Transcontinental Gas Pipe Line Company, LLC

Section 3-1 PCSM Plan for Regional Energy Lateral

Regional Energy Access Expansion Project – Regional Energy Lateral

MLV-515RA20, MLV-515RA30,
Carverton Tie-in, Lower Demunds REL Tie-in,
Hildebrandt Tie-in/MLV-515RA40, & S5-T5/S6-T5 and S4a-T5/S4-T5
Stream Stabilization

April 2021
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SECTION 3.1.1
REGIONAL ENERGY LATERAL NARRATIVE

1. Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), indirectly owned by the Williams Companies, Inc. (Williams) is seeking authorization from the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act and Part 157 of the Commissions regulations, to construct, own, operate, and maintain the proposed Project facilities associated with the Regional Energy Access Expansion Project (Project). The Project is an expansion of Transco's existing natural gas transmission system that will enable Transco to provide an incremental 829,400 dekatherms per day (Dth/d) of year-round firm transportation capacity from the Marcellus Shale production area in northeastern Pennsylvania to multiple delivery points along Transco's Leidy Line in PA and Mainline in PA, NJ, and MD.

The Regional Energy Lateral (REL) is proposed as part of the overall Regional Energy Access Expansion Project (Project). The Regional Energy Lateral component of the Project will consist of approximately 22.3 miles of 30-inch diameter pipeline, partially co-located with existing Transco Leidy Line-A, in Buck, Bear Creek, Plains, Jenkins, Kingston and Dallas Townships, and Laflin, Wyoming, and West Wyoming Boroughs, Luzerne County, Pennsylvania. The Regional Energy Lateral begins at existing Compressor Station 515 in Buck Township and continues westward to its terminus at Transco's existing Hildebrandt Tie-in/MLV-515RA40 in Dallas Township. A separate Post Construction Stormwater Management (PCSM) Plan Narrative is provided for Compressor Station 515.

This PCSM Plan has been developed for Regional Energy Lateral which includes: (1) MLV-515RA20, (2) MLV-515RA30, (3) Carverton Tie-in, (4) Lower Demunds REL Tie-in, and (5) Hildebrandt Tie-in/MLV-515RA40. Additionally, three channels have been added to the SR Plan to restabilize and redirect existing streams, S5-T5/S6-T5 and S4a-T5/S4-T5, in Laflin, PA. The PCSM Plan shall be designed and implemented to be consistent with the PCSM Plan under 25 Pa. Code § 102.8 (relating to PCSM requirements). Work and disturbed areas are located within Transco property, existing easements or legally obtained workspace. The limit of disturbance (LOD) will be approximately 0.56 acres for MLV-515RA20, 0.88 acres for MLV-515RA30, 0.83 acres for the Carverton Tie-in, 0.16 acres for the Lower Demunds REL Tie-in and 0.33 acres for Hildebrandt Tie-in/MLV-515RA40. Subject to FERC's certification of the Project and receipt of the necessary permits and authorizations, Transco anticipates construction of the Project to start in second quarter 2023 to meet a proposed in-service date of fourth quarter 2024.

1.1 MLV-515RA20

The MLV-515RA20 is proposed along the REL Pipeline in Bear Creek Township, Luzerne County at Milepost 7.54. It is proposed as a means to isolate gas flows along sections of a pipeline. Pig launchers/receivers and communication equipment may be located at the MLV facility. The facility will include a 104 foot long gravel access road, 55 ft x 90 ft gravel pad, various diversion channels and an infiltration berm with a soil amendment area PCSM Best Management Practice **(**BMP).

1.2 MLV-515RA30

The MLV-515RA30 is proposed along the REL Pipeline in Wyoming Borough, Luzerne County at Milepost 14.84. It is proposed as a means to isolate gas flows along sections of a pipeline. Pig launchers/receivers and communication equipment may be located at the MLV facility. The facility will include a 140 foot long gravel access road, 62 ft x 96 ft gravel pad, and an infiltration berm PCSM BMP.

1.3 Carverton Tie-in

The Carverton Tie-in is a receipt tie-in proposed in West Wyoming Borough, Luzerne County at Milepost 16.8. Proposed is the installation of new tie-in piping into the proposed REL Pipeline, valves, and aboveground tie-in piping for an annubar meter. The facility will include a 55 ft x 90 ft gravel pad, and an infiltration berm PCSM BMP.

1.4 Lower Demunds REL Tie-in

The Lower Demunds REL Tie-in is a receipt tie-in proposed in Dallas Township, Luzerne County near the terminus of the Regional Energy Lateral at Milepost 22.1. Proposed is the installation of approximately 400 feet of new 20-inch-diameter tie-in piping from Transco's existing Leidy Line A tie-in site to the new proposed REL Pipeline tie-in site, valves, and new aboveground tie-in piping for an annubar meter. The facility will include a 74.5 ft x 84 ft gravel pad. With limited run-on to the pad area, stormwater management will be accomplished by infiltration within the pad area itself. The pad will be bermed around the exterior to retain stormwater for infiltration. An overflow spillway will be used to discharge excess flow to a level spreader. Runoff rates have been reduced by 40% of the pre-construction flow rates in accordance with the Dallas Township ordinance.

1.5 Hildebrandt Tie-in/MLV-515RA40

The Hildebrandt Tie-in/MLV-515RA40 is receipt tie-in proposed in Dallas Township, Luzerne County, at the terminus of the Regional Energy Lateral at Milepost 22.34. Proposed is the installation of new aboveground tie-in piping, valves, and aboveground piping for an annubar meter, and install MLV-515RA40 and associated pig trap. The facility will include an 80 ft x 140 ft gravel pad. With run-on to the pad area diverted by an upgradient channel, stormwater management will be accomplished by infiltration within the pad area itself. The pad will be bermed around the exterior to retain stormwater for infiltration. An overflow spillway will be used to discharge excess flow to the diversion channel and subsequently to a level spreader. Runoff rates have been reduced by 40% of the pre-construction flow rates in accordance with the Dallas Township ordinance.

1.6 S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization

Two areas of existing stream channel and bank stabilization and reconstruction through the REL Pipeline right-of-way are proposed for the project. The first stream section is designated as S4a-T5/S4-T5 and is located between Mileposts 11.0 and 11.1. The second section is designated as S5-T5/S6-T5 and is located between Mileposts 11.2 and 11.3. Work will include channel and bank stabilization, reconstruction where necessary, and new channel sections with step-pools as needed to retore the streams and protect the REL Pipeline.

2. Topographic Features of the Area

Project Location Maps for MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, Hildebrandt Tie-in/MLV-515RA40, and the S4a-T5/S4-T5 and S5-T5/S6-T5 streams are included in Attachment 1. The maps show the topographical features of the general site vicinity and is based on the USGS 7.5 Minute topographical mapping of the AVOCA, Kingston, Pittston, Pleasant Valley Summit, and Wilkes-Barre East, Pennsylvania quadrangles.

3. Receiving Surface Waters

The following table (Table 1) lists each watershed located in MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, Hildebrandt Tie-in/MLV-515RA40, and the S5-T5/S6-T5 and S4A-T5/S4-T5 Stream Stabilization Project Areas, its Chapter 93 Water Quality Standards, and Pennsylvania Fish and Boat Commission classifications. A Wetland and Watercourse Delineation Report is included in Attachment A of the ESCP permit application.

Table 1 – Receiving Waters			
Watershed Name	**Designated Use**	**Existing Use**	**PFBC Classification**
MLV-515RA20			
Mill Creek	CWF, MF	HQ-CWF, MF	Class A Wild Trout
MLV-515RA30			
Susquehanna River	WWF, MF	-	N/A
Carverton Tie-in			
Tributary 28363 to Abrahams Creek	CWF, MF	-	N/A
Lower Demunds REL Tie-in			
Trout Brook	CWF, MF	-	Naturally Reproducing Trout
Hildebrandt Tie-in/MLV-515RA40			
Tributary 63042 to Toby Creek	CWF, MF	-	Naturally Reproducing Trout
S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization			
Gardner Creek	CWF, MF	-	Naturally Producing Wild Trout Stream
CWF: Cold Water Fishes; HQ-CWF: High Quality-Cold Water Fishes; WWF: Warm Water Fishes; MF: Migratory Fishes			

An evaluation of potential hydrologic impacts to wetlands associated with proposed PCSM facilities associated with the Regional Energy Lateral. A discussion related to each PCSM facility is outlined below:

MLV-515RA20

There are no wetlands located with the drainage area or immediately downslope of the proposed PCSM facility associated with MLV-515RA20 that would result in a change to the hydrologic conditions of the area that could impact wetland hydrology.

MLV-515RA30

There are no wetlands immediately downslope of the proposed PCSM facility at MLV-515RA30 that would result in a change to the hydrologic conditions of the area that would result in a significant impact to wetland hydrology. Wetlands within the vicinity of the proposed gravel pad and infiltration berm at located approximately 30 feet lower in elevation. The wetland hydrology associated with W11-T3 is primarily the result of surface drainage patterns northeast of the proposed facility which will not be affected by the proposed Project.

Carverton Tie-In

There are no significant changes in the pre and post construction drainage area associated with the gravel pad and PCSM facilities associated with the Carverton Tie-In. There are no wetlands located with the drainage area or immediately downslope of the proposed PCSM facility that would result in a change to the hydrologic conditions of the area that could impact wetland hydrology.

Lower Demunds Tie-In

Wetland W3-T11 and W81-T2 are in the vicinity of the proposed gravel pad and PCSM facility associated with the Lower Demunds Tie-In. The drainage upslope of Wetland W3-T11 will not be altered by the proposed PCSM facility; therefore, no change to the hydrologic conditions associated with Wetland W3-T11 is anticipated. Wetlands downgradient of the project area associated with Wetland W81-T2 are the result of a seasonal high ground water. Outfall from the riprap apron will sheet flow back into the wetland complex with no significant change to the wetland's hydrology proposed.

Hildebrandt Tie-In / MLV-515RA40

There are no significant changes in the pre and post construction drainage area associated with the gravel pad and PCSM facilities associated with the Hildebrandt Tie-In / MLV-515RA40. There are no wetlands immediately downslope of the proposed PCSM facility that would result in a change to the hydrologic conditions of the area that would result in a significant impact to wetland hydrology. Wetlands further downgradient of the Project area associated with Wetland W16-T4 are the result of a seasonal high ground water. Outfall from the level spreader will sheet flow back into the wetland complex. No significant change to the wetland's hydrology is proposed.

4. Types, Depth, Slope, Locations & Limitation of the Soils and Geologic Formations

The soil associations on site were identified by soil map units as mapped in the Web Soil Survey website (https://websoilsurvey.sc.egov.usda.gov/) by the United States Dept. of Agriculture (USDA), Natural Resources Conservation Service (NRCS). There are 2 soil mapping unit located within the LOD for MLV-515RA20, 3 soil mapping units within the LOD for MLV-515RA30, 2 soil mapping units within the LOD for Carverton Tie-in, 1 soil mapping unit within the LOD for Lower Demunds REL Tie-in, 2 soil mapping units within the LOD for Hildebrandt Tie-

in/MLV-515RA40 and 2 soil mapping units within the LOD for the S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization, see Table 2 below.

Table 2 – Soils mapping units within the LOD	
Soil Mapping Unit	**Soil Series**
MLV-515RA20	
VrB	Volusia channery silt loam, 0 to 8 percent slopes, extremely stony
VoB	Volusia channery silt loam, 0 to 8 percent slopes
MLV-515RA30	
ChB	Chenango gravelly loam, 3 to 8 percent slopes
Ho	Holly silt loam
Ps	Pope soils
Carverton Tie-in	
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes
OpB	Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes
Lower Demunds REL Tie-in	
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes
Hildebrandt Tie-in/MLV-515RA40	
OlB	Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes
S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization	
DEF	Dekalb extremely stony sandy loam, steep
Sm	Strip mine

Detailed descriptions and mapping of soil mapping units are provided in the Attachment 2. Soil use limitations (outlined in Table 3) were reviewed in relation to the MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, Hildebrandt Tie-in/MLV-515RA40, and the S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization sites and resolutions were identified in Section 4.1.

Table 3 – Limitations of Pennsylvania Soils Pertaining to Earth Disturbance Projects (Erosion and Sediment Control Best Management Practice (BMP) Manual – Technical Guidance Number 363-3134-008/Page 401)																	
SOIL NAME	**SOIL WITH SLOPE CLASS**	**CUTBANKS CAVE**	**CORROSIVE TO CONCRETE\STEEL**	**DROUGHTY**	**EASILY ERODIBLE**	**FLOODING**	**DEPTH TO SATURATED ZONE/ SEASONAL HIGH WATER TABLE**	**HYDRIC/ HYDRIC INCLUSIONS**	**LOW STRENGTH / LANDSLIDE PRONE**	**SLOW PERCOLATION**	**PIPING**	**POOR SOURCE OF TOPSOIL**	**FROST ACTION**	**SHRINK - SWELL**	**POTENTIAL SINKHOLE**	**PONDING**	**WETNESS**
Arnot-Rock	ArD	X	C	X	X				X		X	X					
Chenango	ChB	X	C	X		X	X	X		X	X	X					
Dekalb	DEF	X	C	X					X	X	X	X					
Holly Silt Loam	Ho	X	C/S			X	X	X	X	X	X	X				X	X
Oquaga	OlB,OpB	X	C	X	X			X		X			X				
Pope Soil	Ps	X	C/S		X	X		X	X	X	X	X	X				
Strip Mine	Sm																
Volusia	VrB,VoB	X	C/S	X	X		X	X	X	X	X	X	X				
Wellsboro	WlB	X	C/S	X	X		X	X	X	X	X		X				X

4.1. Resolution of Soil Limitations

Transco proposes the following resolutions to compensate for soil limitations summarized in Table 3 above:

1. To offset the caving of cutbanks, trenching operations will be conducted in accordance with the OSHA Technical Manual for Trenching.
2. Preventative coatings shall be used to prevent corrosion of concrete and/ or steel.
3. When bedrock is encountered it will be removed by mechanical methods or blasting. Blasting operations will conform with local, state, and federal regulations.
4. Precautions will be taken to prevent slope failure when working within low strength soils by flattening cut / fill slopes, not overloading, maintaining lateral support, and preventing saturation of soils. Low strength soils will not be used for roadway construction.

5. Excavation in soils prone to flooding, slow percolation, ponding, wetness, located in a seasonal high water table, or which are hydric, will likely encounter water. Compensation will involve dewatering with appropriate means such as pump water filter bags, sediment traps, etc.

6. Soils that have the potential to swell, shrink, or heave due to frost action may cause damage to roadways or pads. Where foundations are critical, compensation may require removal and replacement of soils with suitable material.

7. In circumstances where soils appear to be a poor source of topsoil, droughty or prone to wetness, soil testing will be performed to determine the appropriate applications of soil amendments to promote growth. Soils onsite that are fair sources of topsoil, will be identified, stripped and stockpiled for use during restoration.

8. In order to minimize erosion of soils that are easily erodible, compensation may involve providing a protective lining, to apply seed, mulch, erosion control blankets (either in rolls or hydraulically applied), tracking slopes, upstream diversions, waterbars, etc. to minimize soil erosion.

4.2. Geologic Formations

Transco utilized United States Geological Survey (USGS), Geologic Map of Pennsylvania - Map 1, dated 1980 (online), to evaluate geologic hazards on the Project. Transco utilized United States Geological Survey (USGS), Geologic Map of Pennsylvania - Map 1, dated 1980 (online), to evaluate geologic hazards on the Project. The desktop analysis completed for the Project by CEC revealed that the Regional Energy Lateral Pipeline does not cross known, mapped, or inferred faults. No Karst formations were identified in the site vicinity. However, the analysis outlined that Regional Energy Lateral Pipeline lies within a zone of moderate to high landslide incidence and susceptibility. Also, portions of the Project area were previously mined.

Due to the moderate to high landslide incidence and susceptibility and mining in the Project area, a Geological Hazard Assessment and Mitigation Plan was completed by CEC and is submitted with this application (Attachment B). The Geological Hazard Assessment and Mitigation Plan identifies appropriate best management practices to avoid and mitigate for conditions encountered during construction.

5. Characterizations of Earth Disturbance Activities, Including Past, Present, and Proposed Land Uses

Transco will be installing various tie-in and mainline valve (MLV) facilities along the REL Pipeline as a means of controlling gas flows. Pig launchers/receivers, valves and other ancillary equipment will be located at these facilities. Work and disturbed areas are located within Transco property, existing easements, or legally obtained temporary workspace.

Using data taken from Google Earth and Multi-Resolution Land Characteristics (MRLC) Consortium website (https://www.mrlc.gov/viewer/), it appears portions of the Regional Energy Lateral has been an existing and maintained gas pipeline or other right-of-way for the past 20 years and will continue to be an existing and maintained right-of-way once the Project is complete, with some new right-of-way being created in areas. Portions of the existing ROW's will be expanded upon as a result of the Project's construction. Based on the surrounding land characteristics, land use prior to ROW construction within the past 50 years likely would have been either forested land or meadow. Past, present, and proposed land uses for each site were as follows in Table 4.

Table 4 – Past, Present, and Proposed Land Uses

Site	Past Land Use	Present Land Use	Proposed Land Use
MLV-515RA20	Woodland	Woodland	Mainline Valve Yard/ Pipeline Right-of-Way
MLV-515RA30	Urban Area	Urban Area	Mainline Valve Yard/ Pipeline Right-of-Way
Carverton Tie-in	Woodland	Woodland/ Pipeline Right-of-way	Tie-In/Pipeline Right-of-Way
Lower Demunds REL Tie-in	Woodland	Pipeline Right-of-way	Tie-In/Pipeline Right-of-Way
Hildebrandt Tie-in/ MLV-515RA40	Woodland	Pipeline Right-of-Way	Tie-In/Pipeline Right-of-Way
S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization	Woodland/ Surface Mines	Woodland	Pipeline Right-of-Way

Earth disturbance activities at each facility will include grading to create level gravel pad areas, installation of PCSM BMPs, and construction of gravel access roads. Disturbed areas within the temporary workspaces will be restored to the original contours.

The contractor will construct stormwater BMPs to mitigate the increase in volume and peak rates associated with construction. The proposed BMPs are designed to evaporate and/or infiltrate the net increase in volume between the pre- and post-development 2-year rain events. Refer to the Stormwater BMP Sizing Calculations in Attachment 4 for additional information.

6. Post Construction Stormwater Management Best Management Practices, Installation Sequence and PCSM Critical Stages

Increase in stormwater runoff during and after construction shall be controlled by sequencing the operations and using a selection of Best Management Practices (BMPs). PCSM BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set.

6.1. MLV-515RA20

MLV-515RA20 will utilize several PCSM BMPs to control stormwater runoff and attenuate peak flow rate and volume. Upslope diversion channels will collect and convey upslope drainage area stormwater runoff away from the facility. Downslope channels will convey stormwater runoff from the gravel pad and driveway to a constructed infiltration berm. BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set. For these calculations, Test Pit 3 was selected and used for design criteria. See Attachment 3 for the specific infiltration data. A summary of the PCSM BMP design criteria is below.

MLV-515RA20: Design Criteria

Test Pits		**PCSM BMP**	
	BH 3		**Infiltration Berm**
Existing Ground Elevation (ft)	1424.14	**Minimum Final Grade (ft)**	1424.0
Elevation of Confining Layer (ft)	1422.14 (Bedrock)	**Interpreted Elevation of Confining Layer (ft)**	1422.0
Depth to Confining Layer (in)	24 (Bedrock)	**Provided Separation (in)**	24
Lowest Observed Infiltration Rate (in/hr)	0.63	**Infiltration Rate Used (in/hr)**	0.315

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

1. Protect BMP areas associated with infiltration from compaction prior to and during installation.
2. Maintain proper Erosion and Sediment Control Measures during construction.
3. Valve Yard Pad*
    a. As the Valve Yard Pad reaches final grade, ensure the subgrade elevations direct stormwater runoff to Channels C1 and C2.

b. Compact the subgrade fill to limit infiltration in the pad area. Proper compaction is necessary as the entire Valve Yard Pad is a fill construction.

c. Place aggregate final cover to achieve final grade on Valve Yard Pad.

4. PCSM Diversion Channel*

   a. Construct PCSM diversion channel as shown in the plan. Install level spreader as required.
   b. Stabilize the PCSM channel with specified channel linings.

5. Infiltration Berm and Soil Amendment/ Constructed Filter Area*

   a. Complete site grading and stabilize within the limit of disturbance except where the infiltration berm will be constructed; make every effort to minimize berm footprint and necessary zone of disturbance (including both removal of existing vegetation and disturbance of empty soil) in order to maximize infiltration.

   b. Lightly scarify the soil in the area of the proposed berm before placement of fill for the berm. Decompact subgrade as necessary to a depth of 2' if subgrade has been overcompacted.

   c. Utilize suitable fill material to make up the major portion of the berm. soil should be added in 8-inch lifts and compacted after each addition according to design specifications. The slope and shape of the berm should be graded out as soil is added. outlet pipe shall be installed as shown on plans.

   d. Protect the surface ponding area at the base of the berm from compaction. if compaction of this area does occur, scarify soil to a depth of at least 8 inches.

   e. Begin installation of soil amendment/ constructed filter area.

      - All construction should be completed and stabilized before beginning soil restoration.

      - Soil amendment should only be performed when the soil conditions are dry and should only use a solid shank ripper, not a disk or plow due to their ineffectiveness.

- Till soil by digging, scraping, and mixing of soil to circulate air into the soil mantle in various layers. if compaction occurs down to 20 inches below grade, ripping of soil is likely needed.
- Compost mixture will be suitable material to increase water holding and retention capacity at the ratio of 2:1 (soil: compost). mixture will be a 1:1:1 combination of topsoil, sand, and compost. topsoil shall have minimum organic content of 5%.
- Soil amendment and restoration should not take place within the drip line of trees or tree line to avoid damaging root system. soil amendment and restoration should not take place over utility installations within 30 inches of the surface or where trenching or drainage lines are installed. soil amendment shall not be completed where compaction is required.
- Spread 2-3 inches of approved compost mixture on soil.
- Till added soil into existing soil with a sole-shank ripper that is set to a depth of 6 inches.
- Add an additional 4 inches of approved compost mixture to bring area up to grade.

f. Plant berm and soil amendment/constructed filter with turf, meadow plants, shrubs, or trees, as desired. after planting/seeding, add 2-3 inches of compost blanket to the soil amendment/constructed filter area in areas not protected by grass or other plant.

g. Mulch planted and disturbed areas with compost mulch to prevent erosion while plants become established.

6. Channels CC-C1 and CC-C2*

   a. Construct channels as shown in the plan.
   b. Stabilize the channels with specified channel linings.

7. All temporary E&S BMPs will be removed following site stabilization. Other Erosion and Sediment Control measures are not to be removed until the site is fully stabilized.

8. All installed BMPs will be monitored until final site stabilization is achieved.*
9. Long term operation and maintenance guidelines discussed below shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. Upon commencement of construction activities to ascertain the Infiltration Berm area has been flagged and fence erected to prevent access to the area.
2. At completion of PCSM Diversion Channel to ensure they have been constructed to the proposed lines and grades, the specified lining materials have been installed in accordance with the requirements of the plans and specifications, and if applicable, vegetation has been established.
3. At the beginning of construction of the Infiltration Berm to ensure the infiltration area has not been compacted by construction activities.
4. During construction of the Infiltration Berm and soil amendment area/constructed filter, the licensed professional will observe that the BMP is constructed in accordance with the plans and specifications.
5. At completion of PCSM Channels CC-C1 and CC-C2 to ensure it has been constructed to the proposed line and grade, the specified lining material has been installed in accordance with the requirements of the plans and specifications, and if applicable, vegetation has been established.
6. Following installation of the Valve Yard Pad subgrade to ensure stormwater flow is directed to PCSM Channels CC-C1 and CC-C2.
7. For final inspection of constructed BMPs.
8. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

6.2. MLV-515RA30

MLV-515RA30 will utilize several PCSM BMPs to control stormwater runoff, attenuate peak flow rate and volume, and provide infiltration. Stormwater runoff from the pad will be discharged to a vegetated swale for infiltration and controlled discharge. BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set. For these calculations, Test Pit

3 and Test Pit 4 were selected and used for design criteria. See Attachment 3 for the specific infiltration data. A summary of the PCSM BMP design criteria is below.

MLV-515RA30: Design Criteria

Test Pits			**PCSM BMP**	
	TP 3	**TP 4**	**Infiltration Berm**	
Existing Ground Elevation (ft)	565.62	564.47	**Bottom Elevation of PCSM BMP (ft)**	563.0
Elevation of Confining Layer (ft)	None Found	None Found	**Interpreted Elevation of Confining Layer (ft)**	NA
Depth to Confining Layer (in)	NA	NA	**Provided Separation (in)**	>24 (No Confining Layer Found)
Lowest Observed Infiltration Rate (in/hr)	0.38	1.5	**Infiltration Rate Used (in/hr)**	0.38

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

1. Protect BMP areas associated with infiltration from compaction prior to and during installation.
2. Maintain proper erosion and sediment control measures during construction.
3. Valve pad*
    a. As the valve yard pad reaches final grade, ensure the subgrade elevations direct stormwater runoff to the infiltration berm.
    b. Compact the subgrade fill to limit infiltration in the pad area. Proper compaction is necessary as the entire valve yard pad is a fill construction.
    c. Place aggregate final cover to achieve final grade on valve yard pad.
4. Infiltration berm*
    a. Complete site grading and stabilize within the limit of disturbance except where the infiltration berm was constructed; make every effort to minimize berm footprint and necessary zone of disturbance (including both removal of existing vegetation and disturbance of empty soil) in order to maximize filtration.

b. Lightly scarify the soil in the area of the proposed berm before delivering soil to site.
c. Utilize suitable fill material to make up the major portion of the berm. Soil should be added in 8-inch lifts and compacted after each addition according to design specifications. The slope and shape of the berm should be graded out as soil is added. Outlet pipe shall be installed as shown on plans.
d. Protect the surface ponding area at the base of the berm from compaction. If compaction of this area does occur, scarify soil to a depth of at least 8 inches.
e. Complete final grading of the berm after the top layer of soil is added. Tamp soil done lightly and smooth sides of the berm. The crest and base of the berm should be at level grade.
f. Plant berm with turf, meadow plants, shrubs or trees, as desired.
g. Mulch planted and disturbed areas with compost mulch to prevent erosion while plants become established.

5. All temporary BMPs will be removed following site stabilization. Other erosion and sediment control measures are not to be removed until the site is fully stabilized.
6. All installed BMPs will be monitored until final site stabilization is achieved.*
7. Long term operation and maintenance guidelines discussed on this sheet shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. Upon commencement of construction activities to ascertain the Infiltration Berm area has been flagged and fence erected to prevent access to the area.
2. At the beginning of construction of the Infiltration Berm to ensure the infiltration area has not been compacted by construction activities.
3. During construction of the Infiltration Berm the licensed professional will observe that the BMP is constructed in accordance with the plans and specifications.
4. Following installation of the Valve Yard Pad subgrade to ensure stormwater flow is directed to the infiltration berm.

5. For final inspection of constructed BMPs.
6. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

6.3. Carverton Tie-in

Carverton Tie-in will utilize an infiltration berm with soil amendment to attenuate and infiltrate peak flow rate and volume from impervious areas. The infiltration berm will be constructed along the existing contour to collect excess stormwater runoff. Soil amendment will be done behind the berm to provide additional water quality treatment and to compensate for quickly draining soils potentially in this area. BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set. For these calculations, Test Pit 1 and Test Pit 2 were selected and used for design criteria, with Test Pit 5 also used to evaluate soils within the infiltration berm area. Although infiltration testing was not completed at Test Pit 5, Test Pit 5 is located between Test Pits 1 and 2, and the soil strata of TP-5 is similar to the other test pits. For design purposes, the lowest observed infiltration rate was assumed. Furth, since infiltration rates associated with Test Pit 1 are relatively high, 24" of soil amendment are proposed in the BMP to provide additional water quality treatment and to compensate for the quickly draining soils. See Attachment 3 for the specific infiltration data. A summary of the PCSM BMP design criteria is below.

Carverton Tie-in: Design Criteria

Test Pits				**PCSM BMP**	
	TP 1	**TP 2**	**TP 5**		**Infiltration Berm**
Existing Ground Elevation (ft)	1401.32	1393.18	1398.0	**Minimum Final Grade (ft)**	1398.0
Elevation of Confining Layer (ft)	1399.45 (Bedrock)	1391.10 (Bedrock)	1396.0 (Bedrock)	**Interpreted Elevation of Confining Layer (ft)**	1396.0
Depth to Confining Layer (in)	22.5 (Bedrock)	25 (Bedrock)	24 (Bedrock)	**Provided Separation (in)**	24
Lowest Observed Infiltration Rate (in/hr)	11.6	1.50	-	**Infiltration Rate Used (in/hr)**	0.75

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

1. Protect bmp areas associated with infiltration from compaction prior to and during installation.
2. Maintain proper erosion and sediment control measures during construction.
3. Valve Yard Pad*
    a. As the valve yard pad reaches final grade, ensure the subgrade elevations direct stormwater runoff to the infiltration berm.
    b. Compact the subgrade fill to limit infiltration in the pad area. proper compaction is necessary as the entire valve yard pad is a fill construction.
    c. Place aggregate final cover to achieve final grade on valve yard pad.
4. Infiltration Berm*
    a. Complete site grading and stabilize within the limit of disturbance except where infiltration berm will be constructed; make every effort to minimize berm footprint and necessary zone of disturbance (including both removal of exiting vegetation and disturbance of empty soil) in order to maximize infiltration.
    b. Lightly scarify the soil in the area of the proposed berm before delivering soil to site.
    c. Utilize suitable fill material to make up the major portion of the berm. soil should be added in 8-inch lifts and compacted after each addition according to design specifications. the slope and shape of the berm should be graded out as soil is added.
    d. Protect the surface ponding area at the base of the berm from compaction. if compaction of this area does occur, scarify soil to a depth of at least 8 inches.
    e. Complete final grading of the berm after the top layer of soil is added. tamp soil down lightly and smooth sides of the berm. the crest and base of the berm should be at level grade.
    f. Plant berm with turf, meadow plants, shrubs or trees, as desired.
    g. Mulch planted and disturbed areas with compost mulch to prevent erosion while plants become established.
5. A temporary E&S BMPs will be removed following site stabilization. other erosion and sediment control measures are not to be removed until the site is fully stabilized.
6. All installed BMPs will be monitored until final site stabilization is achieved.*
7. Long term operation and maintenance guidelines discussed shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. At the beginning of construction to ascertain the infiltration berm area has been flagged and fence erected to prevent access to the area.
2. Following installation of the valve yard pad subgrade to ensure stormwater flow is directed to the Infiltration Berm.
3. At the beginning of construction of the infiltration berm to ensure the Infiltration Area has not been compacted by construction activities.
4. During construction of the Infiltration Berm the licensed professional will observe that the berm is constructed in accordance with the plans and specifications.
5. For final inspection of constructed BMPs.
6. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

6.4. Lower Demunds REL Tie-in

The Lower Demunds REL Tie-in will utilize a diversion berm, gravel access road and gravel pad with a subsurface infiltration bed to control stormwater runoff, attenuate peak flow rate and volume, and provide infiltration. Runoff rates have been reduced by 40% of the pre-construction flow rates in accordance with the Dallas Township ordinance. BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set. For these calculations, Test Pit 116 and Test Pit 117 were selected and used for design criteria. See Attachment 3 for the specific infiltration data. A summary of the PCSM BMP design criteria is below.

Lower Demunds REL Tie-in: Design Criteria

Test Pits			**PCSM BMP**	
	TP 116	**TP 117**		**Infiltration Pad**
Existing Ground Elevation (ft)	1276.68	1274.09	**Top of Pad Final Grade (ft)**	1277.5 - 1277.0
Elevation of Confining Layer (ft)	None Found	None Found	**Bottom Elevation of PCSM BMP (ft)**	1275.0
Depth to Confining Layer (in)	>26”	>18”	**Interpreted Elevation of Confining Layer (ft)**	NA
Lowest Observed Infiltration Rate (in/hr)	1.0	>2.0	**Provided Separation (in)**	>24 (No Confining Layer Found)
			Infiltration Rate Used (in/hr)	0.5

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

1. Protect BMP areas associated with infiltration from compaction prior to and during installation.
2. Maintain proper erosion and sediment control measures during construction.
3. PCSM diversion berm/channel
    a. Construct PCSM diversion berm/channel as shown in the plan. Install outlet protection as required.
    b. Stabilize the berm/channel with specified channel linings.
4. Valve yard gravel pad with subsurface infiltration bed*
    a. Install all temporary erosion and sedimentation controls.
    b. Prepare site for grading and perimeter berm construction.
        - All existing vegetation should remain if feasible and should only be removed if necessary for construction.
        - Care should be taken to prevent compaction of the pad bottom.
        - If excavation is required, clear the area to be excavated of all vegetation. Remove all tree roots, rocks, and boulders only in excavation area.
    c. Grade subsoil in bottom of pad, taking care to prevent compaction. Decompact subsoil to achieve design infiltration rates. Ensure flows are directed to the outlet

structure. Compact surrounding perimeter berm areas and around outlet structure.

d. Apply geotextiles and other erosion-control measures.
e. Place aggregate final cover to achieve final grade on valve yard pad.
f. Seed, plant and mulch according to planting plan

5. All temporary E&S BMPs will be removed following site stabilization. Other erosion and sediment control measures are not to be removed until the site is fully stabilized.
6. All installed BMPs will be monitored until final site stabilization is achieved.*
7. Long term operation and maintenance guidelines discussed below shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. Upon commencement of construction activities to ascertain the valve yard pad area has been flagged and fence erected to prevent access to the area.
2. At completion of PCSM diversion berm/channel to ensure it has been constructed to the proposed lines and grades, the specified lining materials have been installed in accordance with the requirements of the plans and specifications, and if applicable, vegetation has been established.
3. At the beginning of construction of the valve yard pad to ensure the infiltration area has not been compacted by construction activities.
4. During construction of the valve yard pad the licensed professional will observe that the bmp is constructed in accordance with the plans and specifications.
5. Following installation of the valve yard pad subgrade to ensure stormwater flow is directed to the outlet structure.
6. For final inspection of constructed BMPs.
7. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

6.5. Hildebrandt Tie-in/MLV-515RA40

The Hildebrandt Tie-in/MLV-515RA40 will utilize a diversion channel, gravel access road and gravel pad with a subsurface infiltration bed to collect and infiltrate peak runoff flow rate and

volume from impervious areas. Runoff rates have been reduced by 40% of the pre-construction flow rates in accordance with the Dallas Township ordinance. BMP design calculations and drawings are provided in Attachment 4 and PCSM Plan set. For these calculations, Test Pit 106 and Test Pit 114/118 were selected and used for design criteria. Test Pit 106, located in the southwest corner of the pad, showed a seasonal high water table located 12" below grade. Test Pit 118, located in the northeast corner of the pad, did not encounter a confining layer within 5' of grade. Therefore, the design accounts for infiltration in only the northeast corner of the pad as depicted on the drawings. See Attachment 3 for the specific infiltration data. A summary of the PCSM BMP design criteria is below. A summary of the PCSM BMP design criteria is below.

Hildebrandt Tie-in/MLV-515RA40: Design Criteria

Test Pits			**PCSM BMP**	
	TP 106	**TP 114/118**		**Infiltration Pad**
Existing Ground Elevation (ft)	1278.48	1281.57	**Top of Pad Final Grade (ft)**	1280.5
Elevation of Confining Layer (ft)	1277.48 (SHWT)	None Found	**Bottom Elevation of PCSM BMP (ft)**	1279.5
Depth to Confining Layer (in)	12 (SHWT)	>60	**Interpreted Elevation of Confining Layer (ft)**	1277.48
Lowest Observed Infiltration Rate (in/hr)	0.44	2.50	**Provided Separation (in)**	24
			Infiltration Rate Used (in/hr)	0.16

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

1. Protect BMP areas associated with infiltration from compaction prior to and during installation.
2. Maintain proper erosion and sediment control measures during construction.
3. PCSM diversion channel D1*
    a. Construct PCSM diversion channel and level spreader as shown in the plan. Install outlet protection as required.
    b. Stabilize the channel with specified channel linings.
4. Valve yard gravel pad with subsurface infiltration bed
    a. Install all temporary erosion and sedimentation controls.
    b. Prepare site for grading and perimeter berm construction.

- All existing vegetation should remain if feasible and should only be removed if necessary for construction.
- Care should be taken to prevent compaction of the pad bottom.
- If excavation is required, clear the area to be excavated of all vegetation. Remove all tree roots, rocks, and boulders only in excavation area

c. Grade subsoil in bottom of pad, taking care to prevent compaction. Decompact subsoil to achieve design infiltration rates. Ensure flows are directed to the outlet structure. Compact surrounding perimeter berm areas and around outlet structure.
d. Apply geotextiles and other erosion-control measures.
e. Place aggregate final cover to achieve final grade on valve yard pad.
f. Seed, plant and mulch according to planting plan

5. All temporary E&S BMPs will be removed following site stabilization. Other erosion and sediment control measures are not to be removed until the site is fully stabilized.
6. All installed BMPs will be monitored until final site stabilization is achieved*
7. Long term operation and maintenance guidelines discussed below shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. Upon commencement of construction activities to ascertain the valve yard pad area has been flagged and fence erected to prevent access to the area.
2. At completion of PCSM diversion channel to ensure it has been constructed to the proposed lines and grades, the specified lining materials have been installed in accordance with the requirements of the plans and specifications, and if applicable, vegetation has been established.
3. At the beginning of construction of the valve yard pad to ensure the infiltration area has not been compacted by construction activities.
4. During construction of the valve yard pad the licensed professional will observe that the bmp is constructed in accordance with the plans and specifications.

5. Following installation of the valve yard pad subgrade to ensure stormwater flow is directed to the outlet structure.
6. For final inspection of constructed BMPs.
7. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

6.6. S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization

Diversion channels will be constructed to restabilize and redirect existing streams, S5-T5/S6-T5 and S4a-T5/S4-T5. BMP design calculations and drawings are provided in Attachment 4 and the PCSM Plan set.

BMP Installation Sequence

The PCSM BMPs should be installed in a manner designed to:

Protect BMP areas associated with infiltration from compaction prior to and during installation.

1. Diversion Channels*
    a. Construct stream channels, as shown in the plan. Install Grade Control Structures, as shown.
    b. Stabilize the channels with specified channel linings and rip-rap stabilization.
2. All temporary E&S BMPs will be removed following site stabilization. Other Erosion and Sediment Control measures are not to be removed until the site is fully stabilized.
3. All installed BMPs will be monitored until final site stabilization is achieved.*
4. Long term operation and maintenance guidelines discussed below shall be followed.

PORTIONS OF THE BMP INSTALLATION SEQUENCE DENOTED WITH AN ASTERISK (*) ABOVE ARE CRITICAL STAGES AS DISCUSSED BELOW.

PCSM Critical Stages

Critical points requiring visits by the licensed professional or delegate are as follows:

1. During construction of the stream channels the licensed professional will observe that the channels are constructed in accordance with the plans and specifications.
2. For final inspection of constructed BMPs.
3. At the establishment of hard surface stabilization or 70% vegetation covers to allow removal of E&S controls.

7. Net Change in Volume and Rate of Runoff

An analysis of pre- and post-development stormwater runoff was performed for the MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40 sites along the Regional Energy Lateral Pipeline. The installation of the valves and associated access roads will increase the volume of stormwater runoff between the pre and post development 2-year rain event due to the increase in the type and size of the impervious area. The increase in impervious area will increase the pre to post development peak runoff for the 1-, 2-, 10-, 25-, 50-, and 100-year storm events. At Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40 runoff rates have been reduced by 40% of the pre-construction flow rates in accordance with the Dallas Township ordinance. Design calculations using HydroCAD software are included in Attachment 4. Refer to the Post-Construction Stormwater Management (PCSM) Plan drawings for additional information.

For the net change volume analysis, specific technical LODs were delineated for the proposed main line valve yard sites and tie-in sites in order to separate them from the entirety of the pipeline LOD. These technical LODs were determined as the portion of the pipeline LOD that is controlled by the BMP. Undetained areas within the technical LODs are part of the pipeline revegetation process and will be restored to meadow in good condition. Also, due to the nature of the project these undetained areas in some instances are impractical to manage as doing so could further impact natural resources and/or impact landowners. For this reason, undetained areas were not included in the net change volume analysis.

7.1. MLV-515RA20

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
3,470	4,093	2,689	-781

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.91	1.35	2.71	3.81	4.87	6.15

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
1.15	1.64	3.12	4.29	5.39	6.72

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.67	0.97	2.21	3.48	4.42	6.01

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-0.24	-0.38	-0.50	-0.33	-0.45	-0.14

7.2. MLV-515RA30

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
1,040	1,520	0	-1,040

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.28	0.46	1.01	1.47	1.93	2.48

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.48	0.70	1.35	1.86	2.35	2.93

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.00	0.00	0.00	0.00	0.00	0.00

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-0.28	-0.46	-1.01	-1.47	-1.93	-2.48

7.3. Carverton Tie-in

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
1,164	1,801	0	-1,164

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.49	0.69	1.27	1.74	2.17	2.70

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.76	0.99	1.64	2.12	2.56	3.09

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.00	0.00	0.00	0.30	1.47	2.50

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-0.49	-0.69	-1.27	-1.44	-0.70	-0.20

7.4. Lower Demunds REL Tie-in

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
795	1,865	345	-450

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.15	0.21	0.40	0.56	0.71	0.89

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.55	0.64	0.95	1.18	1.40	1.65

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.09	0.11	0.16	0.20	0.24	0.28

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-0.06	-0.10	-0.24	-0.36	-0.47	-0.61

7.5. Hildebrandt Tie-in/MLV-515RA40

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
1,443	3,014	404	-1,039

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.27	0.38	0.74	1.03	1.31	1.64

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.96	1.15	1.77	2.23	2.67	3.19

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
0.13	0.18	0.33	0.44	0.55	0.73

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-0.14	-0.20	-0.41	-0.59	-0.76	-0.91

8. Temporary and Permanent Stabilization

Appropriate seed mixtures for temporary and permanent stabilization are outlined on the notes sheet of the plan drawings.

8.1. Permanent Stabilization

Upon final completion of an earth disturbance activity or stage or phase of an activity, the site shall immediately have topsoil restored, replaced, or amended, seeded, mulched or otherwise permanently stabilized and protected from accelerated erosion and sedimentation. E&S BMPs shall be implemented and maintained until the permanent stabilization is completed. Once permanent stabilization has been established, the temporary E&S BMPs shall be removed. Areas disturbed in the act of removing temporary E&S BMPs shall be permanently stabilized upon completion of the temporary E&S BMP removal activity. For an earth disturbance activity or stage or phase of an activity to be considered permanently stabilized, the disturbed areas shall be covered with one of the following:

- A minimum uniform 70% perennial vegetative cover, with a density capable of resisting accelerated erosion and sedimentation.
- An acceptable BMP which permanently minimizes accelerated erosion and sedimentation.
- When erosion and sedimentation controls are to be removed in agricultural non-sensitive areas (streams/wetlands), agricultural landowners shall maintain agricultural BMPs per PaDEP regulations.

8.2. Temporary Stabilization

Upon temporary cessation of an earth disturbance activity or stage or phase of an activity where a cessation of earth disturbance activities will exceed 4 days (including agricultural areas), the site shall be immediately seeded, mulched, or otherwise protected from accelerated erosion and sedimentation pending future earth disturbance activities. For an earth disturbance activity or stage or phase of an activity to be considered temporarily stabilized, the disturbed areas shall be covered with one of the following:

- A minimum uniform coverage of mulch and seed, with a density capable of resisting accelerated erosion and sedimentation.
- An acceptable BMP which temporarily minimizes accelerated erosion and sedimentation.

8.3. Stabilization During Non-Growing Season

When utility construction must be done and is completed during a non-growing season, interim stabilization BMPs must be implemented and adequately maintained. The application of straw mulch at the rate of 3.0 tons per acre is required. The BMPs should be inspected weekly (unless snow covered) and after each runoff event to identify areas that become bare. Temporary erosion and sediment pollution controls must be maintained.

9. Long Term Operation and Maintenance Schedule

PCSM BMPs should be properly maintained to ensure their effectiveness. Transcontinental Gas Pipe Line Company, LLC will be responsible for the long-term operation and maintenance of the PCSM facilities proposed at all sites. Sheet flow conditions and infiltration must be sustained throughout the life of the BMP. BMPs should be inspected for clogging from sediment of debris, damage by foot or vehicular traffic, and flow channelization. Inspections should be made on a quarterly basis for the first two years following installation, and then twice per year thereafter. Inspections should also be made after every storm event greater than 1 inch during the establishment period.

Operation and maintenance guidelines should be provided to facility owners and tenants. Sediment and debris should be routinely removed upon observation. If erosion is observed, measures should be taken to improve the dispersion method to address the source of erosion. Sediment should be removed when the BMP is thoroughly dry. Trash and debris removed from the site should be deposited only at suitable disposal/recycling sites and must comply with applicable local, state, and federal waste regulations. Grass cover should be mowed with low ground pressure equipment as needed to control noxious weeds. Mowing should be done only when the soil is dry in order to prevent tracking damage to vegetation, soil compaction, and flow concentrations. If vegetative cover is not fully established within the designated time, it should be replaced with an alternative species. Unwanted or invasive growth should be removed on an annual basis.

Vegetated areas will be inspected weekly and after runoff events until permanent vegetation is achieved. Once the vegetation is established, inspections of health, diversity, and density should be performed at least twice per year, during both the growing and non-growing season. Bioretention sections may require the re-spreading of mulch in areas where erosion is evident. During periods of extended drought, bioretention areas may require watering. Vegetative cover should be sustained at 85% and reestablished if damage greater than 50% is observed.

Damaged BMPs will be repaired as soon as possible upon discovery. Repairs will be made to restore damaged BMPs to the original design condition.

Erosion problems, damage to vegetation, sediment and debris accumulation, uniformity of in cross-section and pools of standing water should be inspected. BMP outlet structures and protection features should also be maintained in order to ensure optimum performance. Riprap aprons will be inspected weekly and after each runoff event. Displaced riprap within the apron must be replaced immediately. Outlet pipes should also be inspected following each runoff event. Sediment and debris must be removed within 24 hours of discovery or as soon as soil conditions permit access to pipe without further damage.

In addition to the aforementioned items, at MLV-515RA20, PCSM channels and diversion channels shall be inspected for sediment accumulation, damage caused by erosion, and lack of ground cover. Repairs should be made immediately. Channels shall be mowed annually to prevent clogging. The infiltration berm will be inspected for sediment accumulation. Sediment buildup in the berm will be removed and be properly disposed. All damage caused by erosion will be repaired immediately. Side slope areas (both interior and exterior) will be checked for lack of ground cover and gully erosion. These areas will be regraded, as necessary, then fertilized, seeded and mulched. The discharge structure (outlet pipe) will be inspected for damage. Repairs will be made immediately. Debris that has accumulated on and inside the berms will be immediately removed. If problems are found with the outlet pipes, repairs will be made immediately. The riprap outlet protections, OP2, OP3 and OP4, and the level spreaders shall be inspected quarterly, and after every major storm (i.e., 10-year, 24-hour event) to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Displaced riprap within the riprap outlet protection shall be replaced immediately. All other needed repairs will also be made immediately to prevent further damage.

