Urban commercial, 85% imp, HSG C
0.202	95	Urban commercial, 85% imp, HSG D
0.593	92	Paved roads w/open ditches, 50% imp, HSG C
1.697	93	Paved roads w/open ditches, 50% imp, HSG D
0.249	98	Paved parking, HSG D
10.158		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	150	0.0300	0.14		**Sheet Flow, Tc12** Grass: Dense n= 0.240 P2= 2.76"
1.2	235	0.0404	3.24		**Shallow Concentrated Flow, Tc13** Unpaved Kv= 16.1 fps
4.4	763	0.0200	2.87		**Shallow Concentrated Flow, Tc14** Paved Kv= 20.3 fps
23.7	1,148	Total			

Subcatchment 7S: 5'x3' CONC. BOX DA (OFFSITE)



Summary for Subcatchment 8S: 50"x31" CMP DA (INCL. EX. 24" RCP) (OFFSITE)

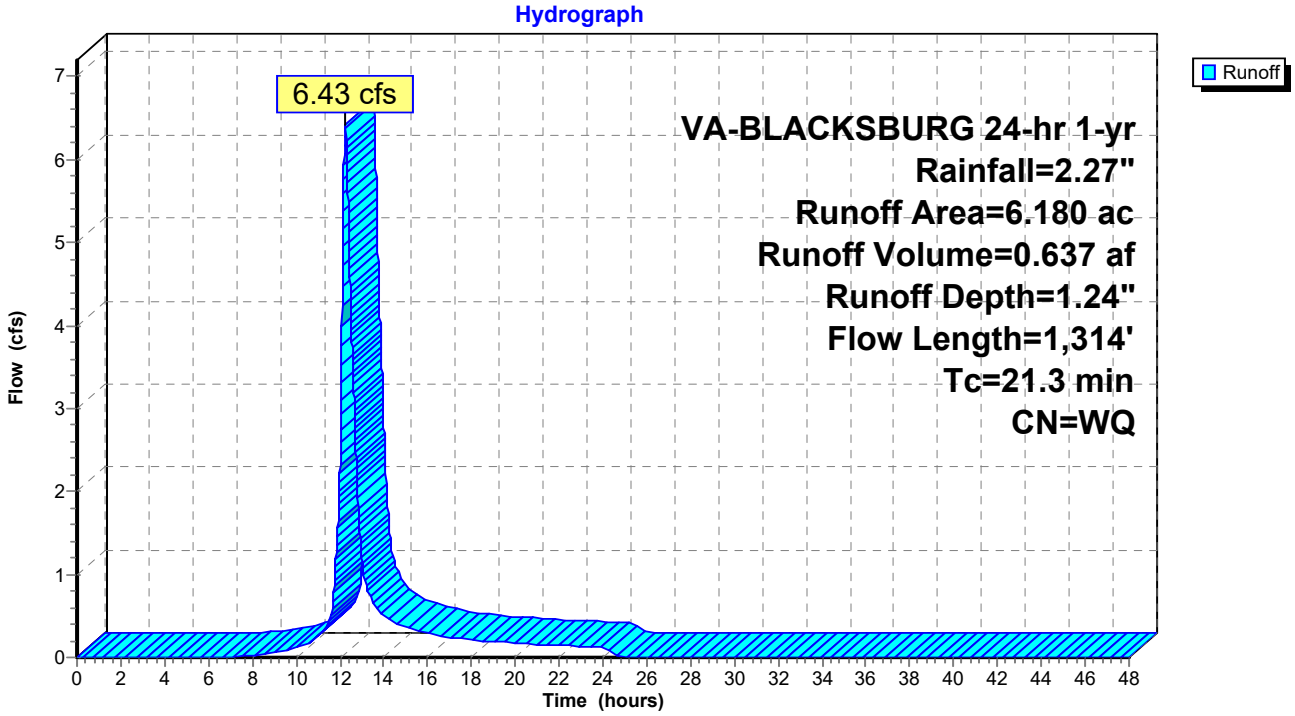
Runoff = 6.43 cfs @ 12.25 hrs, Volume= 0.637 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

	Area (ac)	CN	Description
	0.584	70	Woods, Good, HSG C
	0.004	80	>75% Grass cover, Good, HSG D
	0.330	81	1/3 acre lots, 30% imp, HSG C
	1.247	92	Paved roads w/open ditches, 50% imp, HSG C
*	4.015	90	25% Carry Over from Villas Infiltration Pits
	6.180		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 8S: 50"x31" CMP DA (INCL. EX. 24" RCP) (OFFSITE)



Summary for Subcatchment 21S: 50"x31" CMP DA (INCL. EX. 24" RCP) (ON SITE)

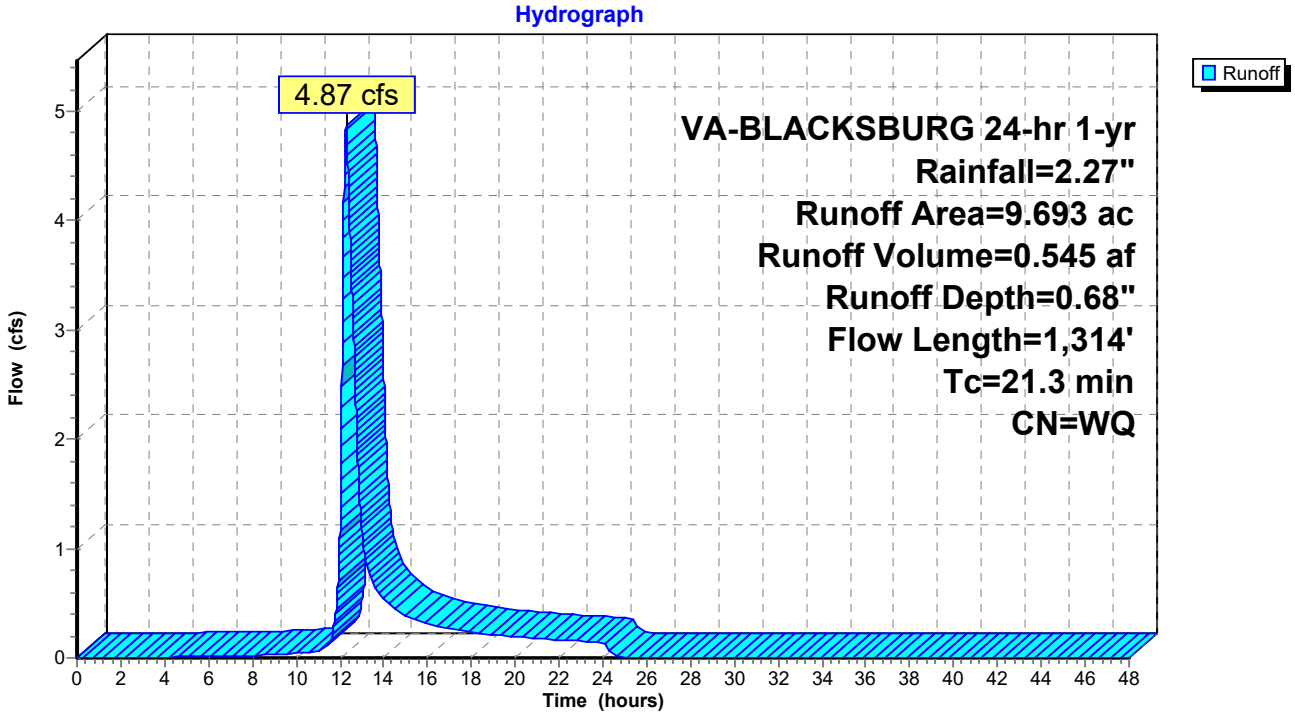
Runoff = 4.87 cfs @ 12.28 hrs, Volume= 0.545 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG 24-hr 1-yr Rainfall=2.27"