At Carverton Tie-In and MLV-515RA20, the infiltration berm will be inspected for sediment accumulation. Sediment buildup in the berm will be removed and be properly disposed. All damage caused by erosion will be repaired immediately. Side slope areas (both interior and exterior) will be checked for lack of ground cover and gully erosion. These areas will be regraded, as necessary, then fertilized, seeded and mulched. Debris that has accumulated on and inside the berms and/or on spillway will be immediately removed. All other needed repairs will also be made immediately to prevent further damage.

At Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40, any disturbance of the gravel pad area requires maintenance and general restoration. The disturbed area should be kept to the minimum necessary to accomplish the maintenance activity and comply with safety requirements. Upon completion of the maintenance activity, excavated areas will be backfilled with material approved by Williams. Compaction is permitted by applicable Williams construction and safety requirements while meeting infiltration requirements. Infiltration testing will be performed on the backfilled areas in accordance with PADEP's Stormwater BMP requirements. The backfilled area must provide an equivalent or better infiltration rate to that of the original PCSM BMP design. Should the backfilled area not achieve the required infiltration rate, remedial activities such as soil decompaction or amendment shall be performed and additional infiltration testing must be performed. Backfill of any excavated area on the gravel pad area must be restored by placing the equivalent stone aggregate to the required thickness. If settlement within the gravel pad area occurs, equivalent stone aggregate shall be placed to maintain the grade of the pad. Finally, if standing water is observed on the gravel pad, the cause must be determined and repairs undertaken.

10. Recycling and Disposal of Materials

If the site will need to have fill imported from an off-site location, the responsibility for performing environmental due diligence and the determination of clean fill will in most cases reside with the operator. If the site will have excess fill that will need to be exported to an off-site location, the responsibility of clean fill determination and environmental due diligence rests on the applicant. If all cut and fill materials will be used on the site, a clean fill determination is not required by the operator unless there is a belief that a spill or release of a regulated substance occurred on site.

Applicants and/or operators must use environmental due diligence to ensure that the fill material associated with this project qualifies as clean fill. Definitions of clean fill and environmental due diligence are provided below. All fill material must be used in accordance with the department's policy "management of fill", document number 258 2182 773. A copy of this policy is available online at www.depweb.state.pa.us.

Clean fill is defined as: uncontaminated, non-water soluble, non-decomposable, inert, solid material. The term includes soil, rock, stone, dredged material, used asphalt, and brick, block or concrete from construction and demolition activities that is separate from other waste and is recognizable as such. The term does not include materials placed in or on the waters of the

commonwealth unless otherwise authorized. (the term "used asphalt" does not include milled asphalt or asphalt that has been processed for re-use.).

Environmental due diligence: investigative techniques, including, but not limited to, visual property inspections, electronic data base searches, review of property ownership, review of property use history, sanborn maps, environmental questionnaires, transaction screens, analytical testing, environmental assessments or audits. Analytical testing is not a required part of due diligence unless visual inspection and/or review of the past land use of the property indicates that the fill may have been subjected to a spill or release of regulated substance. If the fill may have been affected by a spill or release of a regulated substance, it must be tested to determine if it qualifies as clean fill. Testing should be performed in accordance with appendix a of the department's policy "management of fill".

Fill material that does not qualify as clean fill is regulated fill. Regulated fill is waste and must be managed in accordance with the department's municipal or residual waste regulations based on 25 pa. Code chapters 287 residual waste management or 271 municipal waste management, whichever is applicable.

The restoration of the pipeline right-of-way will require the removal of the temporary materials. The temporary materials include, but may not be limited to, stone surfaces and associated geotextiles. The contractors are required to dispose of the materials at suitable disposal or recycling sites and in compliance with local, state and federal regulations.

11. Thermal Impacts

Clearing riparian vegetative cover has the potential to increase stream temperatures. However, due to the nature of the proposed Project and limited extent of riparian forest impacts, potential thermal effects resulting construction or operation of the Project are expected to be negligible and localized. Transco has routed the proposed pipelines to parallel existing rights-of-way to the extend practicable. As such, most pipeline installation activities will take place within or immediately adjacent to an existing cleared and maintained pipeline right-of-way. Transco also reduced workspace to the extent practical within 50 feet of the top-of-bank for all streams crossed by the pipeline. Additionally, Transco has minimized workspace or reduced additional temporary workspace to the extent practicable within forested riparian buffers. A 10-foot-wide corridor centered over the proposed pipeline must be maintained to facilitate period inspection and maintenance activities. The rest of the forested riparian buffers

cleared for the Project will be restored following construction. As outlined in the Wetland and Riparian Reforestation plan included within Section 1-7 of the Application, most of the trees and shrubs adjacent to streams will be cleared at ground level and, to the extent practical, root systems will be left intact to promote stump sprouts to regenerate woody vegetation. In addition, temporarily cleared forested riparian buffers will be replanted with native trees and shrubs to reestablish canopy cover across most of the affected area. These restoration measures are expected to minimize solar exposure and mitigate potential temperature increases, which should further attenuate downstream from the right-of-way.

There will be no increase in stormwater discharge. Stormwater runoff associated with the installation of the MLV's will be routed through stormwater BMPs designed to retain and infiltrate the first surge of water from the site. The first surge of water will be the warmest water for the duration of the storm event and will quickly cool as the storm event progresses. The BMPs are designed to capture and infiltrate this warmest surge of stormwater. Based on routing calculations, stormwater is not discharged from the BMPs for the first 8 hours during a 100-year/24-hour storm event. The retention period is longer for less intense storms. Therefore, as a result of these measures, no significant thermal impact to the receiving waters is anticipated.

12. Antidegradation Requirements

Transco evaluated the feasibility of non-discharge alternatives that would be located outside of exceptional value (EV) or high-quality (HQ) watersheds. Hydraulic models were analyzed from an efficiency and effectiveness point of view to confirm and minimize the necessary pipeline lengths and diameters to meet the Project purpose and need. The hydraulic model determined the sizing of the MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, and Hildebrandt Tie-in/MLV-515RA40 along the Regional Energy Lateral Pipeline. In order for the Project to meet the required purpose and need, siting the Regional Energy Lateral Pipeline outside of EV and HQ watersheds, is not feasible.

Therefore, Transco determined that there are no cost-effective and environmental sound viable non-discharge alternatives for the project. Transco has minimized project impacts to EV and HQ watersheds through the use of co-location with existing pipelines and protecting riparian buffers within the project workspace. Earth disturbance will be minimized to the extent practical and will be phased or sequenced to only disturbed portions that are necessary for the specific scope of work. Wherever possible, the LOD was decreased to avoid disturbing additional ground

and will be kept to the minimum width and depth necessary to safely complete construction activities.

Anti-Degradation Best Available Combination of Technologies (ABACT) standards have been proposed for the MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, and Hildebrandt Tie-in/MLV-515RA40 sites because there are no viable non-discharge alternatives. The Erosion and Sediment Control Plan prepared for the Project outlines a more stringent design and E&S BMPs that meet ABACT standards.

The MLV-515RA20, MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, and Hildebrandt Tie-in/MLV-515RA40 sites will result in increased discharge of stormwater to surface waters which will be mitigated by the implementation of post-construction stormwater management (PCSM) BMPs. Proposed PCSM BMPs are designed with stormwater volume reduction and water quality treatment maximized to the extent practicable within the site constraints to maintain and protect existing water quality and existing and designated uses.

13. Riparian Buffers

No existing riparian buffers have been identified within or near the MLV-515RA30, Carverton Tie-in, Lower Demunds REL Tie-in, Hildebrandt Tie-in/MLV-515RA40, and S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization locations. MLV-515RA20 Valve Yard is located within the forested riparian buffer of stream, S75-T2. After completing the construction activities, the impacted riparian area will be restored back to pre-existing contours and re-seeded with riparian seed mix, outside of those areas where the valve is placed.

14. Offsite Discharge Analysis

The stormwater BMPs being constructed along the Regional Energy Lateral Pipeline are in areas that will discharge stormwater to offsite non-surface water. These areas have been analyzed to reduce the likelihood that these discharges will be erosive to adjacent property owners. The analysis has been performed in accordance with PADEP Document 3150-FS-DEP4124, “Off-Site Discharges of Stormwaters to Areas That Are Not Surface Waters”. The full analysis is presented in Attachment 6 – Offsite Discharge Report. A summary of the findings is presented below.

14.1. MLV-515RA20

The MLV-515RA20 site utilizes an infiltration berm. The collected stormwater discharges through an outlet pipe, through a structural level spreader, and across a riprap apron toward the

adjacent forested area located west of the Limits of Disturbance. The stormwater is discharged as sheet flow and travels along a vegetative flow path until it reaches a Bald Mountain Road culvert and then a delineated stream, S83-T2. Another point of discharge comes from PCSM Diversion Channel DC-D1, which discharges into an earthen level spreader. The stormwater then flows as sheet flow along a vegetative flow path until it reaches delineated stream, S76-T2. Calculations provided for the project site runoff show a reduction in the post-construction discharge rates and volumes. The area downstream of the infiltration berm and channel is over 90% vegetated. The discharge velocities at the structural level spreader is 1.35 feet per second (fps) for the 100 year, 24-hour storm event. The discharge velocity at the apron DC-D1 discharges to is 0.75 fps. Since the outlet velocities are below 2.5 fps, downstream erosion will be minimal, if not negligible.

14.2. MLV-515RA30

The MLV-515RA30 site utilizes an infiltration berm. This infiltration berm does not discharge water during any storms, 1-yr through the 100-yr. If the berm were to discharge water it flows into the adjacent wetland and agricultural areas located southwest of the Limits of Disturbance. The stormwater is discharged as sheet flow and travels along a vegetative flow path until it reaches an unnamed blue line stream, upstream of the Susquehanna River. Calculations provided for the project site runoff show a reduction in the post-construction discharge rates and volumes. The area downstream of the vegetative swale is over 90% vegetated. Calculations indicated that the discharge velocity over the berm is 0.0 fps for the 100-yr storm. Considering the calculations indicate the berm doesn't discharge and the downstream being well vegetated erosion at this site is very unlikely.

14.3. Carverton Tie-in

The Carverton Tie-in site utilizes an infiltration berm. This infiltration berm discharges water, and it flows into the adjacent forested area located east of the Limits of Disturbance. The stormwater is being discharged as sheet flow and travels along a vegetative flow path until it reaches an unnamed blue line stream. Calculations provided for the project site runoff show a reduction in the post-construction discharge rates and volumes. The area downstream of the infiltration berm is over 90% vegetated. Additionally, the velocity coming out of the outfall protection for the 100-year 24-hour was calculated and found to be 0.97 fps. Since the outlet velocity is below 2.5 fps, downstream erosion will be minimal, if not negligible.

14.4. Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40

The Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40 sites each utilize subsurface infiltration beds. These subsurface infiltration beds are located beneath each gravel pad where water accumulates and flows away from the pads.

At the Lower Demunds REL Tie-in, the pad will be bermed around the exterior to retain stormwater for infiltration. An overflow spillway will be used to discharge excess flow to a riprap apron on the east side of the pad. The stormwater is being discharged as sheet flow and travels along a vegetative flow path until it reaches a water collection pond. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the outfall protection is 1.3 fps for the for the 25 year, 24-hour storm event. Since the outlet velocity is below 2.5 fps, downstream erosion will be minimal, if not negligible.

At Hildebrandt Tie-in/MLV-515RA40, the pad will be bermed around the exterior to retain stormwater for infiltration. An overflow spillway on the north side of the pad will be used to discharge excess flow to the diversion channel. The water will then be directed northwest to a level spreader where it is discharged as sheet flow and travels along a vegetative flow path until it reaches an unnamed blueline stream. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed level spreader is 0.95 fps for the for the 25 year, 24-hour storm event. Since the outlet velocity is below 2.5 fps, downstream erosion will be minimal, if not negligible.

15. Non-Structural and Structural Water Quality BMP Description

Limit of disturbance will be minimized to the maximum extent possible by disturbing only those areas necessary to complete the proposed earthwork and BMP installations.

Sensitive features such as wetlands will be protected to the maximum extent possible. These areas will be clearly delineated in the field and protected prior to construction activities taking place. Existing vegetation is not to be removed from the protected area and the areas shall not be subject to grading or movement of existing soils. Protected areas that have been disturbed/compacted during construction will be restored using soil amendment and restoration.

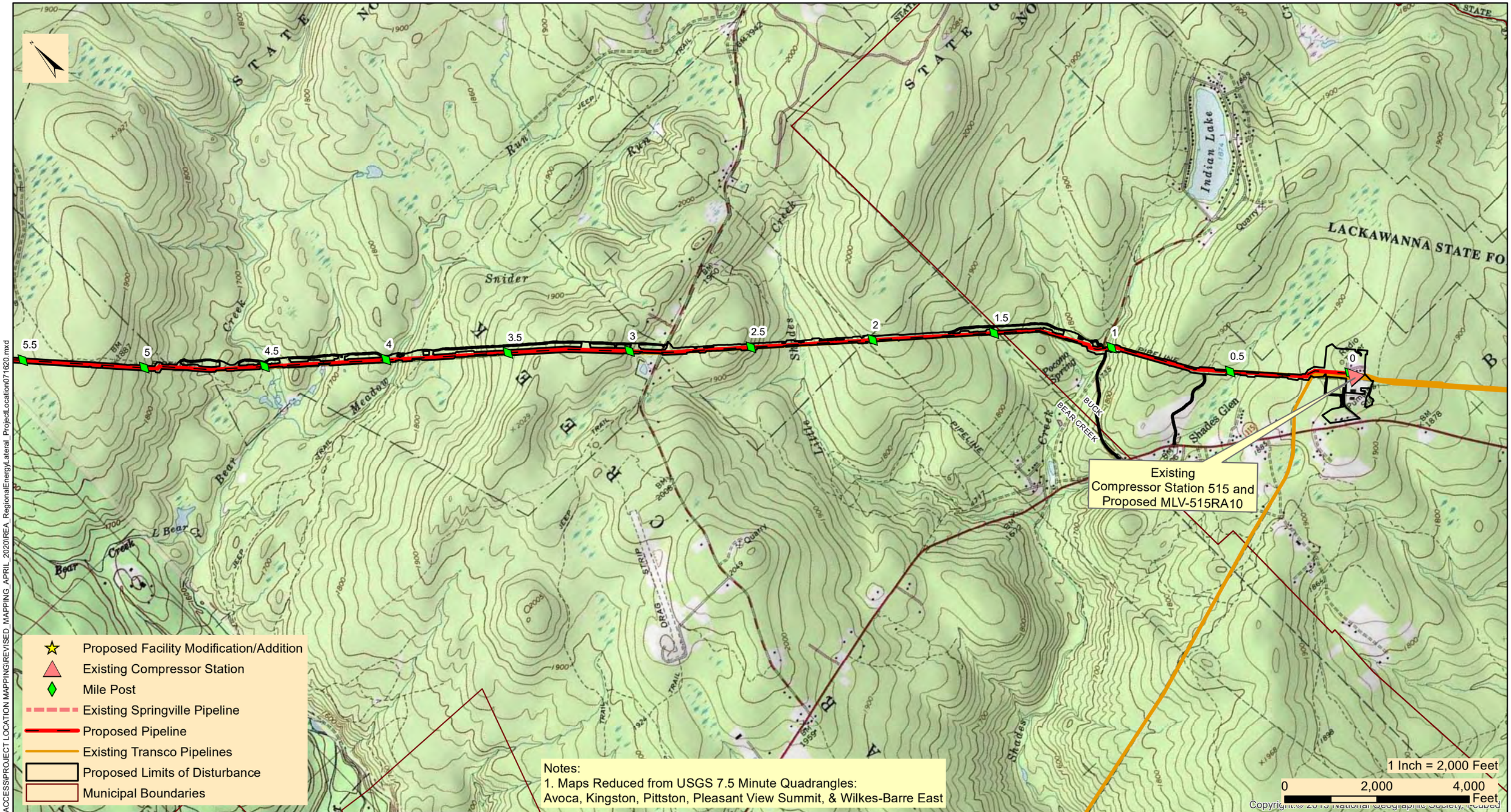
If applicable, temporarily impacted riparian buffers will be fully restored to their preexisting conditions.

Disturbed areas that are not proposed to be impervious will be revegetated as per the seeding and mulching notes provided in PCSM plan notes. Wherever possible, existing natural drainage patterns will be utilized to divert flow to the proposed BMPs.

16. The PCSM Plan Shall be Prepared by a Person Trained and Experienced in PCSM Methods and Techniques

These plans and narrative were prepared by Patrick A Wozinski, PE (BAI Group, LLC) of State College, PA in accordance with the Pennsylvania Department of Environmental Protection Stormwater BMP Manual, December 2006. Plan preparer's resume is provided in Attachment C of the ESCP permit package.

ATTACHMENT 1
PROJECT LOCATION MAPS



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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

REGIONAL ENERGY ACCESS EXPANSION PROJECT

PROPOSED 30" REGIONAL ENERGY LATERAL

PROJECT LOCATION MAP

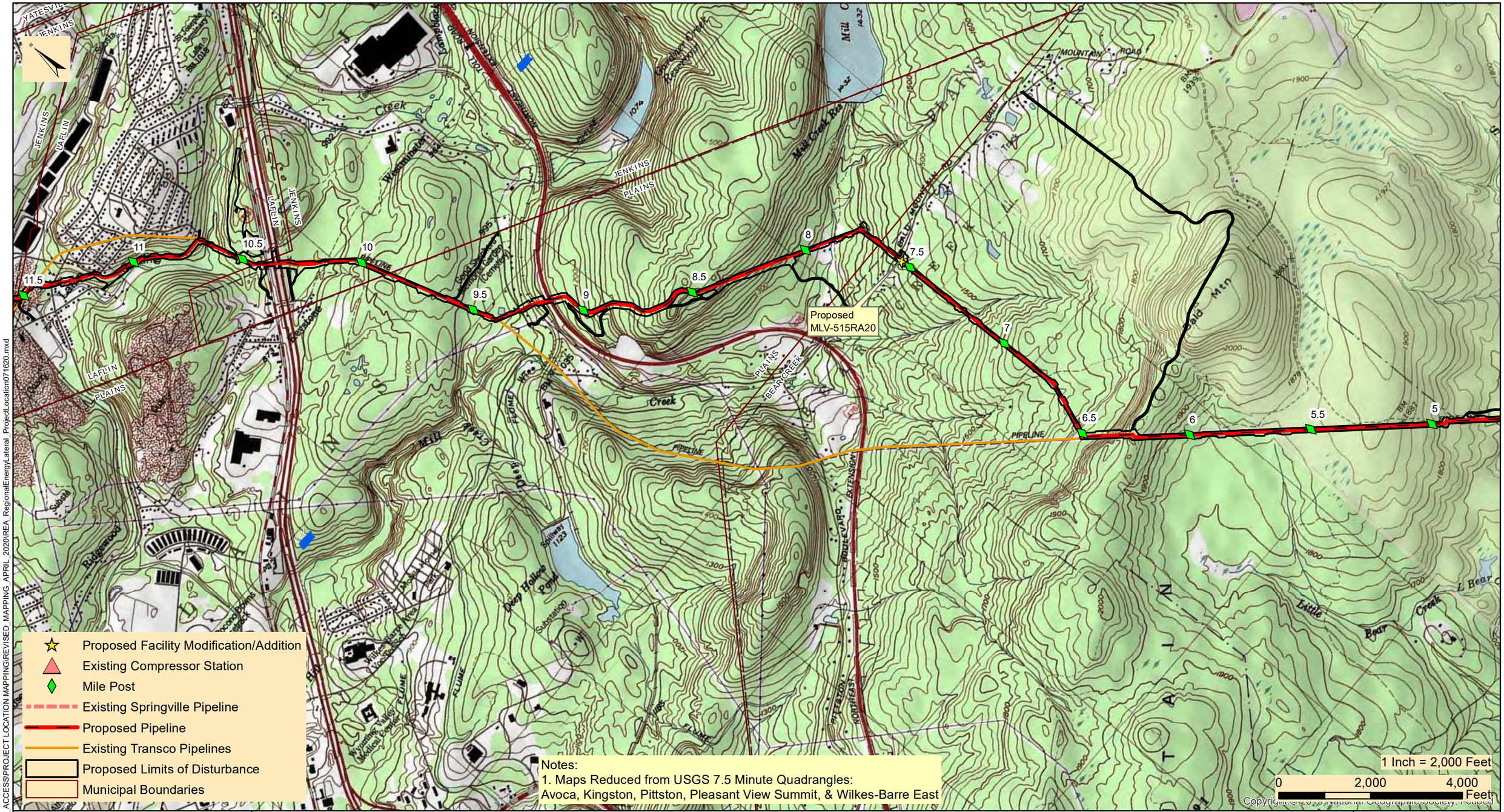
BUCK & BEAR CREEK TOWNSHIPS | LUZERNE COUNTY | PENNSYLVANIA

Date: 2/28/2022

Drawn By: FTN

Figure Number: REL-1

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

REGIONAL ENERGY ACCESS EXPANSION PROJECT

PROPOSED 30" REGIONAL ENERGY LATERAL

PROJECT LOCATION MAP

BEAR CREEK, JENKINS, PLAINS TWPS, & LAFLIN BOROUGH | LUZERNE COUNTY | PENNSYLVANIA

Date: 2/28/2022

Drawn By: FTN

Figure Number: REL-2

Carverton Tie-In

Proposed MLV-515RA30

17.5 17 16.5 16 15.5 14.5 14 13.5 13 12.5 12 11.5 11 10.5 10

- Proposed Facility Modification/Addition
- Existing Compressor Station
- Mile Post
- Existing Springville Pipeline
- Proposed Pipeline
- Existing Transco Pipelines
- Proposed Limits of Disturbance
- Municipal Boundaries

Notes:
1. Maps Reduced from USGS 7.5 Minute Quadrangles:
Avoca, Kingston, Pittston, Pleasant View Summit, & Wilkes-Barre East

1 Inch = 2,000 Feet
0 2,000 4,000 Feet

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REGIONAL ENERGY ACCESS EXPANSION PROJECT
PROPOSED 30" REGIONAL ENERGY LATERAL
PROJECT LOCATION MAP

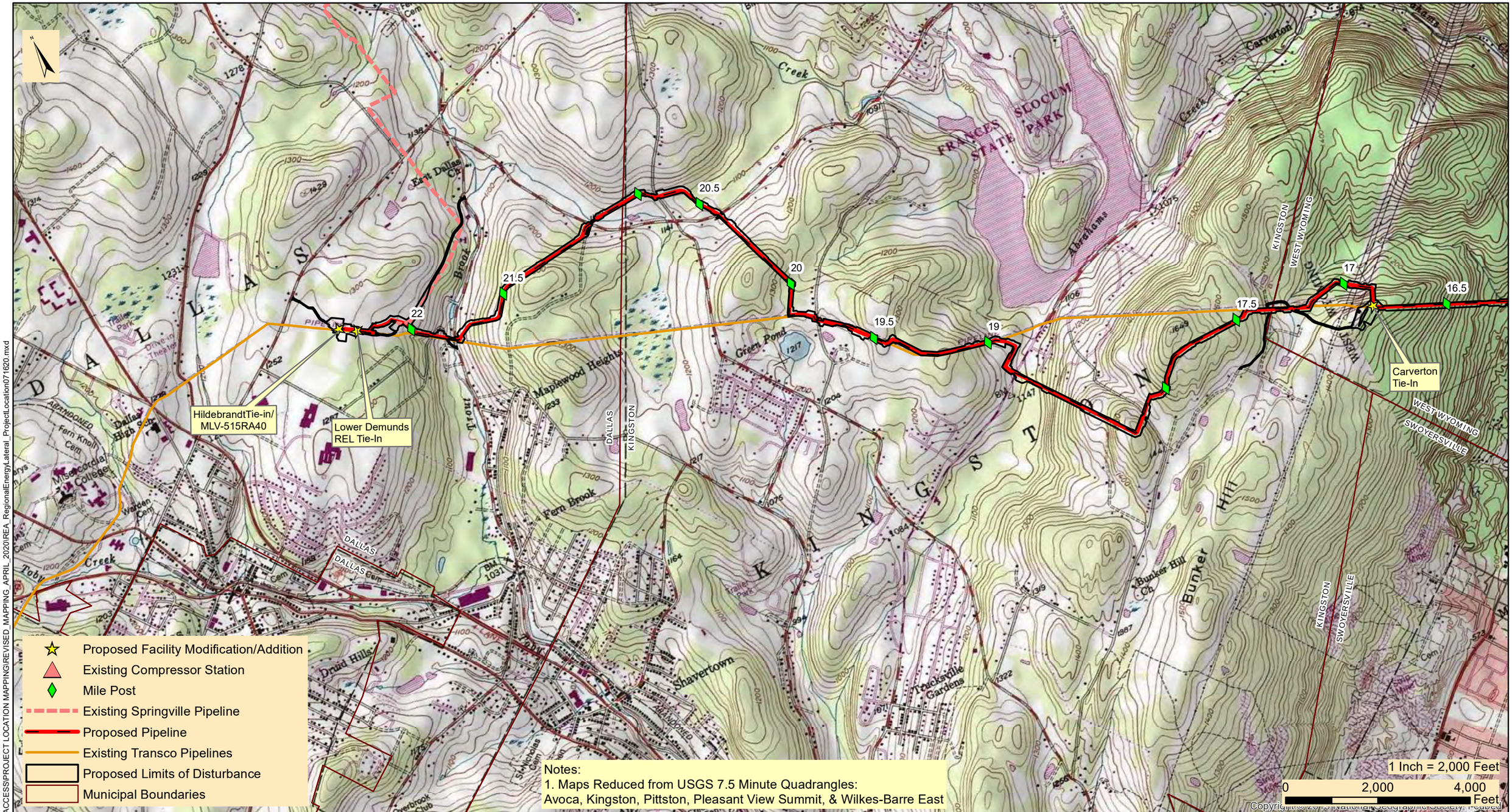
KINGSTON, JENKINS, WEST WYOMING, WYOMING, & LAFLIN — LUZERNE COUNTY — PENNSYLVANIA

Date: 2/28/2022

Drawn By: FTN

Figure Number: REL-3

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

REGIONAL ENERGY ACCESS EXPANSION PROJECT

PROPOSED 30" REGIONAL ENERGY LATERAL

PROJECT LOCATION MAP

DALLAS, KINGSTON, & WEST WYOMING TOWNSHIP | LUZERNE COUNTY | PENNSYLVANIA

Date: 2/28/2022

Drawn By: FTN

Figure Number: REL-4

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2.5 Soil Map and Report – S5-T5/S6-T5 and S4a-T5/S4-T5 Stream Stabilization

ATTACHMENT 2.1

SOIL MAP AND REPORT – MLV-515RA20

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 Luzerne County, Pennsylvania



November 16, 2020

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

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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: 1:1,230 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:20,000.

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: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 20, 2010—Jul 7, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	0.0	0.7%
VoB	Volusia channery silt loam, 0 to 8 percent slopes	2.3	36.2%
VrB	Volusia channery silt loam, 0 to 8 percent slopes, extremely stony	4.0	63.2%
Totals for Area of Interest		**6.3**	**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.

Luzerne County, Pennsylvania

OpD—Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yhm
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

VoB—Volusia channery silt loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2srff
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Volusia and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Volusia

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived from interbedded sedimentary rock

Typical profile

Ap - 0 to 9 inches: channery silt loam
Bw - 9 to 15 inches: channery silt loam
Eg - 15 to 17 inches: channery silt loam
Bx1 - 17 to 29 inches: channery loam
Bx2 - 29 to 54 inches: channery loam
C - 54 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F140XY024NY - Moist Dense Till
Hydric soil rating: No

Minor Components

Mardin

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Chippewa

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

VrB—Volusia channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2srfw
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Volusia, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Volusia, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived from interbedded sedimentary rock

Typical profile

A - 0 to 4 inches: channery silt loam
Bw - 4 to 15 inches: channery silt loam
Eg - 15 to 17 inches: channery silt loam
Bx1 - 17 to 29 inches: channery loam
Bx2 - 29 to 54 inches: channery loam
C - 54 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D
Ecological site: F140XY024NY - Moist Dense Till
Hydric soil rating: No

Minor Components

Mardin, extremely stony
Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, extremely stony
Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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ATTACHMENT 2.2

SOIL MAP AND REPORT – MLV-515RA30

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 Luzerne County, Pennsylvania



October 22, 2020

Preface

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

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

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

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

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

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

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ChB—Chenango gravelly loam, 3 to 8 percent slopes.....13
Ho—Holly silt loam.....14
Ps—Pope soils.....15
W—Water.....16
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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.

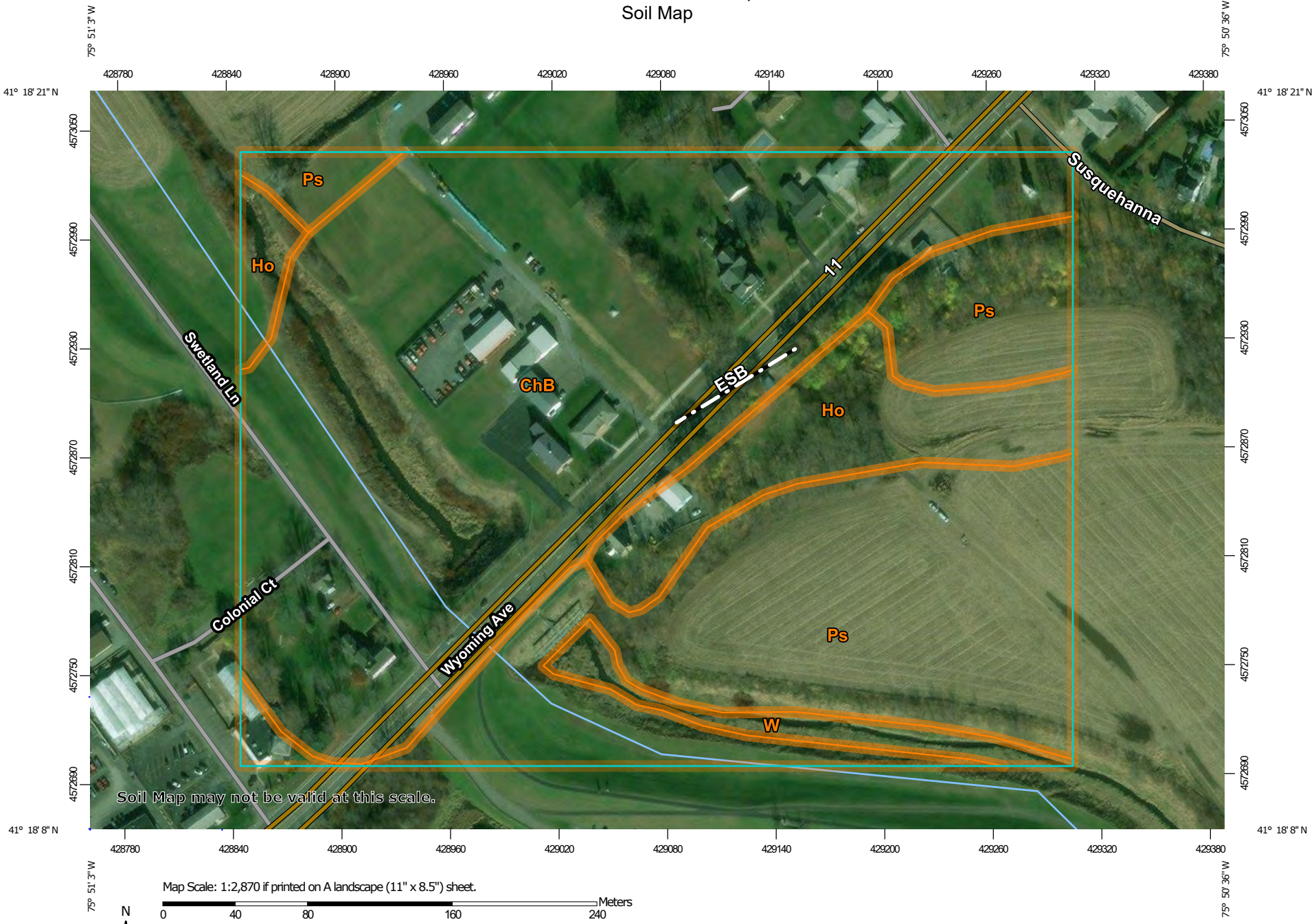
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:2,870 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:20,000.

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: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 20, 2010—Jul 7, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ChB	Chenango gravelly loam, 3 to 8 percent slopes	20.4	52.9%
Ho	Holly silt loam	4.0	10.4%
Ps	Pope soils	13.1	34.0%
W	Water	1.0	2.6%
Totals for Area of Interest		**38.6**	**100.0%**

Map Unit Descriptions

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

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

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

Luzerne County, Pennsylvania

ChB—Chenango gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yg2
Elevation: 600 to 1,800 feet
Mean annual precipitation: 30 to 56 inches
Mean annual air temperature: 40 to 54 degrees F
Frost-free period: 100 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chenango and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chenango

Setting

Landform: Outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly outwash

Typical profile

H1 - 0 to 8 inches: gravelly loam
H2 - 8 to 32 inches: gravelly fine sandy loam
H3 - 32 to 72 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F140XY021NY - Dry Outwash
Hydric soil rating: No

Minor Components

Braceville

Percent of map unit: 5 percent
Landform: Outwash terraces

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, concave
Hydric soil rating: No

Rexford, somewhat poorly drained
Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Ho—Holly silt loam

Map Unit Setting
National map unit symbol: 9ygb
Elevation: 200 to 1,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 120 to 187 days
Farmland classification: Not prime farmland

Map Unit Composition
Holly and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Holly

Setting
Landform: Backswamps, depressions on flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sandstone and shale

Typical profile
H1 - 0 to 5 inches: silt loam
H2 - 5 to 28 inches: silt loam
H3 - 28 to 43 inches: silt loam
H4 - 43 to 60 inches: stratified gravelly sand to silt loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)

Depth to water table: About 0 to 6 inches
Frequency of flooding: FrequentNone
Frequency of ponding: Occasional
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Linden

Percent of map unit: 5 percent
Hydric soil rating: No

Ps—Pope soils

Map Unit Setting

National map unit symbol: 9yht
Elevation: 160 to 1,970 feet
Mean annual precipitation: 30 to 51 inches
Mean annual air temperature: 40 to 54 degrees F
Frost-free period: 100 to 187 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Pope and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pope

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from sandstone and siltstone

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 42 inches: fine sandy loam
H3 - 42 to 62 inches: sandy loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F140XY013PA - High Floodplain
Hydric soil rating: No

Minor Components

Holly

Percent of map unit: 5 percent
Landform: Backswamps, depressions on flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

W—Water

Map Unit Setting

National map unit symbol: 9yj6
Mean annual precipitation: 34 to 51 inches
Mean annual air temperature: 40 to 50 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Bodies of water 2 to: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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ATTACHMENT 2.3

SOIL MAP AND REPORT – CARVERTON TIE-IN

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 Luzerne County, Pennsylvania



November 5, 2020

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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N

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- Gravelly Spot
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- 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 1:20,000.

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: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 20, 2010—Jul 7, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes	14.8	38.4%
MaB	Mardin channery silt loam, 3 to 8 percent slopes	0.1	0.2%
McB	Mardin channery silt loam, 3 to 8 percent slopes, very stony	0.0	0.0%
McD	Mardin channery silt loam, 8 to 25 percent slopes, very stony	0.6	1.6%
OlB	Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes	0.4	1.1%
OlC	Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes	0.4	0.9%
OlD	Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes	1.2	3.0%
OpB	Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes	7.1	18.5%
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	5.4	14.0%
OXF	Oquaga and Lordstown extremely stony silt loams steep	8.7	22.4%
Totals for Area of Interest		**38.7**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion

of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

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

Luzerne County, Pennsylvania

ArD—Arnot-Rock outcrop complex, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2wbn0
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Arnot, rubbly, and similar soils: 50 percent
Rock outcrop: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnot, Rubbly

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, crest, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Loamy till derived mainly from acid sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: very channery silt loam
Bw1 - 3 to 12 inches: very channery silt loam
Bw2 - 12 to 17 inches: very channery silt loam
2R - 17 to 27 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY023NY - Shallow Till Uplands

Hydric soil rating: No

Description of Rock Outcrop

Interpretive groups

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

Minor Components

Oquaga, rubbly

Percent of map unit: 10 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, upper third of mountainflank, side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

MaB—Mardin channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2srhb
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Mardin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

Ap - 0 to 8 inches: channery silt loam
BE - 8 to 12 inches: channery silt loam
Bw1 - 12 to 16 inches: channery silt loam
Bw2 - 16 to 20 inches: channery silt loam
Bx1 - 20 to 36 inches: channery silt loam
Bx2 - 36 to 57 inches: channery silt loam
C - 57 to 72 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

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

Minor Components

Volusia

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Lordstown

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Bath

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

McB—Mardin channery silt loam, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2srj1
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Mardin, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

A - 0 to 4 inches: channery silt loam
BE - 4 to 12 inches: channery silt loam
Bw1 - 12 to 16 inches: channery silt loam
Bw2 - 16 to 20 inches: channery silt loam
Bx1 - 20 to 36 inches: channery silt loam
Bx2 - 36 to 57 inches: channery silt loam
C - 57 to 72 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

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

Minor Components

Lordstown

Percent of map unit: 6 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Mountaintop, nose slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Volusia, very stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, very stony

Percent of map unit: 4 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

McD—Mardin channery silt loam, 8 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2v2zx
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Mardin, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

A - 0 to 4 inches: channery silt loam
BE - 4 to 12 inches: channery silt loam
Bw1 - 12 to 16 inches: channery silt loam
Bw2 - 16 to 20 inches: channery silt loam
Bx1 - 20 to 36 inches: channery silt loam
Bx2 - 36 to 57 inches: channery silt loam
C - 57 to 72 inches: channery silt loam

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

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

Minor Components

Volusia, very stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Bath, very stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Lordstown, very stony

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

OIB—Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yhh
Elevation: 600 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Till derived from sedimentary rock

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

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

OIC—Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9yhj
Elevation: 600 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

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

OID—Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yhk
Elevation: 600 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained

Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

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

OpB—Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yhl
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

OpD—Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yhm
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

OXF—Oquaga and Lordstown extremely stony silt loams steep

Map Unit Setting

National map unit symbol: 9yhg
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

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ATTACHMENT 2.4

SOIL MAP AND REPORT – LOWER DEMUNDS REL TIE-IN & HILDEBRANDT TIE-IN/MLV-515RA40

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 Luzerne County, Pennsylvania



November 12, 2020

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,520 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:20,000.

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: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Aug 29, 2010—Nov 22, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ClA	Chippewa silt loam, 0 to 3 percent slopes	0.1	1.3%
ClB	Chippewa silt loam, 3 to 8 percent slopes	0.5	4.3%
MoB	Morris channery silt loam, 0 to 8 percent slopes	2.6	24.9%
OlB	Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes	2.7	25.4%
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes	4.7	44.1%
Totals for Area of Interest		**10.6**	**100.0%**

Map Unit Descriptions

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

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

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

Luzerne County, Pennsylvania

ClA—Chippewa silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2v32k
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Ap - 0 to 7 inches: silt loam
Eg - 7 to 15 inches: channery silt loam
Bxg - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Chippewa, very poorly drained

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Volusia

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CIB—Chippewa silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v32s
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Ap - 0 to 7 inches: silt loam
Eg - 7 to 15 inches: channery silt loam
Bxg - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Volusia

Percent of map unit: 10 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, very poorly drained

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

MoB—Morris channery silt loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vclq
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Morris and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morris

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam
Bx - 16 to 60 inches: channery silt loam
C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

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

Minor Components

Wellsboro

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Norwich

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

OIB—Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yhh
Elevation: 600 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands

Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Till derived from sedimentary rock

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

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

WlB—Wellsboro channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vck5
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wellsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wellsboro

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

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

Minor Components

Lackawanna

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Morris

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Oquaga

Percent of map unit: 5 percent
Landform: Mountains, hills

Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank, crest, nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

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ATTACHMENT 2.5

SOIL MAP AND REPORT – S5-T5/S6-T5 AND S4A-T5/S4-T5 STREAM STABILIZATION

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 Luzerne County, Pennsylvania



November 23, 2020

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

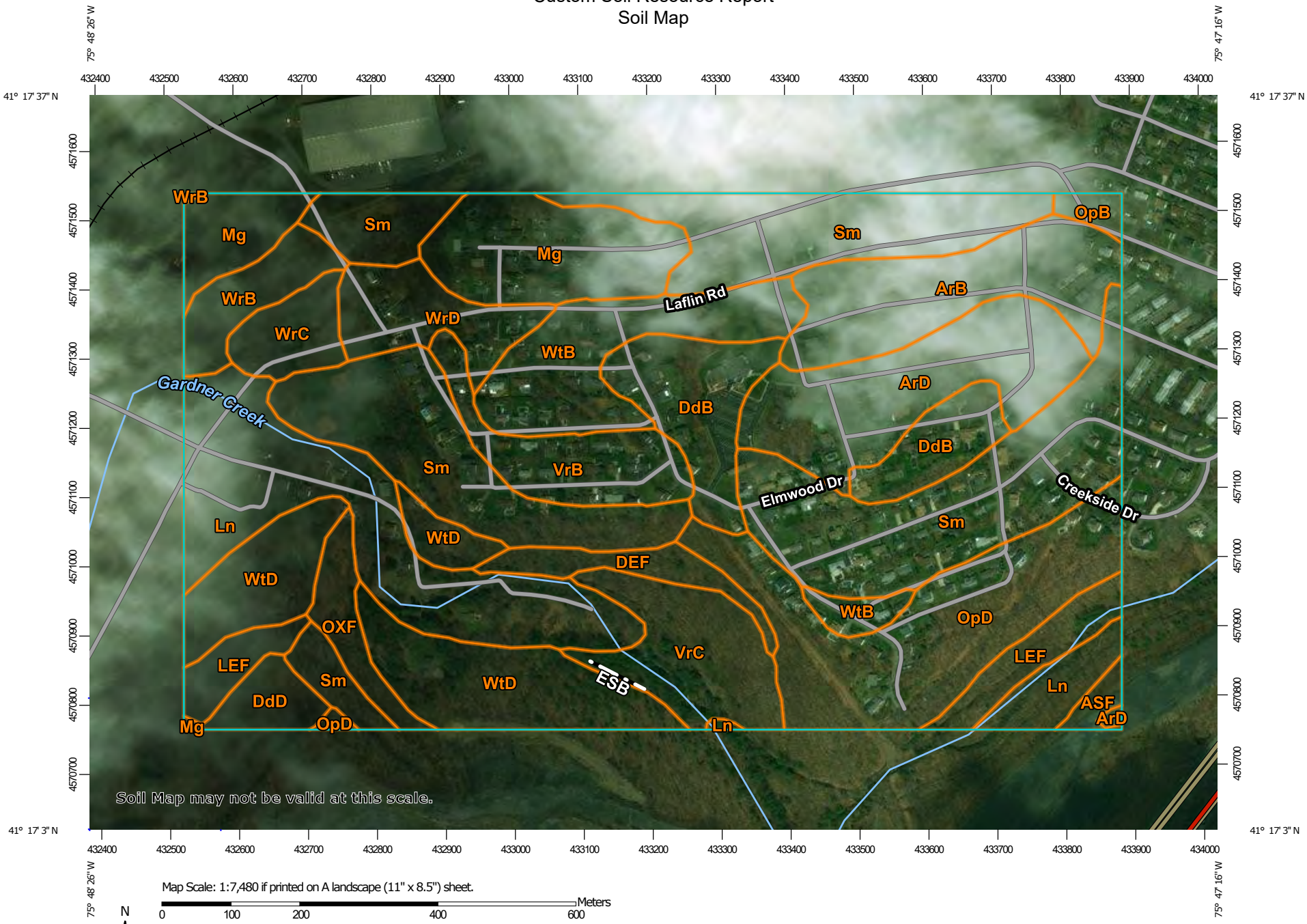
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP 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 1:20,000.

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: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 20, 2010—Jul 7, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ArB	Arnot-Rock outcrop complex, 0 to 8 percent slopes	14.7	5.6%
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes	16.8	6.4%
ASF	Arnot-Rock outcrop complex, steep	1.1	0.4%
DdB	Dekalb channery sandy loam, 0 to 8 percent slopes, rubbly	14.1	5.4%
DdD	Dekalb channery sandy loam, 8 to 25 percent slopes, rubbly	3.0	1.2%
DEF	Dekalb extremely stony sandy loam, steep	3.9	1.5%
LEF	Lackawanna and Bath soils, steep, extremely stony	7.1	2.7%
Ln	Linden soils	26.7	10.2%
Mg	Mine dump	16.8	6.4%
OpB	Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes	1.1	0.4%
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	22.8	8.7%
OXF	Oquaga and Lordstown extremely stony silt loams steep	3.8	1.5%
Sm	Strip mine	59.3	22.7%
VrB	Volusia channery silt loam, 0 to 8 percent slopes, extremely stony	8.3	3.2%
VrC	Volusia channery silt loam, 8 to 15 percent slopes, extremely stony	10.5	4.0%
WrB	Wurtsboro channery loam, 3 to 8 percent slopes	5.1	1.9%
WrC	Wurtsboro channery loam, 8 to 15 percent slopes	4.3	1.7%
WrD	Wurtsboro channery loam, 15 to 25 percent slopes	7.1	2.7%
WtB	Wurtsboro extremely stony loam, 3 to 8 percent slopes	14.3	5.5%
WtD	Wurtsboro extremely stony loam, 8 to 25 percent slopes	20.8	7.9%
Totals for Area of Interest		**261.7**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas

shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Luzerne County, Pennsylvania

ArB—Arnot-Rock outcrop complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2wbmw
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Arnot, extremely stony, and similar soils: 60 percent
Rock outcrop: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnot, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Mountaintop, mountainflank, crest, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from acid sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: very channery silt loam
Bw1 - 3 to 12 inches: very channery silt loam
Bw2 - 12 to 17 inches: very channery silt loam
2R - 17 to 27 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 10.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F140XY023NY - Shallow Till Uplands

Hydric soil rating: No

Description of Rock Outcrop

Interpretive groups

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

Minor Components

Lordstown, very stony

Percent of map unit: 10 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Mountainflank, crest, nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

ArD—Arnot-Rock outcrop complex, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2wbn0
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Arnot, rubbly, and similar soils: 50 percent
Rock outcrop: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnot, Rubbly

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, crest, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Loamy till derived mainly from acid sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: very channery silt loam
Bw1 - 3 to 12 inches: very channery silt loam
Bw2 - 12 to 17 inches: very channery silt loam
2R - 17 to 27 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY023NY - Shallow Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Interpretive groups

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

Minor Components

Oquaga, rubbly

Percent of map unit: 10 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, upper third of mountainflank, side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

ASF—Arnot-Rock outcrop complex, steep

Map Unit Setting

National map unit symbol: 2wbn4
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Arnot, rubbly, and similar soils: 50 percent
Rock outcrop: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnot, Rubbly

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountaintop, mountainflank, free face, free face, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till derived mainly from acid sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: very channery silt loam
Bw1 - 3 to 12 inches: very channery silt loam
Bw2 - 12 to 17 inches: very channery silt loam
2R - 17 to 27 inches: bedrock

Properties and qualities

Slope: 25 to 70 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY023NY - Shallow Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Interpretive groups

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

Minor Components

Cadosia, very stony

Percent of map unit: 10 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Oquaga, rubbly

Percent of map unit: 10 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, upper third of mountainflank, side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

DdB—Dekalb channery sandy loam, 0 to 8 percent slopes, rubbly

Map Unit Setting

National map unit symbol: 2w6nf
Elevation: 1,000 to 2,800 feet
Mean annual precipitation: 37 to 50 inches
Mean annual air temperature: 50 to 56 degrees F
Frost-free period: 155 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Dekalb and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dekalb

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 4 inches: channery sandy loam
E - 4 to 7 inches: channery sandy loam
Bw - 7 to 26 inches: very channery sandy loam
C - 26 to 34 inches: extremely channery sandy loam
R - 34 to 44 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 30.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hazleton

Percent of map unit: 10 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Clymer

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Lehew

Percent of map unit: 3 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Laidig

Percent of map unit: 2 percent
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, concave
Across-slope shape: Linear
Hydric soil rating: No

DdD—Dekalb channery sandy loam, 8 to 25 percent slopes, rubbly

Map Unit Setting

National map unit symbol: 2w6ng
Elevation: 570 to 2,000 feet
Mean annual precipitation: 37 to 50 inches
Mean annual air temperature: 50 to 56 degrees F
Frost-free period: 155 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Dekalb and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dekalb

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 4 inches: channery sandy loam
E - 4 to 7 inches: channery sandy loam
Bw - 7 to 26 inches: very channery sandy loam
C - 26 to 34 inches: extremely channery sandy loam
R - 34 to 44 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 30.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Lehew

Percent of map unit: 10 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Clymer

Percent of map unit: 10 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Hazleton

Percent of map unit: 5 percent
Landform: Mountain slopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

DEF—Dekalb extremely stony sandy loam, steep

Map Unit Setting

National map unit symbol: 9yg7
Elevation: 1,000 to 2,800 feet
Mean annual precipitation: 36 to 60 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Dekalb and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dekalb

Setting

Landform: Mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 6 inches: channery sandy loam
H2 - 6 to 21 inches: channery sandy loam
H3 - 21 to 32 inches: very channery sandy loam
R4 - 32 to 35 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 80 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

LEF—Lackawanna and Bath soils, steep, extremely stony

Map Unit Setting

National map unit symbol: 2v31t
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Lackawanna, extremely stony, and similar soils: 60 percent
Bath, extremely stony, and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lackawanna, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: channery silt loam
Bw1 - 3 to 17 inches: channery silt loam
Bw2 - 17 to 26 inches: channery loam
Bx - 26 to 60 inches: channery loam
C - 60 to 72 inches: very channery loam

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 17 to 36 inches to fragipan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 16 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C

Hydric soil rating: No

Description of Bath, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till derived mainly from gray and brown siltstone, sandstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: channery silt loam
Bw1 - 3 to 15 inches: channery silt loam
Bw2 - 15 to 25 inches: channery loam
E - 25 to 29 inches: channery loam
Bx - 29 to 52 inches: very channery silt loam
C - 52 to 72 inches: very channery silt loam

Properties and qualities

Slope: 25 to 45 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 26 to 38 inches to fragipan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY030NY - Well Drained Dense Till
Hydric soil rating: No

Minor Components

Arnot, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountaintop, mountainflank, free face, nose slope, side slope, free face
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Lordstown, very stony

Percent of map unit: 5 percent
Landform: Mountains, hills

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, nose slope, free face, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Oquaga, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Upper third of mountainflank, crest, nose slope, side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear
Hydric soil rating: No

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ln—Linden soils

Map Unit Setting

National map unit symbol: 9ygv
Elevation: 200 to 1,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 120 to 187 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Linden and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Linden

Setting

Landform: Flood plains
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 45 inches: silt loam

H3 - 45 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Holly

Percent of map unit: 8 percent
Landform: Backswamps, depressions on flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Mg—Mine dump

Map Unit Setting

National map unit symbol: 9yh6
Mean annual precipitation: 34 to 51 inches
Mean annual air temperature: 40 to 50 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Dumps, mine (unstable fill): 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps, Mine (unstable Fill)

Setting

Parent material: Coal extraction mine spoil

Typical profile

H1 - 0 to 6 inches: very channery silt loam

H2 - 6 to 60 inches: very channery silt loam

Properties and qualities

Slope: 0 to 50 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 in/hr)
Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydric soil rating: No

OpB—Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yhl
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

OpD—Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yhm
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

OXF—Oquaga and Lordstown extremely stony silt loams steep

Map Unit Setting

National map unit symbol: 9yhg
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Sm—Strip mine

Map Unit Setting
National map unit symbol: 9yhz
Mean annual precipitation: 34 to 51 inches
Mean annual air temperature: 40 to 50 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition
Pits, strip mine: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Strip Mine

Setting
Parent material: Coal extraction mine spoil

Typical profile
H1 - 0 to 6 inches: very channery sandy loam
H2 - 6 to 60 inches: very channery silt loam

Properties and qualities
Slope: 0 to 50 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 in/hr)
Available water capacity: Very low (about 1.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydric soil rating: No

VrB—Volusia channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2srfw
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Volusia, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Volusia, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived from interbedded sedimentary rock

Typical profile

A - 0 to 4 inches: channery silt loam
Bw - 4 to 15 inches: channery silt loam
Eg - 15 to 17 inches: channery silt loam
Bx1 - 17 to 29 inches: channery loam
Bx2 - 29 to 54 inches: channery loam
C - 54 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY024NY - Moist Dense Till

Hydric soil rating: No

Minor Components

Mardin, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, extremely stony

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

VrC—Volusia channery silt loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2srfy
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Volusia, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Volusia, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived from interbedded sedimentary rock

Typical profile

A - 0 to 4 inches: channery silt loam
Bw - 4 to 15 inches: channery silt loam
Eg - 15 to 17 inches: channery silt loam

Bx1 - 17 to 29 inches: channery loam
Bx2 - 29 to 54 inches: channery loam
C - 54 to 72 inches: channery silt loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY024NY - Moist Dense Till
Hydric soil rating: No

Minor Components

Mardin, extremely stony

Percent of map unit: 6 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, extremely stony

Percent of map unit: 4 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

WrB—Wurtsboro channery loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yjj
Elevation: 800 to 1,800 feet
Mean annual precipitation: 30 to 46 inches
Mean annual air temperature: 45 to 50 degrees F

Frost-free period: 110 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wurtsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsboro

Setting

Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 8 inches: channery loam
H2 - 8 to 21 inches: gravelly loam
H3 - 21 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 17 to 28 inches to fragipan
Drainage class: Moderately 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: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.5 inches)

Interpretive groups

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

Minor Components

Swartswood

Percent of map unit: 10 percent
Hydric soil rating: No

Chippewa

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

WrC—Wurtsboro channery loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9yjk
Elevation: 800 to 1,800 feet
Mean annual precipitation: 30 to 46 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wurtsboro and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsboro

Setting

Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 8 inches: channery loam
H2 - 8 to 21 inches: gravelly loam
H3 - 21 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 17 to 28 inches to fragipan
Drainage class: Moderately 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: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.5 inches)

Interpretive groups

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

Minor Components

Swartswood
Percent of map unit: 10 percent
Hydric soil rating: No

Chippewa
Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

WrD—Wurtsboro channery loam, 15 to 25 percent slopes

Map Unit Setting
National map unit symbol: 9yjl
Elevation: 1,000 to 1,800 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Wurtsboro and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsboro

Setting
Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy till derived from sandstone

Typical profile
H1 - 0 to 5 inches: channery loam
H2 - 5 to 22 inches: channery loam
H3 - 22 to 60 inches: channery loam

Properties and qualities
Slope: 15 to 25 percent
Depth to restrictive feature: 17 to 28 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches

Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups

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

WtB—Wurtsboro extremely stony loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9yjm
Elevation: 590 to 1,970 feet
Mean annual precipitation: 30 to 51 inches
Mean annual air temperature: 40 to 55 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Wurtsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsboro

Setting

Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 8 inches: channery loam
H2 - 8 to 21 inches: gravelly loam
H3 - 21 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 17 to 28 inches to fragipan
Drainage class: Moderately 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: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Swartwood

Percent of map unit: 10 percent
Hydric soil rating: No

Chippewa

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

WtD—Wurtsboro extremely stony loam, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yjn
Elevation: 330 to 2,460 feet
Mean annual precipitation: 30 to 70 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 100 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Wurtsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wurtsboro

Setting

Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 8 inches: channery loam
H2 - 8 to 21 inches: gravelly loam
H3 - 21 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 17 to 28 inches to fragipan
Drainage class: Moderately 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: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Swartswood

Percent of map unit: 10 percent
Hydric soil rating: No

Chippewa

Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Volusia, rubbly

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

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ATTACHMENT 3
INFILTRATION TEST REPORTS

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3.1 MLV-515RA20 – Bald Mountain Infiltration Report

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3.4 Hildebrandt Tie-in/MLV-515RA40 Infiltration Report

ATTACHMENT 3.1

MLV-515RA20 – BALD MOUNTAIN INFILTRATION REPORT

341 10th Avenue Suite 103, Royersford PA 19468 • 610.495.5585
Civil, Environmental, & Geological Consultants

March 3, 2022

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC.
A SUBSIDIARY OF THE WILLIAMS COMPANIES, INC.
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA20 MAIN LINE VALVE PROJECT

SITE EVALUATION AND SOIL INFILTRATION TEST REPORT

1.0 SITE SOILS

Based upon mapping provided by the United States Department of Agriculture's Natural Resources Conservation Service (USDA NRCS) Web Soil Survey[1], the project areas under consideration for infiltration best management practices (BMP) are underlain by the following soil series: Volusia channery silt loam, 0 to 8 percent slopes, extremely stony (VrB).

Volusia channery silt loam, 0 to 8 percent slopes, extremely stony (VrB) soils consist of gently sloping, somewhat poorly drained soils, found on hill and mountain footslopes and summits. The parent material is loamy till derived from interbedded sedimentary rock. A fragipan is typically located at a depth ranging from 10 to 22 inches. Depth to the water table ranges from 6 to 18 inches. The available water capacity of VrB soils is very low and permeability is slow.

The soil infiltration testing described in this report focuses on VrB soils. These soils are anticipated as being the primary soils in the areas of possible BMPs.

2.0 FIELD INVESTIGATION AND TESTING METHODOLOGY

BAI completed a total of 12 boreholes and 24 double-ring infiltrometer tests, two infiltration tests per borehole. Locations were selected to be representative of the main soil series in the areas of potential infiltration BMPs. Figure 1 presents field-located stations of boreholes and corresponding double-ring infiltrometer tests.

Six boreholes (BH-1 through BH-6) were hand dug for soil characterization up to 34 inches on September 18, 2020. Infiltration tests were also performed in six boreholes at approximately 18 inches deep to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used double-ring infiltrometer (DRI) tests.

Six boreholes (BH-7 through BH-12) were hand dug for soil characterization up to 23 inches on September 10, 2020. Infiltration tests were also performed in six boreholes at approximately 18 inches deep to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used DRI tests.

The double-ring infiltrometer consisted of PVC construction with a nine-inch diameter outer ring (OR) and a six-inch diameter inner ring (IR) set two inches deep into the bottom of each borehole (approximately 18 inches below grade). DRI tests were used to determine infiltration rates of shallow soils at various locations across the site. DRI testing was initiated by completing a one-

[1] htBH://websoilsurvey.nrcs.usda.gov/app/

hour pre-soak, which involved adding two inches of head to both the OR and IR. By noting the drop in head in each infiltrometer at 30-minute increments during the pre-soak, BAI determined that 30-minute testing intervals for infiltration tests 1A, 1B, 3A, 3B, 4A, 4B, 5A, 5B, 6B, 8B, 9B, 10A, and 10B would be used for DRI testing as per the Pennsylvania stormwater Best Management Practices Manual (Document ID 363-0300-002) Appendix C. Ten minute testing intervals were used for infiltration tests 2A, 2B, 6A, 7A, 7B, 8A, 9A, 11A, 11B, 12A, and 12B.

Following the pre-soak, the boreholes were refilled to a two inch head level in both the IR and OR. As the water level decreased, the change in head was measured from a fixed reference point in the IR every 10 or 30 minutes for the infiltration tests depending on the infiltration rate during the presoak. The IR and OR were refilled following each reading. Results for DRI tests are discussed in Section 3.0.

3.0 FINDINGS AND CONCLUSIONS

Based upon examination of each borehole, soils beneath the Site consist of brown (7.5YR 2.5/1 to 7.5YR 3/1) clayey sand to a maximum depth of 13 inches below ground. From roughly 9 to 17 inches a brown (10YR 4/3) silty sand or poorly sorted sand was observed. The soil from 17 to 34 inches consisted of a friable brown (10YR 5/6) sandy silt. The depth to refusal varied throughout the Site due to a boulder field, ranging from 11 to 34 inches below grade surface (bgs). A SHWT was noted around 24 inches bgs in BH-1 and BH-6 but was not found in the area of the proposed BMP (i.e. BH-3). Infiltration testing was completed within the same soil series at 12 locations spread out in the areas of the potential BMP locations. The testing location of BH-3 was in the location of the proposed BMP and both testing elevation and the BMP elevation are within the same consistent brown to dark brown sandy silts.

For the limiting zone investigation, each of the excavated boreholes had a limiting zone at the SHWT or bedrock. The shallowest limiting zone was in BH-9 at around nine inches bgs, where boulders were encountered that could not be removed by hand. The deepest limiting zone was in BH-6 at 28 inches bgs, where well developed mottled soil was observed. The water table was not encountered in the boreholes. The following tables summarizes the limiting zones identified in each borehole.

Limiting Zone Investigation Results					
Borehole	Elevation (MSL ft)	Seasonal High Water Table (in)	Water Table (in)	Bedrock (in)	Total Depth (in)
BH-1	1418.78	24	Not encountered	17	24
BH-2	1420.896	Not encountered	Not encountered	20	20
BH-3	1424.138	Not encountered	Not encountered	24	24
BH-4	1427.777	Not encountered	Not encountered	13	13
BH-5	1431.25	Not encountered	Not encountered	11	11.5
BH-6	1430.583	28	Not encountered	34	34
BH-7	1406.42	Not encountered	Not encountered	19	23
BH-8	1406.249	Not encountered	Not encountered	23	19
BH-9	1401.481	9	Not encountered	21.5	21.5
BH-10	1404.731	Not encountered	Not encountered	23	23
BH-11	1398.178	Not encountered	Not encountered	16	16
BH-12	1395.946	Not encountered	Not encountered	16	16

Infiltration testing was completed within the same mapped soil series at twelve locations spread out in the areas of the potential BMP locations. However, only the infiltration rates of BH-3 were used since they are representative of the area of the proposed BMP. The following table summarizes the DRI readings for each test pit relevant to the proposed BMP. Based on field observations, the infiltration testing was completed at an appropriate location in the soil profile and is representative to the BMP's infiltration elevation.

Infiltration Testing Results								
Borehole	Infiltration Test	Testing Elevation	Reading Interval (min)	Reading 1 (in.)	Reading 2 (in.)	Reading 3 (in.)	Reading 4 (in.)	Infiltration Rate (in./hr)
BH-3	IT 3A	1422.30'	30	1.50	1.50	1.25	1.25	2.75
	IT 3B	1422.30'	30	0.50	0.25	0.25	0.25	0.63

Bottom Elevation of Proposed BMP = 1424' to 1430.50'

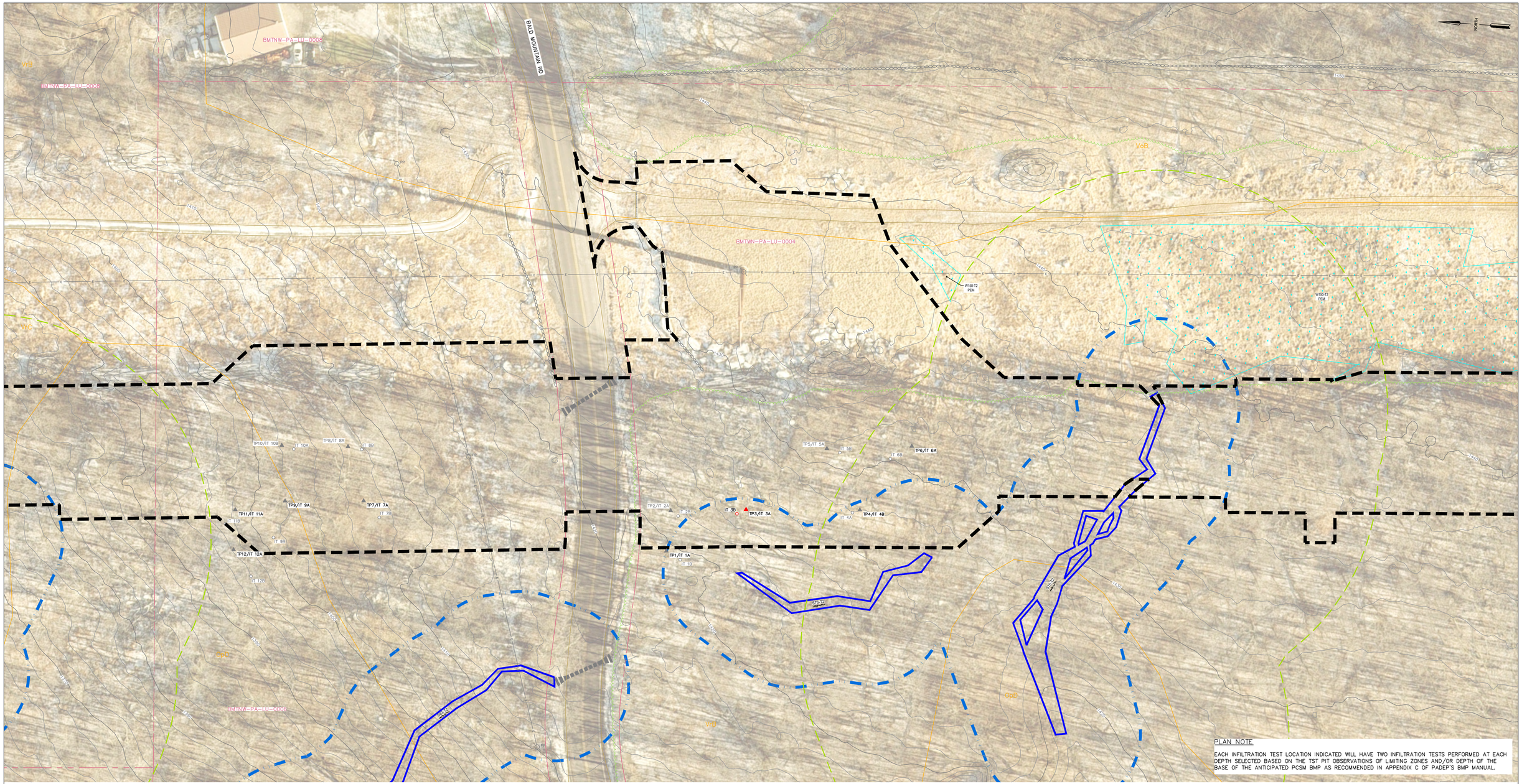
BH-3

The infiltration rate within BH-3/IT 3A was 2.75 iph based upon an average rate of drop of 1.38 inches over the last four 30-minute infiltration readings. The infiltration rate within IT 3B was 0.63 iph based upon an average rate of drop of 0.315 inches over the last four 30-minute infiltration readings.

4.0 REFERENCES

Pennsylvania Department of Environmental Protection. "Pennsylvania Stormwater Best Management Practices Manual" Document No. 363-0300-02, December 2006.

"Web Soil Survey - Home." Web Soil Survey - Home. United States Department of Agriculture, 6 Dec. 2013. Web. 29 December 2020. <htBH://websoilsurvey.nrcs.usda.gov/app/>.



PLAN NOTE

EACH INFILTRATION TEST LOCATION INDICATED WILL HAVE TWO INFILTRATION TESTS PERFORMED AT EACH DEPTH SELECTED BASED ON THE TST PIT OBSERVATIONS OF LIMITING ZONES AND/OR DEPTH OF THE BASE OF THE ANTICIPATED PCSM BMP AS RECOMMENDED IN APPENDIX C OF PADEP'S BMP MANUAL.

LEGEND

- EXISTING WATERBAR AND OUTLET STRUCTURE
- LIMITS OF DISTURBANCE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- PROPERTY LINE
- EXISTING FENCE
- EXISTING STRUCTURE
- EXISTING ROAD (GRAVEL)
- EXISTING ROAD (PAVED)
- EXISTING GRAVEL AREAS
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING EASEMENT
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- TP 12 / IT 12B — BOREHOLE USED IN BMP DESIGN
- TP 12 / IT 12B — INFILTRATION TEST LOCATION USED IN BMP DESIGN
- BOREHOLE NOT USED IN BMP DESIGN
- TP 12 / IT 12B — INFILTRATION PIT LOCATION NOT USED IN BMP DESIGN

SOIL LEGEND

LCD LACKAWANNA CHANNERY SILT LOAM, 8 TO 25 PERCENT SLOPES, EXTREMELY STONY
OPD OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 8 TO 25 PERCENT SLOPES
VOB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES
VOC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES
VRB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY
VRC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES, EXTREMELY STONY

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" =30'

BAP GROUP
WHM consulting, LLC

PATRICK A. WOZNISKI
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
PATRICK A. WOZNISKI
PE076243
PENNSYLVANIA PROFESSIONAL ENGINEER

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
1	03/01/22	RWS	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA20 MAIN LINE VALVE
SOIL TEST PIT LOCATIONS

EXISTING CONDITIONS PLAN

BEAR CREEK TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY: EJL	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:
APPROVED BY: PW	DATE: 03/31/21		SHEET 1
WO: 1222636	RID: 209	DRAWING NUMBER: 26-1000-70-28-D	OF 1

ATTACHMENT 3.2

MLV-515RA30 – WYOMING AVE. INFILTRATION REPORT

341 10th Avenue Suite 103, Royersford PA 19468 • 610.495.5585
Civil, Environmental, & Geological Consultants

March 3, 2022

TRANSCONTINENTAL GAS PIPELINE COMPANY, LLC.
A SUBSIDIARY OF THE WILLIAMS COMPANIES, INC.
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV515RA30 MAIN LINE VALVE PROJECT

SITE EVALUATION AND SOIL INFILTRATION TEST REPORT

1.0 SITE SOILS

Based upon mapping provided by the United States Department of Agriculture's Natural Resources Conservation Service (USDA NRCS) Web Soil Survey[1], the project areas under consideration for infiltration best management practices (BMP) are underlain by the following soil series: Chenango gravelly loam, 3 to 8 percent slopes (ChB).

Chenango gravelly loam, 3 to 8 percent slopes (ChB) soils consist of gently sloping, well drained soils found on outwash terrace toe slopes. The parent material is gravelly outwash. Depth to the water table is greater than 80 inches below ground surface (bgs). The available water capacity of ChB soils is low and permeability is slow.

The soil infiltration testing described in this section focused on ChB soils. These soils are anticipated as being the primary soils in the areas of possible BMPs.

2.0 FIELD INVESTIGATION AND TESTING METHODOLOGY

BAI completed a total of four test pits and eight double-ring infiltrometer tests, two infiltration tests per test pit. Locations were selected to be representative of the main soil series in the areas of potential infiltration BMPs. Figure 1 presents field-located stations of test pits and corresponding double-ring infiltrometer tests.

Four test pits (TP 1 through TP 4) were opened using an excavator for soil characterization up to 74 inches bgs on August 17, 2020. Infiltration tests were also performed in the four test pits between 49 and 74 inches bgs to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used double-ring infiltrometer (DRI) tests.

The double-ring infiltration tests consisted of PVC or metal construction. The PVC DRI had a nine-inch diameter outer ring (OR) and a six-inch diameter inner ring (IR) set two inches deep into the bottom of each test pit (approximately 48 inches below grade). The metal DRI had a 12-inch diameter outer ring (OR) and a 6-inch diameter inner ring (IR) set two inches deep into the bottom of each test pit (approximately 48 inches below grade).

DRI tests were used to determine infiltration rates of shallow soils at various locations across the site. DRI testing was initiated by completing a one-hour pre-soak, which involved adding two inches of head to both the OR and IR. By noting the drop in head in each infiltrometer at 30-

[1] http://websoilsurvey.nrcs.usda.gov/app/

minute increments during the pre-soak, BAI determined whether a 10 or 30-minute testing interval for the infiltration tests would be used for DRI testing as per the Pennsylvania stormwater Best Management Practices Manual (Document ID 363-0300-002) Appendix C.

Following the pre-soak, the test pits were refilled to a two-inch head level in both the IR and OR. Drop in head was measured from a fixed reference point in the IR every 10 or 30 minutes for the infiltration tests. The IR and OR were refilled following each reading. Results for DRI tests are discussed in Section 3.0.

3.0 FINDINGS AND CONCLUSIONS

Based upon examination of each test pit, soils beneath the Site consist of brown (10YR 4/3) loose, clayey sand to a depth of 10 inches bgs. At approximately 12 inches bgs, broken asphalt was encountered. From roughly 6 to 14 inches a brown (10YR 5/6) sandy silt was observed. Broken asphalt was encountered again between 28 and 36 inches. A second layer brown (10YR 4/2) sandy layer was observed at a depth of 36 to 40 inches bgs with more broken asphalt between 38 and 49 inches bgs. Based on the test pit observations, natural Chenango soils beneath the Site have been covered with a mixture of fill materials.

For the limiting zone investigation, no redoxiomorphic features were observed.

Limiting Zone Investigation Results

Test Pit	Elevation (MSL ft)	Seasonal High Water Table (in)	Water Table (in)	Bedrock (in)	Total Depth (in)
TP 1	563.91	Not encountered	Not encountered	Not encountered	74
TP 2	564.31	Not encountered	Not encountered	Not encountered	51
TP 3	565.62	Not encountered	Not encountered	Not encountered	73
TP 4	564.47	Not encountered	Not encountered	Not encountered	49

Infiltration testing was completed within the same mapped soil series at four locations spread out in the areas of the potential BMP locations. However, only the infiltration rates for TP 3 through 4 were used for the BMP design since they are representative of the area of the proposed BMP. Based on field observations, the infiltration testing was completed at an appropriate location in the soil profile and is representative to the BMP's infiltration elevation.

Infiltration Testing Results

Test pit	Infiltration Test	Testing Elevation (MSL ft)	Reading Interval (min)	Reading 1 (in.)	Reading 2 (in.)	Reading 3 (in.)	Reading 4 (in.)	Infiltration Rate (in./hr)
TP 3	IT 3A	561.62'	30	0.25	0.187	0.187	0.062	0.38
	IT 3B	561.62'	10	0.75	0.75	0.75	0.75	4.50
TP 4	IT 4A	560.47'	30	0.75	0.75	0.75	0.75	1.50
	IT 4B	560.47'	10	1.50	1.25	1.25	1.25	7.88

*Bottom Elevation of proposed BMP = 563.0'

TP 3

The infiltration rate for IT 3A was 0.38 iph with an average rate of 0.19 inches over the last four 30-minute infiltration readings. Infiltration test IT 3B had an infiltration rate of 4.50 iph with an

average rate of 0.75 inches over the last four 10-minute infiltration readings. The elevation of the test and the elevation of the proposed BMP are both within the same unconsolidated fill material described above therefore the testing data for TP-3 is considered representative.

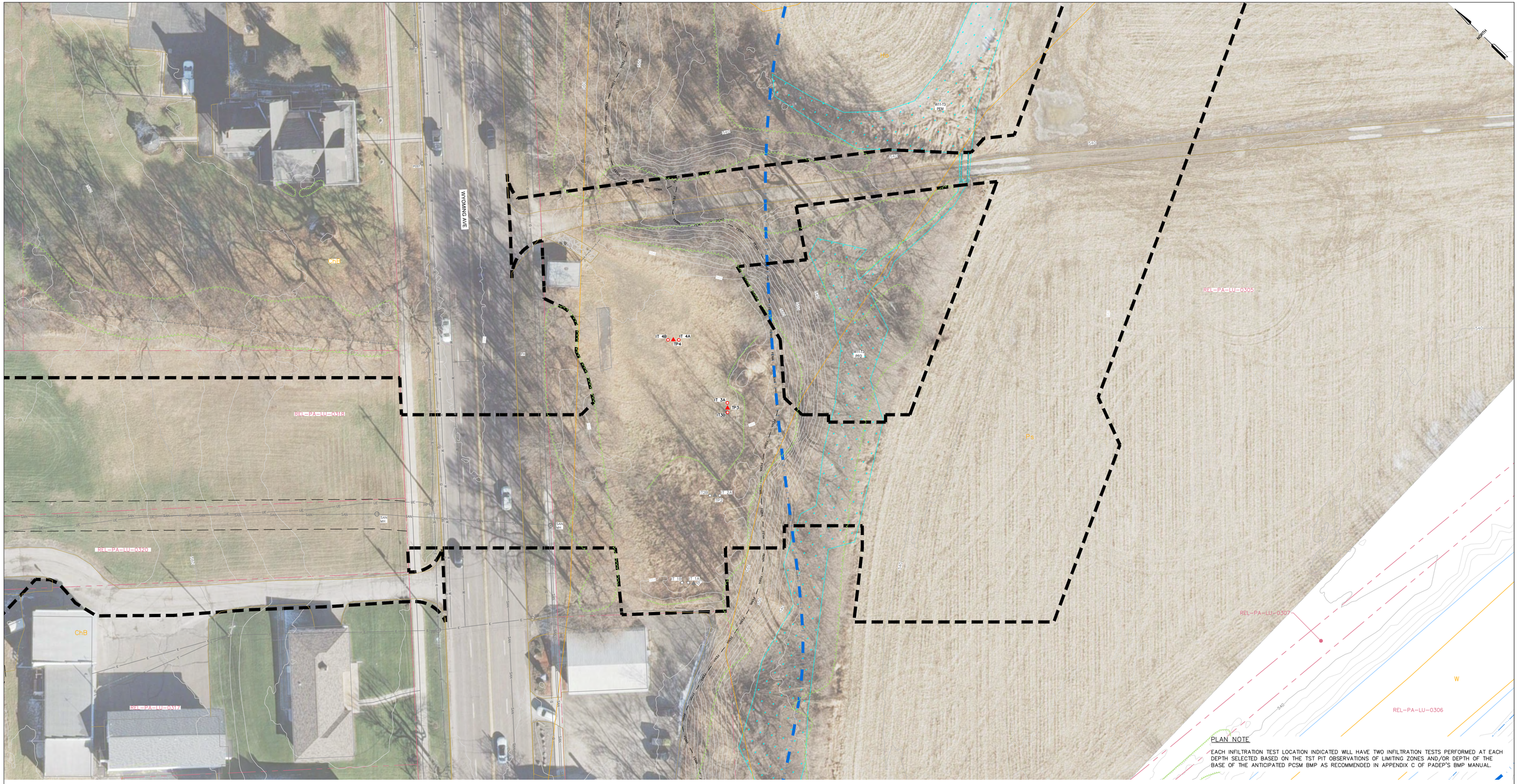
TP 4

The infiltration rate for IT 4A was 1.50 iph with an average rate of 0.75 inches over the last four 30-minute infiltration readings. Infiltration test IT 4B had an infiltration rate of 7.88 iph with an average rate of 1.313 inches over the last four 10-minute infiltration readings.

4.0 REFERENCES

Pennsylvania Department of Environmental Protection. "Pennsylvania Stormwater Best Management Practices Manual" Document No. 363-0300-02, December 2006.

"Web Soil Survey - Home." Web Soil Survey - Home. United States Department of Agriculture, 6 Dec. 2013. Web. 1 June 2019. <http://websoilsurvey.nrcs.usda.gov/app/>.



PLAN NOTE

EACH INFILTRATION TEST LOCATION INDICATED WILL HAVE TWO INFILTRATION TESTS PERFORMED AT EACH DEPTH SELECTED BASED ON THE TST PIT OBSERVATIONS OF LIMITING ZONES AND/OR DEPTH OF THE BASE OF THE ANTICIPATED PCSM BMP AS RECOMMENDED IN APPENDIX C OF PADEP'S BMP MANUAL.

LEGEND

- EXISTING WATERBAR AND OUTLET STRUCTURE
- LIMITS OF DISTURBANCE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA — FEMA 100-YEAR FLOODPLAIN
- MrB2 — SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- PROPERTY LINE
- X — EXISTING FENCE
- EXISTING STRUCTURE
- EXISTING ROAD (GRAVEL)
- EXISTING ROAD (PAVED)
- EXISTING GRAVEL AREAS
- 1250 — EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING EASEMENT
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- TP 1 — TEST PIT USED FOR BMP DESIGN
- IT 1A — INFILTRATION TEST USED FOR BMP DESIGN
- TP 1 — TEST PIT NOT USED FOR BMP DESIGN
- IT 1A — INFILTRATION PIT NOT USED FOR BMP DESIGN

SOIL LEGEND

ChB	CHENANGO GRAVELLY LOAM, 3 TO 8 PERCENT SLOPES
HO	HOLLY SILT LOAM
Ps	PIOPE SOILS
W	WATER

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" = 30'

BA GROUP

WHM consulting, INC.
designs, permits, resolutions

PATRICK WOZINSKI, P.E.
COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL PATRICK A. WOZINSKI ENGINEER PE074243
PENNSYLVANIA PROFESSIONAL ENGINEER

REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
1	03/01/22	RWS	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS PROJECT
MLV-515RA30 MAIN LINE VALVE
SOIL TEST PIT LOCATIONS

EXISTING CONDITIONS PLAN

WYOMING BOROUGH, LUZURNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: 1" = 30'
CHECKED BY: EJL	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:
APPROVED BY: PW	DATE: 03/31/21		
WO: 1222636	RID: 209	DRAWING NUMBER: 26-1000-70-28-D	SHEET 1 OF 1

ATTACHMENT 3.3

CARVERTON TIE-IN INFILTRATION REPORT

341 10th Avenue Suite 103, Royersford PA 19468 • 610.495.5585
Civil, Environmental, & Geological Consultants

March 4, 2022

TRANSCONTINENTAL GAS PIPELINE COMPANY, LLC.
A SUBSIDIARY OF THE WILLIAMS COMPANIES, INC.
REGIONAL ENERGY ACCESS EXPANSION PROJECT
CARVERTON TIE-IN PROJECT

SITE EVALUATION AND SOIL INFILTRATION TEST REPORT

1.0 SITE SOILS

Based upon mapping provided by the United States Department of Agriculture's Natural Resources Conservation Service (USDA NRCS) Web Soil Survey[1], the project areas under consideration for infiltration best management practices (BMP) are underlain by the following soil series: Arnot-Rock outcrop complex, 8 to 25 percent slopes (ArD), Oquaga and Lordstown extremely stony silt loams, 3 to 8 precent slopes (OpB) and Oquaga and Lordstown extremely stony silt loams steep (OXF).

Arnot-Rock outcrop complex, 8 to 25 percent slopes (ArD) soils consist of steeply sloping, well drained soils found on hill and mountain shoulders and backslopes. The parent material is loamy till derived from acid sandstone, siltstone, and shale. Bedrock is typically found at approximately 17 to 27 inches below ground surface (bgs). Lithic bedrock is typically located at a depth ranging from 10 to 20 inches bgs. Depth to the water table is more than 80 inches bgs. The available water capacity of ArD soils is very low and permeability is slow.

The soil infiltration testing described in this report focuses on ArD soils. These soils are anticipated as being the primary soils in the areas of possible BMP.

2.0 FIELD INVESTIGATION AND TESTING METHODOLOGY

BAI completed a total of six test pits and six double-ring infiltrometer tests. Two infiltration tests were completed for the first 3 test pits (TP 1 through TP 3). Locations were selected to be representative of the main soil series in the areas of potential infiltration BMP.

Three test pits (TP 1 through TP 3) were opened using an excavator for soil characterization up to 45.5 inches bgs on August 20, 2020. Infiltration tests were also performed in three test pits between 25 and 45.5 inches deep to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used double-ring infiltrometer (DRI) tests.

Three test pits (TP 4 through TP 6) were opened using an excavator to confirm the 2-foot separation necessary between the limiting zone and the bottom of the proposed infiltration BMP. They were dug to a depth up to 32 inches bgs on January 26, 2022. Infiltration tests were not performed.

The double-ring infiltrometer consisted of PVC construction with a nine-inch diameter outer ring (OR) and a six-inch diameter inner ring (IR) set two inches deep into the bottom of each borehole

[1] http://websoilsurvey.nrcs.usda.gov/app/

(approximately 30 inches below grade). DRI tests were used to determine infiltration rates of shallow soils at various locations across the site. DRI testing was initiated by completing a one-hour pre-soak, which involved adding two inches of head to both the OR and IR. By noting the drop in head in each infiltrometer at 30-minute increments during the pre-soak, BAI determined whether a 10 or 30-minute testing interval for the infiltration tests would be used for DRI testing as per the Pennsylvania stormwater Best Management Practices Manual (Document ID 363-0300-002) Appendix C.

Following the pre-soak, the test pits were refilled to a two inch head level in both the IR and OR. As the water level decreased, the change in head was measured from a fixed reference point in the IR every 10 or 30 minutes for the infiltration tests. The IR and OR were refilled following each reading. Figure 1 presents field-located stations of test pits and corresponding DRI tests. Results for DRI tests are discussed in Section 3.0.

3.0 FINDINGS AND CONCLUSIONS

Based upon examination of each test pit, soils beneath the Site consist of brown (10YR 3/2) loose, well sorted sand to a depth of at least 6 inches bgs. From roughly 6 to 14 inches bgs a brown (10YR 5/6) sandy silt was observed. At a depth of 14 inches bgs, a friable brown (10YR 4/4) silty sand or well sorted sand layer until bedrock was encountered. The depth to bedrock was varied throughout the Site, being around 24 inches bgs in TP 1 and 2, and a depth of 40 bgs inches downslope in TP 3. TP 5 was completed in the footprint of the BMP to confirm the 2-foot separation necessary between the bottom of the BMP and elevation of the limiting zone. Bedrock consisted of fractured sandstone. Testing was completed within the same soil series at three locations spread out in the areas of the potential BMP locations.

For the limiting zone investigation, each of test pit excavated had a limiting zone where bedrock was encountered. The shallowest observation of bedrock was in TP 2 at around 22.5 inches bgs. The deepest limiting zone was in TP 3 at 40 inches bgs. Neither water table nor SHWT were encountered in the test pits.

The following table summarizes the limiting zones identified in each test pit.

Limiting Zone Investigation Results					
Test Pit	Elevation (MSL ft)	Seasonal High Water Table (in)	Water Table (in)	Bedrock (in)	Total Depth (in)
TP 1	1401.32	Not encountered	Not encountered	22.5	30
TP 2	1393.13	Not encountered	Not encountered	25	25
TP 3	1397.81	Not encountered	Not encountered	40	45.5
TP 4	1394.00	Not encountered	Not encountered	28	28
TP 5	1398.00	Not encountered	Not encountered	24	24
TP 6	1393.75	Not encountered	Not encountered	32	32

Infiltration testing was completed within the same mapped soil series at the 2020 test pit locations spread out in the areas of the potential BMP locations. However, only the infiltration rates for TP 1 and TP 2 were used since they are representative of the area of the proposed BMPs. The following table summarizes the DRI readings for each test pit relevant to the proposed BMP.

		Infiltration Testing Results						
Test pit	Hole	Testing Elevation	Reading Interval (min)	Reading 1 (in.)	Reading 2 (in.)	Reading 3 (in.)	Reading 4 (in.)	Infiltration Rate (in./hr)
TP 1	IT 1A	1399.45	10	>2	>2	>2	1.75	>12
	IT 1B	1399.45	10	>2	>2	>2	>2	>12
TP 2	IT 2A	1391.10	30	0.75	0.75	0.75	0.75	1.50
	IT 2B	13.91.10	30	0.875	0.875	0.875	0.875	1.75

Bottom of proposed BMP Elevation = 1398'

TP 1

The infiltration rate for IT 1A was more than 12 inches per hour (iph) based upon an average rate of drop more than 2 inches over the last four 10-minute infiltration readings. The infiltration rate for IT 1B was more than 12 iph based upon an average rate of drop more than 2 inches over the last four 10-minute infiltration readings.

TP 2

The infiltration rate for IT 2A was 1.50 iph based upon an average rate of drop of 0.75 inches over the four 30-minute infiltration readings. The infiltration rate for IT 2B was 1.75 iph based upon an average rate of drop of 0.875 inches over the four 30-minute infiltration readings.

4.0 REFERENCES

Pennsylvania Department of Environmental Protection. "Pennsylvania Stormwater Best Management Practices Manual" Document No. 363-0300-02, December 2006.

"Web Soil Survey - Home." Web Soil Survey - Home. United States Department of Agriculture, 6 Dec. 2013. Web. 23 December 2020. <http://websoilsurvey.nrcs.usda.gov/app/>.



PLAN NOTE

EACH INFILTRATION TEST LOCATION INDICATED WILL HAVE TWO INFILTRATION TESTS PERFORMED AT EACH DEPTH SELECTED BASED ON THE TST PIT OBSERVATIONS OF LIMITING ZONES AND/OR DEPTH OF THE BASE OF THE ANTICIPATED PCSM BMP AS RECOMMENDED IN APPENDIX C OF PADEP'S BMP MANUAL.

LEGEND

- EXISTING WATERBAR AND OUTLET STRUCTURE
- LIMITS OF DISTURBANCE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA — FEMA 100-YEAR FLOODPLAIN
- MrB2 — SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- PROPERTY LINE
- X — EXISTING FENCE
- EXISTING STRUCTURE
- EXISTING ROAD (GRAVEL)
- EXISTING ROAD (PAVED)
- EXISTING GRAVEL AREAS
- 1250 — EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING LEIDY / TGPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- TP 3 — TEST PIT USED IN BMP DESIGN
- IT 3A — INFILTRATION TEST USED IN BMP DESIGN
- TP 3 — TEST PIT NOT USED IN BMP DESIGN
- IT 3A — INFILTRATION TEST NOT USED IN BMP DESIGN

SOIL LEGEND

ARD ARNOT-ROCK OUTCROP COMPLEX, 8 TO 25 PERCENT SLOPES
OPB OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 3 TO 8 PERCENT SLOPES
OPD OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 8 TO 25 PERCENT SLOPES
OXF OPUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, STEEP

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN MARCH 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" =30'

BA GROUP

WHM designs, permits, resolutions | consulting, INC.

PAT WOZNSKI, P.E.
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
PATRICK A. WOZNSKI
ENGINEER
PE076243
PENNSYLVANIA PROFESSIONAL ENGINEER

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
1	03/01/22	RWS	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS PROJECT -
CARVERTON TIE-IN
SOIL TEST PIT LOCATIONS

EXISTING CONDITIONS PLAN

WEST WYOMING BOROUGH, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: 1" = 30'		
CHECKED BY: EJL	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:		
APPROVED BY: PW	DATE: 03/31/21	DRAWING NUMBER: 26-1000-70-28-D	SHEET 1 OF 1		
WO: 1211227	RID: 304				

ATTACHMENT 3.4

HILDEBRANDT TIE-IN/MLV-515RA40
INFILTRATION REPORT

341 10th Avenue Suite 103, Royersford PA 19468 • 610.495.5585
Civil, Environmental, & Geological Consultants

March 3, 2022

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC.
A SUBSIDIARY OF THE WILLIAMS COMPANIES, INC.
REGIONAL ENERGY ACCESS EXPANSION PROJECT
HILDEBRANDT TIE-IN/MLV-515RA40 AND LOWER DEMUNDS REL TIE-IN PROJECT

SITE EVALUATION AND SOIL INFILTRATION TEST REPORT

1.0 SITE SOILS

Based upon mapping provided by the United States Department of Agriculture's Natural Resources Conservation Service (USDA NRCS) Web Soil Survey[1], the project areas under consideration for infiltration best management practices (BMP) are underlain by the following soil series: Wellsboro channery silt loam, 3 to 8 percent slopes (WlB), Oquaga and Lordstown channery silt loams, 3 to 8 precent loams (OlB), Morris channery silt loam, 0 to 8 precent slopes (MoB), Chippewa silt loam, 0 to 3 percent slopes (ClA), and Chippewa silt loam, 3 to 8 percent slopes (ClB).

WlB soils consist of moderately well drained soils found on hill and mountain shoulders and summits. The parent material is loamy till derived mainly from reddish sandstone, siltstone, and shale. A fragipan is typically located at a depth ranging from 14 to 30 inches below ground surface (bgs). Depth to the water table ranges from 13 to 24 inches bgs. The available water capacity of WlB soils is low and permeability is slow.

OlB soils consist of moderately well drained soils found on hill slopes and shoulders. The parent material is reddish ablated till derived mainly from sandstone and siltstone. Bedrock begins at a depth ranging from 30 to 42 inches. Depth to the water table is more than 80 inches bgs. The available water capacity of OlB soils is very low and permeability is high.

MoB soils consist of somewhat poorly drained soils found on hill and mountain footslopes and summits. The parent material is loamy till derived mainly from reddish sandstone, siltstone, and shale. A fragipan is typically located at a depth ranging from 10 to 22 inches bgs. Depth to the water table ranges from 6 to 18 inches bgs. The available water capacity of MoB soils is very low and permeability is very slow.

The soil infiltration testing described in this report focused on WlB, MoB and OlB soils. These soils are anticipated as being the primary soils in the areas of possible infiltration BMPs.

2.0 FIELD INVESTIGATION AND TESTING METHODOLOGY

BAI completed a total of 12 test pits, 5 bore holes and 30 double-ring infiltrometer tests. Two infiltration tests were done for TP 101, TP 102, TP 105 through TP 112, TP 113 through TP 119. Locations were selected to be representative of the main soil series in the areas of potential infiltration BMPs. Figure 1 presents the locations of bore holes, test pits and corresponding double-ring infiltrometer tests.

[1] http://websoilsurvey.nrcs.usda.gov/app/

Ten test pits (TP 101, TP 102, TP 105 through TP 112) were opened using an excavator for soil characterization up to 49 inches bgs on September 14, 15, & 17 2020. Infiltration tests were performed in the ten test pits between 33 and 49 inches bgs to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used double-ring infiltrometer (DRI) tests.

Five bore holes (TP 113 through TP 117) were opened using shovels and dig bars for soil characterization up to 27 inches bgs on September 22, 2020. Infiltration tests were performed in the five bore holes between 18 and 27 inches deep to evaluate infiltration rates of shallow soils in the study area. The infiltration tests used DRI tests.

Two test pits, TP 118 and TP 119, were opened were opened using an excavator to confirm the 2-foot separation necessary between the limiting zone and the bottom of the proposed infiltration BMP up to 64 inches bgs on January 27, 2022. Infiltration tests were not performed. TP118 was excavated in the area near TP114 at a deeper depth and therefore combined into TP 114/118 since they both represent the immediate area.

The double-ring infiltration tests consisted of PVC rings. The PVC DRI had a nine-inch diameter outer ring (OR) and a six-inch diameter inner ring (IR) set two inches deep into the bottom of each test pit or borehole (up to 48 inches bgs).

DRI tests were used to determine infiltration rates of shallow soils at various locations across the site. DRI testing was initiated by completing a one-hour pre-soak, which involved adding two inches of head to both the OR and IR. By noting the drop in head in each infiltrometer at 30-minute increments during the pre-soak, BAI determined whether a 10 or 30-minute testing interval for the infiltration tests would be used for DRI testing as per the Pennsylvania Stormwater Best Management Practices Manual (Document ID 363-0300-002) Appendix C.