Area (ac)	CN	Description
5.138	74	>75% Grass cover, Good, HSG C
4.006	80	>75% Grass cover, Good, HSG D
0.423	98	Paved parking, HSG C
0.126	98	Paved parking, HSG D
9.693		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.0400	0.16		**Sheet Flow, Tc10** Grass: Dense n= 0.240 P2= 2.76"
5.2	1,164	0.0541	3.74		**Shallow Concentrated Flow, Tc11** Unpaved Kv= 16.1 fps
21.3	1,314	Total			

Subcatchment 21S: 50"x31" CMP DA (INCL. EX. 24" RCP) (ON SITE)



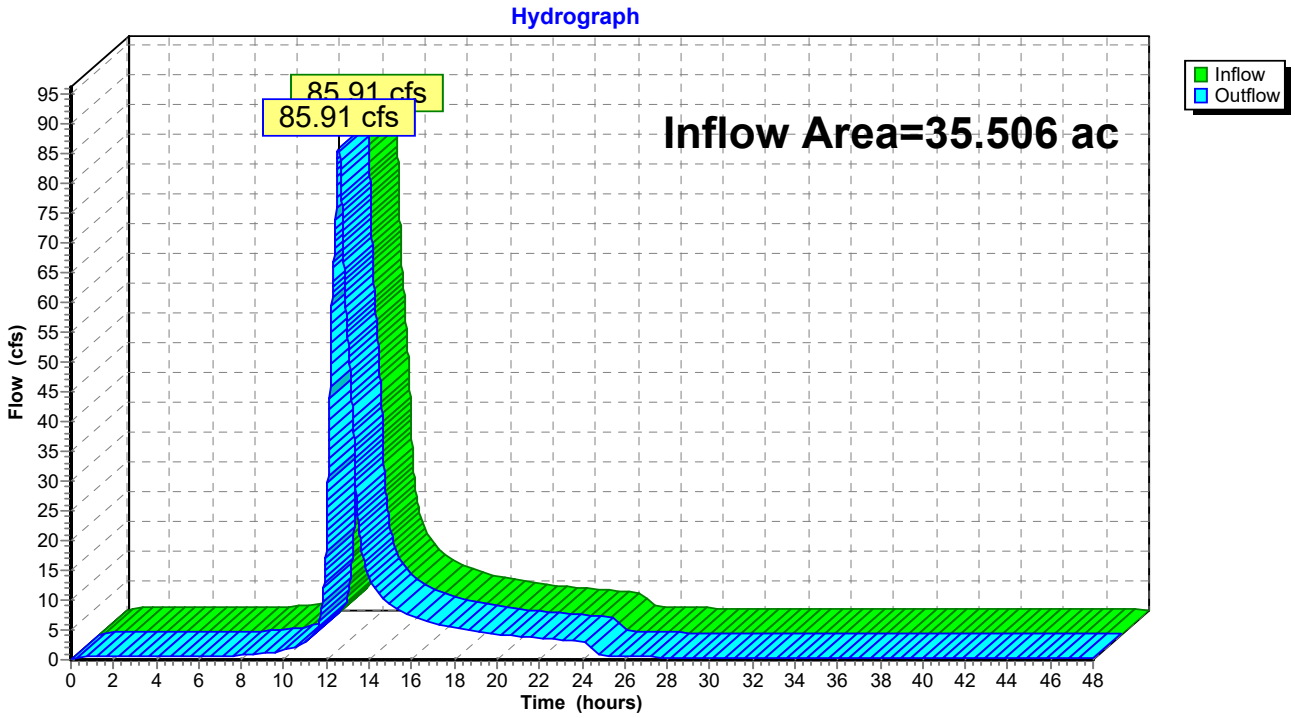
Summary for Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	35.506 ac,	Inflow Depth >	4.80"	for	1-yr event
Inflow =	85.91 cfs @	12.56 hrs,	Volume=	14.206 af	
Outflow =	85.91 cfs @	12.57 hrs,	Volume=	14.206 af,	Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: ANALYSIS POINT 2 - CHURCH ST. BOX CULVERT



Summary for Pond 3P: EX. MH "B"

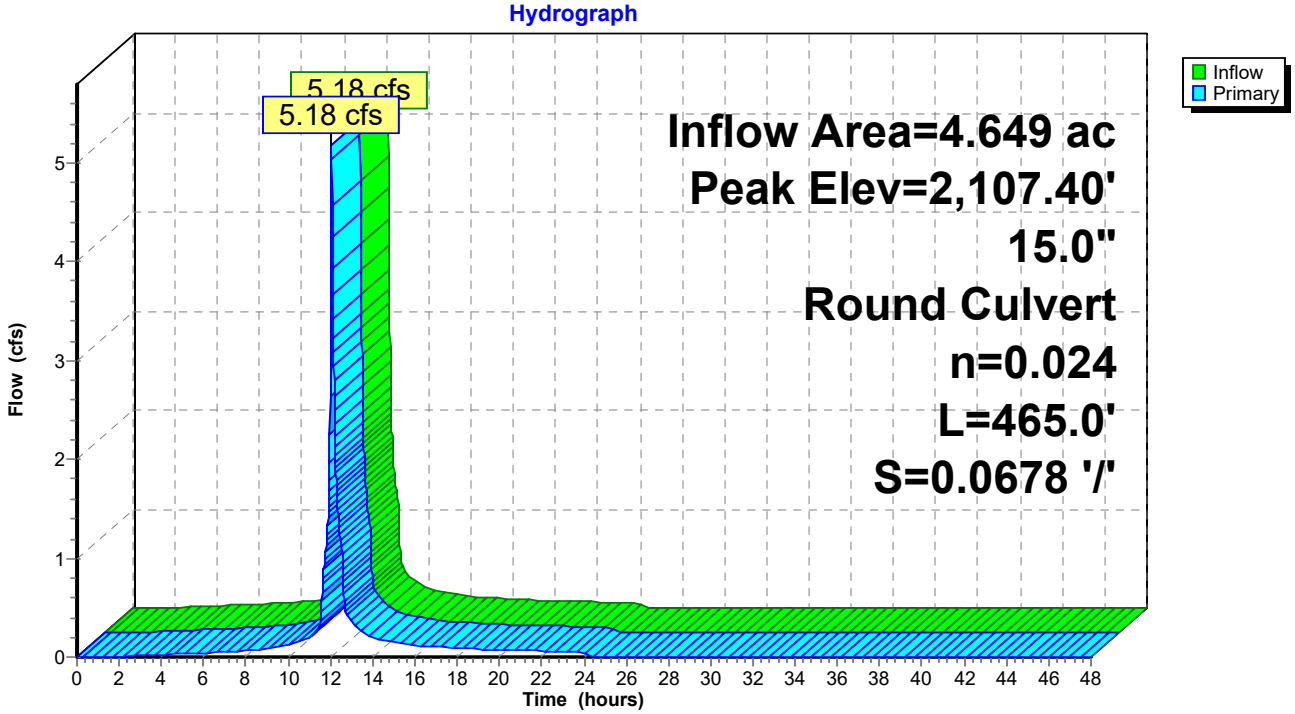
Inflow Area = 4.649 ac, Inflow Depth = 0.84" for 1-yr event
Inflow = 5.18 cfs @ 12.05 hrs, Volume= 0.324 af
Outflow = 5.18 cfs @ 12.06 hrs, Volume= 0.324 af, Atten= 0%, Lag= 0.6 min
Primary = 5.18 cfs @ 12.06 hrs, Volume= 0.324 af

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,107.40' @ 12.06 hrs
Flood Elev= 2,108.82'

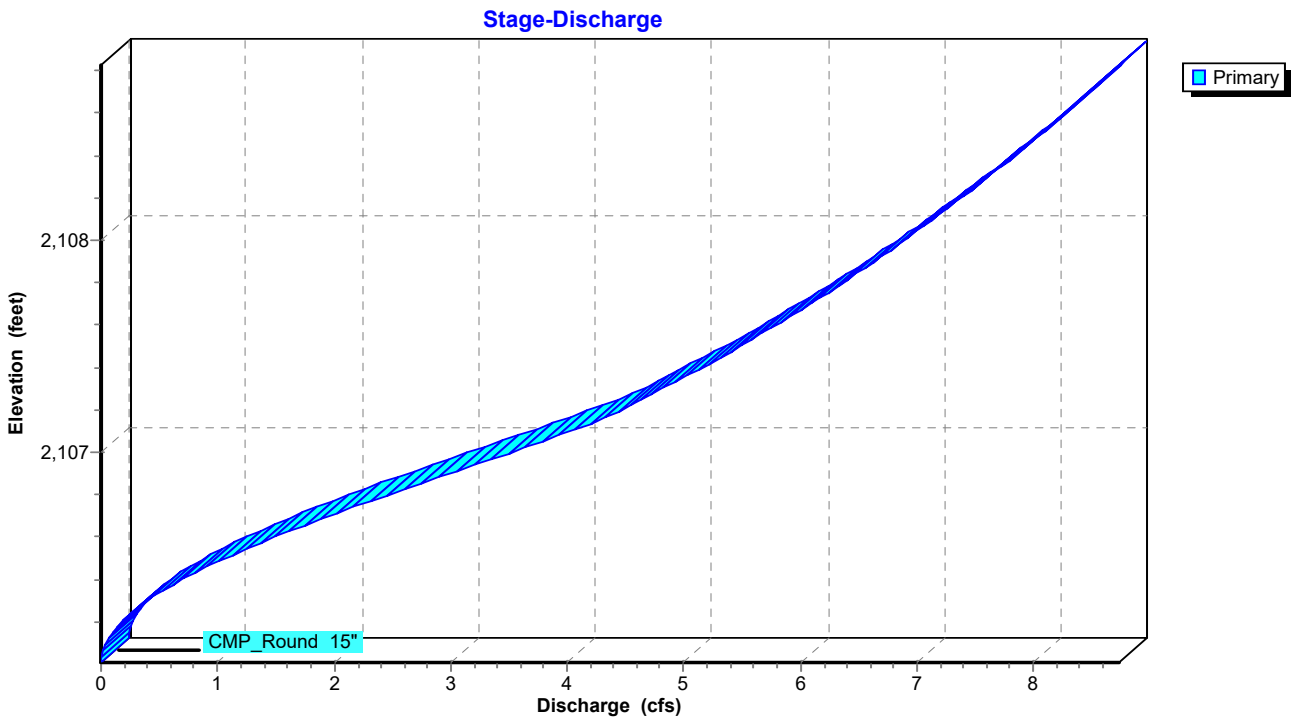
Device	Routing	Invert	Outlet Devices
#1	Primary	2,106.01'	**15.0" Round CMP_Round 15"** L= 465.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,106.01' / 2,074.50' S= 0.0678 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=5.17 cfs @ 12.06 hrs HW=2,107.40' TW=0.00' (Dynamic Tailwater)
└**1=CMP_Round 15"** (Inlet Controls 5.17 cfs @ 4.21 fps)

Pond 3P: EX. MH "B"



Pond 3P: EX. MH "B"



Summary for Pond 19P: EX 50"x31" CMP

[58] Hint: Peaked 0.16' above defined flood level

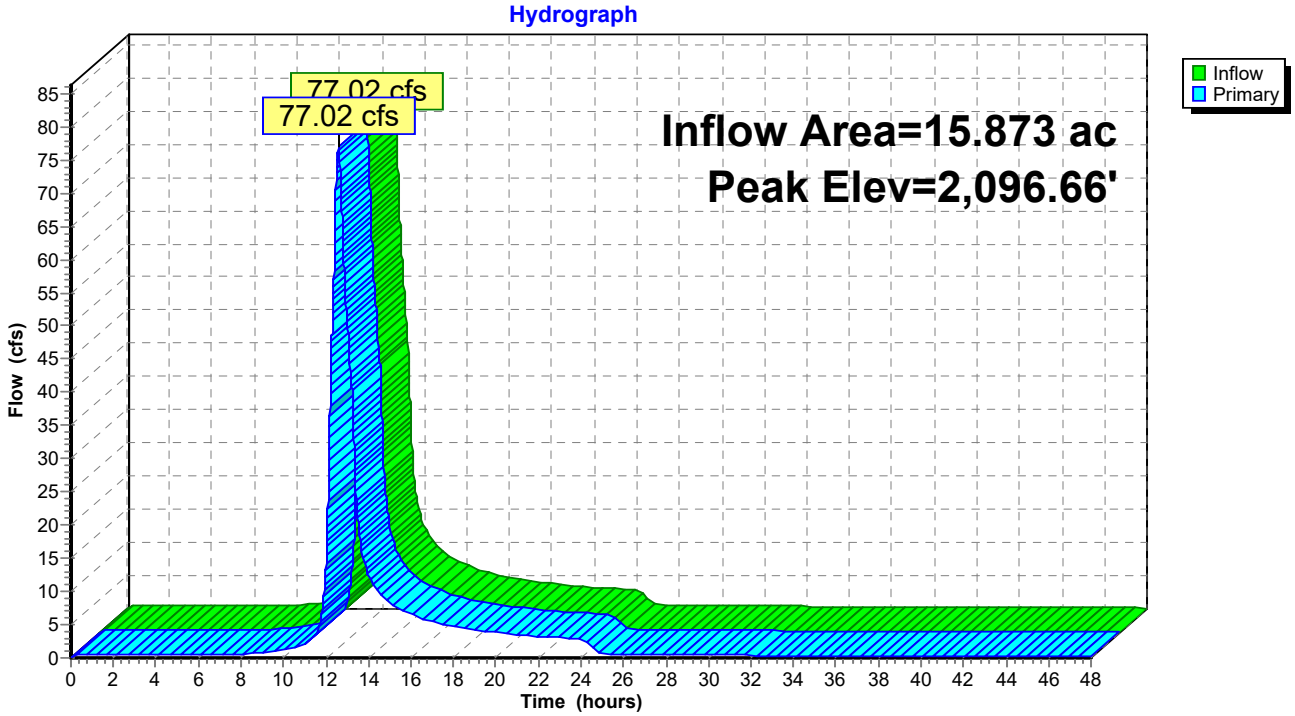
Inflow Area =	15.873 ac,	Inflow Depth >	9.50"	for	1-yr event
Inflow =	77.02 cfs @	12.57 hrs,	Volume=	12.568 af	
Outflow =	77.02 cfs @	12.58 hrs,	Volume=	12.568 af,	Atten= 0%, Lag= 0.6 min
Primary =	77.02 cfs @	12.58 hrs,	Volume=	12.568 af	