Following the pre-soak, the test pits were refilled to a two-inch head level in both the IR and OR. Drop in head was measured from a fixed reference point in the IR every 10 or 30 minutes for the infiltration tests. The IR and OR were refilled following each reading. Results for DRI tests are discussed in Section 3.0.

3.0 FINDINGS AND CONCLUSIONS

Based upon examination of each test pit, soils beneath the Site consist of brown (10YR 4/3) clayey sand to well sorted sand to a maximum depth of 12 inches bgs. Around 12 inches, a friable, sandy silt (10YR 5/6) was encountered. For test pits and boreholes to the east, a dense, brown (10YR 4/4) lean clay was encountered at approximately 22 to 50 inches bgs (TP 102 and TP 111). The remaining test pits and bore holes had a brown (10YR 4/6) sandy silt to clayey sand beginning at 28 inches bgs.

Testing was completed within the same soil series at 19 locations spread out in the areas of the potential BMP locations. Based on field observations, the infiltration testing was completed at an appropriate location in the soil profile and is representative to the BMP's infiltration elevation.

For the limiting zone investigation, seven test pits excavated had a limiting zone at the seasonal high water table (SHWT). The shallowest observation of SWHT was in TP 111 at around six inches bgs. The deepest limiting zone was in TP 106 at 49 inches bgs where bedrock was encountered. The table below summarizes the limiting zone investigation for each test pit/bore hole.

Limiting Zone Investigation Results

Test Pit	Elevation (MSL ft)	Seasonal High Water Table (in)	Water Table (in)	Bedrock (in)	Total Depth (in)
TP 101	1274.62	29	Not encountered	44	44
TP 102	1272.27	10	Not encountered	49	49
TP 105	1278.00	26	Not encountered	36	36
TP 106	1278.48	12	Not encountered	49	49
TP 107	1281.36	Not encountered	Not encountered	33	33
TP 108	1277.89	29	Not encountered	40	40
TP 109	1279.37	Not encountered	Not encountered	40	40
TP 110	1274.00	24	Not encountered	38	38
TP 111	1272.74	6	Not encountered	42	42
TP 112	1279.09	Not encountered	Not encountered	43	43
TP 113	1276.81	Not encountered	Not encountered	Not encountered	23
TP 114/118	1281.57	Not encountered	Not encountered	Not encountered	59
TP 115	1278.07	Not encountered	Not encountered	Not encountered	27
TP 116	1276.68	Not encountered	Not encountered	Not encountered	26
TP 117	1274.09	Not encountered	Not encountered	Not encountered	18
TP 119	1280.00	Not encountered	Not encountered	Not encountered	64

Infiltration testing was completed within the same mapped soil series at fifteen locations spread out in the areas of the potential BMP locations. However, only the infiltration rates for TP 106, TP 114, TP 116 and TP 117 were used since they are representative of the area of the proposed BMPs. The following table summarizes the DRI readings for each test pit/bore hole relevant to the proposed BMPs.

Infiltration Testing Results

Test pit	Infiltration Test	Testing Elevation	Reading Interval (min)	Reading 1 (in.)	Reading 2 (in.)	Reading 3 (in.)	Reading 4 (in.)	Infiltration Rate (in./hr)
TP 106*	IT 106A	1274.60’	30	0.25	0.25	0.125	0.25	0.44
	IT 106B	1274.60’	30	0.25	0.25	0.25	0.25	0.50
TP 114/118*	IT 114A	1279.50’	30	1.25	1.25	1.25	1.25	2.50
	IT 114B	1279.50’	10	1.00	1.00	1.00	1.00	6.00
TP 116**	IT 116A	1274.50’	30	0.50	0.50	0.50	0.50	1.00
	IT 116B	1274.50’	30	0.50	0.50	0.50	0.50	1.00
TP 117**	IT 117A	1272.60’	30	>2	>2	>2	>2	>4
	IT 117B	1272.60’	10	>2	>2	>2	>2	>12

* Bottom Elevation of Proposed BMP = 1279.50’

** Bottom Elevation of Proposed BMP = 1275.00'

TP 106

The infiltration rate for IT 106A was 0.44 iph with an average rate of 0.22 inches over the last four 30-minute infiltration readings. Infiltration test IT 106B had an infiltration rate of 0.50 iph with an average of 0.25 inches over the last four 30-minute infiltration readings.

TP 114/118

The infiltration rate for IT 114A was 2.50 iph with an average rate of 1.25 inches over the last four 30-minute infiltration readings. Infiltration test IT 114B had an infiltration rate of 6.00 iph with an average of 1.50 inches over the last four 10-minute infiltration readings.

TP 116

The infiltration rate for IT 116A was 1.00 iph with an average rate of 0.50 inches over the last four 30-minute infiltration readings. Infiltration test IT 116B had an infiltration rate of 1.00 iph with an average of 0.50 inches over the last four 30-minute infiltration readings.

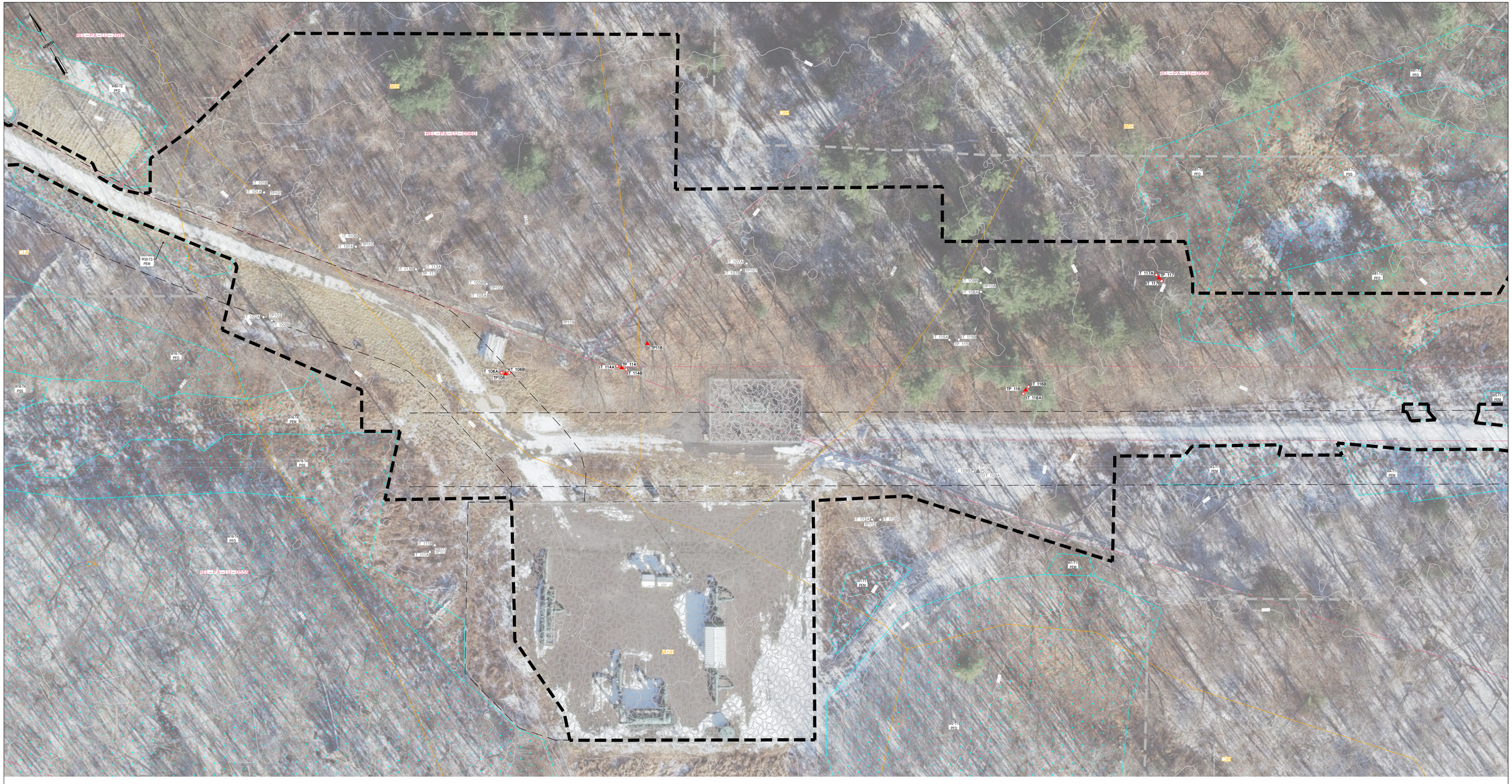
TP 117

The infiltration rate for IT 117A was more than 4 iph with an average rate of more than 2 inches over the last four 30-minute infiltration readings. Infiltration test IT 117B had an infiltration rate of more than 12 iph with an average of more than 2 inches over the last four 10-minute infiltration readings.

4.0 REFERENCES

Pennsylvania Department of Environmental Protection. "Pennsylvania Stormwater Best Management Practices Manual" Document No. 363-0300-02, December 2006.

"Web Soil Survey - Home." Web Soil Survey - Home. United States Department of Agriculture, 6 Dec. 2013. Web. 23 December 2020. <http://websoilsurvey.nrcs.usda.gov/app/>.


NORTH
PROPERTY LINE
PROPERTY LINE
PROPERTY LINE
MIE
MIE
MI

ATTACHMENT 4

PCSM PLAN BMP DESIGN WORKSHEETS AND CALCULATIONS

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ATTACHMENT 4

PCSM PLAN BMP DESIGN WORKSHEETS AND CALCULATIONS

ATTACHMENT 4.1

CN TABLE –
MLV-515RA20

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.2

CN TABLE –
MLV-515RA30

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.3

CN TABLE – CARVERTON TIE-IN

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.4

CN TABLE –
LOWER DEMUNDS REL TIE-IN

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.5

CN TABLE – HILDEBRANDT TIE-IN/MLV-515RA40

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.6

CN TABLE – S5-T5/S6-T5 AND S4A-T5/S4-T5 STREAM STABILIZATION

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1] Average runoff condition, and $I_a = 0.2S$.
[2] *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
[3] *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
[4] Actual curve number is less than 30; use CN = 30 for runoff computations.
[5] CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
[6] *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT 4.7

STORMWATER BMP MANUAL APPENDIX D WORKSHEETS – MLV-515RA20

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **Williams REAE - MLV-515RA20**

Application Type: **Individual E&S Application**

County: **Luzerne**

Municipality: **Jenkins Township**

Project Type: **Utility Replacement**

◉ New Project ○ Minor / Major Amendment

Area: **0.90** acres
(In Watershed)

Total Earth Disturbance: **0.90** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	0.40	0.40	0.00	0.16		CWF, MF	Yes
Undetained Areas	0.50	0.50	0.00	0.00		CWF, MF	
Totals:	**0.90**	**0.90**		**0.16**			

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: Williams REAE - MLV-515RA20

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **2.95** inches

Alternative 2-Year / 24-Hour Storm Event _____ inches

Alternative Source: _____

Pre-Construction Conditions: *No. Rows:* **2** ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	0.50	D	78	0.564	1.09	1,965
Forested (Good Condition)	0.40	D	77	0.597	1.04	1,505
TOTAL (ACRES):	**0.90**				**TOTAL (CF):**	**3,470**

Post-Construction Conditions: *No. Rows:* **2**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Streets and Roads - Gravel (Including ROW)	0.16	D	91	0.198	2.02	1,176
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	0.74	D	78	0.564	1.09	2,917
TOTAL (ACRES):	**0.90**				**TOTAL (CF):**	**4,093**

NET CHANGE IN VOLUME TO MANAGE (CF): **623**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **2** *Start BMP Numbering at:* **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Constructed Filter	-	to BMP No. 2	0.37	1,929	1,086	0.00	12	No		0	**0**	
001	2	Infiltration Berm & Retentive Grading	-	Off-Site	0.03	2,104	1,437	0.32	55	No		997	**1,404**	
												Totals:	**1,404**	

INFILTRATION & ET CREDITS (CF): **1,404**

NET CHANGE IN VOLUME TO MANAGE (CF): **623**

TOTAL CREDITS (CF): **1,404**

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: Williams REAE - MLV-515RA20

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**2.95**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**4.3**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**6.26**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**7.39**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**1.35**	**0.97**	**-0.38**	***Rate Control Satisfied***
10-Year Storm:	**2.71**	**2.21**	**-0.50**	***Rate Control Satisfied***
50-Year Storm:	**4.87**	**4.42**	**-0.45**	***Rate Control Satisfied***
100-Year Storm:	**6.15**	**6.01**	**-0.14**	***Rate Control Satisfied***

Water Quality

Project: Williams REAE - MLV-515RA20

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	0.50	D	1,965	48.8	0.22	2.30	5.99	0.03	0.28
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	0.40	D	1,505	45.0	0.13	1.05	4.23	0.01	0.10
	TOTAL (ACRES):	**0.90**					**TOTALS:**	**10.22**	**0.04**	**0.38**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Streets and Roads - Gravel (Including ROW)	Highway (general)	0.16	D	1,176	141.0	0.43	2.65	10.35	0.03	0.19

Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	0.74	D	2,917	48.8	0.22	2.30	8.89	0.04	0.42
	TOTAL (ACRES):	**0.90**					**TOTALS:**	**19.24**	**0.07**	**0.61**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS): | **9.03** | **0.03** | **0.23**

☑ **Characterize Undetained Areas (for Untreated Stormwater)** *No. Rows:*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	**0.093**	**D**	**78**	**0.564**	**1.09**	**369**

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Constructed Filter	-	0.37	1,929	0		1,929	-	-	-	-	-	-
001	2	Infiltration Berm & Retentive Grading	-	0.03	2,104	1,404		700	10.00	0.24	0.96	0.44	0.01	0.04

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	0.44	0.01	0.04
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	1.12	0.01	0.05
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	1.56	0.02	0.09
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	10.22	0.04	0.38

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Patrick Wozinski	07/19/2022
Spreadsheet User Name	Date

DEP PCSM SPREADSHEET

SUPPLEMENTAL CALCULATIONS FOR LOADING RATIOS AND INFILTRATION PERIOD

Transcontinental Gas Pipe Line Company, LLC
Regional Energy Access Expansion Project
PCSM Ratio Table - MLV-515RA20

Ratio Calculations

Site	Drainage Area (SF)	Impervious Area (SF)	Infiltration Area (SF)	Drainage Area : Infiltration Area	Impervious Area : Infiltration Area Ratio[2]
MLV-515RA20					
Infiltration Berm	17,216	6,957	2,523	6.8 : 1	2.8 : 1

1. PADEP Stormwater BMP Manual recommends that BMPs be designed with a maximum total loading
2. PADEP Stormwater BMP Manual requires BMPs to be designed with a maximum impervious loading

Ratio 1= Drainage area/Infiltration Area
Ratio 2= Impervious Area/ Infiltration Area

Infiltration Period (hrs) Calculations

Site	Pipe Outlet	Bottom	Depth (ft)	Infiltration rate (in/h)	Infiltration rate (ft/h)	Infiltration Period (hrs)
MLV-515RA20						
Infiltration Berm	1425.45	1424.00	1.45	0.32	0.026	55.2

Infiltration Period(hrs) = Depth(ft)/ Infiltration Rate(ft/h)
Depth = Spillway - Bottom

ATTACHMENT 4.8

STORMWATER BMP MANUAL APPENDIX D WORKSHEETS – MLV-515RA30

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **Williams REAE - MLV-515RA30**

Application Type: **Individual E&S Application**

County: **Luzerne**

Municipality: **Wyoming Borough**

Project Type: **Utility Replacement**

◉ New Project ○ Minor / Major Amendment

Area: **0.88** acres
(In Watershed)

Total Earth Disturbance: **0.88** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	0.47	0.47	0.00	0.24	Discharge to Non-Surface Waters		Yes
Undetained Areas	0.41	0.41	0.00	0.00	Discharge to Non-Surface Waters		
Totals:	**0.88**	**0.88**		**0.24**			

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: Williams REAE - MLV-515RA30

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **2.57** inches

Alternative 2-Year / 24-Hour Storm Event: inches

Alternative Source:

Pre-Construction Conditions: *No. Rows:* **4** ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.04	A	98	0.041	2.34	340
Impervious as Meadow	0.01	A	30	4.667	0.00	0
Pervious as Meadow	0.04	A	30	4.667	0.00	0
Pervious as Meadow	0.38	D	78	0.564	0.83	1,150
TOTAL (ACRES):	**0.47**				**TOTAL (CF):**	**1,490**

Post-Construction Conditions: *No. Rows:* **5**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.05	A	98	0.041	2.34	425
Impervious Areas: Streets and Roads - Gravel (Including ROW)	0.01	A	76	0.632	0.74	27
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.17	D	98	0.041	2.34	1,444

Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	0.04	A	30	4.667	0.00	0
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	0.20	D	78	0.564	0.83	605
	TOTAL (ACRES):	**0.47**			**TOTAL (CF):**	**2,501**

NET CHANGE IN VOLUME TO MANAGE (CF): **1,011**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **1** *Start BMP Numbering at:* **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Infiltration Berm & Retentive Grading	-	Off-Site	0.47	1,703	4,548	0.38	12	No		1,013	**1,555**	
												Totals:	**1,555**	

INFILTRATION & ET CREDITS (CF): **1,555**

NET CHANGE IN VOLUME TO MANAGE (CF): **1,011**

TOTAL CREDITS (CF): **1,555**

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: Williams REAE - MLV-515RA30

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**2.57**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**3.73**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**5.39**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**6.34**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**0.46**	**0.00**	**-0.46**	***Rate Control Satisfied***
10-Year Storm:	**1.01**	**0.00**	**-1.01**	***Rate Control Satisfied***
50-Year Storm:	**1.93**	**0.00**	**-1.93**	***Rate Control Satisfied***
100-Year Storm:	**2.48**	**0.00**	**-2.48**	***Rate Control Satisfied***

Water Quality

Project: Williams REAE - MLV-515RA30

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.04	A	340	65.0	0.29	2.05	1.38	0.01	0.04
Impervious as Meadow	Grassland/Herbaceous	0.01	A	0	48.8	0.22	2.30	0.00	0.00	0.00
Pervious as Meadow	Grassland/Herbaceous	0.04	A	0	48.8	0.22	2.30	0.00	0.00	0.00
Pervious as Meadow	Grassland/Herbaceous	0.38	D	1,150	48.8	0.22	2.30	3.50	0.02	0.17
	TOTAL (ACRES):	**0.47**					**TOTALS:**	**4.88**	**0.02**	**0.21**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.05	A	425	65.0	0.29	2.05	1.72	0.01	0.05

Impervious Areas: Streets and Roads - Gravel (Including ROW)	Highway (general)	0.01	A	27	141.0	0.43	2.65	0.24	0.00	0.00
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.17	D	1,444	65.0	0.29	2.05	5.86	0.03	0.18
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	0.04	A	0	48.8	0.22	2.30	0.00	0.00	0.00
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	0.20	D	605	48.8	0.22	2.30	1.84	0.01	0.09
	TOTAL (ACRES):	**0.47**					**TOTALS:**	**9.67**	**0.04**	**0.33**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**4.78**	**0.02**	**0.12**

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN

001	1	Infiltration Berm & Retentive Grading	-	0.47	1,703	1,555		148	10.00	0.24	0.96	0.09	0.00	0.01

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**0.09**	**0.00**	**0.01**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**3.08**	**0.01**	**0.11**
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**3.18**	**0.02**	**0.11**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**4.88**	**0.02**	**0.21**

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Pat Wosinski	2/24/2022
Spreadsheet User Name	Date

DEP PCSM SPREADSHEET

SUPPLEMENTAL CALCULATIONS FOR LOADING RATIOS AND INFILTRATION PERIOD

Transcontinental Gas Pipe Line Company, LLC
Regional Energy Access Expansion Project
PCSM Ratio Table - MLV-515RA30

Ratio Calculations

Site	Drainage Area (SF)	Impervious Area (SF)	Infiltration Area (SF)	Drainage Area : Infiltration Area Ratio[1]	Impervious Area : Infiltration Area Ratio[2]
MLV-515RA30					
Infiltration Berm	20,227	8,544	4,548	4.4 : 1	1.9 : 1

1. PADEP Stormwater BMP Manual recommends that BMPs be designed with a maximum total
2. PADEP Stormwater BMP Manual requires BMPs to be designed with a maximum impervious

Ratio 1= Drainage area/Infiltration Area
Ratio 2= Impervious Area/ Infiltration Area

Infiltration Period (hrs) Calculations

Site	Top	Bottom	Depth (ft)	Infiltration rate (in/h)	Infiltration rate (ft/h)	Infiltration Period (hrs)
MLV-515RA30						
Infiltration Berm	565.00	563.00	2.00	0.38	0.032	63.2

Infiltration Period(hrs) = Depth(ft)/ Infiltration Rate(ft/h)
Depth = Spillway - Bottom

ATTACHMENT 4.9

STORMWATER BMP MANUAL APPENDIX D WORKSHEETS – CARVERTON TIE-IN

Instructions

Instructions | General | Volume | Rate | Quality

If prompted by Excel after opening the DEP Post-Construction Stormwater Management (PCSM) Spreadsheet, enable editing and macros. This spreadsheet consists of five hyperlink tabs: Instructions, General, Volume, Rate and Quality. Each tab has a corresponding worksheet. To begin, click on the General tab. **NOTE - The spreadsheet is intended for the evaluation of volume, rate, and water quality for discharges to a single receiving water.** If for example there are 3 post-construction discharge points to Mud Run and 3 post-construction discharge points to Clear Creek, two spreadsheets should be completed (one each for Mud Run and Clear Creek).

Only those cells that are highlighted are available for data entry by the user:

Click on the button below to open detailed instructions on the use of the DEP PCSM Spreadsheet:

OPEN INSTRUCTIONS

If you have questions concerning use of this spreadsheet, contact the Bureau of Clean Water a RA-EPChapter102@pa.gov.

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **William REAE - Carverton**

Application Type: **Individual E&S Application**

County: **Luzerne**

Municipality: **West Wyoming Borough**

Project Type: **Other**

◉ New Project ○ Minor / Major Amendment

Area: **0.83** acres
(In Watershed)

Total Earth Disturbance: **0.83** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	0.34	0.34	0.06	0.00	Discharge to Non-Surface Waters	CWF, MF	Yes
Undetained Areas	0.49	0.49	0.02	0.00	Discharge to Non-Surface Waters	CWF, MF	
Totals:	**0.83**	**0.83**	**0.077**				

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: William REAE - Carverton

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **2.61** inches

Alternative 2-Year / 24-Hour Storm Even _____ inches

Alternative Source: _____

Pre-Construction Conditions: *No. Rows:* 3 ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	0.23	D	78	0.564	0.86	709
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.06	C	98	0.041	2.38	492
Impervious as Meadow	0.06	D	78	0.564	0.86	187
TOTAL (ACRES):	**0.34**				**TOTAL (CF):**	**1,389**

Post-Construction Conditions: *No. Rows:* 3

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	0.06	D	98	0.041	2.38	518
Impervious Areas: Streets and Roads - Gravel (Including ROW)	0.12	D	91	0.198	1.71	745
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Fair Condition (Grass Cover 50% to 75%)	0.16	D	84	0.381	1.20	698
TOTAL (ACRES):	**0.34**				**TOTAL (CF):**	**1,962**

ET CHANGE IN VOLUME TO MANAGE (CF): **573**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **1** *Start BMP Numbering at:* **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Infiltration Berm & Retentive Grading	-	Off-Site	0.34	1,801	2,005	0.75	30	No		1,801	**1,801**	
												Totals:	**1,801**	

INFILTRATION & ET CREDITS (CF): **1,801**

NET CHANGE IN VOLUME TO MANAGE (CF): **573**

TOTAL CREDITS (CF): **1,801**

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: William REAE - Carverton

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**2.61**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**3.79**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**5.48**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**6.44**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**0.69**	**0.00**	**-0.69**	***Rate Control Satisfied***
10-Year Storm:	**1.27**	**0.00**	**-1.27**	***Rate Control Satisfied***
50-Year Storm:	**2.17**	**1.47**	**-0.70**	***Rate Control Satisfied***
100-Year Storm:	**2.70**	**2.50**	**-0.20**	***Rate Control Satisfied***

Water Quality

Project: William REAE - Carverton

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	0.23	D	709	48.8	0.22	2.30	2.16	0.01	0.10
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.06	C	492	65.0	0.29	2.05	2.00	0.01	0.06
Impervious as Meadow	Grassland/Herbaceous	0.06	D	187	48.8	0.22	2.30	0.57	0.00	0.03
	TOTAL (ACRES):	**0.34**					**TOTALS:**	**4.73**	**0.02**	**0.19**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	Urban Highway	0.06	D	518	142.0	0.32	3.00	4.60	0.01	0.10
Impervious Areas: Streets and Roads - Gravel (Including ROW)	Highway (general)	0.12	D	745	141.0	0.43	2.65	6.56	0.02	0.12
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Fair Condition (Grass Cover 50% to 75%)	Open Space	0.16	D	698	78.0	0.25	1.25	3.40	0.01	0.05

TOTAL (ACRES):	**0.34**	**TOTALS:**	**14.56**	**0.04**	**0.27**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**9.83**	**0.02**	**0.08**

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Infiltration Berm & Retentive Grading	-	0.34	1,801	1,801		0	10.00	0.24	0.96	0.00	0.00	0.00

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**0.00**	**0.00**	**0.00**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**1.19**	**0.00**	**0.02**
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**1.19**	**0.00**	**0.02**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**4.73**	**0.02**	**0.19**

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Patrick Wozinski, P.E.	2/22/2022
Spreadsheet User Name	Date

DEP PCSM SPREADSHEET

SUPPLEMENTAL CALCULATIONS FOR LOADING RATIOS AND INFILTRATION PERIOD

Transcontinental Gas Pipe Line Company, LLC
Regional Energy Access Expansion Project
PCSM Ratio Table - Carverton Tie-In

Ratio Calculations

Site	Drainage Area (SF)	Impervious Area (SF)	Infiltration Area (SF)	Drainage Area : Infiltration Area Ratio[1]	Impervious Area : Infiltration Area Ratio[2]
Carverton Tie-In					
Infiltration Berm	14,998	7,797	2,005	7.5 : 1	3.9 : 1

1. PADEP Stormwater BMP Manual recommends that BMPs be designed with a maximum total
2. PADEP Stormwater BMP Manual requires BMPs to be designed with a maximum impervious

Ratio 1= Drainage area/Infiltration Area
Ratio 2= Impervious Area/ Infiltration Area

Infiltration Period (hrs) Calculations

Site	Spillway	Bottom	Depth (ft)	Infiltration rate (in/h)	Infiltration rate (ft/h)	Infiltration Period (hrs)
Carverton Tie-In						
Infiltration Berm	1399.85	1398.00	1.85	0.75	0.063	29.6

Infiltration Period(hrs) = Depth(ft)/ Infiltration Rate(ft/h)
Depth = Spillway - Bottom

ATTACHMENT 4.10

STORMWATER BMP MANUAL APPENDIX D WORKSHEETS – LOWER DEMUNDS REL TIE-IN

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **Lower Demunds REL Tie-In**

Application Type: **Individual E&S Application**

County: **Luzerne**

Municipality: **Dallas Township**

Project Type: **Utility Replacement**

◉ New Project ○ Minor / Major Amendment

Area: **0.16** acres
(In Watershed)

Total Earth Disturbance: **0.16** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	0.13	0.13	0.00	0.13			Yes
Undetained Areas	0.03	0.03	0.00	0.03			
Totals:	**0.16**	**0.16**		**0.162**			

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: Lower Demunds REL Tie-In

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.4** inches

Alternative 2-Year / 24-Hour Storm Event: inches

Alternative Source:

Pre-Construction Conditions: *No. Rows:* **2**

☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Forested (Good Condition)	0.09	D	77	0.597	1.36	458
Pervious as Meadow	0.07	D	78	0.564	1.42	356
TOTAL (ACRES):	**0.16**				**TOTAL (CF):**	**814**

Post-Construction Conditions: *No. Rows:* **1**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.16	D	98	0.041	3.17	1,862
TOTAL (ACRES):	**0.16**				**TOTAL (CF):**	**1,862**

NET CHANGE IN VOLUME TO MANAGE (CF): **1,048**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **1** *Start BMP Numbering at:* **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Infiltration Bed	-	Off-Site	0.13	1,394	5,056	0.50	42	No	0.5	772	**1,394**	
												Totals:	**1,394**	

INFILTRATION & ET CREDITS (CF):	**1,394**
NET CHANGE IN VOLUME TO MANAGE (CF):	**1,048**
TOTAL CREDITS (CF):	**1,394**

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: Lower Demunds REL Tie-In

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**3.4**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**5**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**7.33**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**8.67**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**0.20**	**0.11**	**-0.09**	***Rate Control Satisfied***
10-Year Storm:	**0.39**	**0.16**	**-0.23**	***Rate Control Satisfied***
50-Year Storm:	**0.69**	**0.24**	**-0.45**	***Rate Control Satisfied***
100-Year Storm:	**0.87**	**0.28**	**-0.59**	***Rate Control Satisfied***

Water Quality

Project: Lower Demunds REL Tie-In

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	0.09	D	458	45.0	0.13	1.05	1.29	0.00	0.03
Pervious as Meadow	Grassland/Herbaceous	0.07	D	356	48.8	0.22	2.30	1.09	0.00	0.05
	TOTAL (ACRES):	**0.16**					**TOTALS:**	**2.37**	**0.01**	**0.08**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.16	D	1,862	65.0	0.29	2.05	7.56	0.03	0.24
	TOTAL (ACRES):	**0.16**					**TOTALS:**	**7.56**	**0.03**	**0.24**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	5.19	0.03	0.16

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Infiltration Bed	-	0.13	1,394	1,394		0	22.00	0.10	2.38	0.00	0.00	0.00

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**0.00**	**0.00**	**0.00**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**1.90**	**0.01**	**0.06**
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**1.90**	**0.01**	**0.06**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**2.37**	**0.01**	**0.08**

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Patrick Wozinski, P.E.	2/18/2022
Spreadsheet User Name	Date

DEP PCSM SPREADSHEET

SUPPLEMENTAL CALCULATIONS FOR LOADING RATIOS AND INFILTRATION PERIOD

Transcontinental Gas Pipe Line Company, LLC
Regional Energy Access Expansion Project
PCSM Ratio Table - Lower Demunds REL Tie-In

Ratio Calculations

Site	Drainage Area (SF)	Impervious Area (SF)	Infiltration Area (SF)	Drainage Area : Infiltration Area Ratio[1]	Impervious Area : Infiltration Area Ratio[2]
Lower Demunds REL Tie-In					
Infiltration Bed	5,755	5,755	5,056	1.1 : 1	1.1 : 1

1. PADEP Stormwater BMP Manual recommends that BMPs be designed with a maximum total loading
2. PADEP Stormwater BMP Manual requires BMPs to be designed with a maximum impervious loading

Ratio 1= Drainage area/Infiltration Area
Ratio 2= Impervious Area/ Infiltration Area

Infiltration Period (hrs) Calculations

Site	Spillway (ft)	Bottom (ft)	Depth (ft)	Infiltration rate (in/h)	Infiltration rate (ft/h)	Infiltration Period (hrs)
Lower Demunds REL Tie-In						
Infiltration Berm	1276.75	1275.00	1.75	0.50	0.042	42.1

Infiltration Period(hrs) = Depth(ft)/ Infiltration Rate(ft/h)
Depth = Spillway - Bottom

ATTACHMENT 4.11

STORMWATER BMP MANUAL APPENDIX D WORKSHEETS – HILDEBRANDT TIE-IN/MLV-515RA40

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **Hildebrandt Tie-In/MLV-515RA40**

Application Type: **Individual E&S Application**

County: **Luzerne**

Municipality: **Dallas Township**

Project Type: **Utility Replacement**

◉ New Project ○ Minor / Major Amendment

Area: **0.32** acres
(In Watershed)

Total Earth Disturbance: **0.32** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	0.25	0.25	0.00	0.25			Yes
Undetained Areas	0.08	0.08	0.00	0.01			
Totals:	**0.32**	**0.32**		**0.257**			

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: Hildebrandt Tie-In/MLV-515RA40

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.4** inches

Alternative 2-Year / 24-Hour Storm Event: inches

Alternative Source:

Pre-Construction Conditions: *No. Rows:* **4** ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Forested (Good Condition)	0.03	C	70	0.857	0.95	103
Forested (Good Condition)	0.10	D	77	0.597	1.36	492
Pervious as Meadow	0.02	C	71	0.817	1.00	73
Pervious as Meadow	0.17	D	78	0.564	1.42	898
TOTAL (ACRES):	**0.32**				**TOTAL (CF):**	**1,566**

Post-Construction Conditions: *No. Rows:* **3**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	0.01	C	71	0.817	1.00	47
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	0.05	D	78	0.564	1.42	279
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.26	D	98	0.041	3.17	2,954
TOTAL (ACRES):	**0.32**				**TOTAL (CF):**	**3,280**

NET CHANGE IN VOLUME TO MANAGE (CF): 1,714

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* 1 *Start BMP Numbering at:* 1

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Infiltration Bed	-	Off-Site	0.25	2,614	9,410	0.16 *	56	No	0.5	1,412	**2,614**	
												Totals:	**2,614**	

INFILTRATION & ET CREDITS (CF): 2,614

NET CHANGE IN VOLUME TO MANAGE (CF): 1,714

TOTAL CREDITS (CF): 2,614

VOLUME REQUIREMENT SATISFIED

* Infiltration is occurring in 4,173 sf of the pad. For Hydrocad Modeling does not allow for infiltration only in a portion of the pad. Therefore, the full area of the pad (9,410 sf) was assumed, but at a reduced infiltration rate. The infiltration rate from onsite testing (0.44"/hr) was reduced by the same approximate ratio as the infiltration/non-infiltration area of the pad.

Rate Control

Project: Hildebrandt Tie-In/MLV-515RA40

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**3.4**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**5**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**7.33**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**8.67**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**0.38**	**0.18**	**-0.20**	***Rate Control Satisfied***
10-Year Storm:	**0.74**	**0.33**	**-0.41**	***Rate Control Satisfied***
50-Year Storm:	**1.31**	**0.55**	**-0.76**	***Rate Control Satisfied***
100-Year Storm:	**1.64**	**0.73**	**-0.91**	***Rate Control Satisfied***

Water Quality

Project: Hildebrandt Tie-In/MLV-515RA40

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	0.03	C	103	45.0	0.13	1.05	0.29	0.00	0.01
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	0.10	D	492	45.0	0.13	1.05	1.38	0.00	0.03
Pervious as Meadow	Grassland/Herbaceous	0.02	C	73	48.8	0.22	2.30	0.22	0.00	0.01
Pervious as Meadow	Grassland/Herbaceous	0.17	D	898	48.8	0.22	2.30	2.74	0.01	0.13
	TOTAL (ACRES):	**0.32**					**TOTALS:**	**4.63**	**0.02**	**0.18**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	0.01	C	47	48.8	0.22	2.30	0.14	0.00	0.01

Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	0.05	D	279	48.8	0.22	2.30	0.85	0.00	0.04
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.26	D	2,954	65.0	0.29	2.05	11.99	0.05	0.38
	TOTAL (ACRES):	**0.32**					**TOTALS:**	**12.98**	**0.06**	**0.42**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**8.35**	**0.04**	**0.25**

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Infiltration Bed	-	0.25	2,614	2,614		0	22.00	0.10	2.38	0.00	0.00	0.00

	TSS	**TP**	**TN**
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**0.00**	**0.00**	**0.00**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**2.64**	**0.01**	**0.09**
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**2.64**	**0.01**	**0.09**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**4.63**	**0.02**	**0.18**

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Patrick Wozinski, P.E.	2/18/2022
Spreadsheet User Name	Date

DEP PCSM SPREADSHEET

SUPPLEMENTAL CALCULATIONS FOR LOADING RATIOS AND INFILTRATION PERIOD

Transcontinental Gas Pipe Line Company, LLC
Regional Energy Access Expansion Project
PCSM Ratio Table - Hildebrant Tie-In / MLV-515RA40

Ratio Calculations

Site	Drainage Area (SF)	Impervious Area (SF)	Infiltration Area (SF)	Drainage Area : Infiltration Area Ratio[1]	Impervious Area : Infiltration Area Ratio[2]
Hildebrant Tie-In / MLV-515RA40					
Infiltration Bed	10,716	10,716	9,410	1.1 : 1	1.1 : 1

1. PADEP Stormwater BMP Manual recommends that BMPs be designed with a maximum total
2. PADEP Stormwater BMP Manual requires BMPs to be designed with a maximum impervious

Ratio 1= Drainage area/Infiltration Area
Ratio 2= Impervious Area/ Infiltration Area

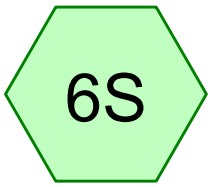
Infiltration Period (hrs) Calculations

Site	Spillway	Bottom	Depth (ft)	Infiltration rate (in/h)	Infiltration rate (ft/h)	Infiltration Period (hrs)
Hildebrant Tie-In / MLV-515RA40						
Infiltration Berm	1280.25	1279.50	0.75	0.16	0.013	57.7

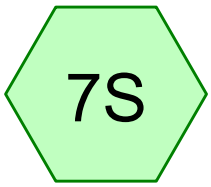
Infiltration Period(hrs) = Depth(ft)/ Infiltration Rate(ft/h)
Depth = Spillway - Bottom

ATTACHMENT 4.12

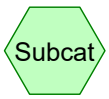
BMP HYDROCAD REPORT – MLV-515RA20



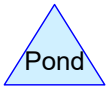
Pre DA



Post DA









Routing Diagram for Zenker Pre and Post-REV3
Prepared by {enter your company name here}, Printed 7/19/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,795	91	Gravel roads, HSG D (7S)
51,181	78	Meadow, non-grazed, HSG D (6S, 7S)
20,001	77	Woods, Good, HSG D (6S)
77,977	**79**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
77,977	HSG D	6S, 7S
0	Other	
77,977		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	6,795	0	6,795	Gravel roads	
0	0	0	51,181	0	51,181	Meadow, non-grazed	
0	0	0	20,001	0	20,001	Woods, Good	
0	**0**	**0**	**77,977**	**0**	**77,977**	**TOTAL AREA**	

Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>0.64"
Flow Length=183' Tc=10.7 min CN=77 Runoff=0.91 cfs 2,081 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>0.78"
Flow Length=247' Tc=9.9 min CN=80 Runoff=1.15 cfs 2,530 cf

Total Runoff Area = 77,977 sf Runoff Volume = 4,611 cf Average Runoff Depth = 0.71"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

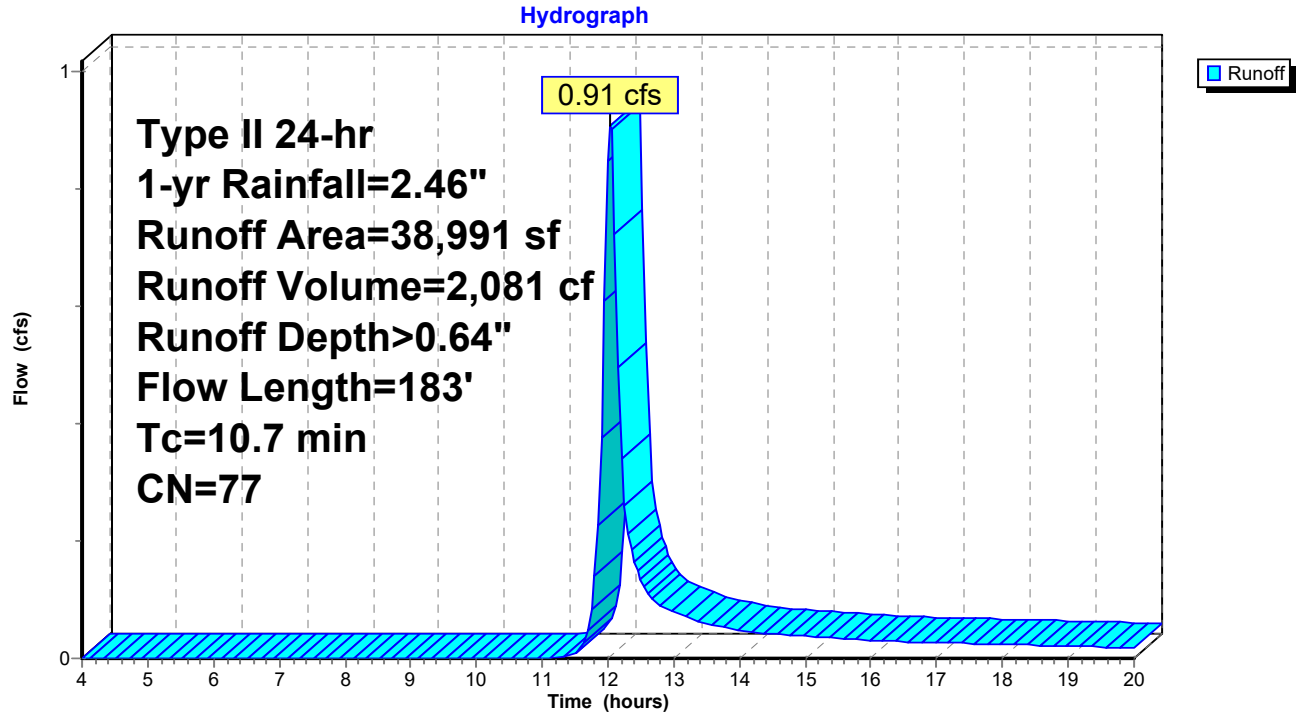
Runoff = 0.91 cfs @ 12.04 hrs, Volume= 2,081 cf, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

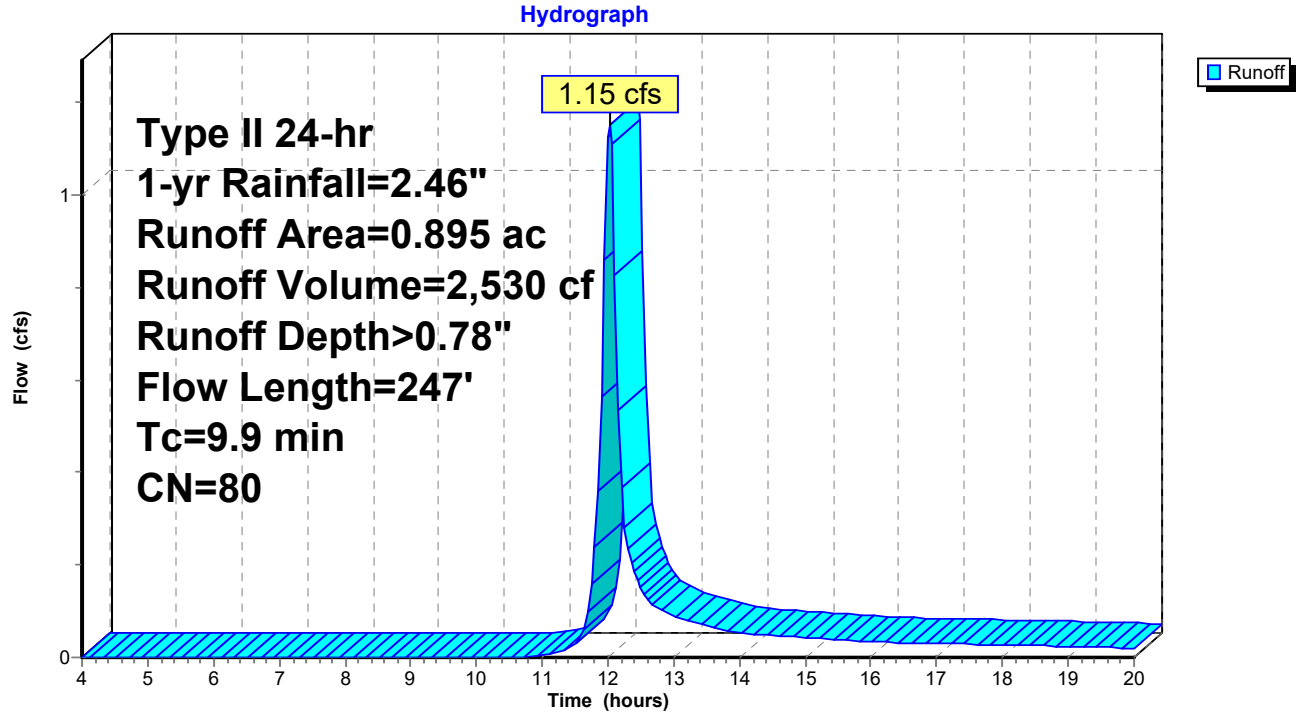
Runoff = 1.15 cfs @ 12.02 hrs, Volume= 2,530 cf, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=183' Tc=10.7 min CN=77 Runoff=1.35 cfs 3,044 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>1.10"
Flow Length=247' Tc=9.9 min CN=80 Runoff=1.64 cfs 3,589 cf

Total Runoff Area = 77,977 sf Runoff Volume = 6,632 cf Average Runoff Depth = 1.02"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

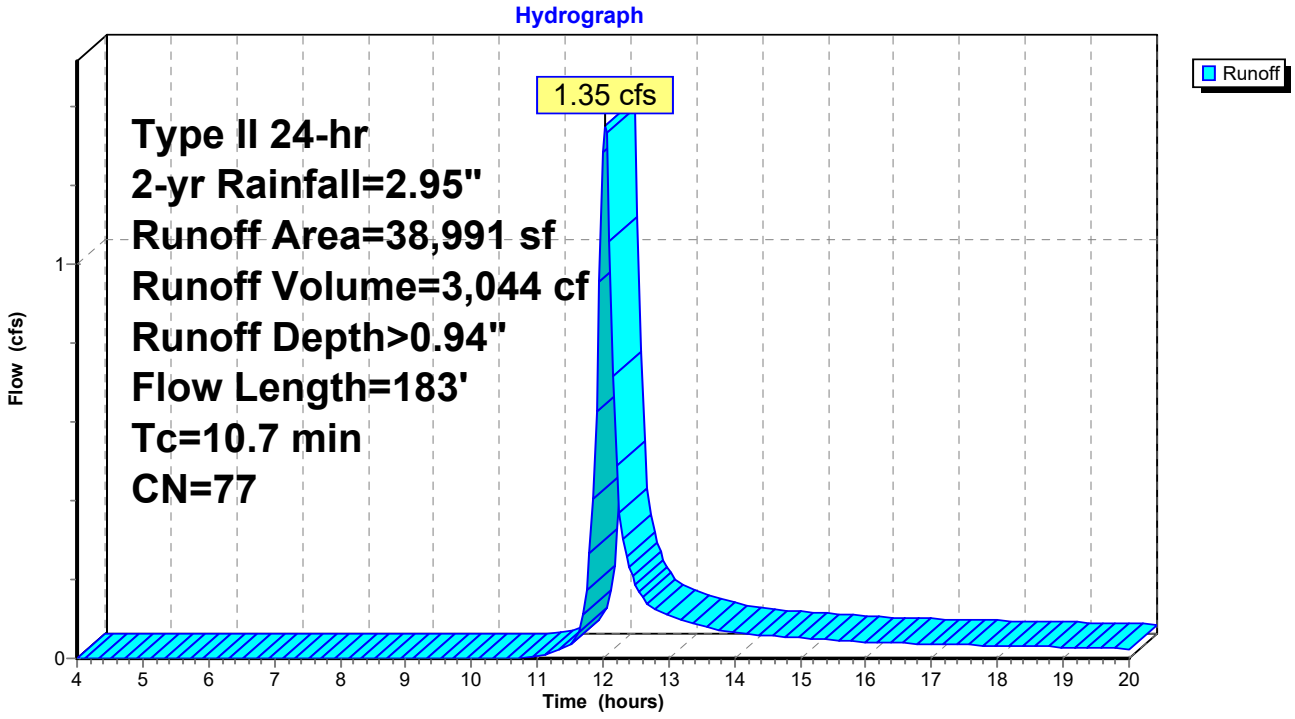
Runoff = 1.35 cfs @ 12.03 hrs, Volume= 3,044 cf, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