Routing by Sim-Route method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 2,096.66' @ 12.58 hrs
Flood Elev= 2,096.50'

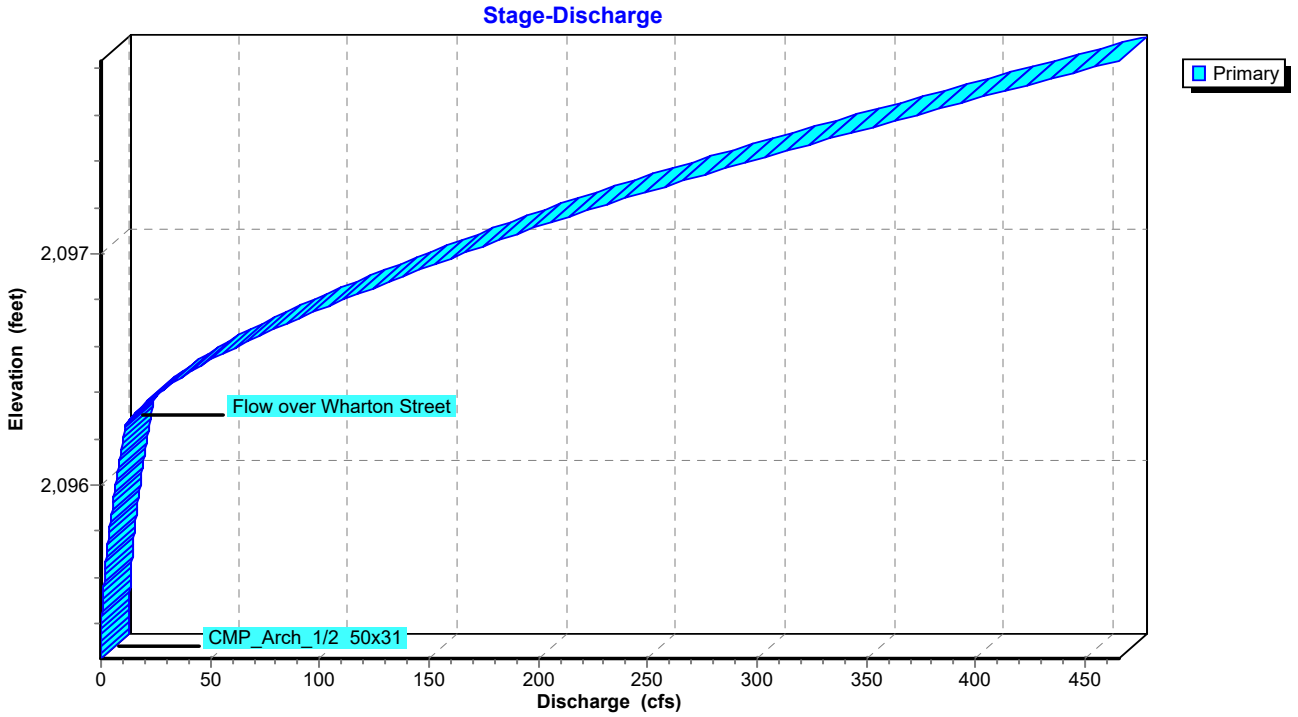
Device	Routing	Invert	Outlet Devices
#1	Primary	2,095.25'	**50.0" W x 31.0" H, R=25.1"/77.3" Pipe Arch CMP_Arch_1/2 50x31** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,095.25' / 2,093.71' S= 0.0440 '/' Cc= 0.900 n= 0.024 Corrugated metal, Flow Area= 8.41 sf
#2	Primary	2,096.25'	**80.0' long x 30.0' breadth Flow over Wharton Street** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=77.01 cfs @ 12.58 hrs HW=2,096.66' TW=0.00' (Dynamic Tailwater)
└─**1=CMP_Arch_1/2 50x31** (Inlet Controls 19.46 cfs @ 3.70 fps)
└─**2=Flow over Wharton Street** (Weir Controls 57.55 cfs @ 1.74 fps)

Pond 19P: EX 50"x31" CMP



Pond 19P: EX 50"x31" CMP

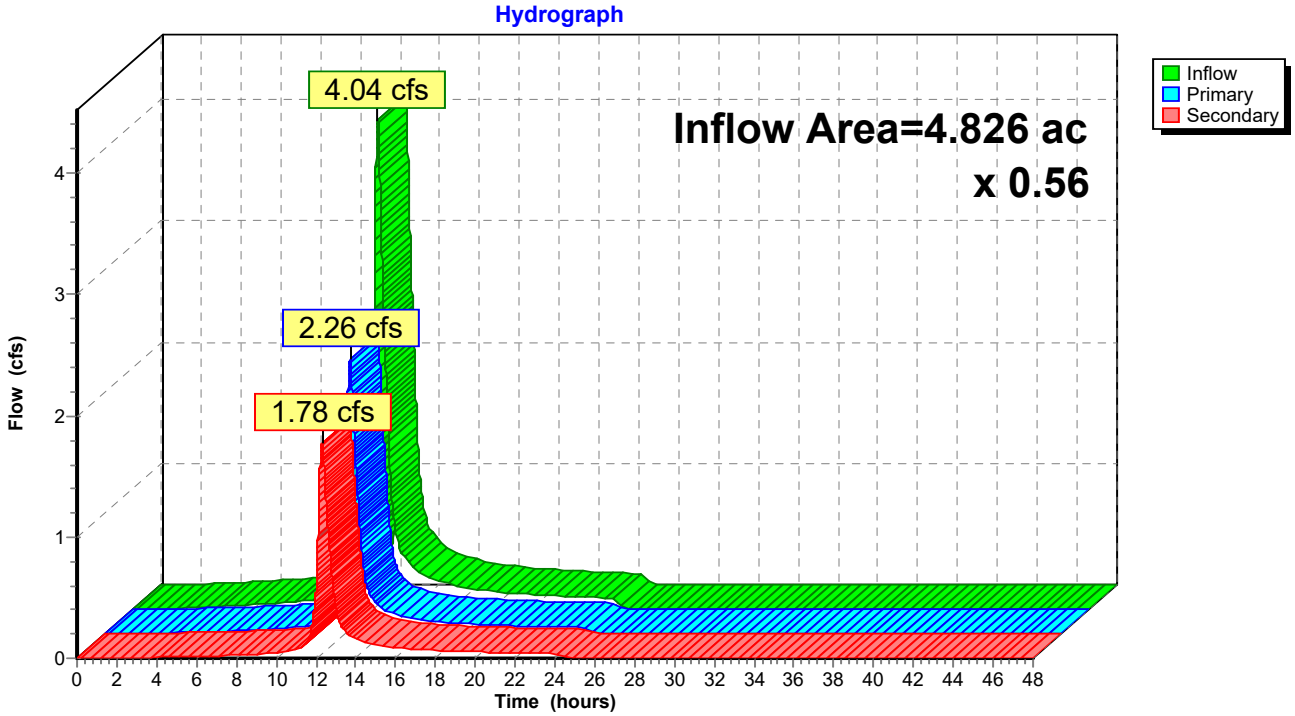


Summary for Link 1L: 5' x 3' CONC. BOX CHANNEL PROTECTION

Inflow Area =	4.826 ac,	Inflow Depth =	1.12"	for	1-yr event
Inflow =	4.04 cfs @	12.29 hrs,	Volume=	0.450 af	
Primary =	2.26 cfs @	12.30 hrs,	Volume=	0.252 af,	Atten= 44%, Lag= 0.6 min
Secondary =	1.78 cfs @	12.30 hrs,	Volume=	0.198 af	

Primary outflow = Inflow x 0.56, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: 5' x 3' CONC. BOX CHANNEL PROTECTION

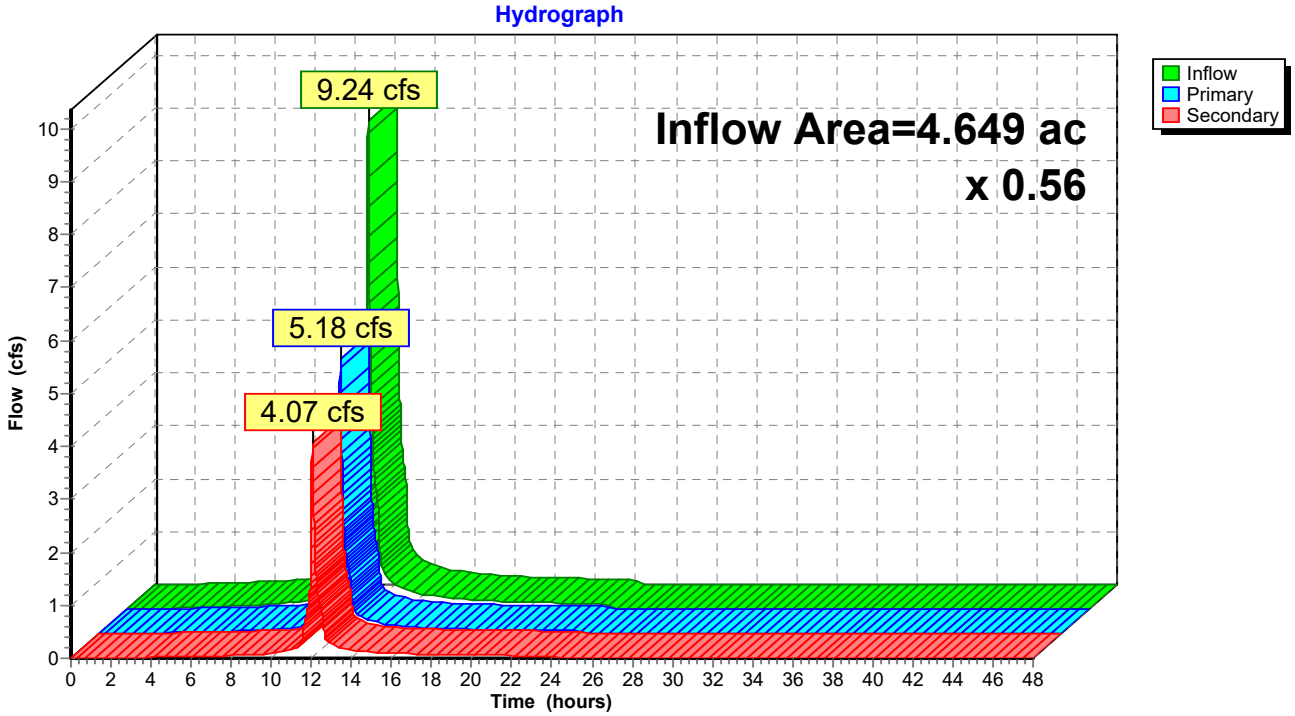


Summary for Link 2L: EX. MH "B" CHANNEL PROTECTION

Inflow Area =	4.649 ac,	Inflow Depth =	1.49"	for	1-yr event
Inflow =	9.24 cfs @	12.04 hrs,	Volume=	0.578 af	
Primary =	5.18 cfs @	12.05 hrs,	Volume=	0.324 af,	Atten= 44%, Lag= 0.6 min
Secondary =	4.07 cfs @	12.05 hrs,	Volume=	0.254 af	

Primary outflow = Inflow x 0.56, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: EX. MH "B" CHANNEL PROTECTION