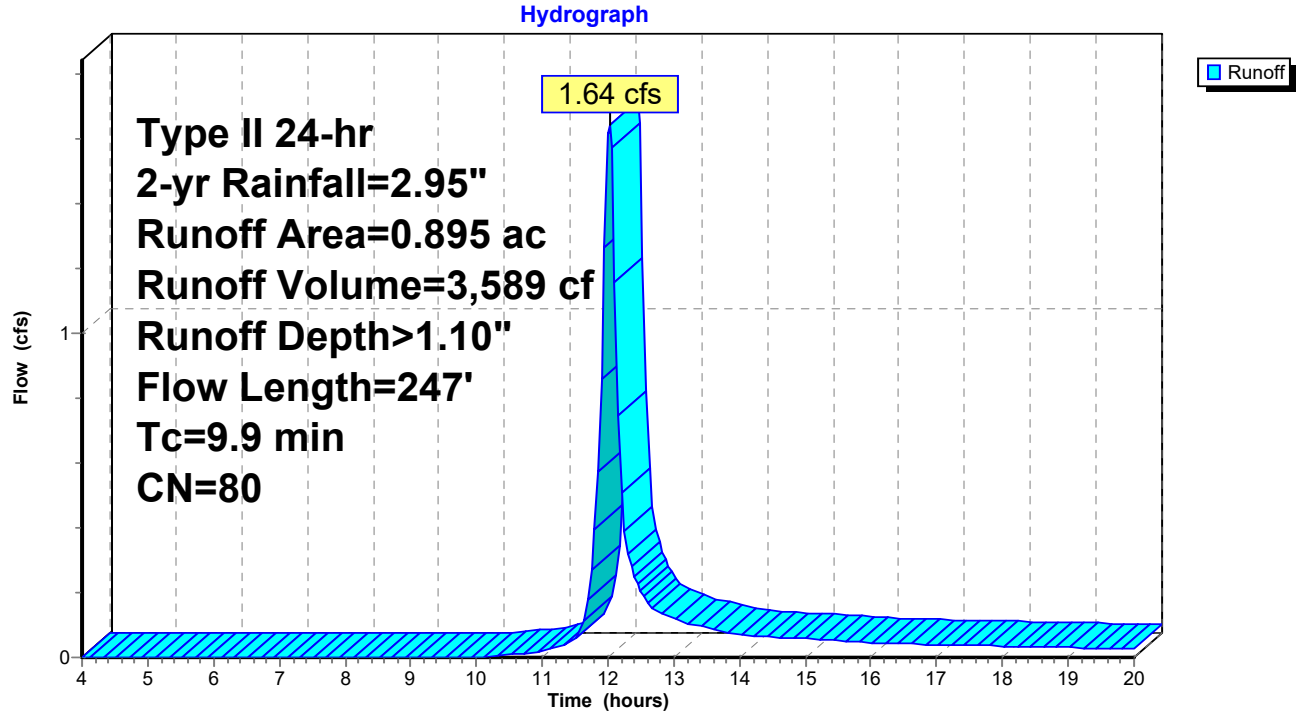
Runoff = 1.64 cfs @ 12.02 hrs, Volume= 3,589 cf, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>1.88"
Flow Length=183' Tc=10.7 min CN=77 Runoff=2.71 cfs 6,106 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>2.11"
Flow Length=247' Tc=9.9 min CN=80 Runoff=3.12 cfs 6,866 cf

Total Runoff Area = 77,977 sf Runoff Volume = 12,971 cf Average Runoff Depth = 2.00"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

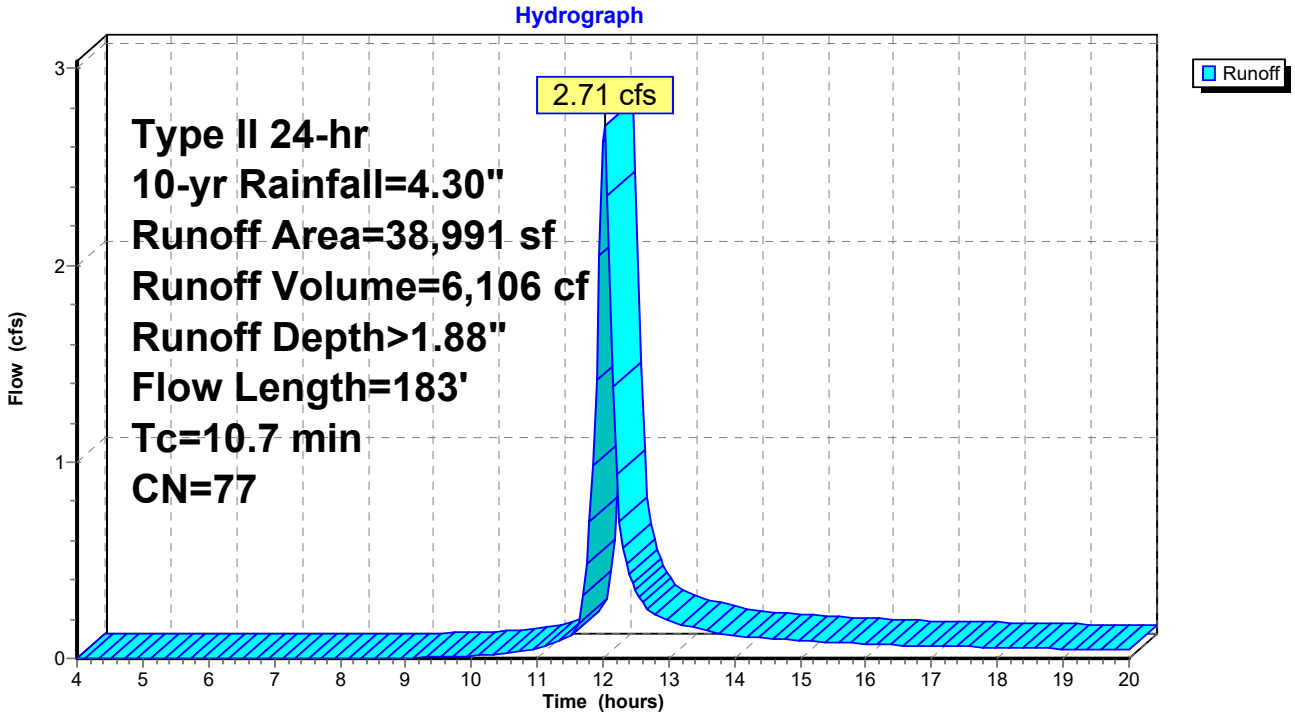
Runoff = 2.71 cfs @ 12.03 hrs, Volume= 6,106 cf, Depth> 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

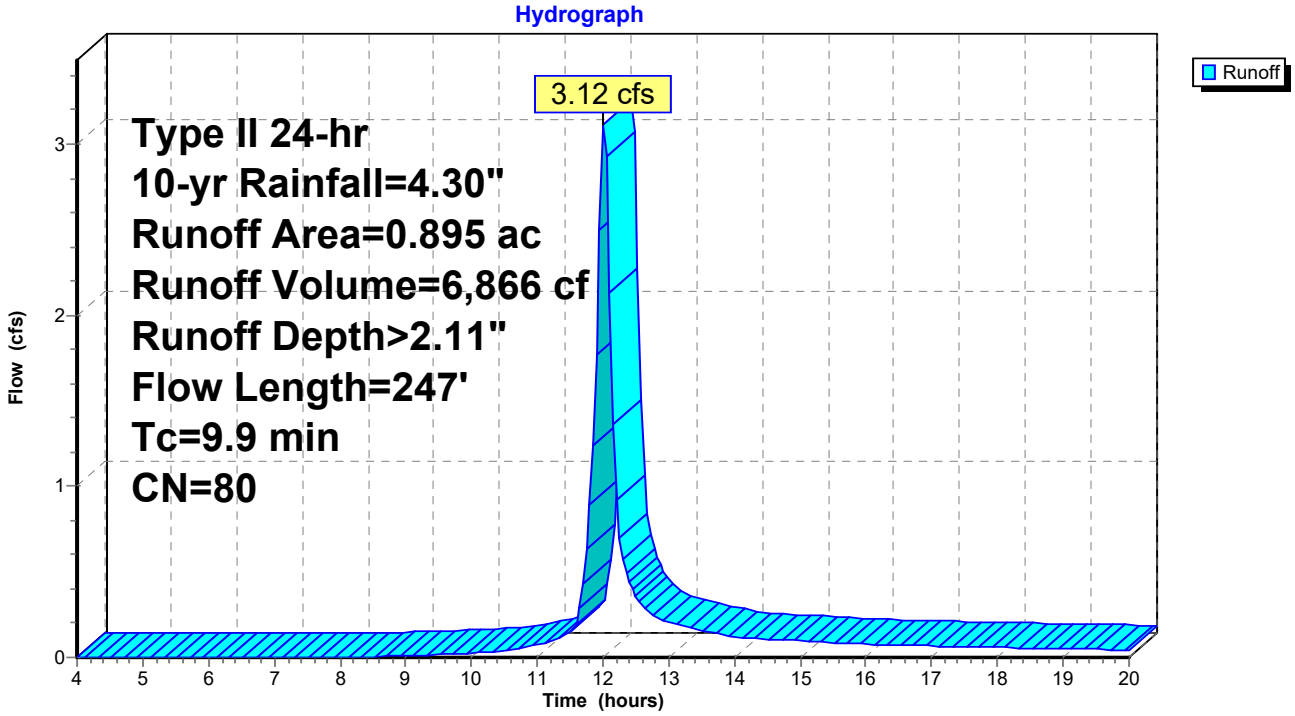
Runoff = 3.12 cfs @ 12.01 hrs, Volume= 6,866 cf, Depth> 2.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>2.67"
Flow Length=183' Tc=10.7 min CN=77 Runoff=3.81 cfs 8,672 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>2.94"
Flow Length=247' Tc=9.9 min CN=80 Runoff=4.29 cfs 9,556 cf

Total Runoff Area = 77,977 sf Runoff Volume = 18,228 cf Average Runoff Depth = 2.81"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

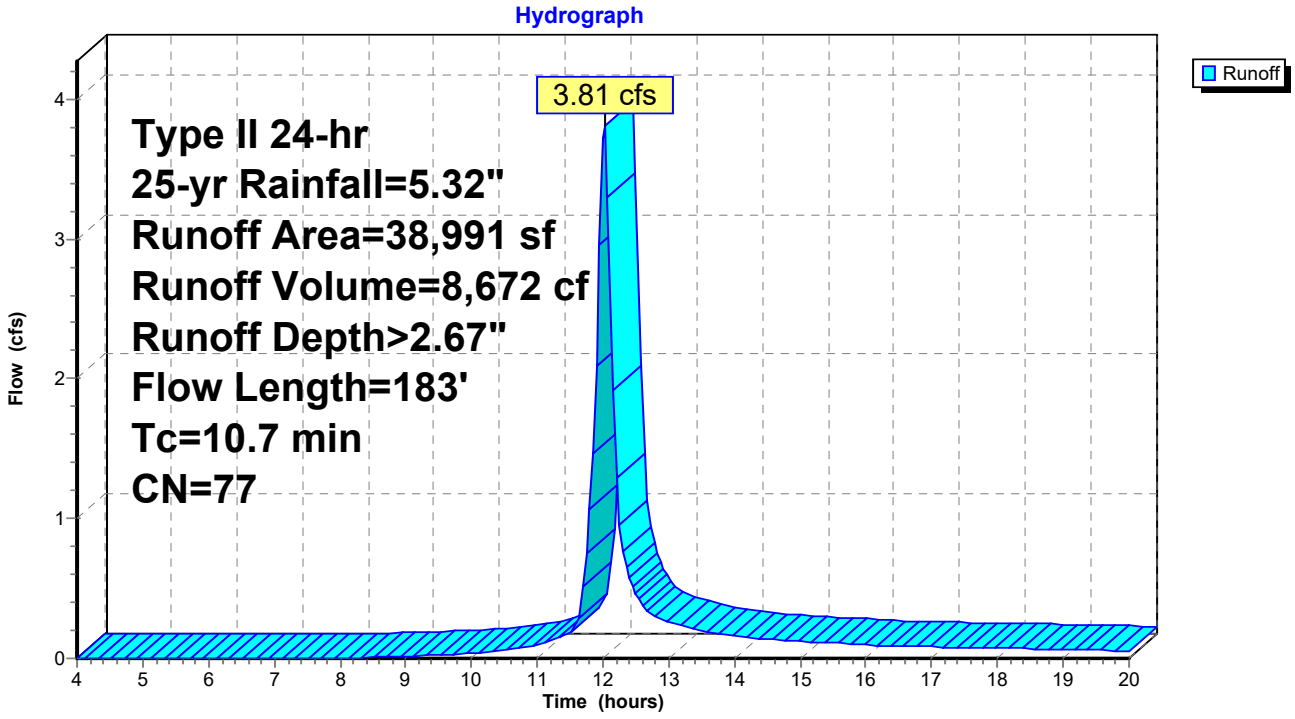
Runoff = 3.81 cfs @ 12.02 hrs, Volume= 8,672 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

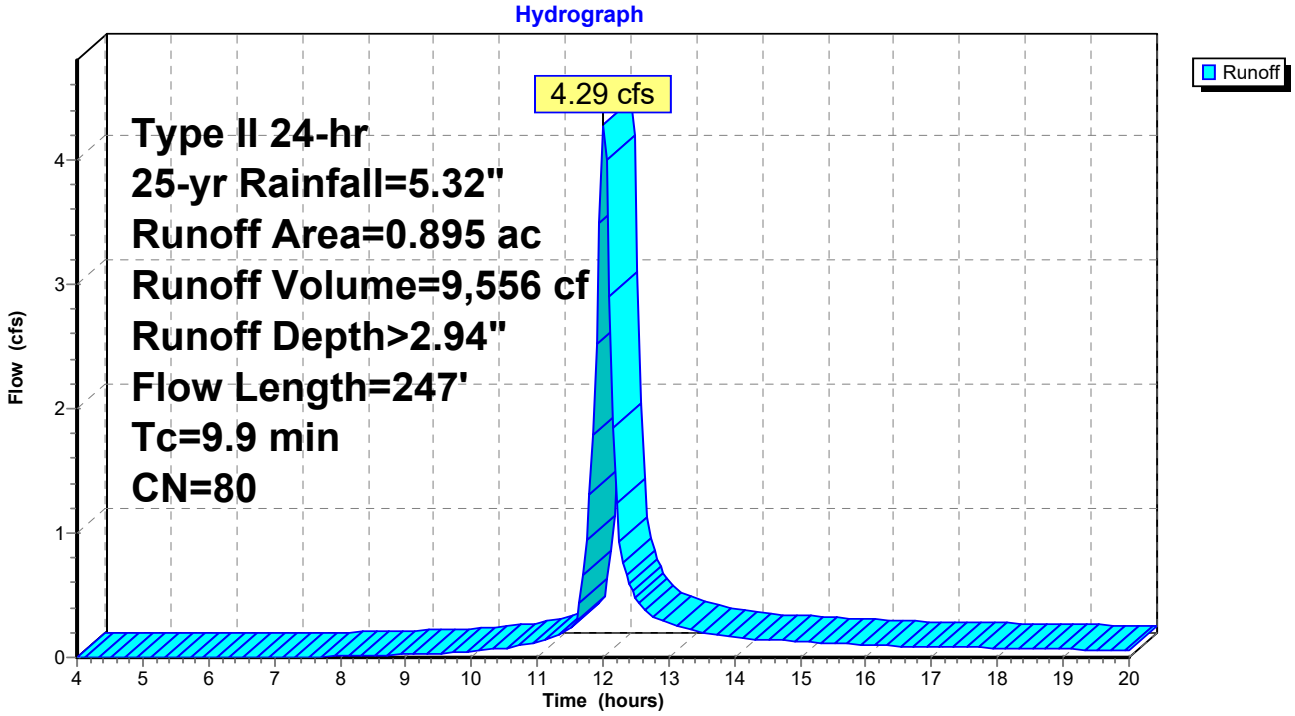
Runoff = 4.29 cfs @ 12.01 hrs, Volume= 9,556 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>3.43"
Flow Length=183' Tc=10.7 min CN=77 Runoff=4.87 cfs 11,157 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>3.74"
Flow Length=247' Tc=9.9 min CN=80 Runoff=5.39 cfs 12,135 cf

Total Runoff Area = 77,977 sf Runoff Volume = 23,292 cf Average Runoff Depth = 3.58"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

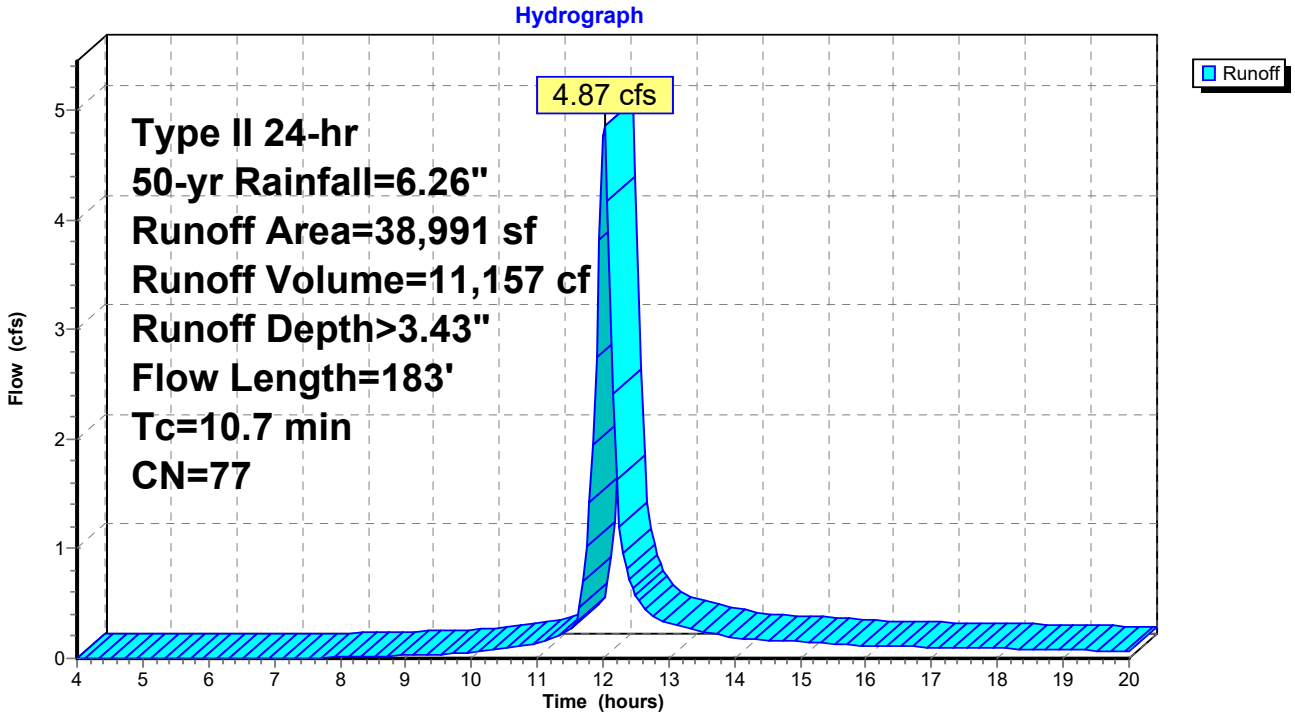
Runoff = 4.87 cfs @ 12.02 hrs, Volume= 11,157 cf, Depth> 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

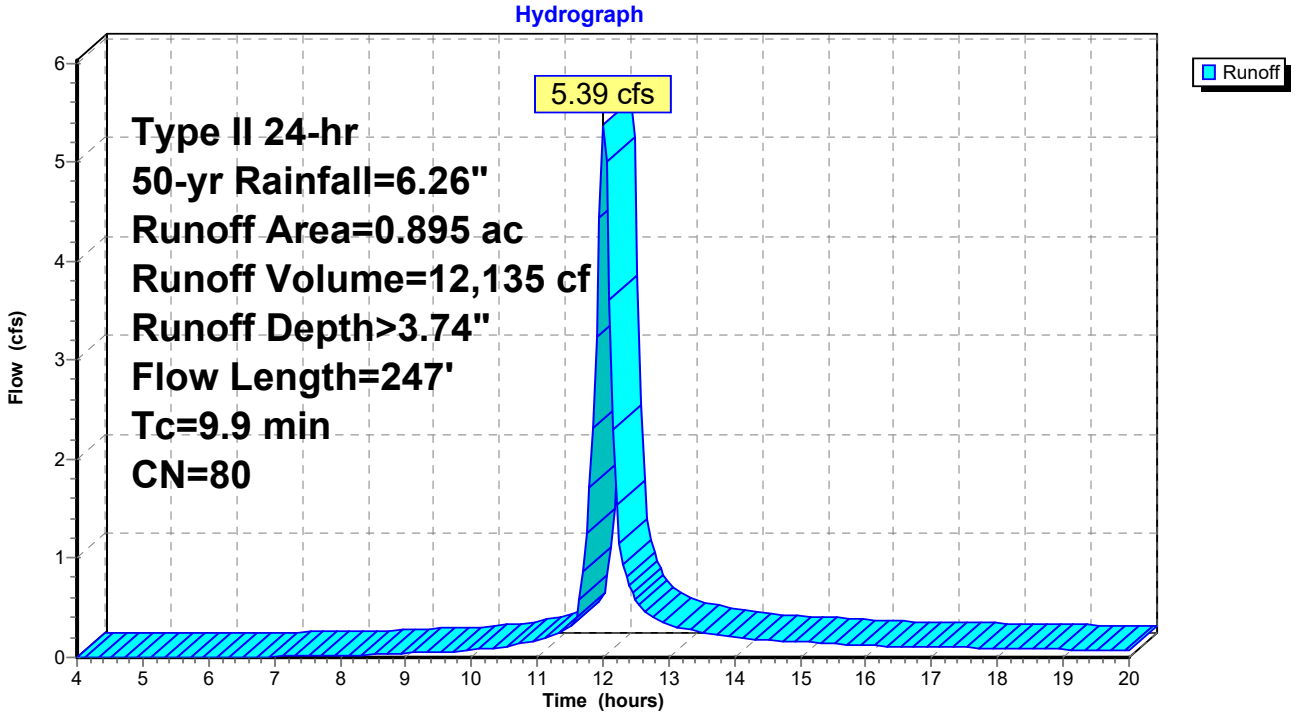
Runoff = 5.39 cfs @ 12.01 hrs, Volume= 12,135 cf, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Pre DA Runoff Area=38,991 sf 0.00% Impervious Runoff Depth>4.39"
Flow Length=183' Tc=10.7 min CN=77 Runoff=6.15 cfs 14,249 cf

Subcatchment 7S: Post DA Runoff Area=0.895 ac 0.00% Impervious Runoff Depth>4.72"
Flow Length=247' Tc=9.9 min CN=80 Runoff=6.72 cfs 15,320 cf

Total Runoff Area = 77,977 sf Runoff Volume = 29,568 cf Average Runoff Depth = 4.55"
100.00% Pervious = 77,977 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Pre DA

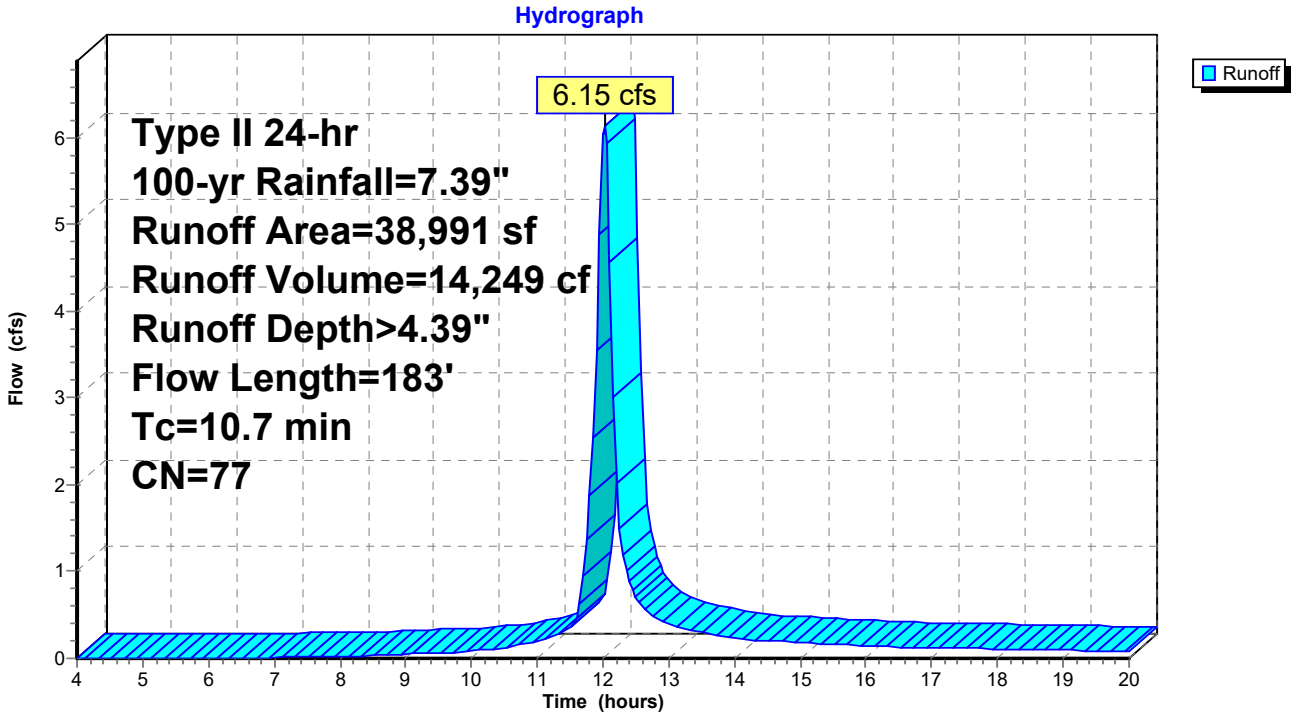
Runoff = 6.15 cfs @ 12.02 hrs, Volume= 14,249 cf, Depth> 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
18,990	78	Meadow, non-grazed, HSG D
20,001	77	Woods, Good, HSG D
38,991	77	Weighted Average
38,991		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	100	0.1600	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
1.0	83	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.7	183	Total			

Subcatchment 6S: Pre DA



Summary for Subcatchment 7S: Post DA

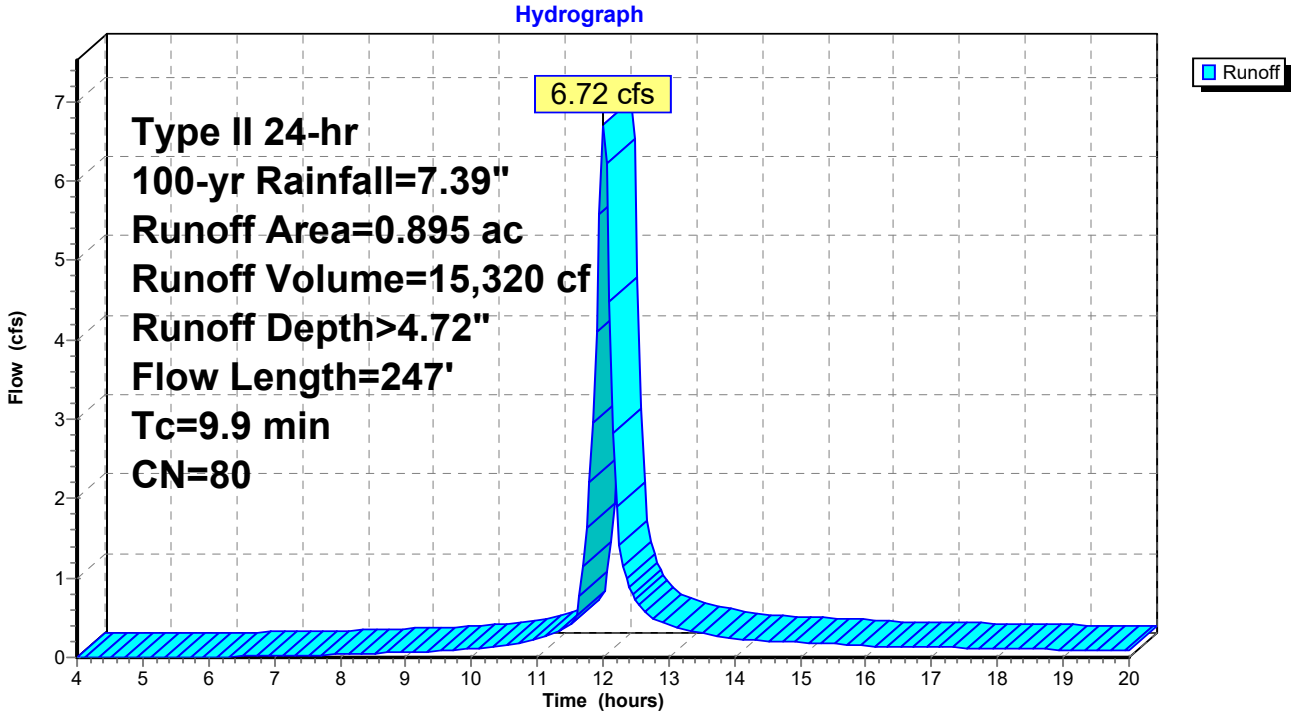
Runoff = 6.72 cfs @ 12.01 hrs, Volume= 15,320 cf, Depth> 4.72"

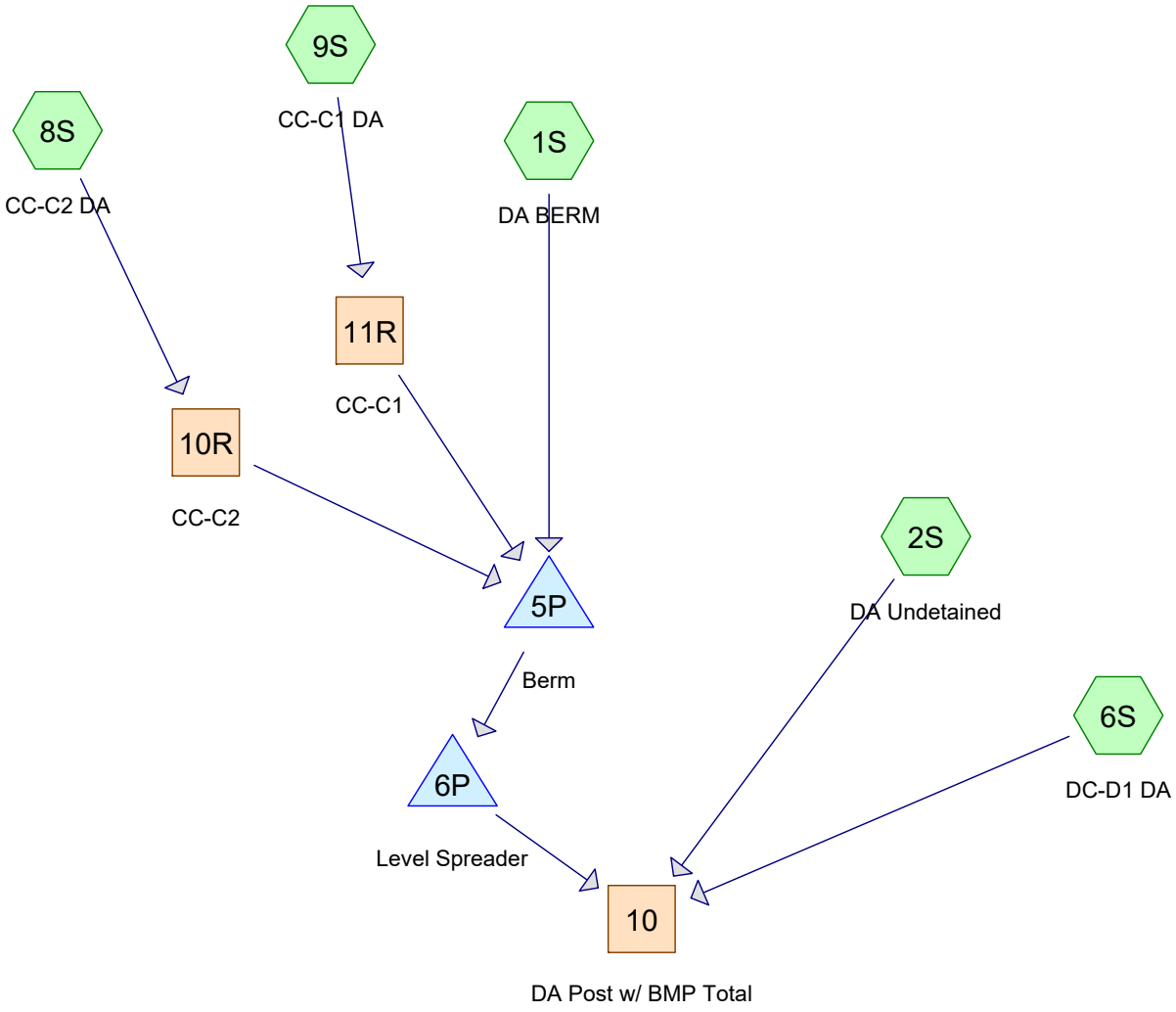
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (ac)	CN	Description
0.156	91	Gravel roads, HSG D
0.739	78	Meadow, non-grazed, HSG D
0.895	80	Weighted Average
0.895		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	33	0.2450	2.88		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.95"
1.7	147	0.0818	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	67	0.1190	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.95"
9.9	247	Total			

Subcatchment 7S: Post DA





Subcat Reach Pond Link

Routing Diagram for Zenker Post w BMP- REV3

Prepared by {enter your company name here}, Printed 7/19/2022

HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,957	91	Gravel roads, HSG D (8S, 9S)
32,034	78	Meadow, non-grazed, HSG D (1S, 2S, 6S, 8S, 9S)
38,991	**80**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
38,991	HSG D	1S, 2S, 6S, 8S, 9S
0	Other	
38,991		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	6,957	0	6,957	Gravel roads	
0	0	0	32,034	0	32,034	Meadow, non-grazed	
0	**0**	**0**	**38,991**	**0**	**38,991**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	5P	1,425.45	1,422.00	13.0	0.2654	0.010	3.0	0.0	0.0

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.13 cfs 266 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.12 cfs 257 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=0.76"
Tc=5.0 min CN=78 Runoff=0.55 cfs 1,126 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=0.97"
Tc=5.0 min CN=82 Runoff=0.27 cfs 549 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=1.42"
Tc=5.0 min CN=89 Runoff=0.36 cfs 738 cf

Reach 10: DA Post w/ BMP Total Inflow=0.67 cfs 1,413 cf
Outflow=0.67 cfs 1,413 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.09' Max Vel=1.26 fps Inflow=0.27 cfs 549 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.25 cfs 549 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.21' Max Vel=1.35 fps Inflow=0.36 cfs 738 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.34 cfs 738 cf

Pond 5P: Berm Peak Elev=1,425.46' Storage=1,012 cf Inflow=0.69 cfs 1,552 cf
Discarded=0.01 cfs 912 cf Primary=0.00 cfs 30 cf Outflow=0.02 cfs 942 cf

Pond 6P: Level Spreader Peak Elev=1,422.00' Storage=0 cf Inflow=0.00 cfs 30 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 30 cf Outflow=0.00 cfs 30 cf

Total Runoff Area = 38,991 sf Runoff Volume = 2,935 cf Average Runoff Depth = 0.90"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

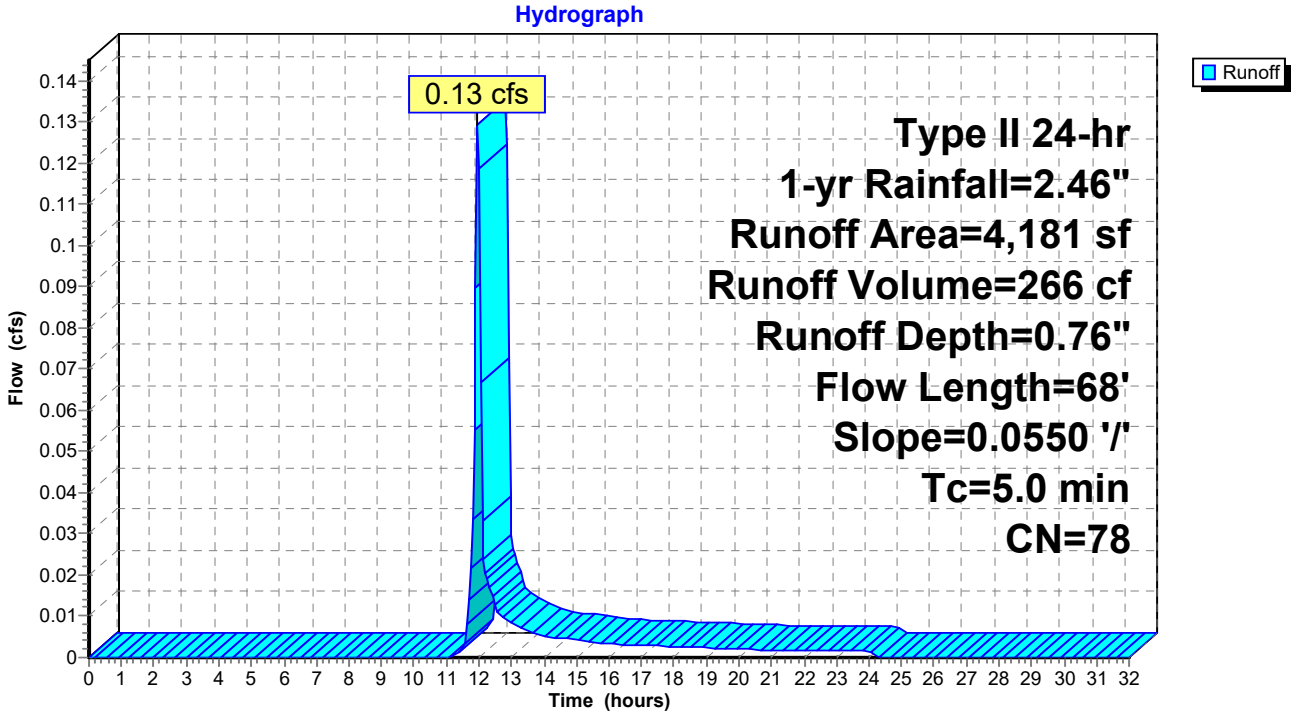
Runoff = 0.13 cfs @ 11.97 hrs, Volume= 266 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

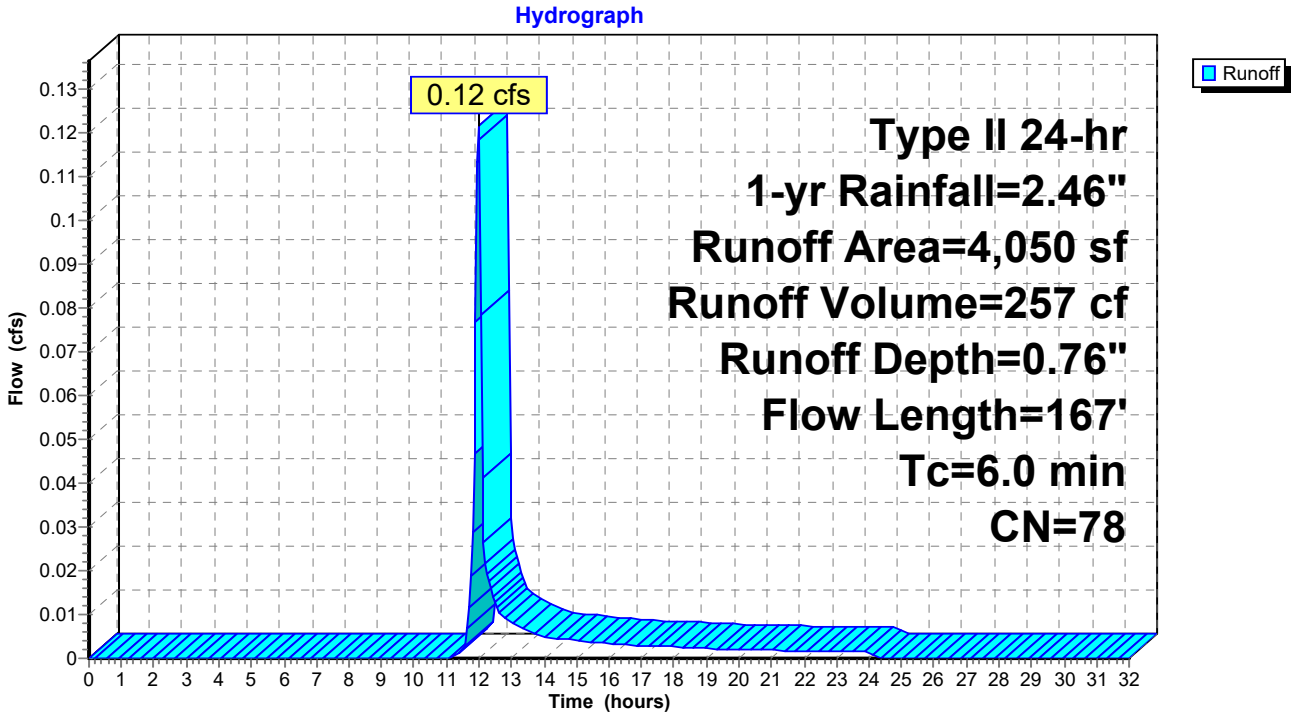
Runoff = 0.12 cfs @ 11.98 hrs, Volume= 257 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

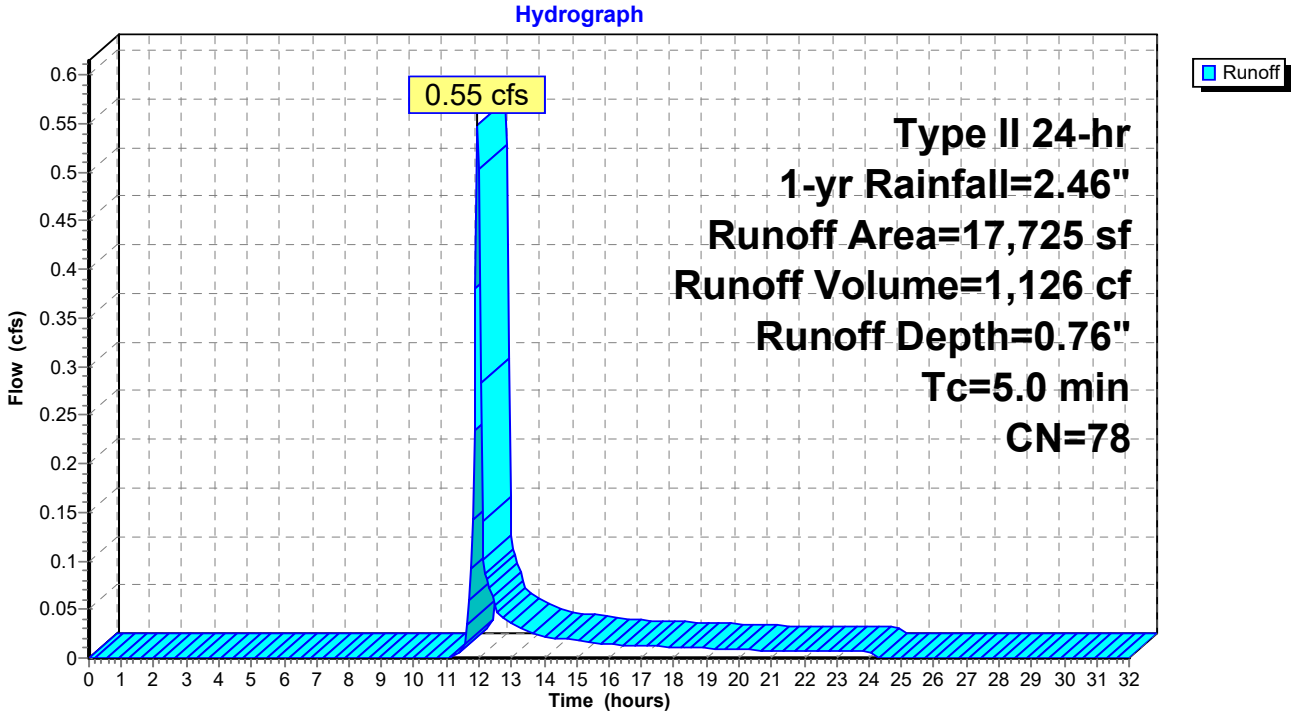
Runoff = 0.55 cfs @ 11.97 hrs, Volume= 1,126 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

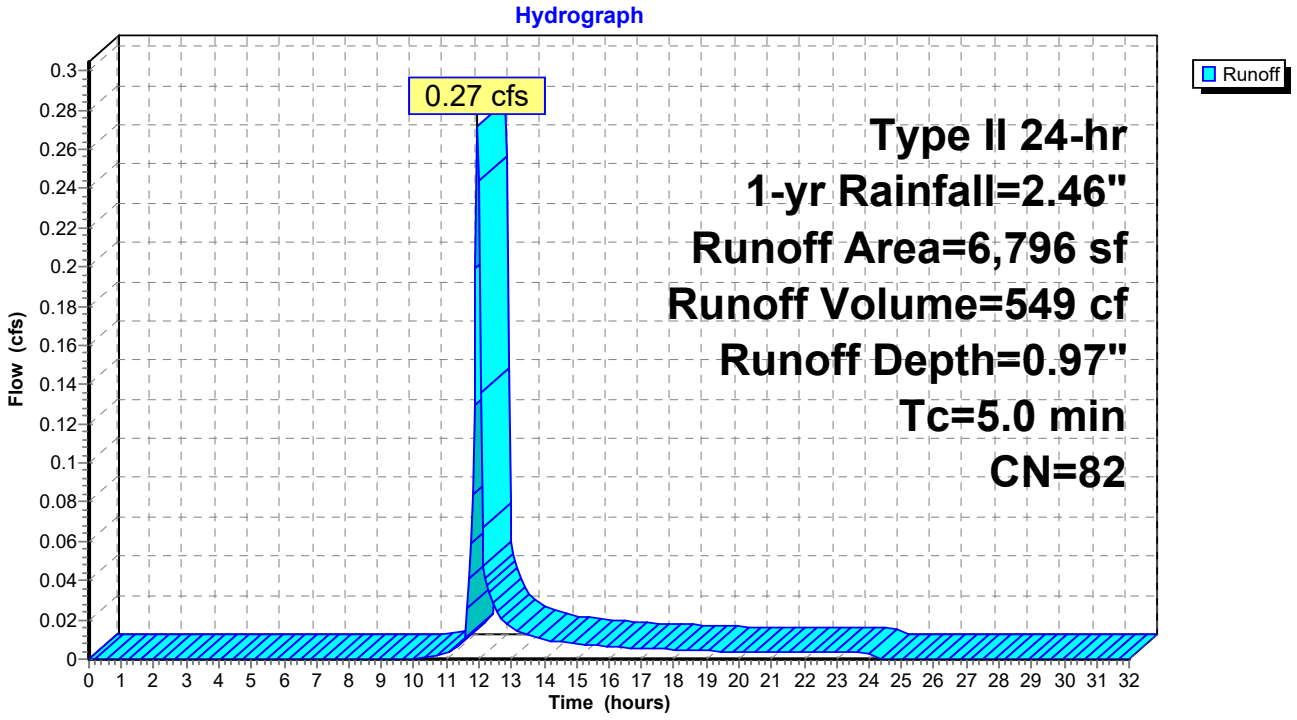
Runoff = 0.27 cfs @ 11.96 hrs, Volume= 549 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