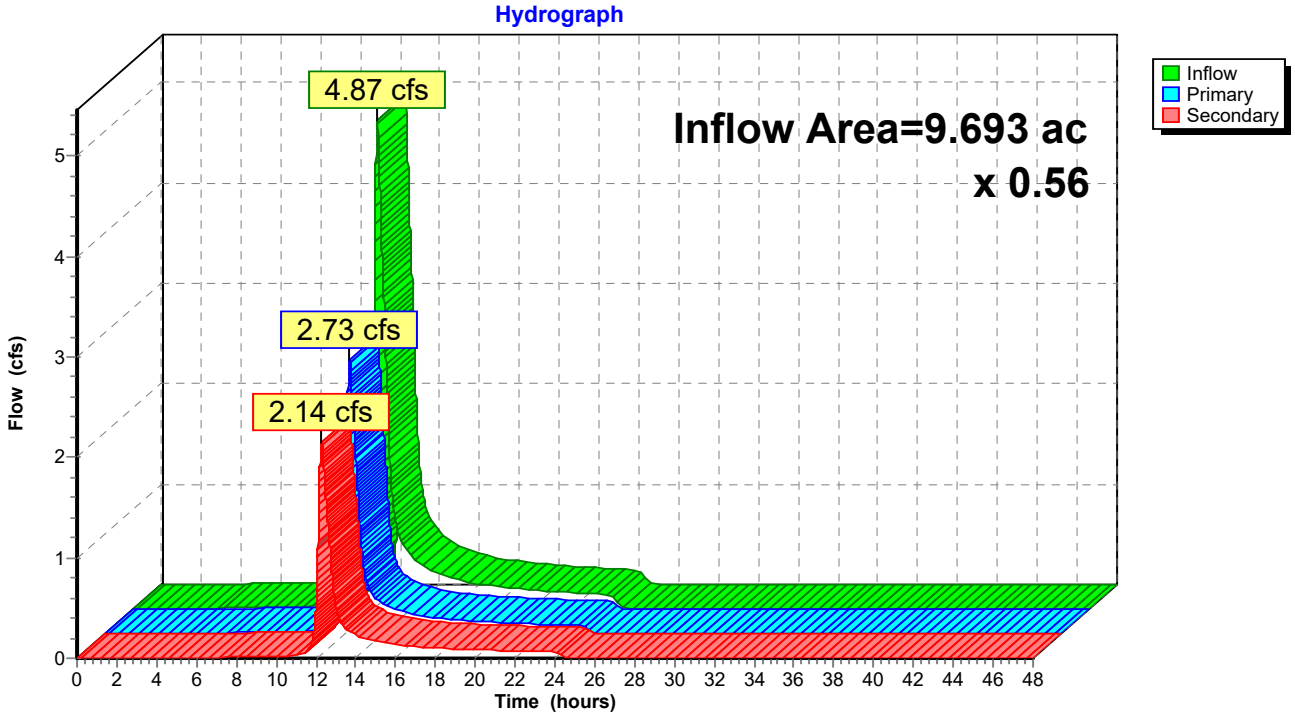


Summary for Link 3L: 50" x 31" CMP CHANNEL PROTECTION

Inflow Area =	9.693 ac,	Inflow Depth =	0.68"	for	1-yr event
Inflow =	4.87 cfs @	12.28 hrs,	Volume=	0.545 af	
Primary =	2.73 cfs @	12.29 hrs,	Volume=	0.305 af,	Atten= 44%, Lag= 0.6 min
Secondary =	2.14 cfs @	12.29 hrs,	Volume=	0.240 af	

Primary outflow = Inflow x 0.56, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 3L: 50" x 31" CMP CHANNEL PROTECTION



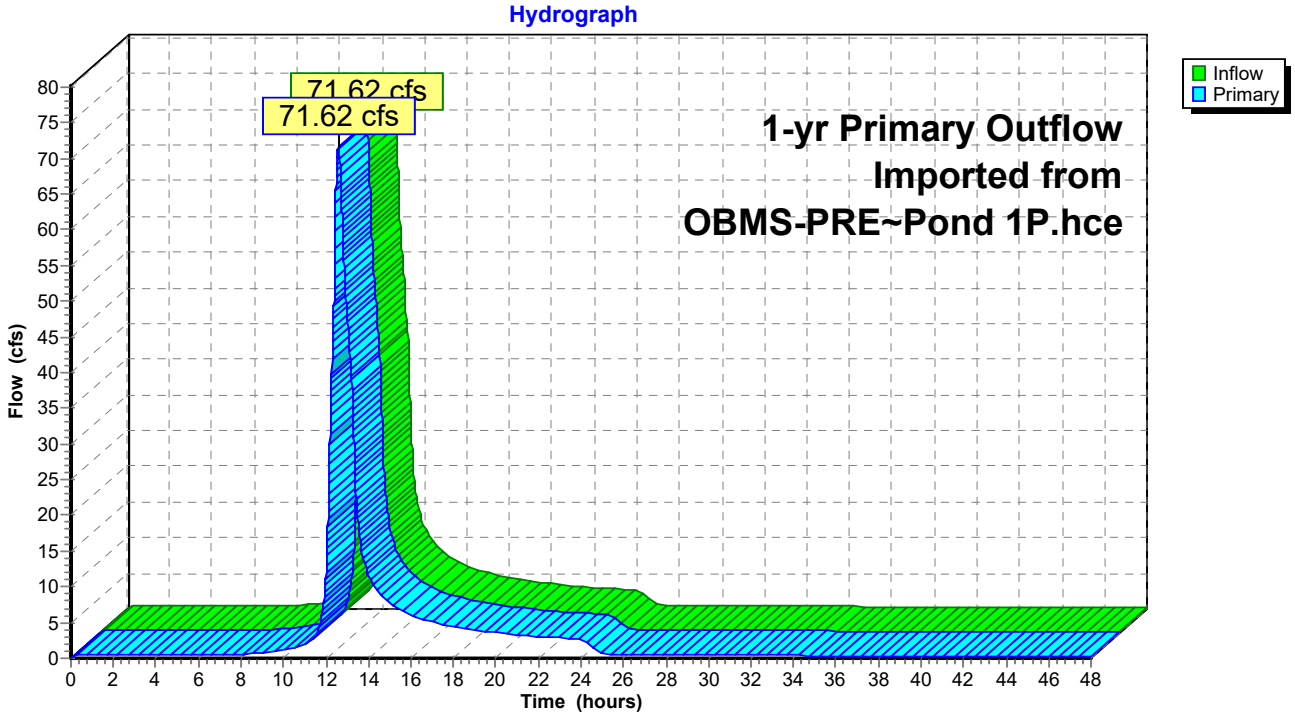
Summary for Link 4L: BERRYFIELD POND OUTFLOW

Inflow	=	71.62 cfs @	12.57 hrs,	Volume=	11.626 af
Primary	=	71.62 cfs @	12.58 hrs,	Volume=	11.626 af, Atten= 0%, Lag= 0.6 min

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

1-yr Primary Outflow Imported from OBMS-PRE~Pond 1P.hce

Link 4L: BERRYFIELD POND OUTFLOW



Project Name:	Old Blacksburg Middle School Site	CLEAR ALL	data input cells
Date:	2-Oct		constant values
	Linear Development Project? No		calculation cells
Site Information			final results

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area *(acres)* →	21.00	*Check:*	
Maximum reduction required:	*20%*	*BMP Design Specifications List:*	2011 Stds & Specs
The site's net increase in impervious cover (acres) is:	*8.96*	*Linear project?*	No
Post-Development TP Load Reduction for Site (lb/yr):	*19.00*	*Land cover areas entered correctly?*	✓
		Total disturbed area entered?	✓

Pre-ReDevelopment Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			4.08	10.94	15.02
Impervious Cover (acres)			0.75	5.23	5.98
					21.00

Post-Development Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			1.62	4.44	6.06
Impervious Cover (acres)			3.21	11.73	14.94
Area Check	**OK.**	**OK.**	**OK.**	**OK.**	21.00

Constants

Annual Rainfall (inches)	43
Target Rainfall Event (inches)	1.00
Total Phosphorus (TP) EMC (mg/L)	0.26
Total Nitrogen (TN) EMC (mg/L)	1.86
Target TP Load (lb/acre/yr)	0.41
Pj (unitless correction factor)	0.90

Runoff Coefficients (Rv)

	A Soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

LAND COVER SUMMARY -- PRE-REDEVELOPMENT

Land Cover Summary-Pre		
Pre-ReDevelopment	**Listed**	**Adjusted[1]**
Forest/Open Space Cover (acres)	0.00	0.00
Weighted Rv(forest)	0.00	0.00
% Forest	0%	0%
Managed Turf Cover (acres)	15.02	6.06
Weighted Rv(turf)	0.24	0.24
% Managed Turf	72%	50%
Impervious Cover (acres)	5.98	5.98
Rv(impervious)	0.95	0.95
% Impervious	28%	50%
Total Site Area (acres)	**21.00**	**12.04**
Site Rv	**0.44**	**0.59**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary-Post (Final)	
Post ReDev. & New Impervious	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	6.06
Weighted Rv (turf)	0.24
% Managed Turf	29%
Impervious Cover (acres)	14.94
Rv(impervious)	0.95
% Impervious	71%
Final Site Area (acres)	**21.00**
Final Post Dev Site Rv	**0.75**

Land Cover Summary-Post	
Post-ReDevelopment	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	6.06
Weighted Rv (turf)	0.24
% Managed Turf	50%
ReDev. Impervious Cover (acres)	5.98
Rv(impervious)	0.95
% Impervious	50%
Total ReDev. Site Area (acres)	**12.04**
ReDev Site Rv	**0.59**

Land Cover Summary-Post	
Post-Development New Impervious	
New Impervious Cover (acres)	8.96
Rv(impervious)	0.95

Treatment Volume and Nutrient Load

Pre-ReDevelopment Treatment Volume (acre-ft)	0.7761	0.5956
Pre-ReDevelopment Treatment Volume (cubic feet)	33,808	25,945
Pre-ReDevelopment TP Load (lb/yr)	**21.24**	**16.30**
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	1.01	1.35
Baseline TP Load (lb/yr) (**0.41 lbs/acre/yr** applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		*4.94*

Treatment Volume and Nutrient Load

Final Post-Development Treatment Volume (acre-ft)	1.3050
Final Post-Development Treatment Volume (cubic feet)	56,844
Final Post-Development TP Load (lb/yr)	**35.71**
Final Post-Development TP Load per acre (lb/acre/yr)	1.70

Post-ReDevelopment Treatment Volume (acre-ft)	0.5956
Post-ReDevelopment Treatment Volume (cubic feet)	25,945
Post-ReDevelopment Load (TP) (lb/yr)*	**16.30**
Post-ReDevelopment TP Load per acre (lb/acre/yr)	1.35
Max. Reduction Required (Below Pre-ReDevelopment Load)	**20%**
TP Load Reduction Required for Redeveloped Area (lb/yr)	**3.26**

Post-Development Treatment Volume (acre-ft)	0.7093
Post-Development Treatment Volume (cubic feet)	30,899
Post-Development TP Load (lb/yr)	**19.41**
TP Load Reduction Required for New Impervious Area (lb/yr)	**15.74**

[1] *Adjusted Land Cover Summary:*
Pre ReDevelopment land cover minus pervious land cover (forest/open space 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, 0.41 lbs/acre/year).

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**19.00**

Nitrogen Loads (Informational Purposes Only)

Pre-ReDevelopment TN Load (lb/yr)	151.96	Final Post-Development TN Load (Post-ReDevelopment & New Impervious) (lb/yr)	255.50

Drainage Area A

CLEAR BMP AREAS

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)					0.00	0.00
Managed Turf (acres)			1.62	4.05	5.67	0.24
Impervious Cover (acres)			3.15	10.94	14.09	0.95
				Total	19.76	

Total Phosphorus Available for Removal in D.A. A (lb/yr)	33.65
Post Development Treatment Volume in D.A. A (ft^3)	53,558

Stormwater Best Management Practices (RR = Runoff Reduction)

--Select from dropdown lists--

Practice	Runoff Reduction Credit (%)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft^3)	Runoff Reduction (ft^3)	Remaining Runoff Volume (ft^3)	Total BMP Treatment Volume (ft^3)	Phosphorus Removal Efficiency (%)	Phosphorus Load from Upstream Practices (lb)	Untreated Phosphorus Load to Practice (lb)	Phosphorus Removed By Practice (lb)	Remaining Phosphorus Load (lb)	Downstream Practice to be Employed
1. Vegetated Roof (RR)													
1.a. Vegetated Roof #1 (Spec #5)	45				0	0	0	0		0.00	0.00	0.00	
1.b. Vegetated Roof #2 (Spec #5)	60				0	0	0	0		0.00	0.00	0.00	
2. Rooftop Disconnection (RR)													
2.a. Simple Disconnection to A/B Soils (Spec #1)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.b. Simple Disconnection to C/D Soils (Spec #1)	25			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.c. To Soil Amended Filter Path as per specifications (existing C/D soils) (Spec #4)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.d. To Dry Well or French Drain #1, Micro-Infiltration #1 (Spec #8)	50			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.e. To Dry Well or French Drain #2, Micro-Infiltration #2 (Spec #8)	90			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.f. To Rain Garden #1, Micro-Bioretention #1 (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2, Micro-Bioretention #2 (Spec #9)	80			0	0	0	0	50	0.00	0.00	0.00	0.00	
2.h. To Rainwater Harvesting (Spec #6)	0			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.i. To Stormwater Planter, Urban Bioretention (Spec #9, Appendix A)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
3. Permeable Pavement (RR)													
3.a. Permeable Pavement #1 (Spec #7)	45			0	0	0	0	25	0.00	0.00	0.00	0.00	
3.b. Permeable Pavement #2 (Spec #7)	75				0	0	0	25		0.00	0.00	0.00	
4. Grass Channel (RR)													
4.a. Grass Channel A/B Soils (Spec #3)	20			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.b. Grass Channel C/D Soils (Spec #3)	10			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.c. Grass Channel with Compost Amended Soils as per specs (see Spec #4)	30			0	0	0	0	15	0.00	0.00	0.00	0.00	
5. Dry Swale (RR)													
5.a. Dry Swale #1 (Spec #10)	40			0	0	0	0	20	0.00	0.00	0.00	0.00	
5.b. Dry Swale #2 (Spec #10)	60			0	0	0	0	40	0.00	0.00	0.00	0.00	
6. Bioretention (RR)													
6.a. Bioretention #1 or Micro-Bioretention #1 or Urban Bioretention (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	None
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	80			0	0	0	0	50	0.00	0.00	0.00	0.00	None
7. Infiltration (RR)													
7.a. Infiltration #1 (Spec #8)	50			0	0	0	0	25	0.00	0.00	0.00	0.00	
7.b. Infiltration #2 (Spec #8)	90			0	0	0	0	25	0.00	0.00	0.00	0.00	
8. Extended Detention Pond (RR)													
8.a. ED #1 (Spec #15)	0			0	0	0	0	15	0.00	0.00	0.00	0.00	
8.b. ED #2 (Spec #15)	15			0	0	0	0	15	0.00	0.00	0.00	0.00	
9. Sheetflow to Filter/Open Space (RR)													
9.a. Sheetflow to Conservation Area, A/B Soils (Spec #2)	75			0	0	0	0	0	0.00	0.00	0.00	0.00	
9.b. Sheetflow to Conservation Area, C/D Soils (Spec #2)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
9.c. Sheetflow to Vegetated Filter Strip, A Soils or Compost Amended B/C/D Soils (Spec #2 & #4)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	