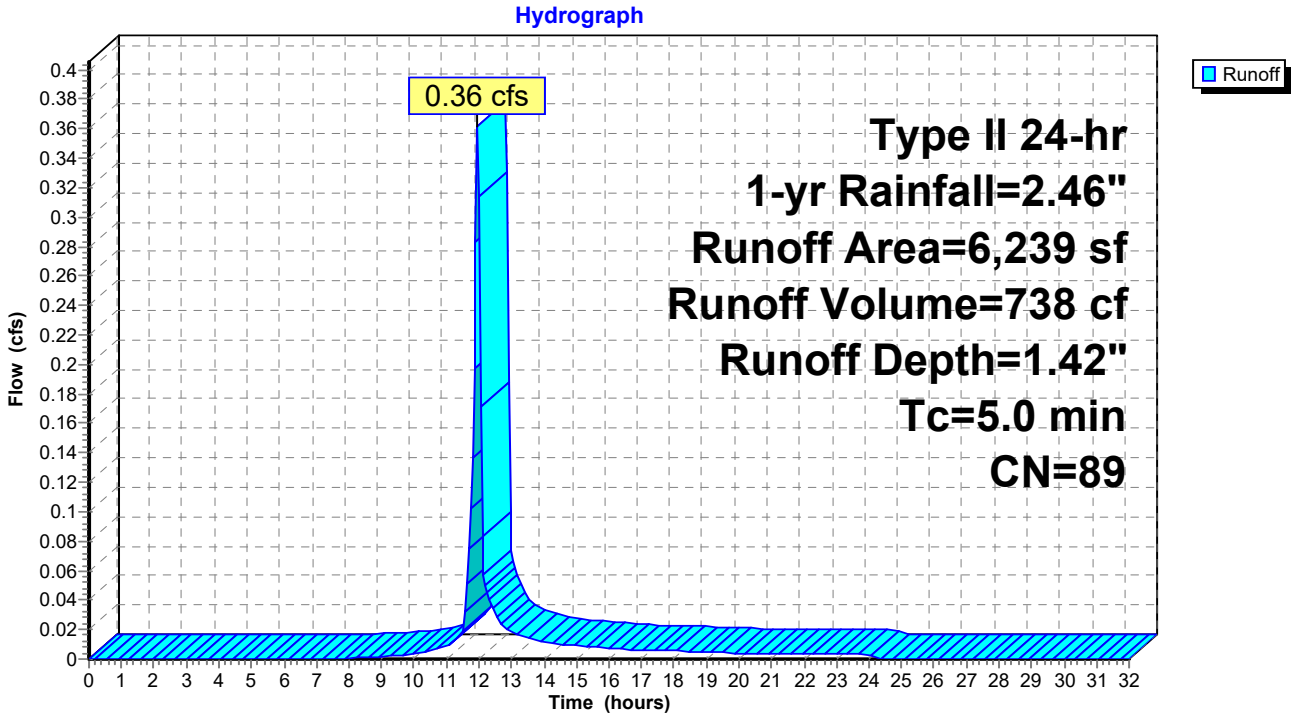
Runoff = 0.36 cfs @ 11.96 hrs, Volume= 738 cf, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



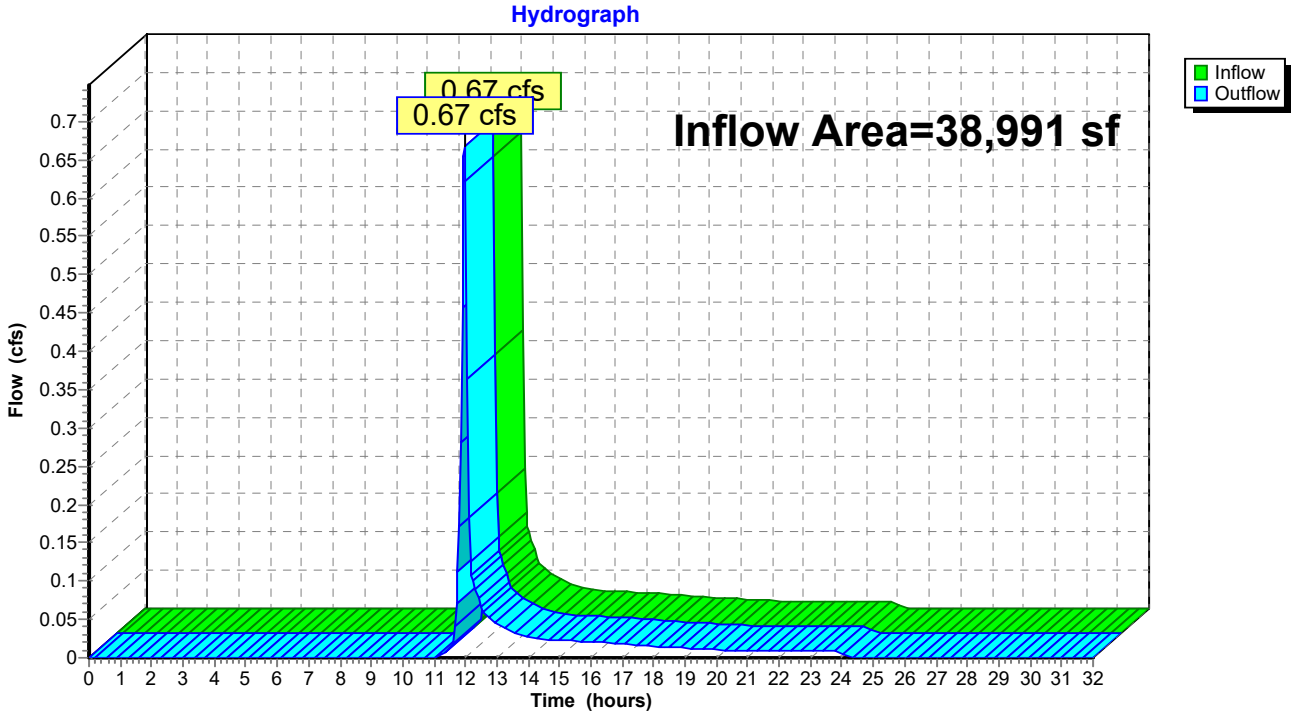
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 0.43" for 1-yr event
Inflow = 0.67 cfs @ 11.97 hrs, Volume= 1,413 cf
Outflow = 0.67 cfs @ 11.97 hrs, Volume= 1,413 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 0.97" for 1-yr event
Inflow = 0.27 cfs @ 11.96 hrs, Volume= 549 cf
Outflow = 0.25 cfs @ 12.03 hrs, Volume= 549 cf, Atten= 8%, Lag= 4.2 min

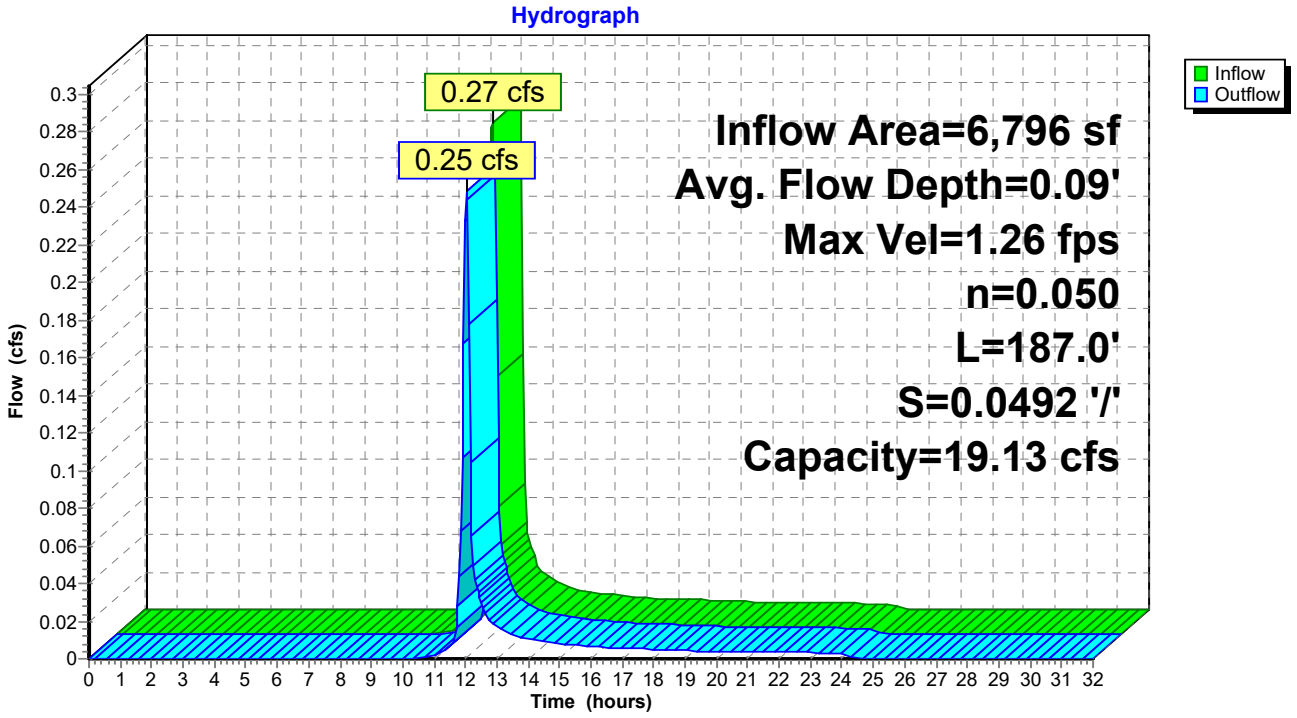
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.26 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 8.8 min

Peak Storage= 38 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



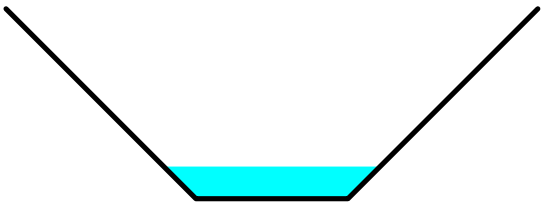
Summary for Reach 11R: CC-C1

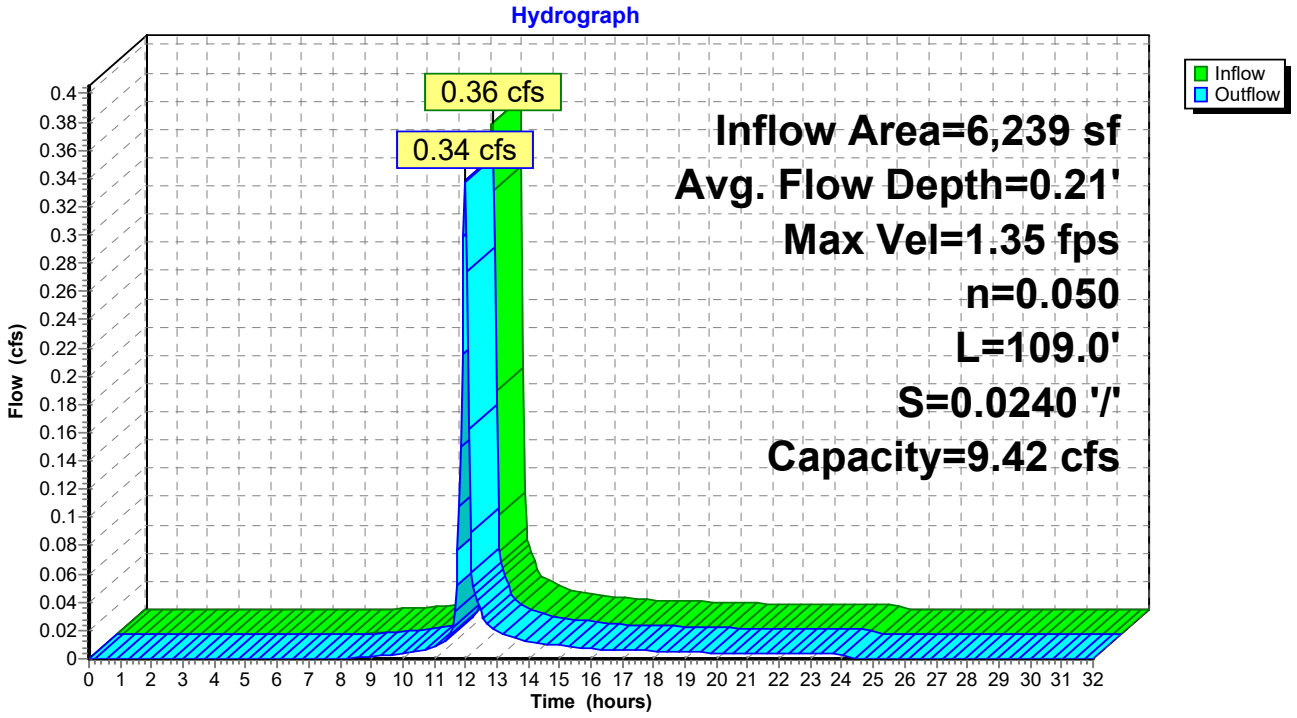
Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 1.42" for 1-yr event
Inflow = 0.36 cfs @ 11.96 hrs, Volume= 738 cf
Outflow = 0.34 cfs @ 11.99 hrs, Volume= 738 cf, Atten= 7%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.35 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 5.3 min

Peak Storage= 28 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'





Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.08" for 1-yr event
Inflow = 0.69 cfs @ 12.00 hrs, Volume= 1,552 cf
Outflow = 0.02 cfs @ 16.03 hrs, Volume= 942 cf, Atten= 98%, Lag= 241.9 min
Discarded = 0.01 cfs @ 16.03 hrs, Volume= 912 cf
Primary = 0.00 cfs @ 16.03 hrs, Volume= 30 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.46' @ 16.03 hrs Surf.Area= 1,454 sf Storage= 1,012 cf

Plug-Flow detention time= 550.3 min calculated for 941 cf (61% of inflow)
Center-of-Mass det. time= 430.9 min (1,271.2 - 840.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

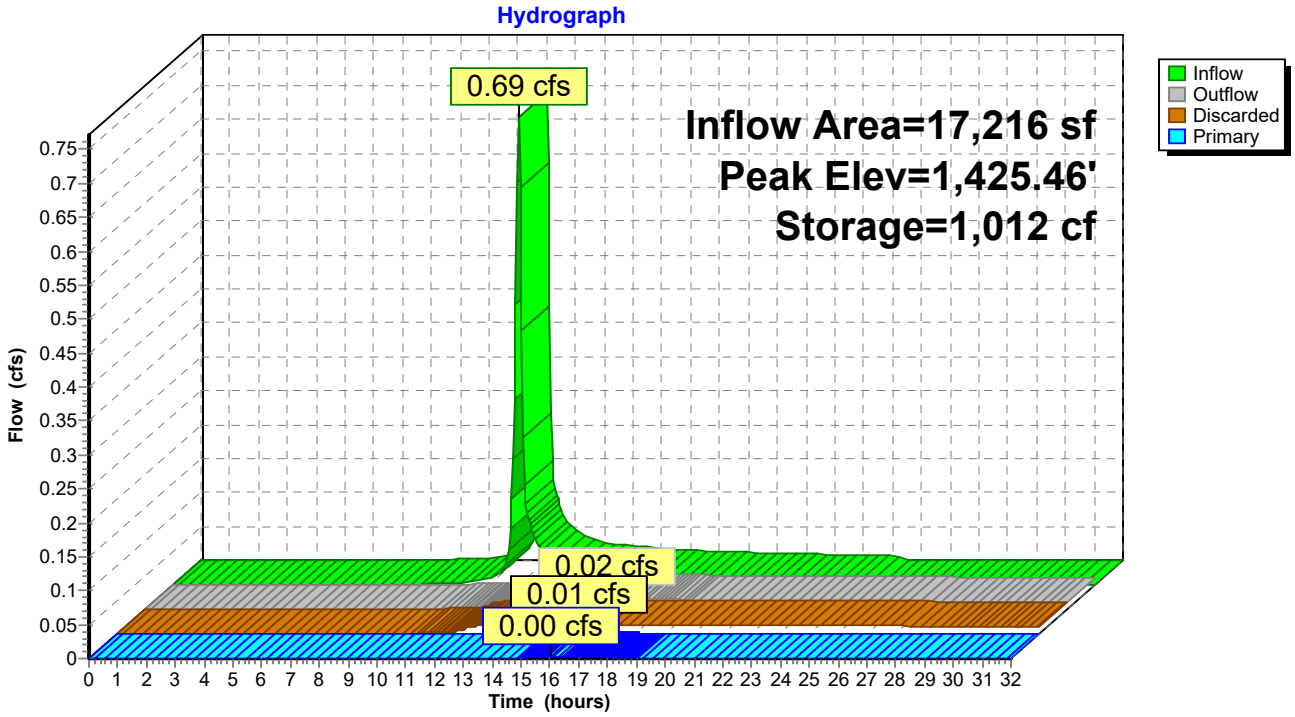
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.01 cfs @ 16.03 hrs HW=1,425.46' (Free Discharge)
└**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,425.46' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.00 cfs @ 0.28 fps)

Pond 5P: Berm


Hydrograph
0.69 cfs
0.02 cfs
0.01 cfs
0.00 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.46'
Storage=1,012 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Summary for Pond 6P: Level Spreader

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 0.02" for 1-yr event
Inflow = 0.00 cfs @ 16.03 hrs, Volume= 30 cf
Outflow = 0.00 cfs @ 16.03 hrs, Volume= 30 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 16.03 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 16.03 hrs, Volume= 30 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.00' @ 16.03 hrs Surf.Area= 35 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 30 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (997.8 - 997.8)

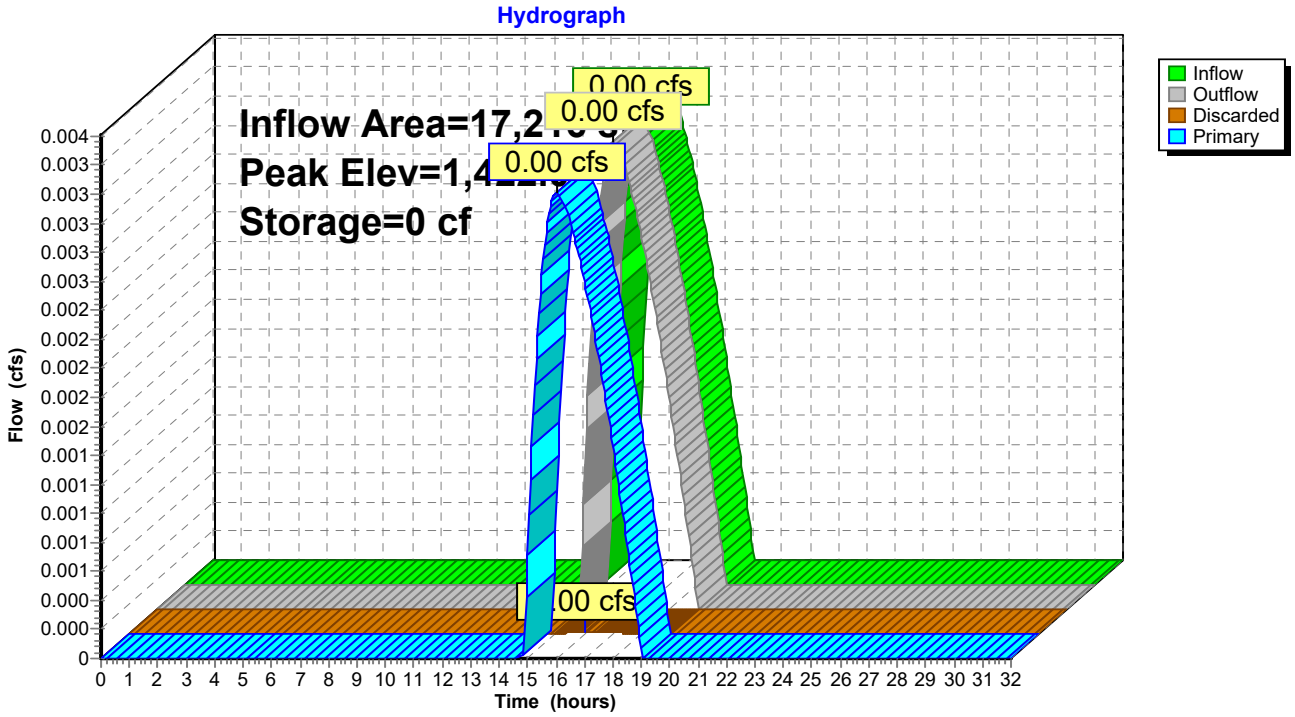
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,422.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,422.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.05 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=1.09"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.19 cfs 381 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=1.09"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.18 cfs 369 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=1.09"
Tc=5.0 min CN=78 Runoff=0.80 cfs 1,615 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=1.34"
Tc=5.0 min CN=82 Runoff=0.38 cfs 759 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=1.85"
Tc=5.0 min CN=89 Runoff=0.47 cfs 964 cf

Reach 10: DA Post w/ BMP Total Inflow=0.97 cfs 2,482 cf
Outflow=0.97 cfs 2,482 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.11' Max Vel=1.42 fps Inflow=0.38 cfs 759 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.34 cfs 759 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.25' Max Vel=1.46 fps Inflow=0.47 cfs 964 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.44 cfs 964 cf

Pond 5P: Berm Peak Elev=1,425.52' Storage=1,095 cf Inflow=0.94 cfs 2,104 cf
Discarded=0.01 cfs 961 cf Primary=0.07 cfs 499 cf Outflow=0.09 cfs 1,460 cf

Pond 6P: Level Spreader Peak Elev=1,422.01' Storage=0 cf Inflow=0.07 cfs 499 cf
Discarded=0.00 cfs 1 cf Primary=0.07 cfs 498 cf Outflow=0.07 cfs 499 cf

Total Runoff Area = 38,991 sf Runoff Volume = 4,088 cf Average Runoff Depth = 1.26"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

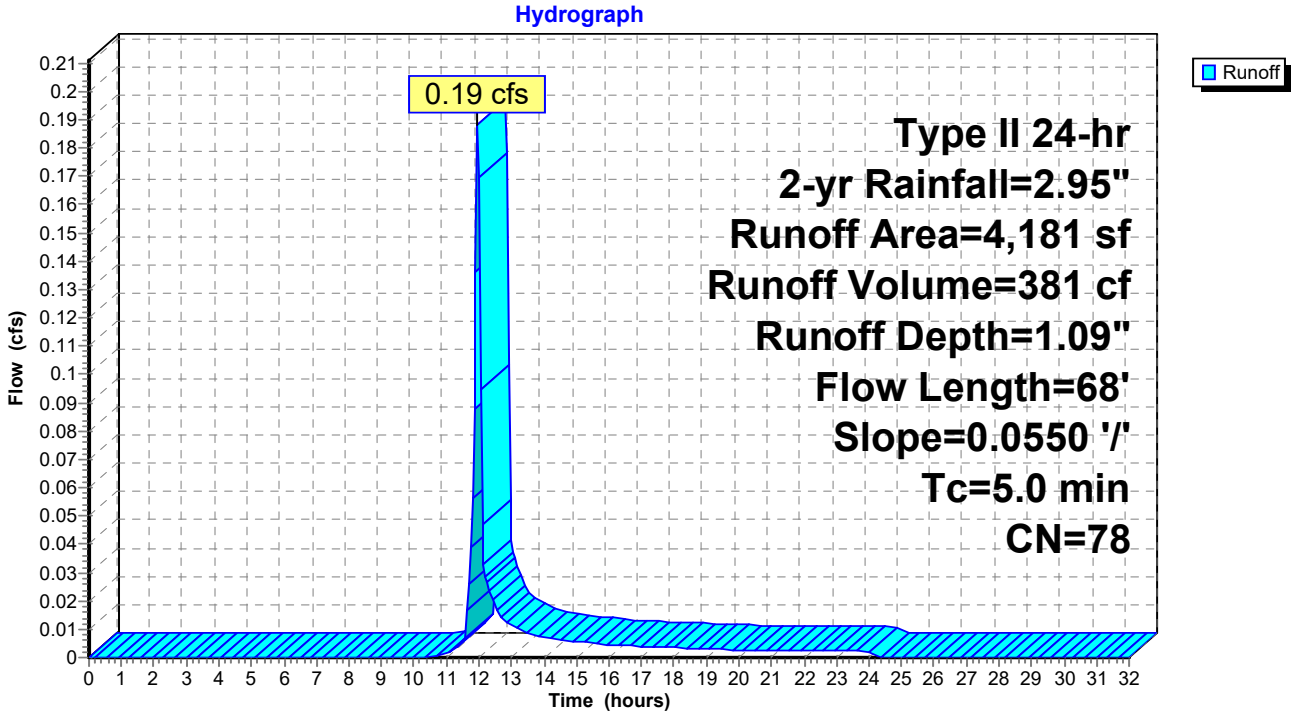
Runoff = 0.19 cfs @ 11.96 hrs, Volume= 381 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

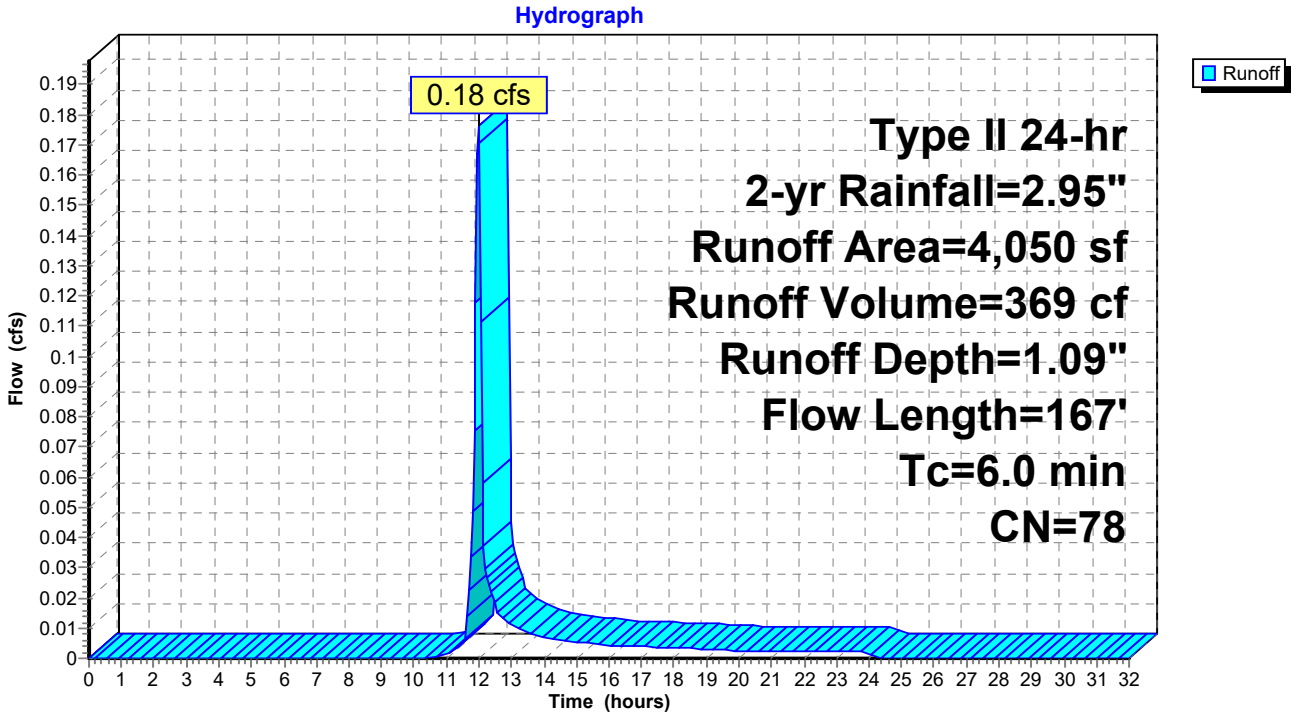
Runoff = 0.18 cfs @ 11.98 hrs, Volume= 369 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

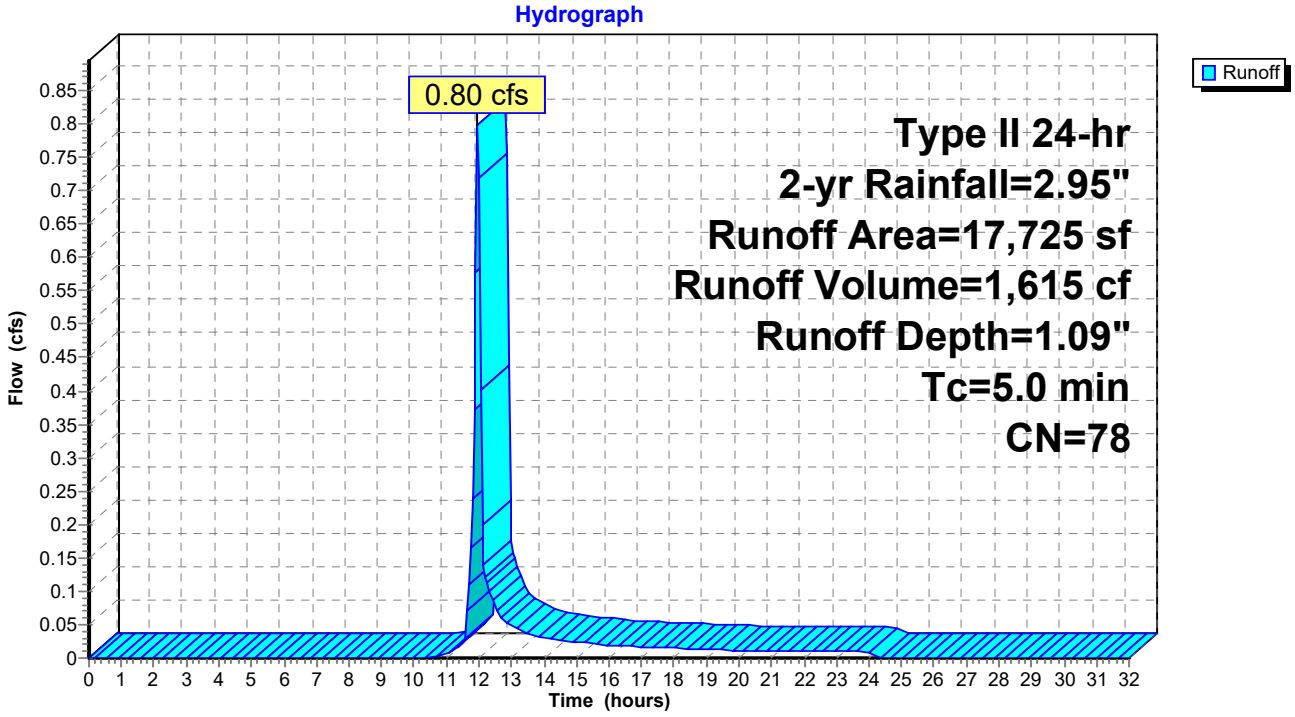
Runoff = 0.80 cfs @ 11.96 hrs, Volume= 1,615 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

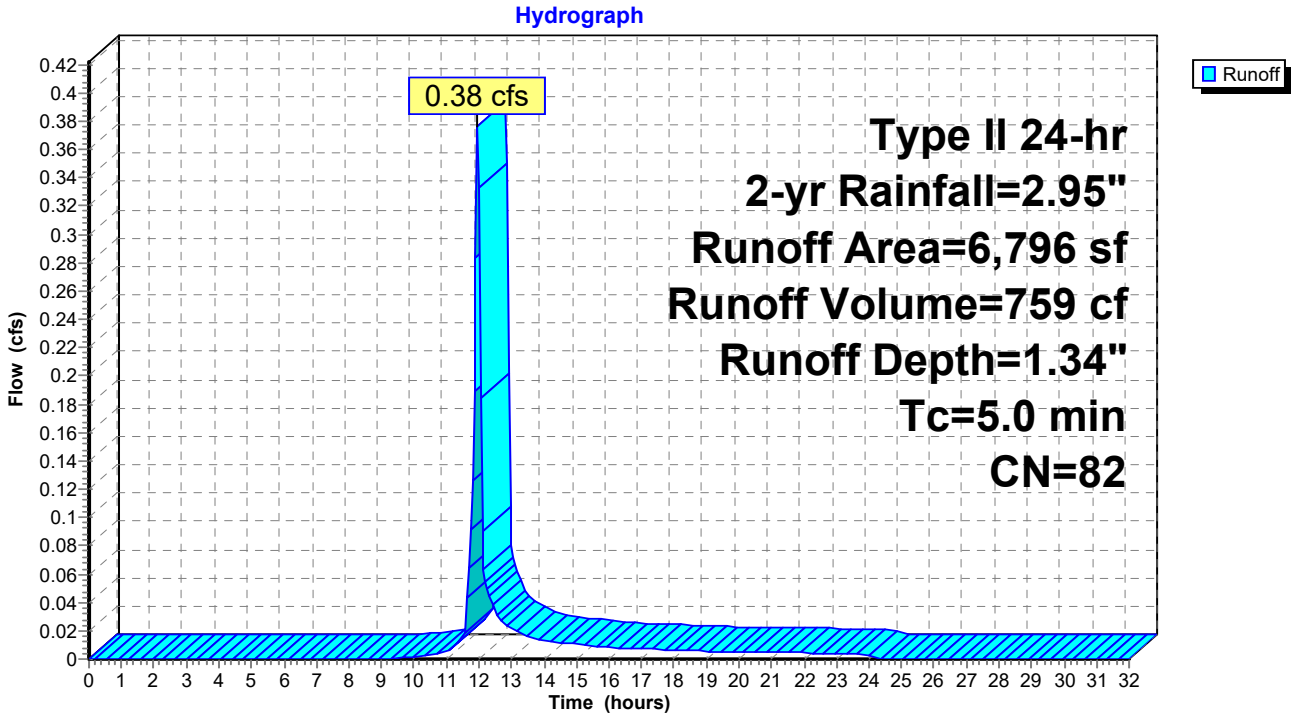
Runoff = 0.38 cfs @ 11.96 hrs, Volume= 759 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

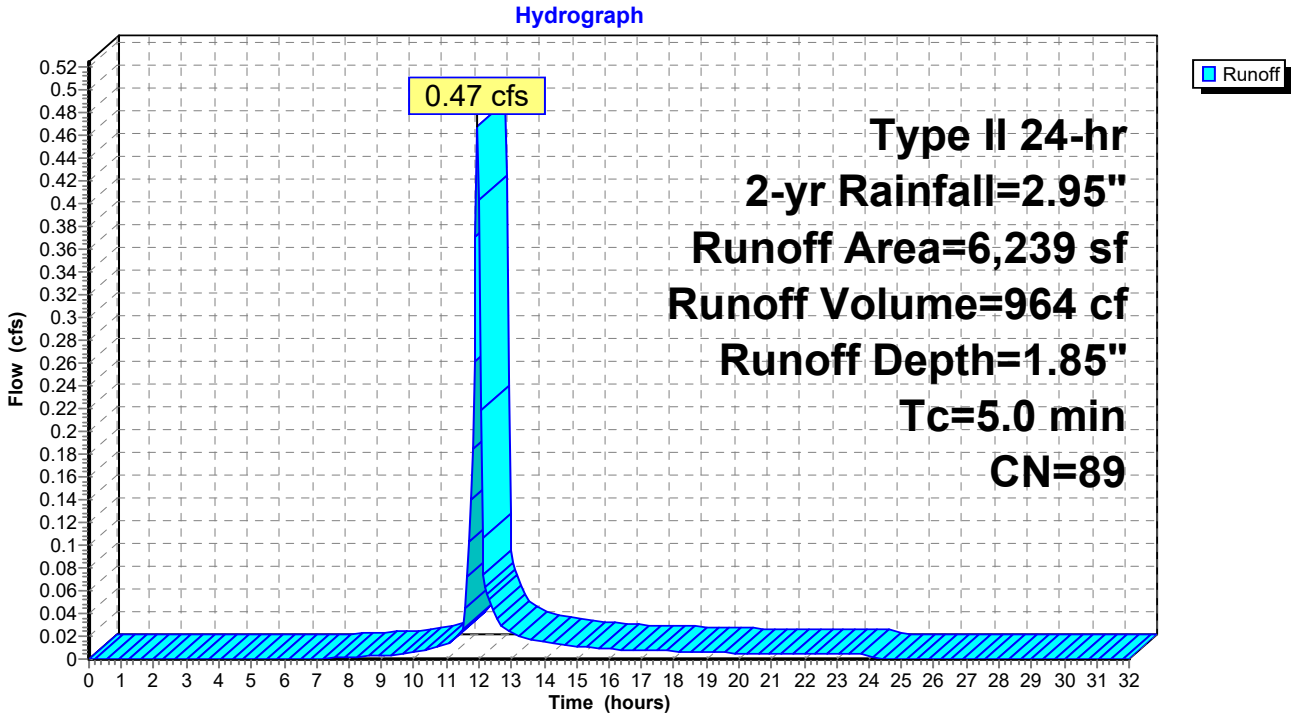
Runoff = 0.47 cfs @ 11.95 hrs, Volume= 964 cf, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



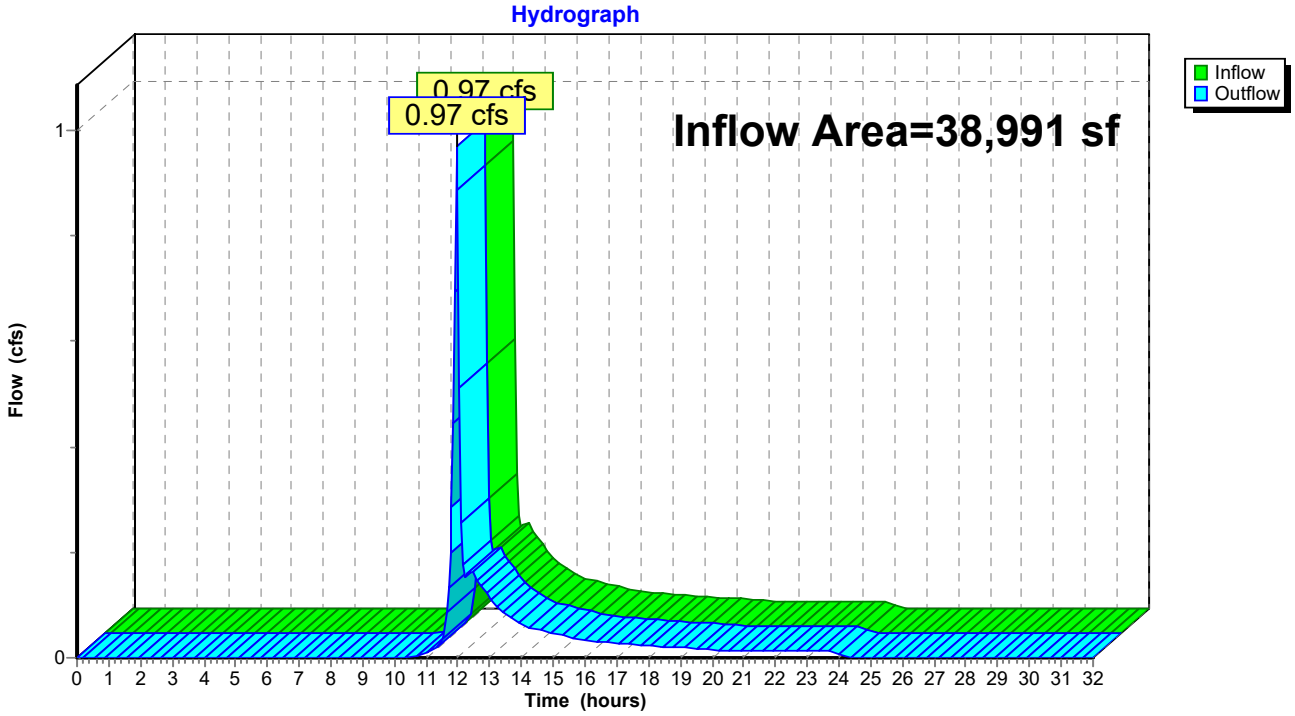
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 0.76" for 2-yr event
Inflow = 0.97 cfs @ 11.96 hrs, Volume= 2,482 cf
Outflow = 0.97 cfs @ 11.96 hrs, Volume= 2,482 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 1.34" for 2-yr event
Inflow = 0.38 cfs @ 11.96 hrs, Volume= 759 cf
Outflow = 0.34 cfs @ 12.02 hrs, Volume= 759 cf, Atten= 9%, Lag= 3.7 min

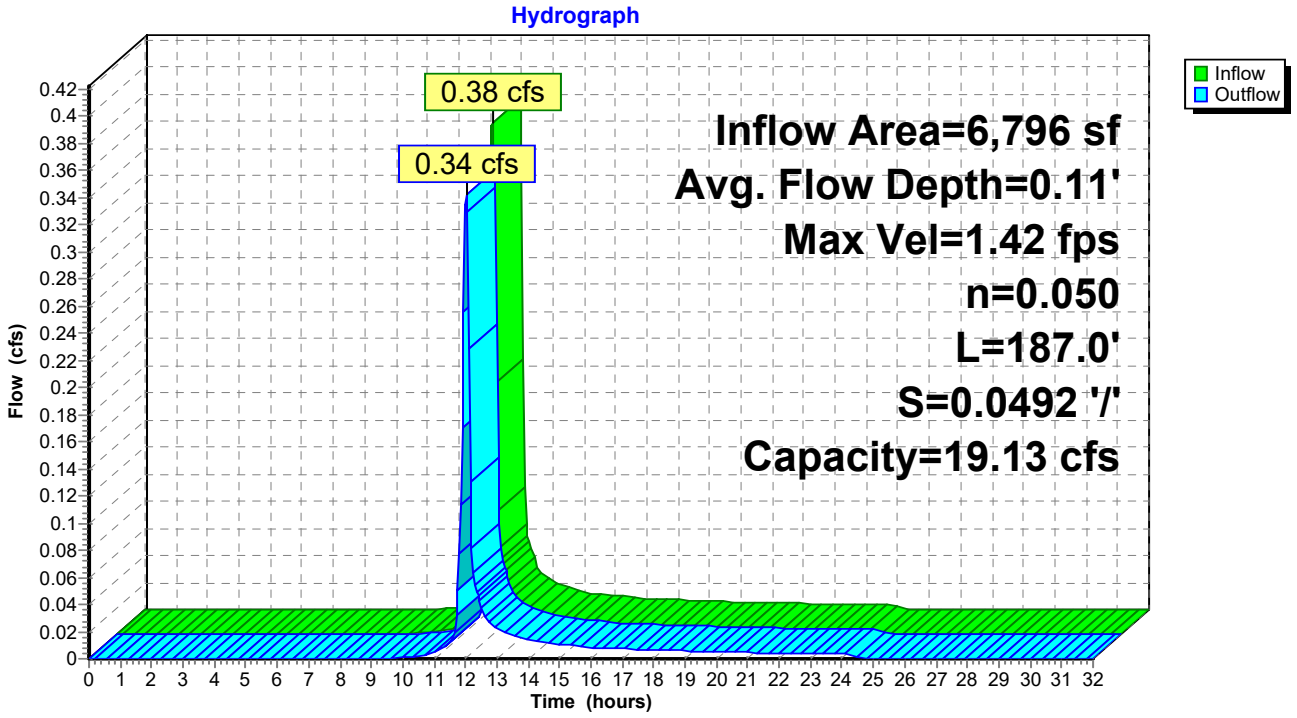
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.42 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 8.4 min

Peak Storage= 47 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



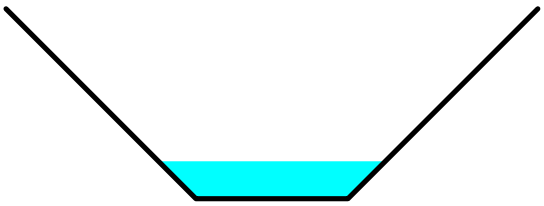
Summary for Reach 11R: CC-C1

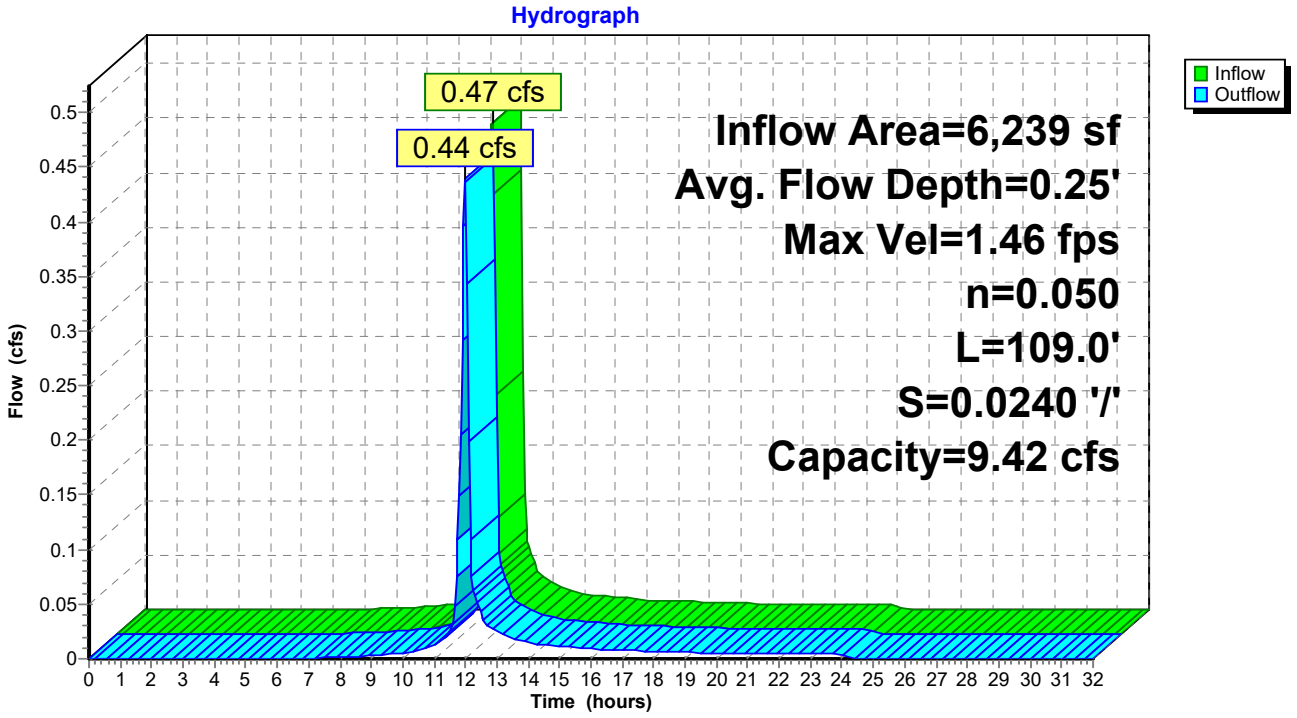
Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 1.85" for 2-yr event
Inflow = 0.47 cfs @ 11.95 hrs, Volume= 964 cf
Outflow = 0.44 cfs @ 11.99 hrs, Volume= 964 cf, Atten= 6%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.46 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 4.9 min