TOTAL IMPERVIOUS COVER TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL RUNOFF REDUCTION IN D.A. A (ft^3)	0	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	33.65	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	33.65	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

10. Wet Swale (no RR)													
10.a. Wet Swale #1 (Spec #11)	0			0	0	0	0	20	0.00	0.00	0.00	0.00	
10.b. Wet Swale #2 (Spec #11)	0			0	0	0	0	40	0.00	0.00	0.00	0.00	
11. Filtering Practices (no RR)													
11.a.Filtering Practice #1 (Spec #12)	0			0	0	0	0	60	0.00	0.00	0.00	0.00	
11.b. Filtering Practice #2 (Spec #12)	0			0	0	0	0	65	0.00	0.00	0.00	0.00	
12. Constructed Wetland (no RR)													
12.a.Constructed Wetland #1 (Spec #13)	0			0	0	0	0	50	0.00	0.00	0.00	0.00	
12.b. Constructed Wetland #2 (Spec #13)	0			0	0	0	0	75	0.00	0.00	0.00	0.00	
13. Wet Ponds (no RR)													
13.a. Wet Pond #1 (Spec #14)	0			0	0	0	0	50	0.00	0.00	0.00	0.00	
13.b. Wet Pond #1 (Coastal Plain) (Spec #14)	0			0	0	0	0	45	0.00	0.00	0.00	0.00	
13.c. Wet Pond #2 (Spec #14)	0			0	0	0	0	75	0.00	0.00	0.00	0.00	
13.d. Wet Pond #2 (Coastal Plain) (Spec #14)	0			0	0	0	0	65	0.00	0.00	0.00	0.00	
14. Manufactured Treatment Devices (no RR)													
14.a. Manufactured Treatment Device-Hydrodynamic	0			0	0	0	0	20	0.00	0.00	0.00	0.00	None
14.b. Manufactured Treatment Device-Filtering	0	5.67	14.09	0	0	53,558	53,558	40	0.00	33.61	13.45	20.17	14.c. MTD - Generic
14.c. Manufactured Treatment Device-Generic	0			53,558	0	53,558	53,558	50	20.17	0.00	10.08	10.08	

TOTAL IMPERVIOUS COVER TREATED (ac)	14.09	AREA CHECK:	OK.
TOTAL MANAGED TURF AREA TREATED (ac)	5.67	AREA CHECK:	OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	19.00
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	33.65
TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	23.53
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. A (lb/yr)	23.53
TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. A (lb/yr)	10.12

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

NITROGEN REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
NITROGEN REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
TOTAL NITROGEN REMOVED IN D.A. A (lb/yr)	0.00

Site Results (Water Quality Compliance)

Area Checks	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	AREA CHECK
FOREST/OPEN SPACE (ac)	0.00	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER (ac)	14.09	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER TREATED (ac)	14.09	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA (ac)	5.67	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA TREATED (ac)	5.67	0.00	0.00	0.00	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	

Site Treatment Volume (ft^3)	56,844

Runoff Reduction Volume and TP By Drainage Area

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	TOTAL
RUNOFF REDUCTION VOLUME ACHIEVED (ft^3)	0	0	0	0	0	0
TP LOAD AVAILABLE FOR REMOVAL (lb/yr)	33.65	0.00	0.00	0.00	0.00	33.65
TP LOAD REDUCTION ACHIEVED (lb/yr)	23.53	0.00	0.00	0.00	0.00	23.53
TP LOAD REMAINING (lb/yr)	10.12	0.00	0.00	0.00	0.00	10.12
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Total Phosphorus

FINAL POST-DEVELOPMENT TP LOAD (lb/yr)	35.71
TP LOAD REDUCTION REQUIRED (lb/yr)	19.00
TP LOAD REDUCTION ACHIEVED (lb/yr)	23.53
TP LOAD REMAINING (lb/yr):	12.19
REMAINING TP LOAD REDUCTION REQUIRED (lb/yr):	0.00 **

** TARGET TP REDUCTION EXCEEDED BY 4.53 LB/YEAR **

Total Nitrogen (For Information Purposes)

POST-DEVELOPMENT LOAD (lb/yr)	255.50
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	0.00
REMAINING POST-DEVELOPMENT NITROGEN LOAD (lb/yr)	255.50

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

BMP Design Specifications List: **2011 Stds & Specs**

Site Summary

Total Rainfall (in):	**43**
Total Disturbed Acreage:	**21.00**

Site Land Cover Summary

Pre-ReDevelopment Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.00	4.08	10.94	15.02	72
Impervious Cover (acres)	0.00	0.00	0.75	5.23	5.98	28
					21.00	100

Post-ReDevelopment Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.00	1.62	4.44	6.06	29
Impervious Cover (acres)	0.00	0.00	3.21	11.73	14.94	71
					21.00	100

Site Tv and Land Cover Nutrient Loads

	Final Post-Development (Post-ReDevelopment & New Impervious)	Post-ReDevelopment	Post-Development (New Impervious)	Adjusted Pre-ReDevelopment
Site Rv	0.75	0.59	0.95	0.59
Treatment Volume (ft^3)	56,844	25,945	30,899	25,945
TP Load (lb/yr)	35.71	16.30	19.41	16.30
Total TP Load Reduction Required (lb/yr)	**19.00**	3.26	15.74	

Pre-ReDevelopment TP Load per acre (lb/acre/yr)	Final Post-Development TP Load per acre (lb/acre/yr)	Post-ReDevelopment TP Load per acre (lb/acre/yr)
1.35	**1.70**	**1.35**

	Final Post-Development Load (Post-ReDevelopment & New Impervious)	Pre-ReDevelopment
TN Load (lb/yr)	255.50	151.96

Site Compliance Summary

Maximum % Reduction Required Below Pre-ReDevelopment Load	20%

Total Runoff Volume Reduction (ft^3)	0
Total TP Load Reduction Achieved (lb/yr)	23.53
Total TN Load Reduction Achieved (lb/yr)	0.00
Remaining Post Development TP Load (lb/yr)	12.19
Remaining TP Load Reduction (lb/yr) Required	**0.00**

**** TARGET TP REDUCTION EXCEEDED BY 4.53 LB/YEAR ****

Drainage Area Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	5.67	0.00	0.00	0.00	0.00	5.67
Impervious Cover (acres)	14.09	0.00	0.00	0.00	0.00	14.09
Total Area (acres)	**19.76**	**0.00**	**0.00**	**0.00**	**0.00**	**19.76**

Drainage Area Compliance Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
TP Load Reduced (lb/yr)	23.53	0.00	0.00	0.00	0.00	23.53
TN Load Reduced (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Drainage Area A Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.00	1.62	4.05	5.67	29
Impervious Cover (acres)	0.00	0.00	3.15	10.94	14.09	71
					19.76	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed

Total Impervious Cover Treated (acres)	14.09
Total Turf Area Treated (acres)	5.67
Total TP Load Reduction Achieved in D.A. (lb/yr)	23.53
Total TN Load Reduction Achieved in D.A. (lb/yr)	0.00