Peak Storage= 33 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'





Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.47" for 2-yr event
Inflow = 0.94 cfs @ 11.99 hrs, Volume= 2,104 cf
Outflow = 0.09 cfs @ 12.57 hrs, Volume= 1,460 cf, Atten= 91%, Lag= 34.8 min
Discarded = 0.01 cfs @ 12.57 hrs, Volume= 961 cf
Primary = 0.07 cfs @ 12.57 hrs, Volume= 499 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.52' @ 12.57 hrs Surf.Area= 1,544 sf Storage= 1,095 cf

Plug-Flow detention time= 401.1 min calculated for 1,460 cf (69% of inflow)
Center-of-Mass det. time= 294.5 min (1,126.1 - 831.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

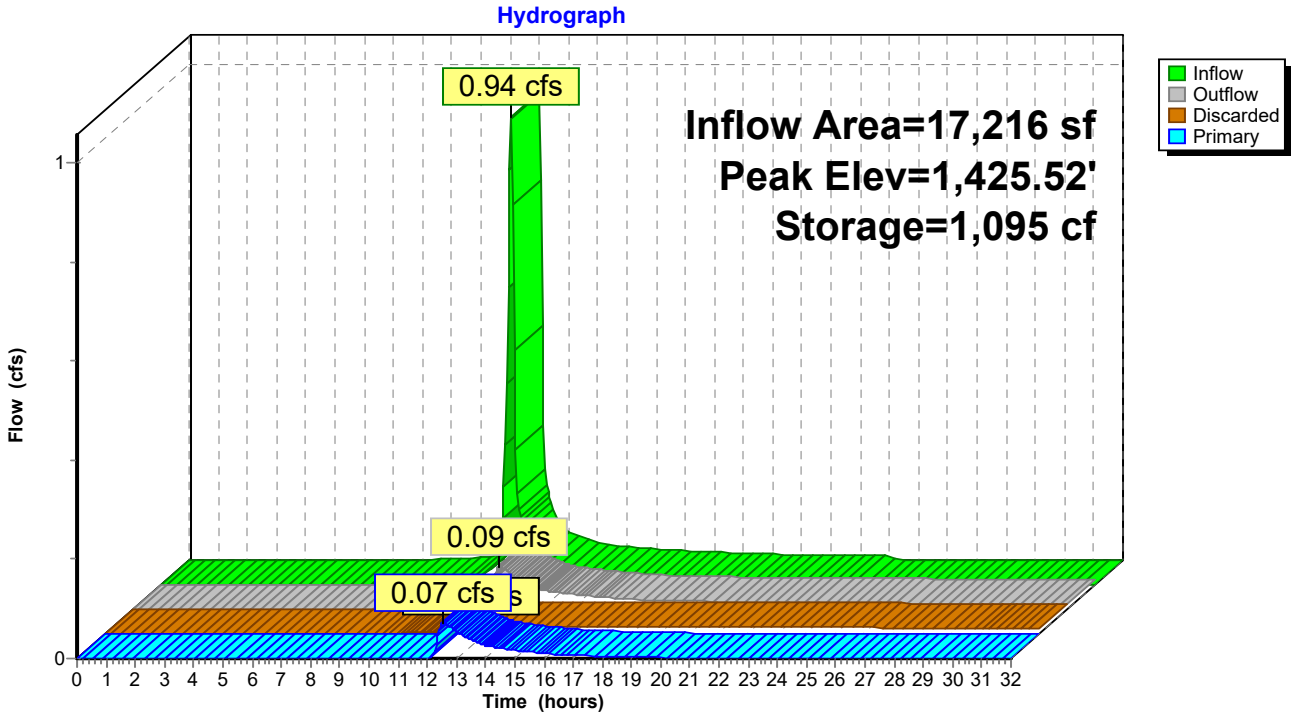
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.01 cfs @ 12.57 hrs HW=1,425.52' (Free Discharge)
└**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.07 cfs @ 12.57 hrs HW=1,425.52' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.07 cfs @ 0.69 fps)

Pond 5P: Berm


Hydrograph
0.94 cfs
0.09 cfs
0.07 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.52'
Storage=1,095 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.01'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 0.35" for 2-yr event
Inflow = 0.07 cfs @ 12.57 hrs, Volume= 499 cf
Outflow = 0.07 cfs @ 12.58 hrs, Volume= 499 cf, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.58 hrs, Volume= 1 cf
Primary = 0.07 cfs @ 12.58 hrs, Volume= 498 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.01' @ 12.58 hrs Surf.Area= 35 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 498 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (850.2 - 850.1)

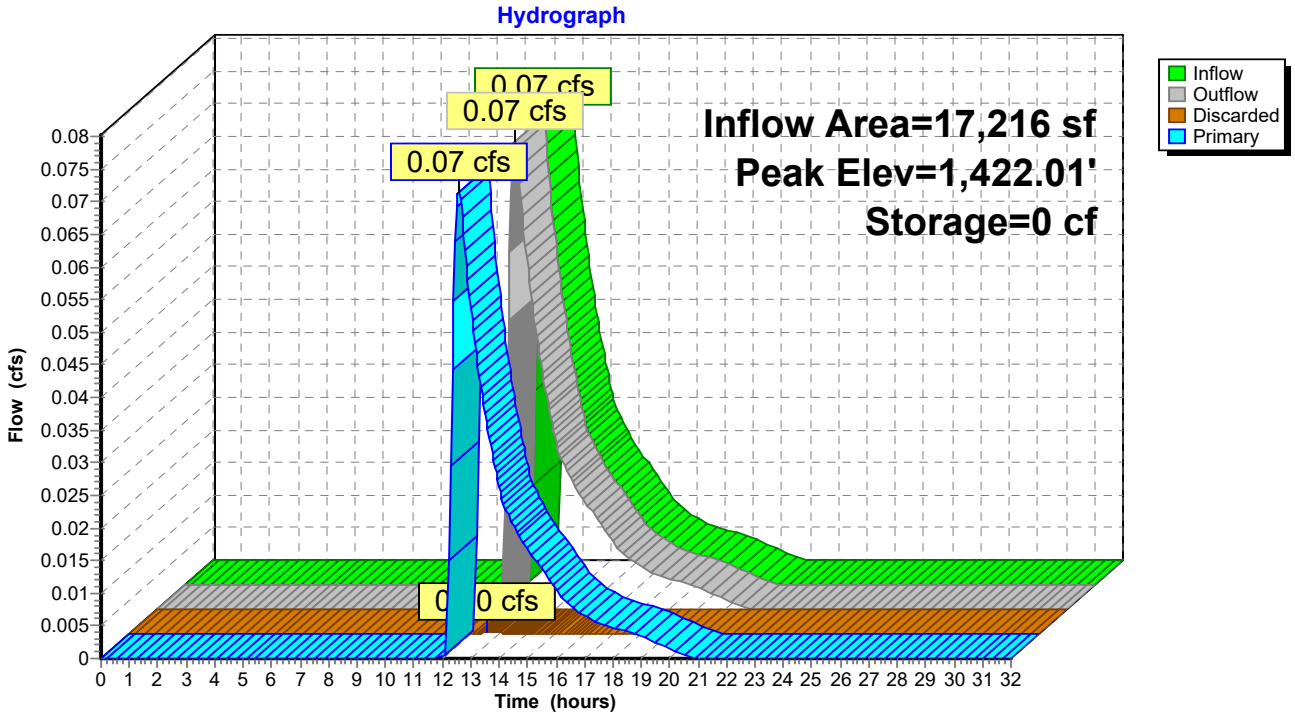
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.58 hrs HW=1,422.01' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.06 cfs @ 12.58 hrs HW=1,422.01' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.23 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.37 cfs 742 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.34 cfs 718 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=2.13"
Tc=5.0 min CN=78 Runoff=1.56 cfs 3,144 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=2.46"
Tc=5.0 min CN=82 Runoff=0.68 cfs 1,394 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=3.11"
Tc=5.0 min CN=89 Runoff=0.76 cfs 1,615 cf

Reach 10: DA Post w/ BMP Total Inflow=2.21 cfs 5,910 cf
Outflow=2.21 cfs 5,910 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.16' Max Vel=1.74 fps Inflow=0.68 cfs 1,394 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.63 cfs 1,394 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.33' Max Vel=1.70 fps Inflow=0.76 cfs 1,615 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.72 cfs 1,615 cf

Pond 5P: Berm Peak Elev=1,425.75' Storage=1,502 cf Inflow=1.68 cfs 3,750 cf
Discarded=0.02 cfs 1,024 cf Primary=0.78 cfs 2,051 cf Outflow=0.80 cfs 3,074 cf

Pond 6P: Level Spreader Peak Elev=1,422.04' Storage=1 cf Inflow=0.78 cfs 2,051 cf
Discarded=0.00 cfs 3 cf Primary=0.78 cfs 2,047 cf Outflow=0.78 cfs 2,051 cf

Total Runoff Area = 38,991 sf Runoff Volume = 7,613 cf Average Runoff Depth = 2.34"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

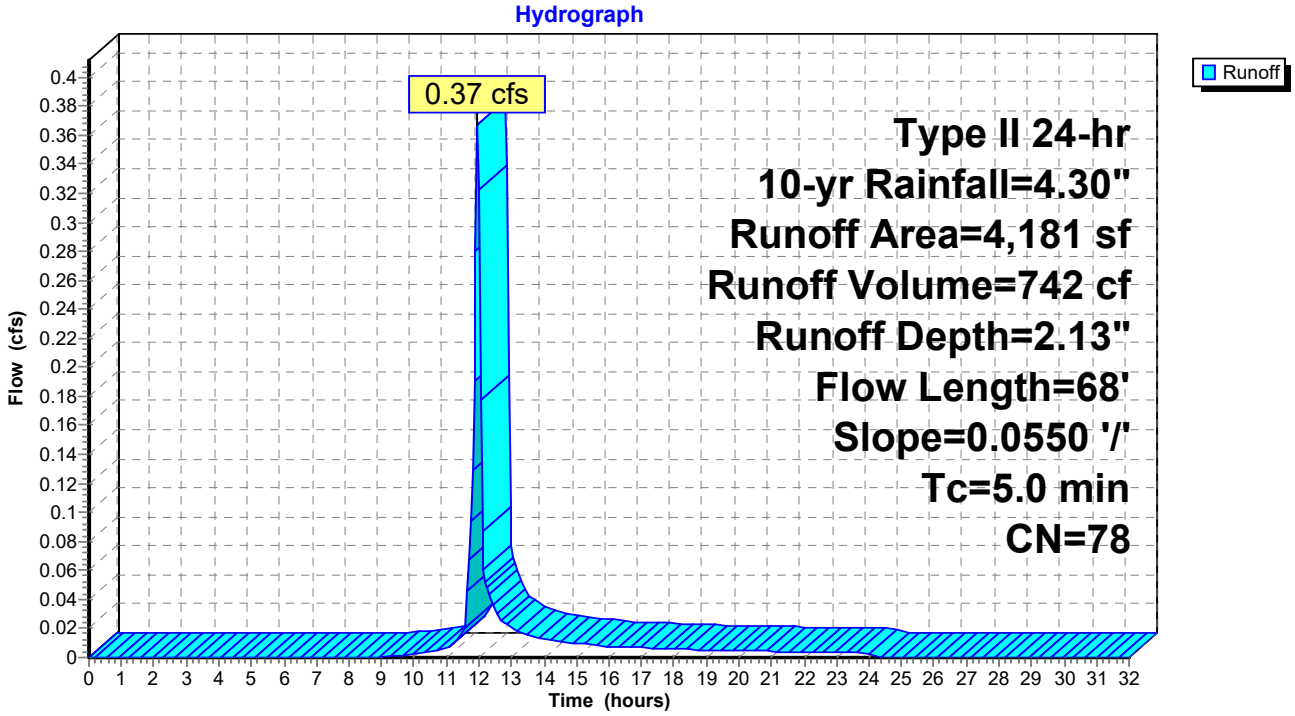
Runoff = 0.37 cfs @ 11.96 hrs, Volume= 742 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

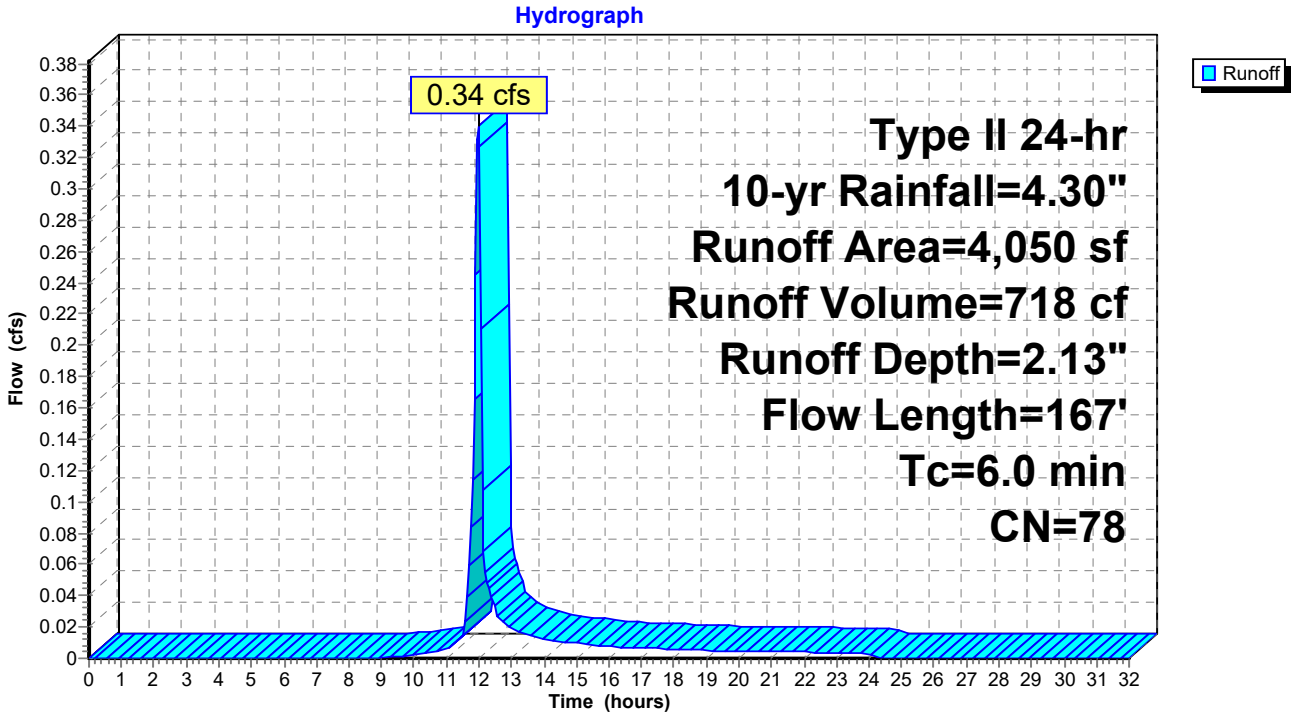
Runoff = 0.34 cfs @ 11.97 hrs, Volume= 718 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

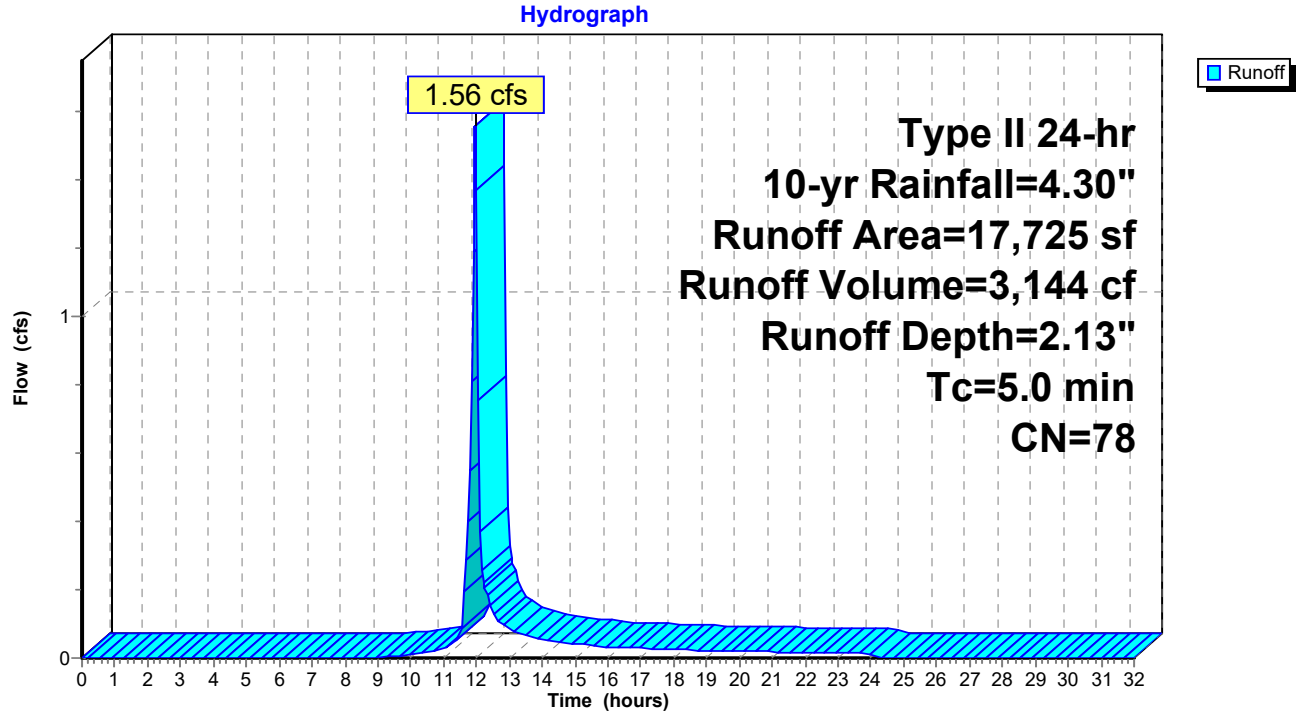
Runoff = 1.56 cfs @ 11.96 hrs, Volume= 3,144 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

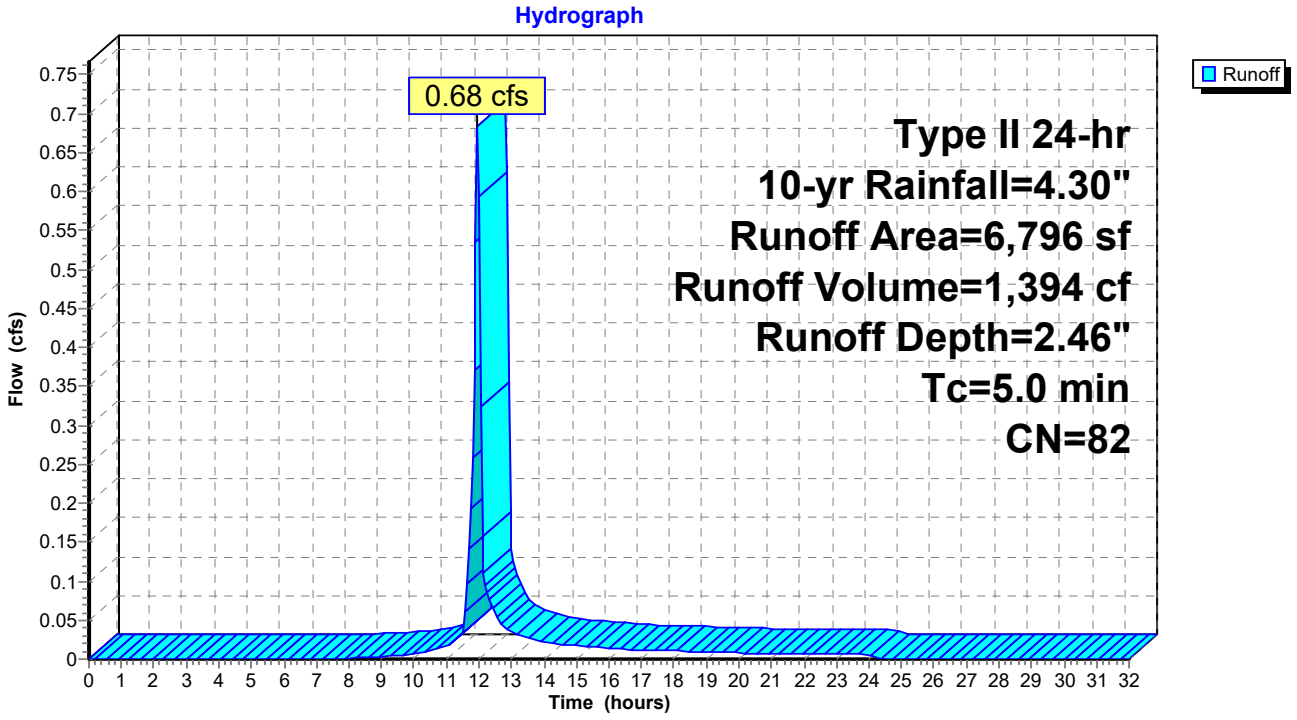
Runoff = 0.68 cfs @ 11.96 hrs, Volume= 1,394 cf, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

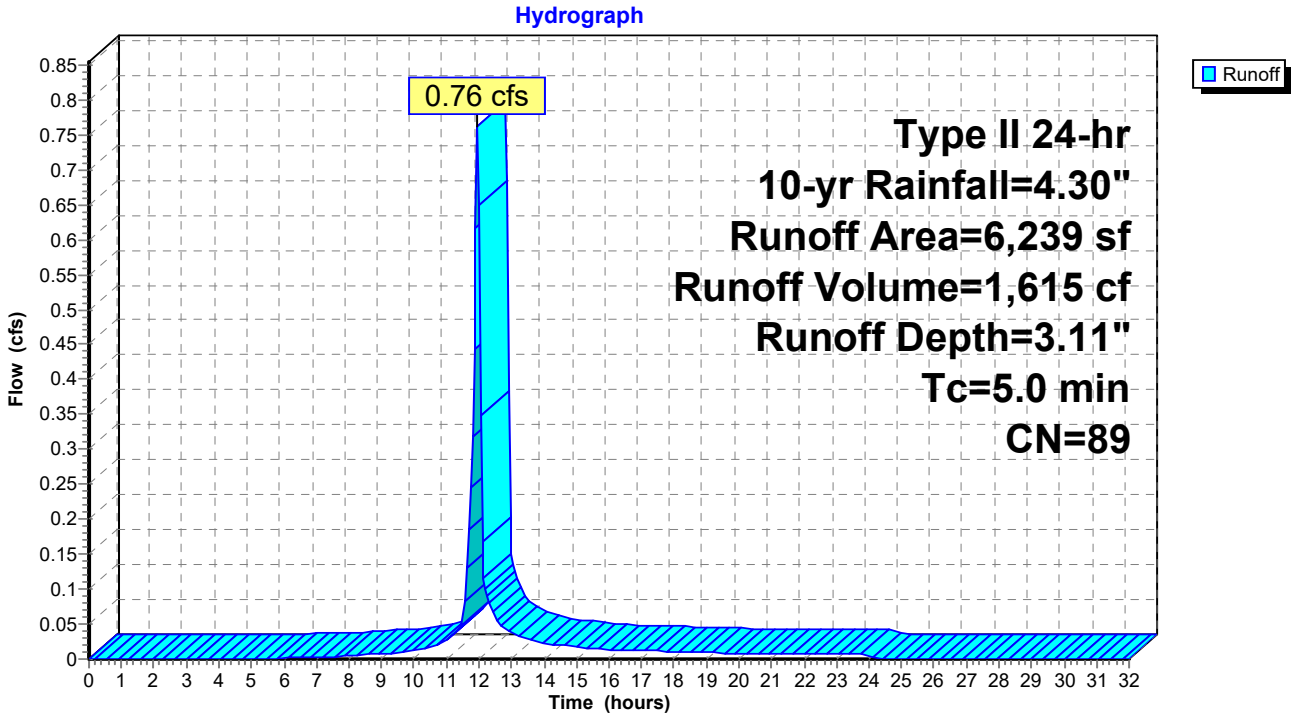
Runoff = 0.76 cfs @ 11.95 hrs, Volume= 1,615 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



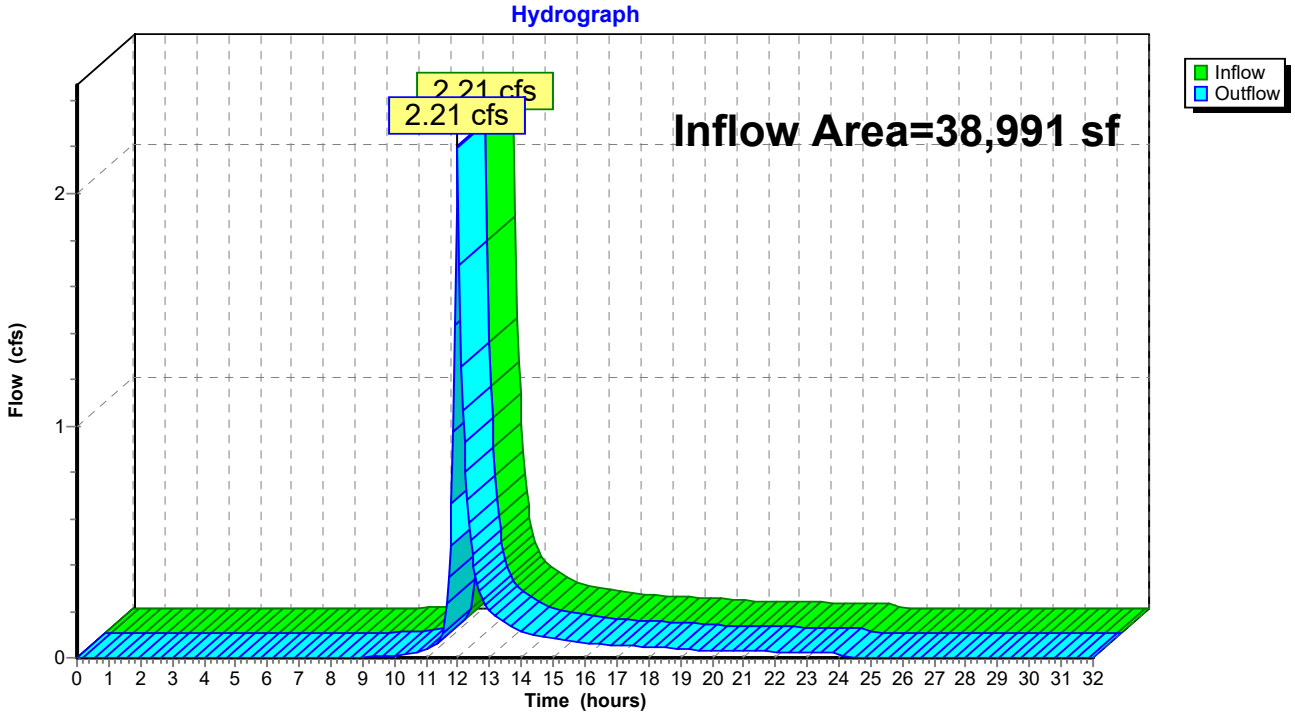
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 1.82" for 10-yr event
Inflow = 2.21 cfs @ 11.99 hrs, Volume= 5,910 cf
Outflow = 2.21 cfs @ 11.99 hrs, Volume= 5,910 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 2.46" for 10-yr event
Inflow = 0.68 cfs @ 11.96 hrs, Volume= 1,394 cf
Outflow = 0.63 cfs @ 12.01 hrs, Volume= 1,394 cf, Atten= 8%, Lag= 2.9 min

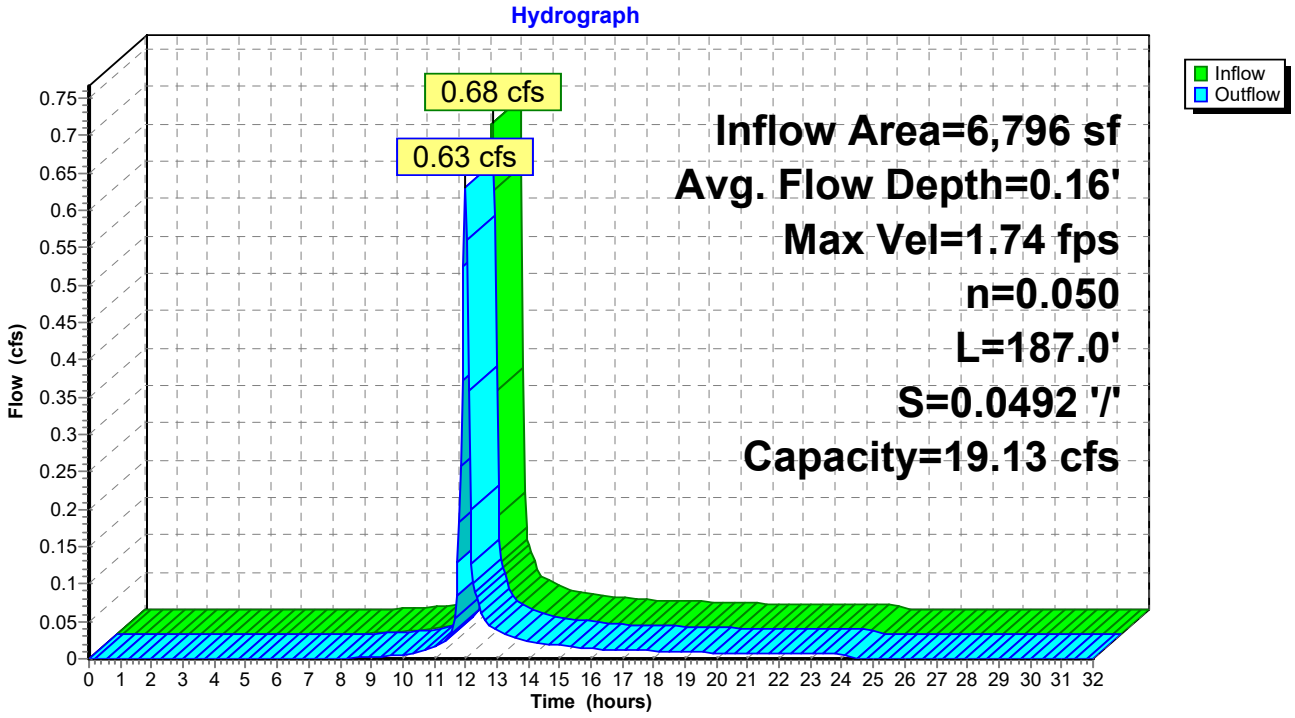
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.74 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 7.4 min

Peak Storage= 70 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



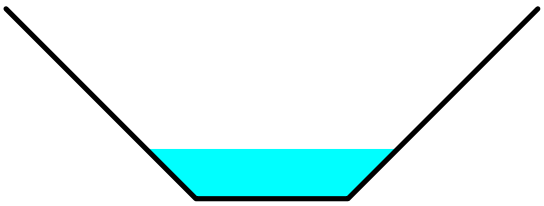
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 0.76 cfs @ 11.95 hrs, Volume= 1,615 cf
Outflow = 0.72 cfs @ 11.98 hrs, Volume= 1,615 cf, Atten= 6%, Lag= 1.8 min

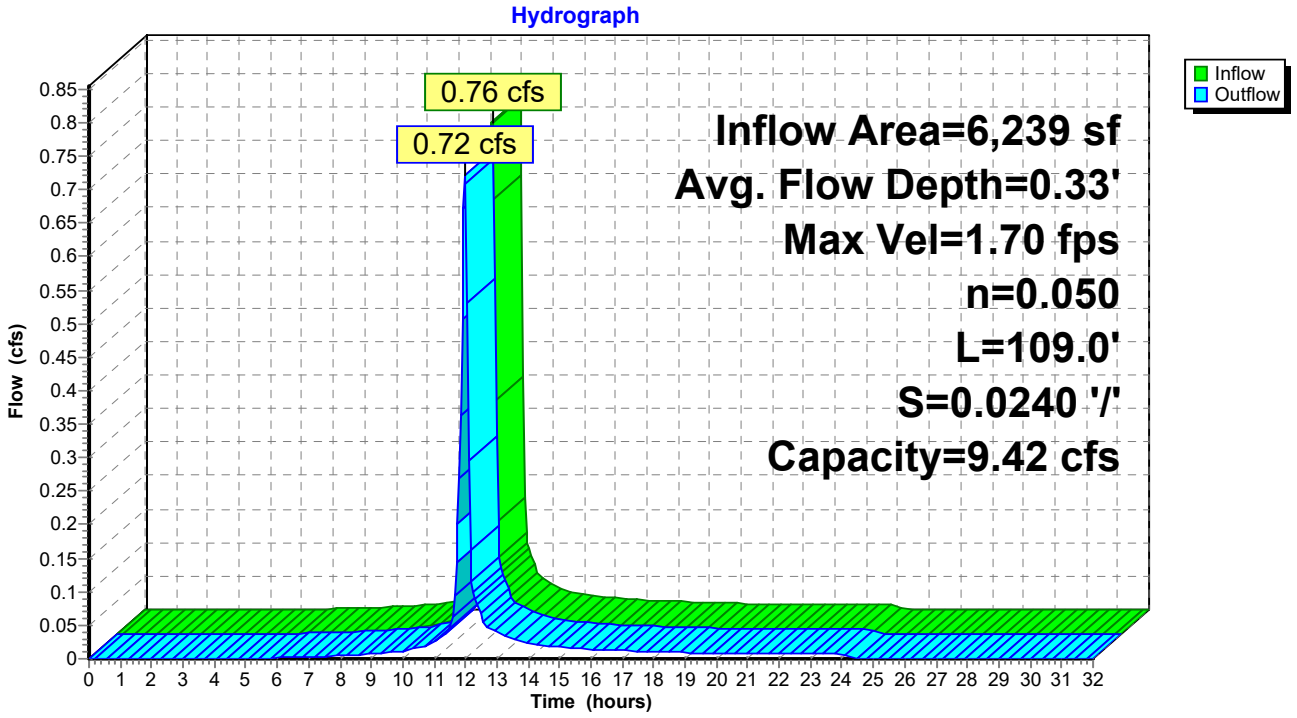
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 4.3 min

Peak Storage= 47 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 2.61" for 10-yr event
Inflow = 1.68 cfs @ 11.99 hrs, Volume= 3,750 cf
Outflow = 0.80 cfs @ 12.10 hrs, Volume= 3,074 cf, Atten= 52%, Lag= 7.0 min
Discarded = 0.02 cfs @ 12.10 hrs, Volume= 1,024 cf
Primary = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.75' @ 12.10 hrs Surf.Area= 1,930 sf Storage= 1,502 cf

Plug-Flow detention time= 225.2 min calculated for 3,069 cf (82% of inflow)
Center-of-Mass det. time= 148.2 min (963.3 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

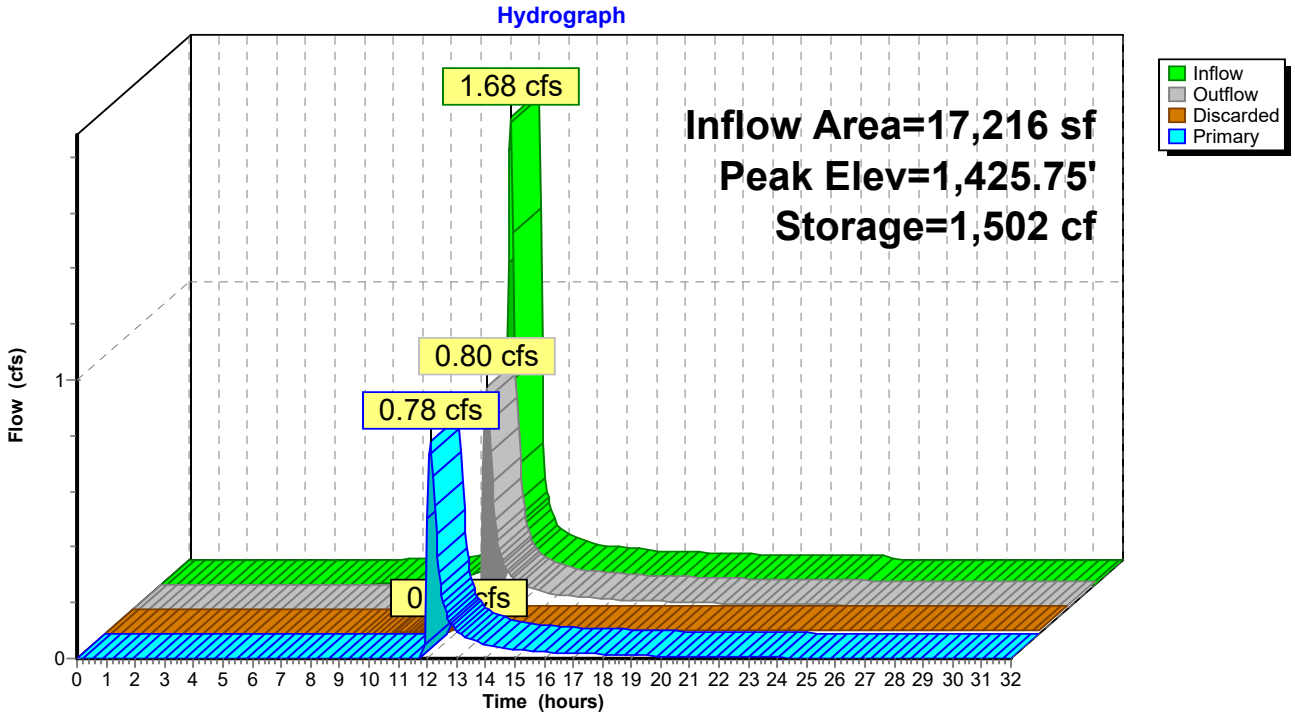
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.10 hrs HW=1,425.75' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.78 cfs @ 12.10 hrs HW=1,425.75' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.78 cfs @ 1.59 fps)

Pond 5P: Berm


Hydrograph
1.68 cfs
0.80 cfs
0.78 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.75'
Storage=1,502 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.04'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.43" for 10-yr event
Inflow = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf
Outflow = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.10 hrs, Volume= 3 cf
Primary = 0.78 cfs @ 12.10 hrs, Volume= 2,047 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.04' @ 12.10 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 2,047 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (822.0 - 822.0)

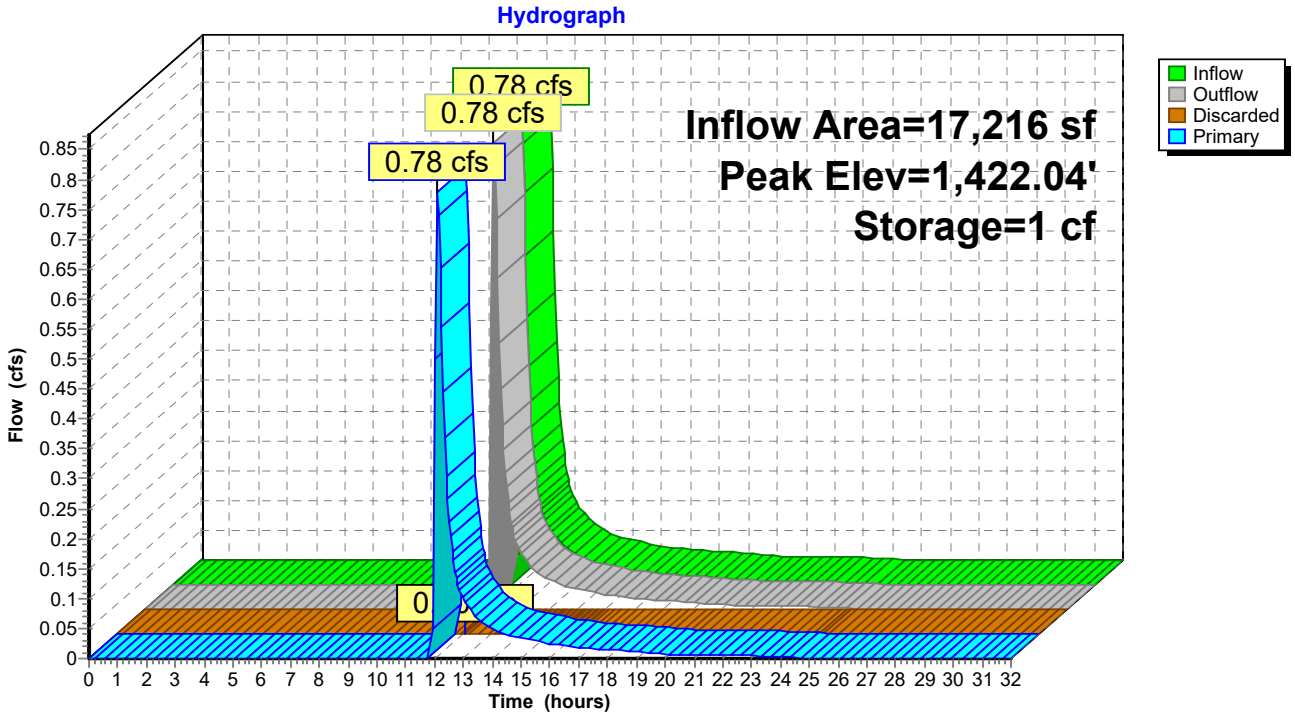
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.10 hrs HW=1,422.04' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.78 cfs @ 12.10 hrs HW=1,422.04' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.78 cfs @ 0.54 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=2.99"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.51 cfs 1,040 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=2.99"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.47 cfs 1,008 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=2.99"
Tc=5.0 min CN=78 Runoff=2.17 cfs 4,410 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=3.37"
Tc=5.0 min CN=82 Runoff=0.92 cfs 1,907 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=4.08"
Tc=5.0 min CN=89 Runoff=0.99 cfs 2,121 cf

Reach 10: DA Post w/ BMP Total Inflow=3.48 cfs 8,737 cf
Outflow=3.48 cfs 8,737 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.19' Max Vel=1.92 fps Inflow=0.92 cfs 1,907 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.86 cfs 1,907 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.38' Max Vel=1.83 fps Inflow=0.99 cfs 2,121 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.93 cfs 2,121 cf

Pond 5P: Berm Peak Elev=1,425.94' Storage=1,888 cf Inflow=2.26 cfs 5,068 cf
Discarded=0.02 cfs 1,061 cf Primary=1.12 cfs 3,324 cf Outflow=1.14 cfs 4,385 cf

Pond 6P: Level Spreader Peak Elev=1,422.05' Storage=1 cf Inflow=1.12 cfs 3,324 cf
Discarded=0.00 cfs 4 cf Primary=1.12 cfs 3,319 cf Outflow=1.12 cfs 3,324 cf

Total Runoff Area = 38,991 sf Runoff Volume = 10,485 cf Average Runoff Depth = 3.23"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

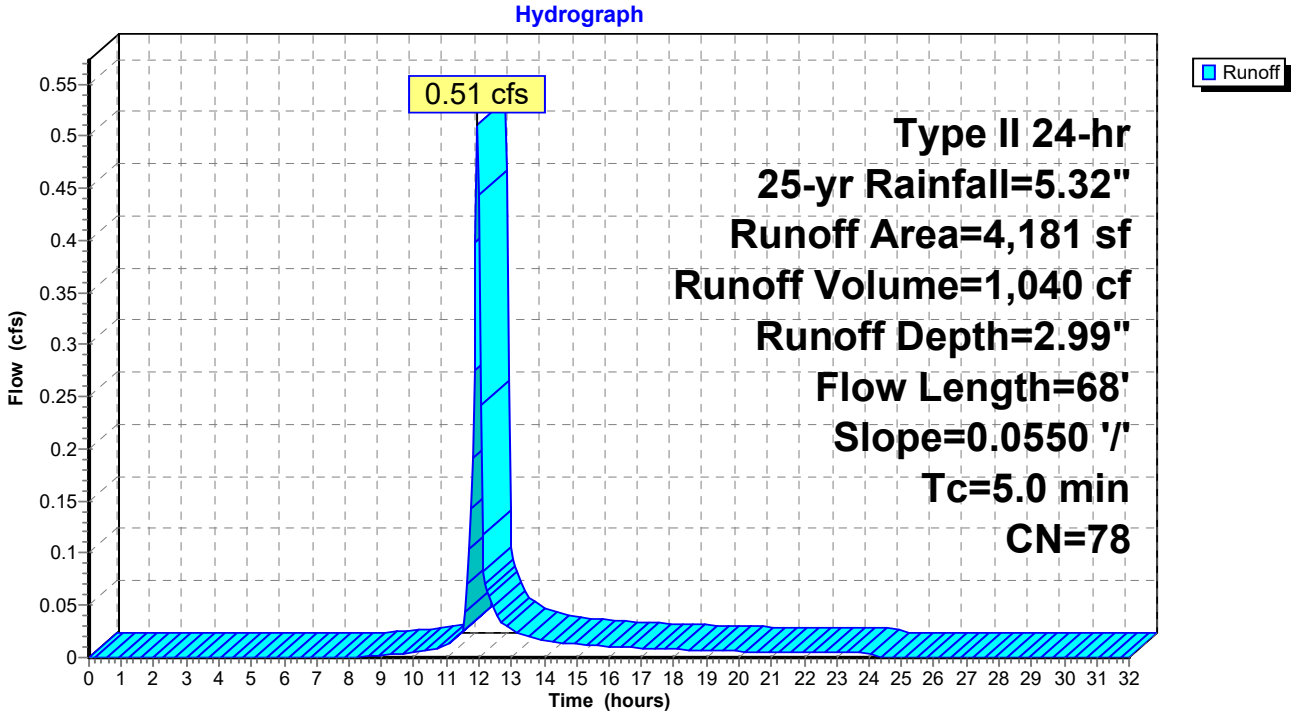
Runoff = 0.51 cfs @ 11.96 hrs, Volume= 1,040 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

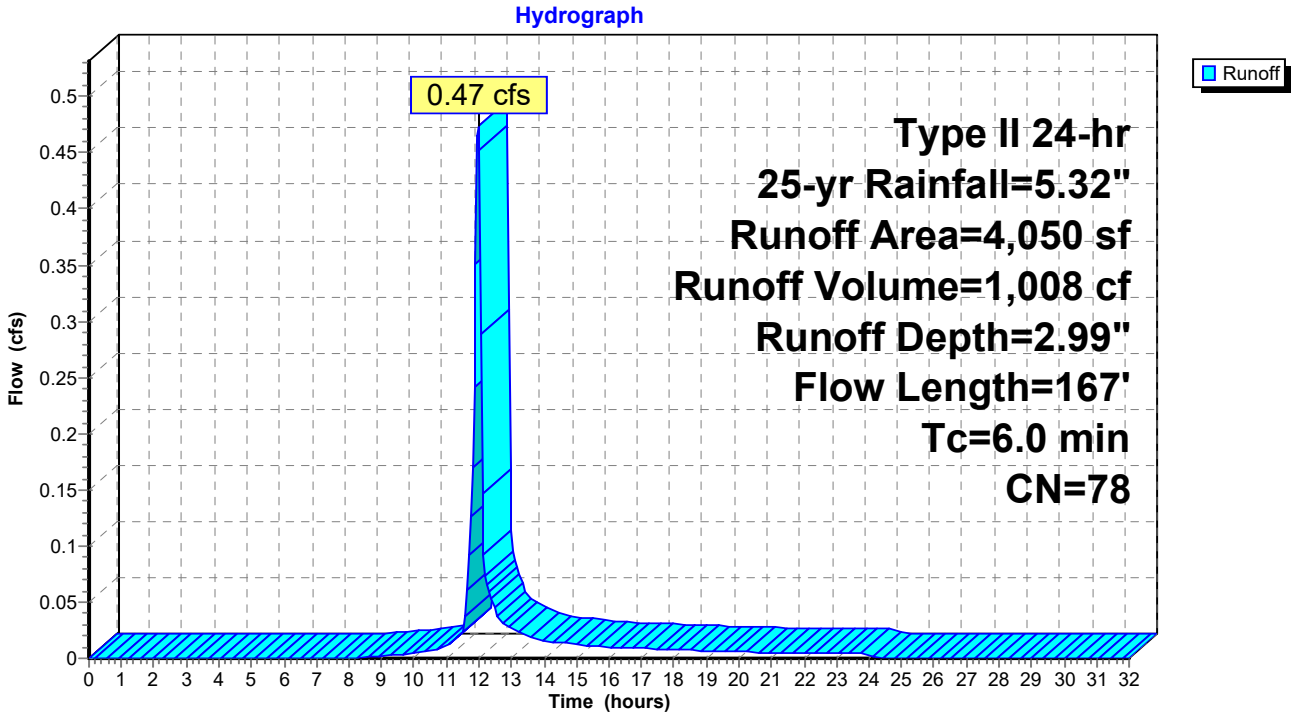
Runoff = 0.47 cfs @ 11.97 hrs, Volume= 1,008 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

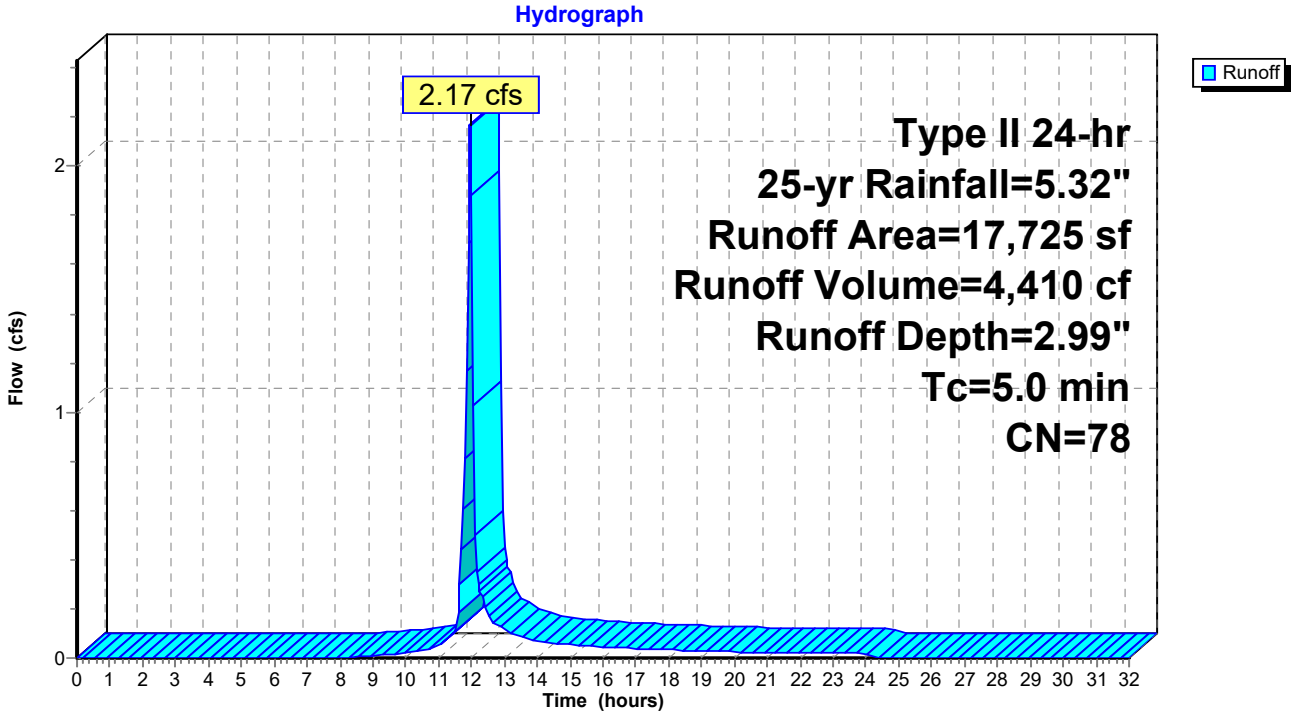
Runoff = 2.17 cfs @ 11.96 hrs, Volume= 4,410 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

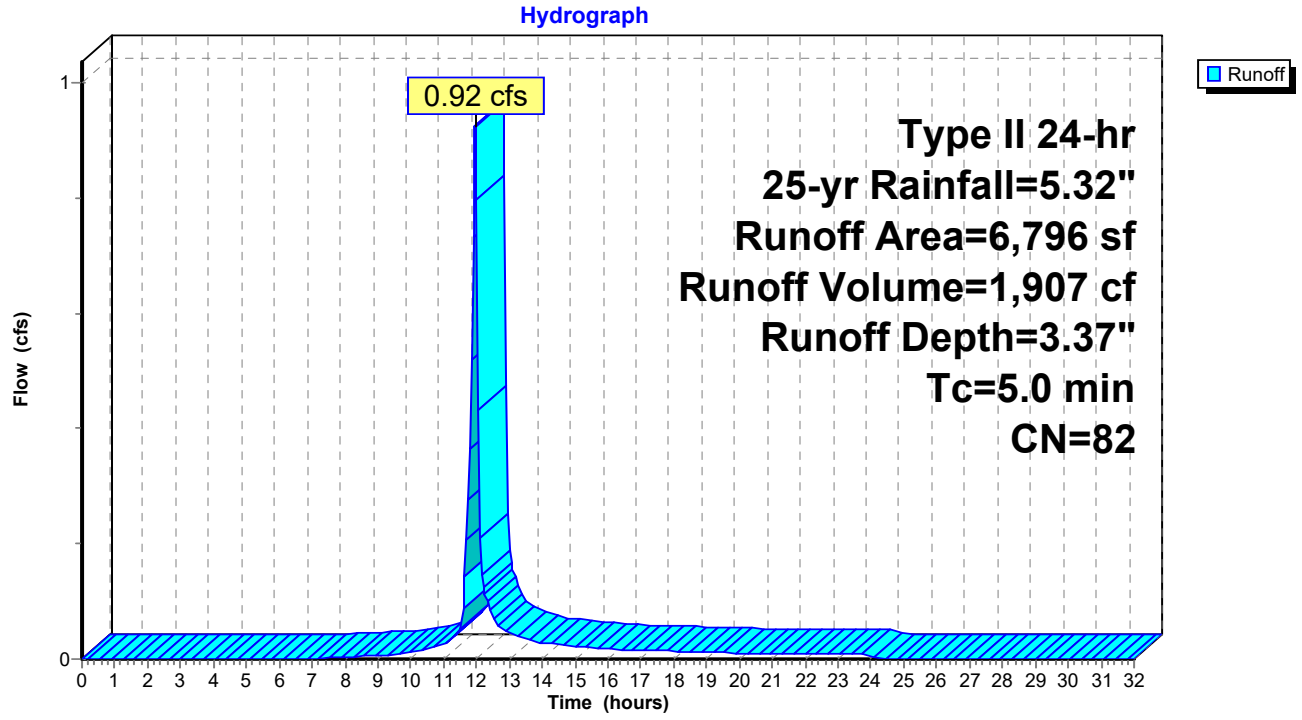
Runoff = 0.92 cfs @ 11.95 hrs, Volume= 1,907 cf, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

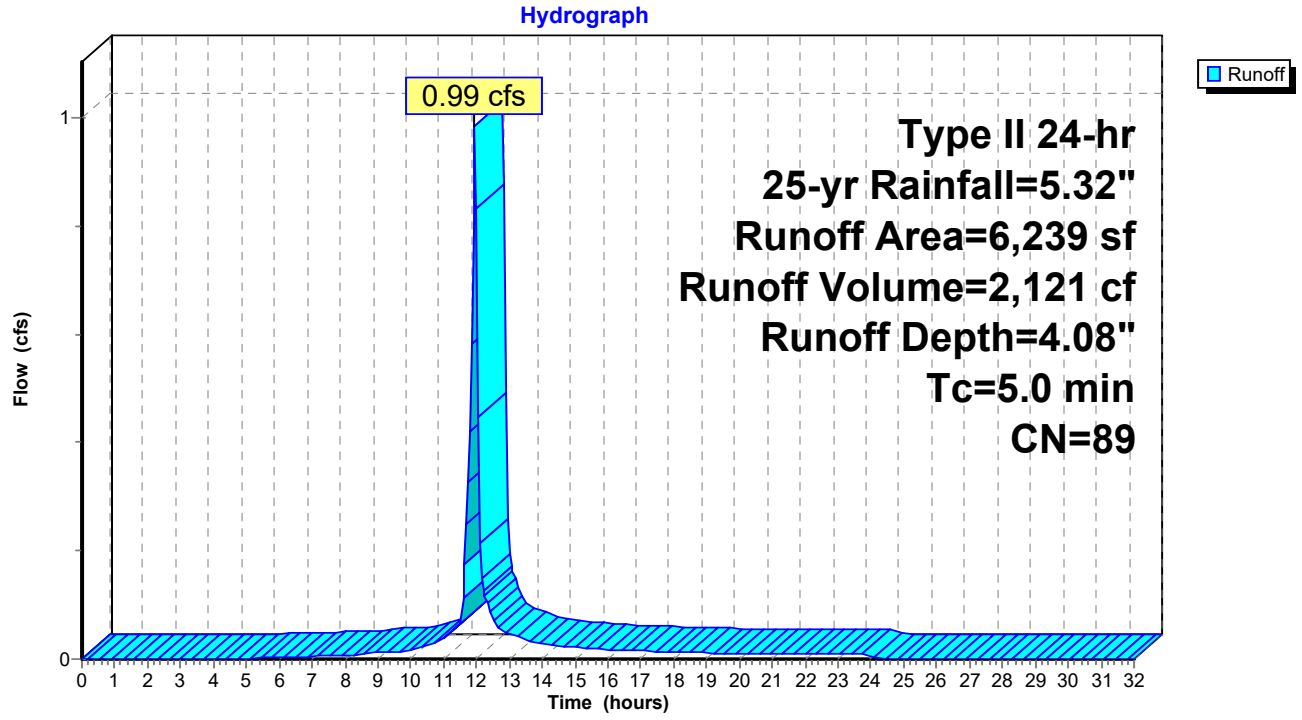
Runoff = 0.99 cfs @ 11.95 hrs, Volume= 2,121 cf, Depth= 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



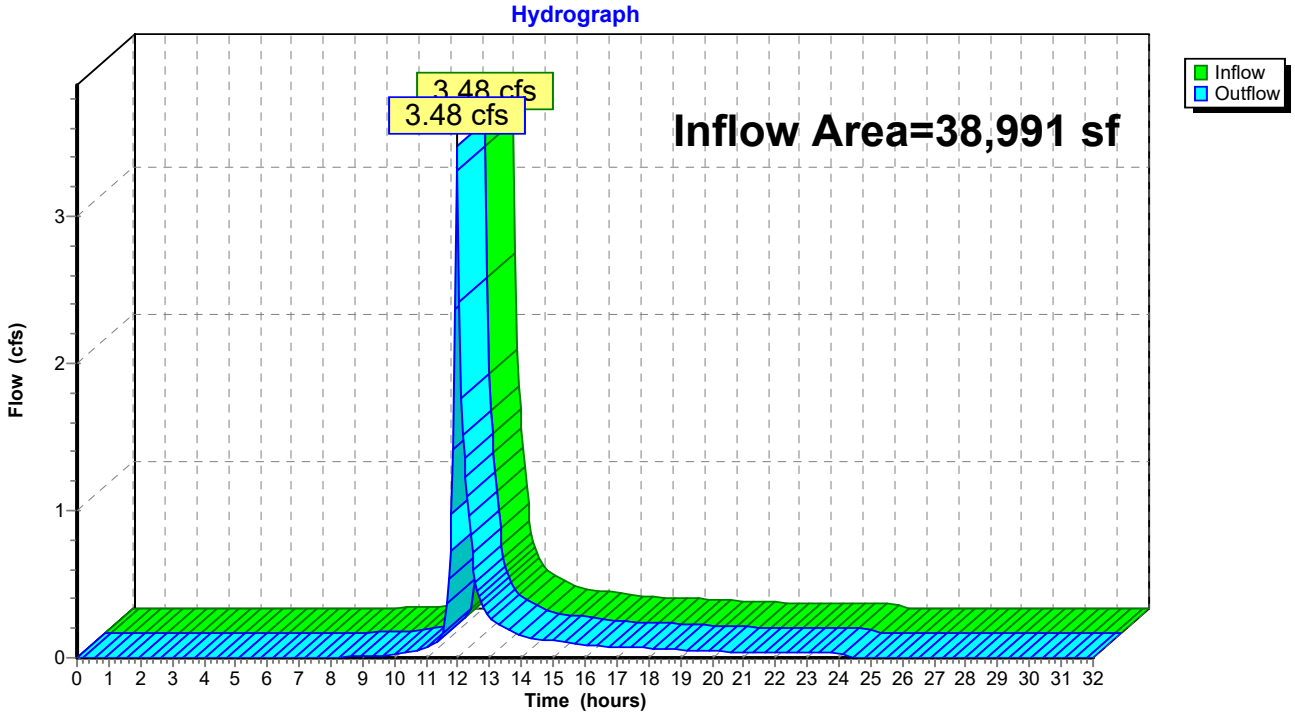
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 2.69" for 25-yr event
Inflow = 3.48 cfs @ 11.97 hrs, Volume= 8,737 cf
Outflow = 3.48 cfs @ 11.97 hrs, Volume= 8,737 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 3.37" for 25-yr event
Inflow = 0.92 cfs @ 11.95 hrs, Volume= 1,907 cf
Outflow = 0.86 cfs @ 12.00 hrs, Volume= 1,907 cf, Atten= 7%, Lag= 2.7 min

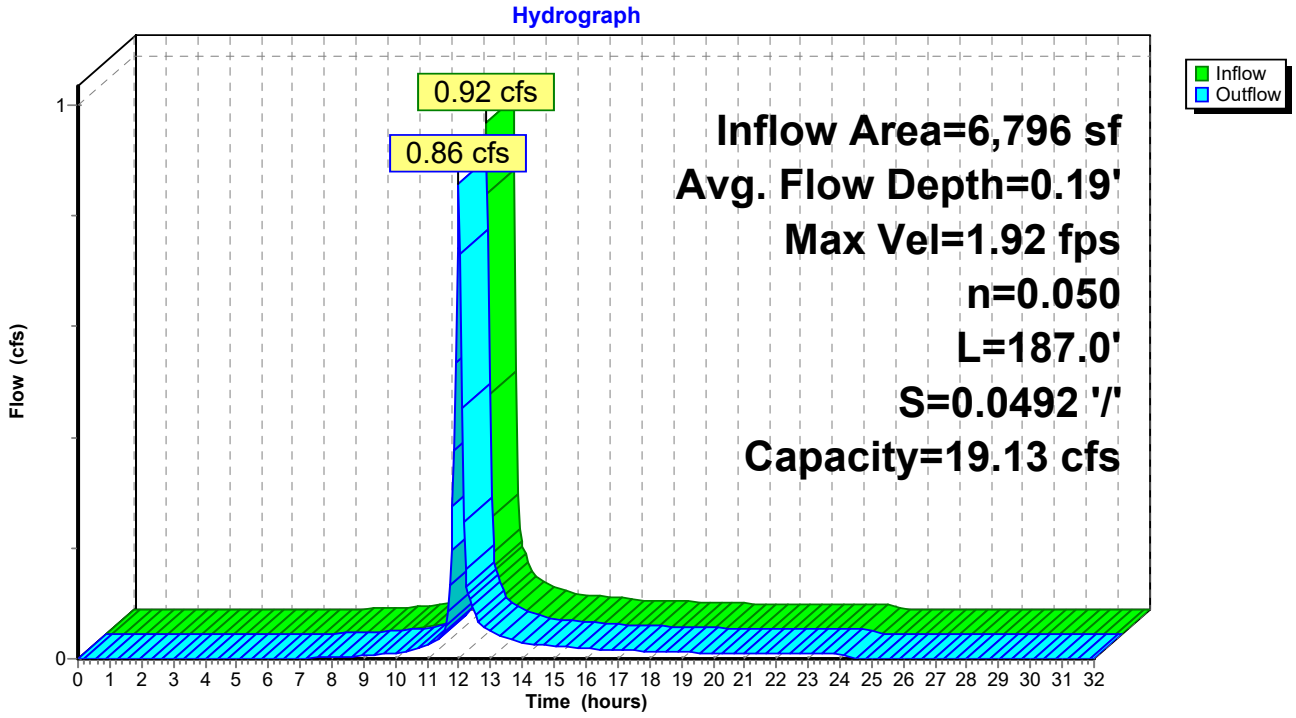
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 6.8 min

Peak Storage= 86 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



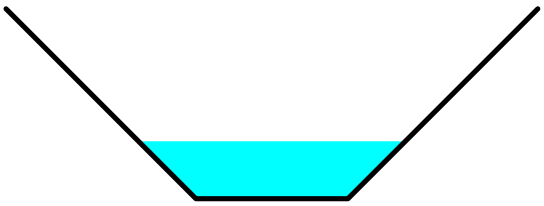
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 4.08" for 25-yr event
Inflow = 0.99 cfs @ 11.95 hrs, Volume= 2,121 cf
Outflow = 0.93 cfs @ 11.98 hrs, Volume= 2,121 cf, Atten= 5%, Lag= 1.7 min

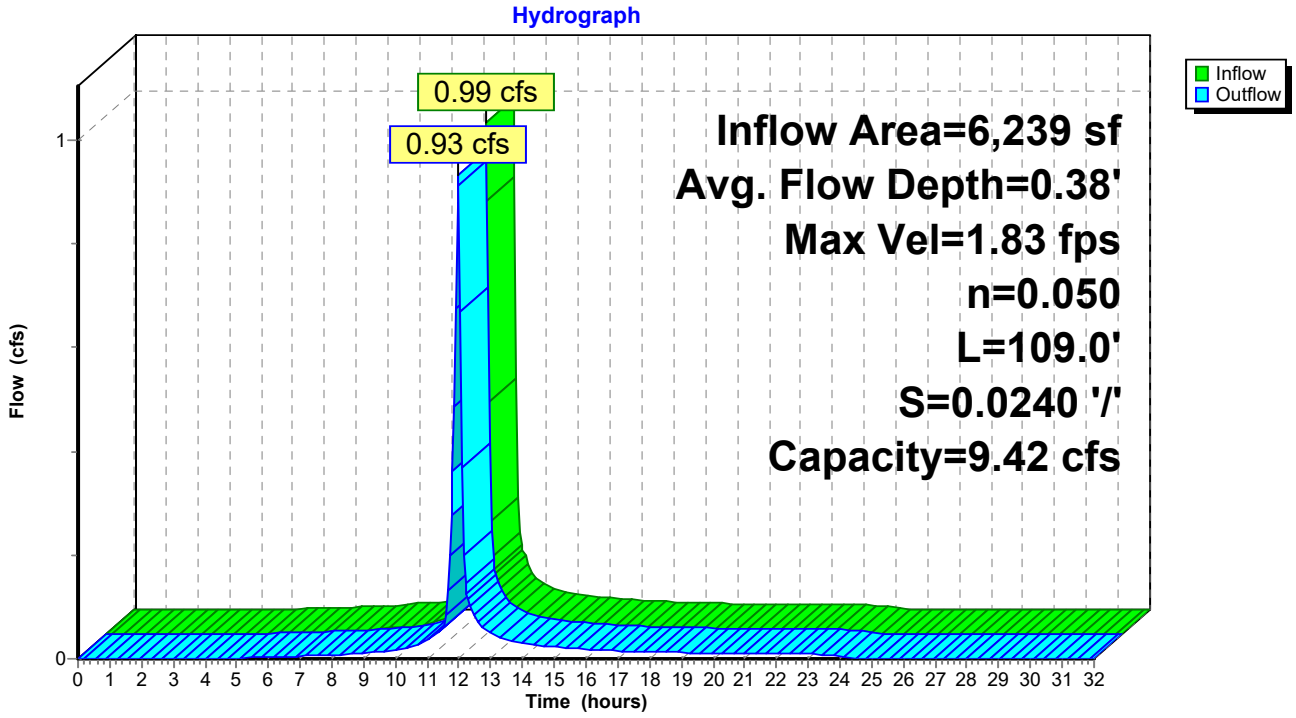
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.83 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 4.0 min

Peak Storage= 57 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.53" for 25-yr event
Inflow = 2.26 cfs @ 11.98 hrs, Volume= 5,068 cf
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 4,385 cf, Atten= 49%, Lag= 6.5 min
Discarded = 0.02 cfs @ 12.09 hrs, Volume= 1,061 cf
Primary = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.94' @ 12.09 hrs Surf.Area= 2,234 sf Storage= 1,888 cf

Plug-Flow detention time= 175.6 min calculated for 4,385 cf (87% of inflow)
Center-of-Mass det. time= 111.5 min (918.1 - 806.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

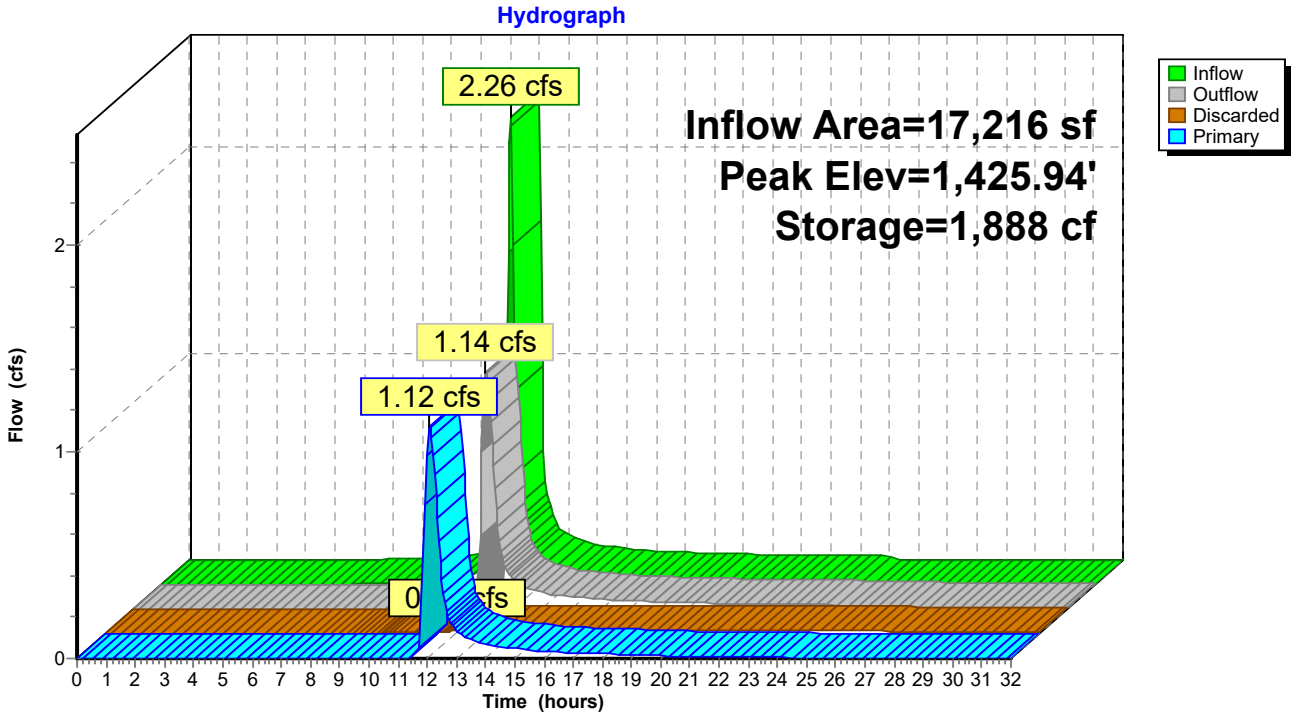
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.09 hrs HW=1,425.93' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.11 cfs @ 12.09 hrs HW=1,425.93' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 1.11 cfs @ 2.27 fps)

Pond 5P: Berm


Hydrograph
2.26 cfs
1.14 cfs
1.12 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.94'
Storage=1,888 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.05'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 2.32" for 25-yr event
Inflow = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf
Outflow = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.09 hrs, Volume= 4 cf
Primary = 1.12 cfs @ 12.09 hrs, Volume= 3,319 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.05' @ 12.09 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 3,318 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (819.4 - 819.3)

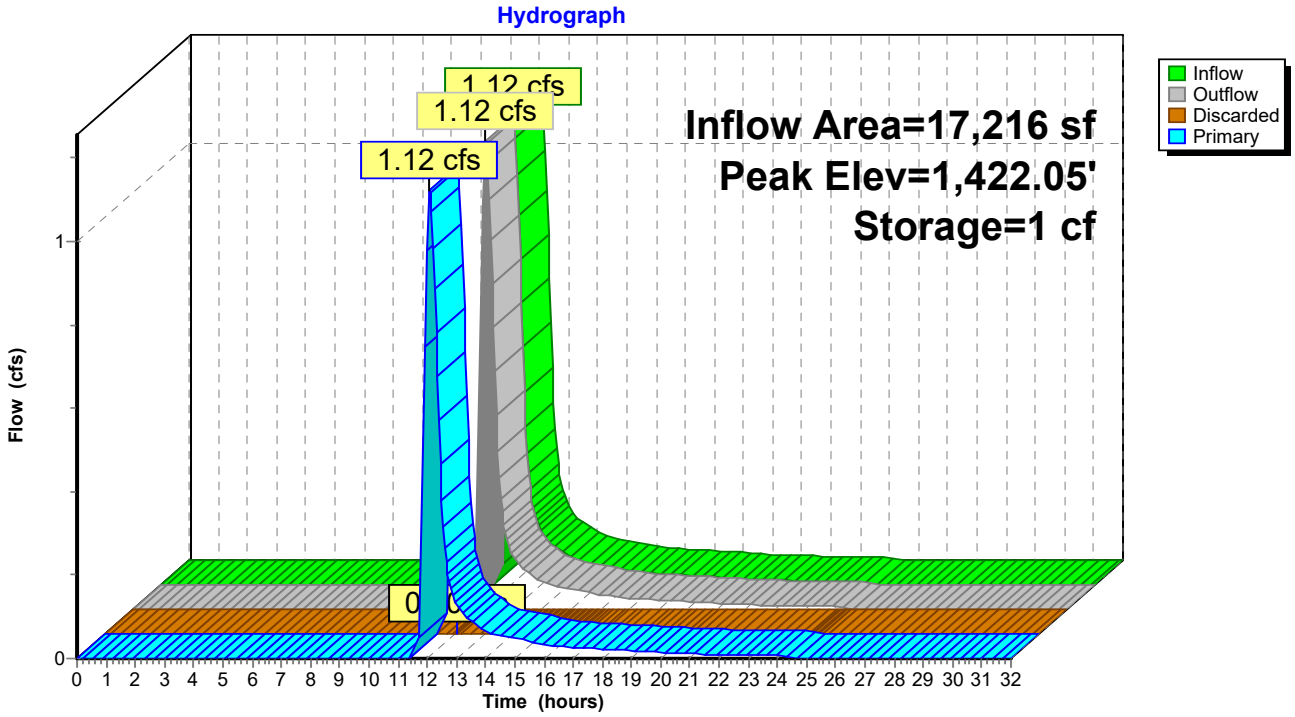
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=1,422.05' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.11 cfs @ 12.09 hrs HW=1,422.05' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 0.61 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=3.81"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.65 cfs 1,327 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=3.81"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.60 cfs 1,286 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=3.81"
Tc=5.0 min CN=78 Runoff=2.74 cfs 5,627 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=4.23"
Tc=5.0 min CN=82 Runoff=1.15 cfs 2,394 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=4.99"
Tc=5.0 min CN=89 Runoff=1.19 cfs 2,593 cf

Reach 10: DA Post w/ BMP Total Inflow=4.42 cfs 11,208 cf
Outflow=4.42 cfs 11,208 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.22' Max Vel=2.07 fps Inflow=1.15 cfs 2,394 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=1.07 cfs 2,394 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.42' Max Vel=1.93 fps Inflow=1.19 cfs 2,593 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=1.13 cfs 2,593 cf

Pond 5P: Berm Peak Elev=1,426.00' Storage=2,044 cf Inflow=2.80 cfs 6,314 cf
Discarded=0.02 cfs 1,094 cf Primary=1.29 cfs 4,301 cf Outflow=1.31 cfs 5,395 cf

Pond 6P: Level Spreader Peak Elev=1,422.06' Storage=1 cf Inflow=1.29 cfs 4,301 cf
Discarded=0.00 cfs 5 cf Primary=1.29 cfs 4,296 cf Outflow=1.29 cfs 4,301 cf

Total Runoff Area = 38,991 sf Runoff Volume = 13,227 cf Average Runoff Depth = 4.07"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

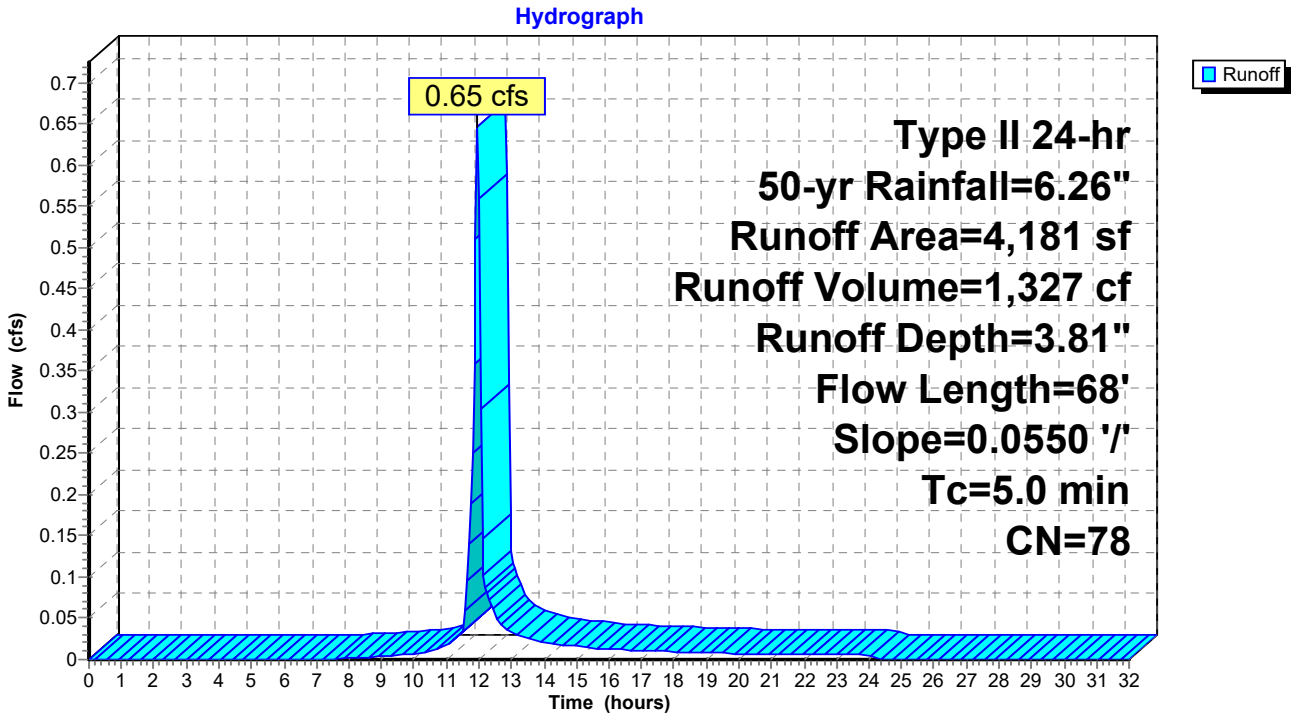
Runoff = 0.65 cfs @ 11.96 hrs, Volume= 1,327 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

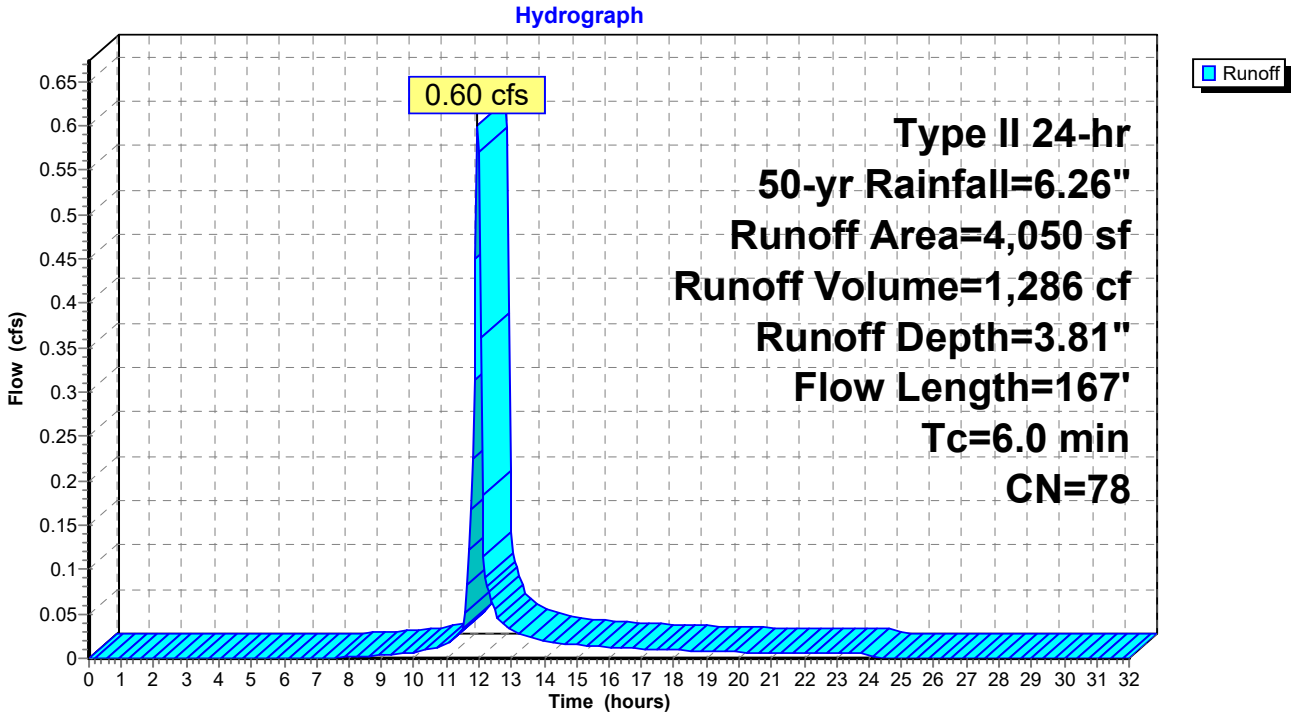
Runoff = 0.60 cfs @ 11.97 hrs, Volume= 1,286 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

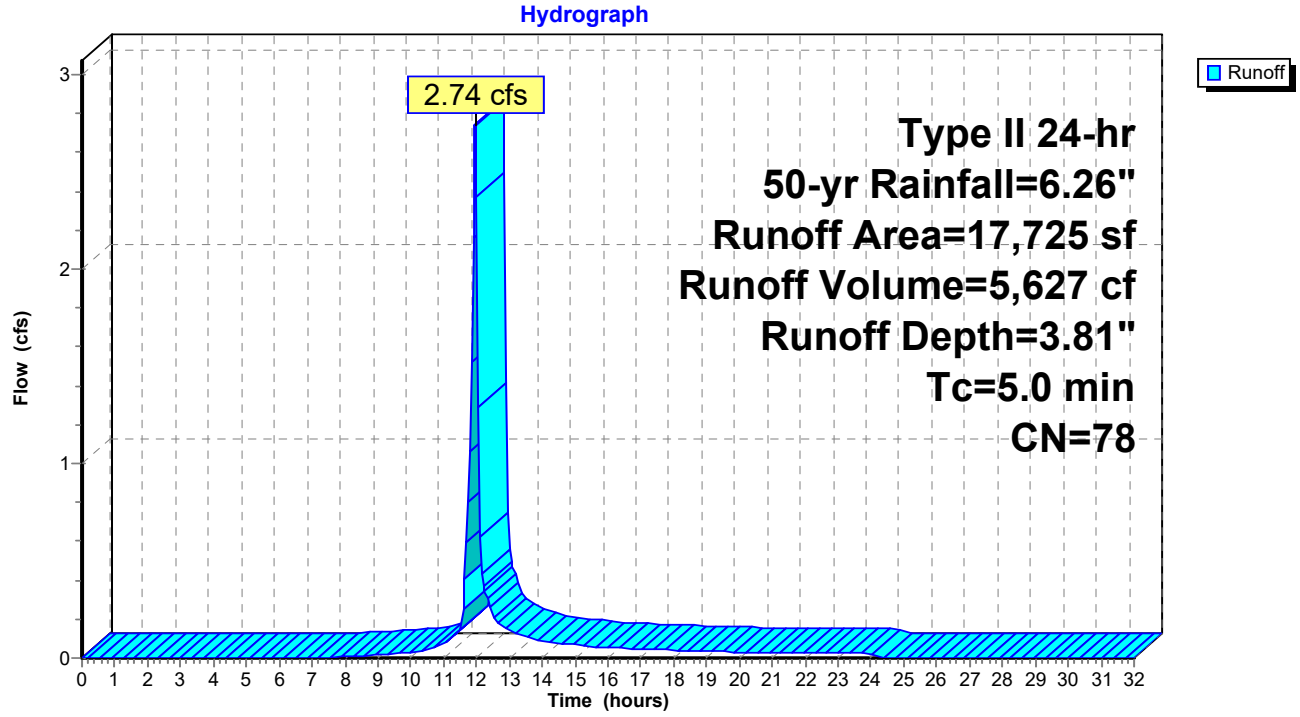
Runoff = 2.74 cfs @ 11.96 hrs, Volume= 5,627 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

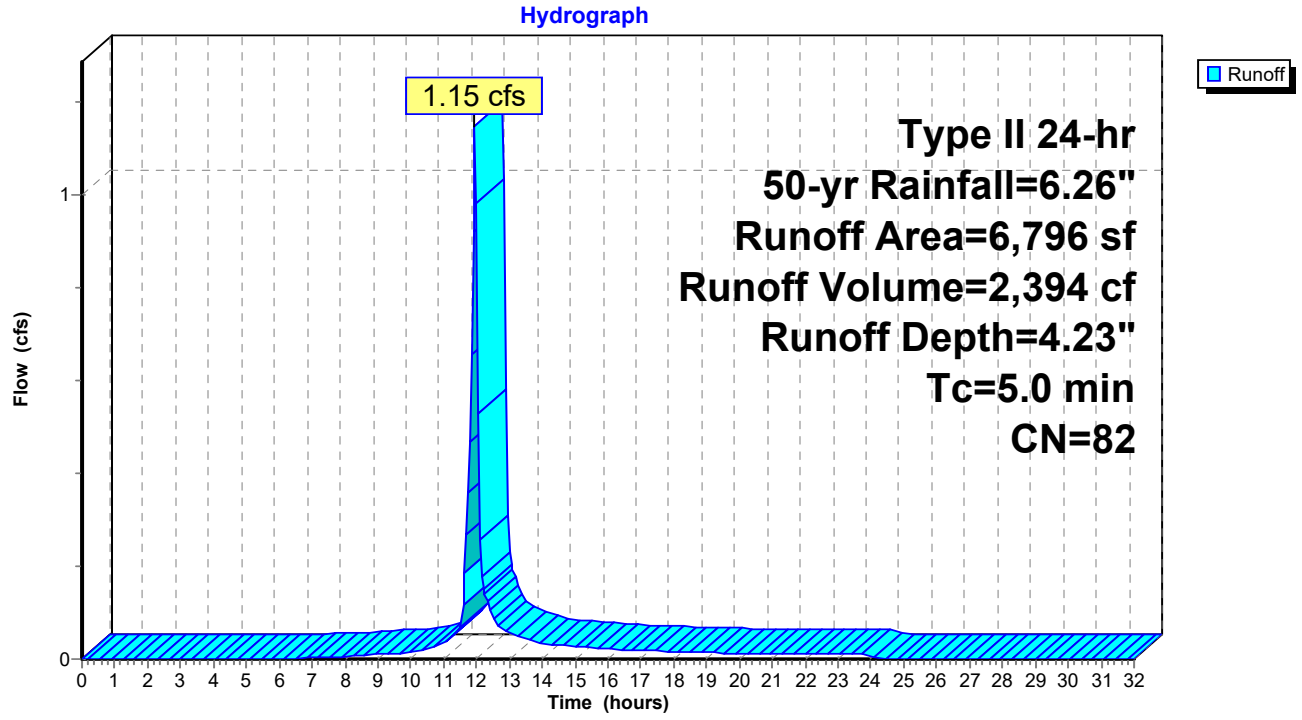
Runoff = 1.15 cfs @ 11.95 hrs, Volume= 2,394 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

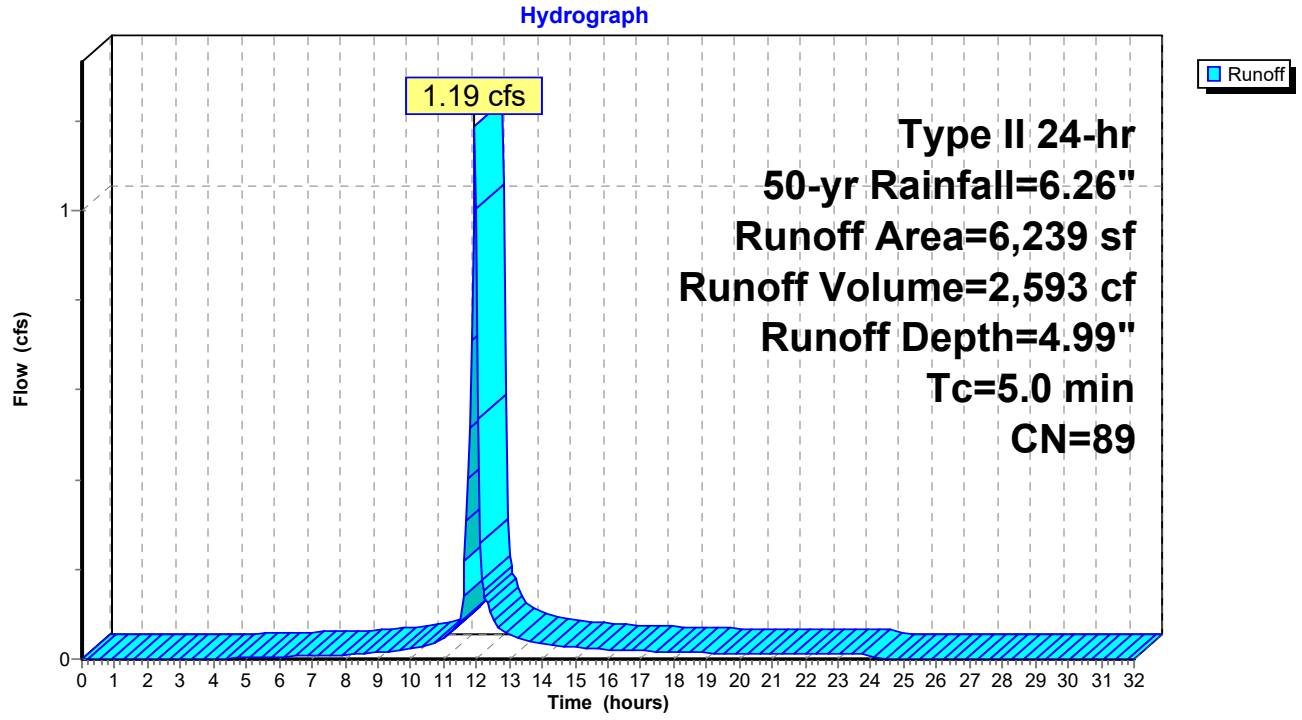
Runoff = 1.19 cfs @ 11.95 hrs, Volume= 2,593 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



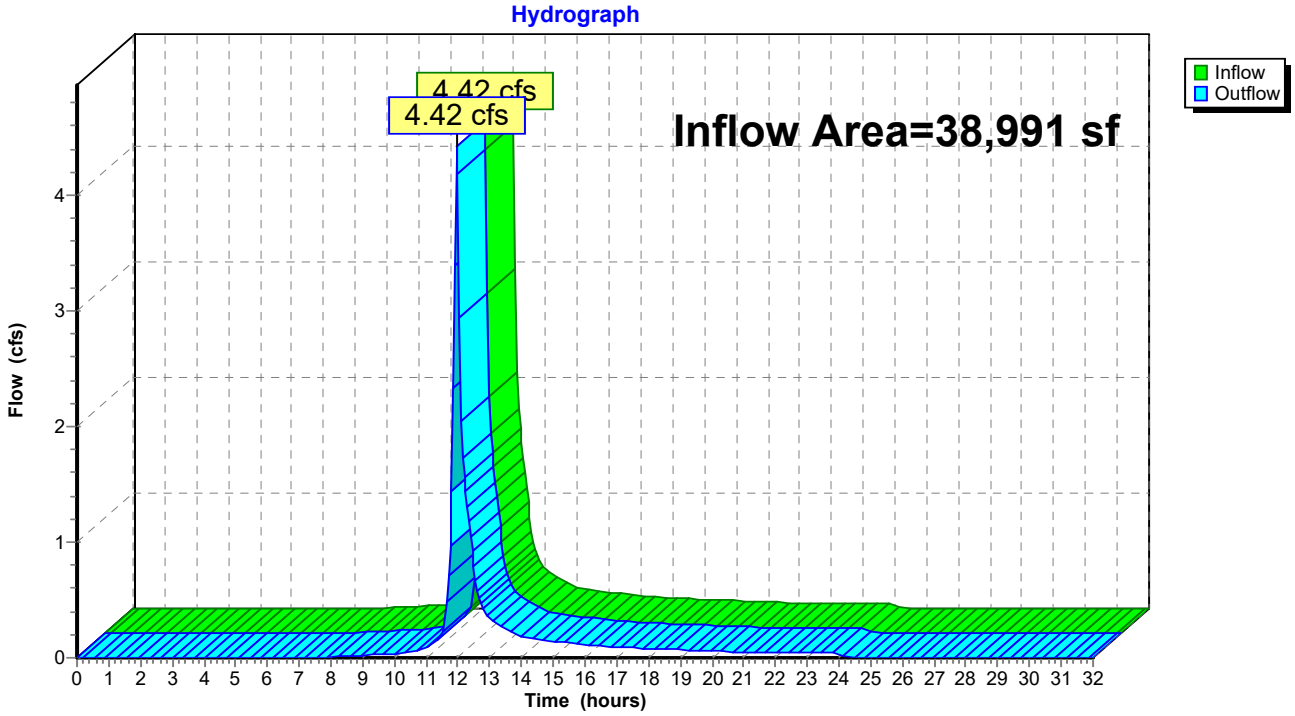
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 3.45" for 50-yr event
Inflow = 4.42 cfs @ 11.97 hrs, Volume= 11,208 cf
Outflow = 4.42 cfs @ 11.97 hrs, Volume= 11,208 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 4.23" for 50-yr event
Inflow = 1.15 cfs @ 11.95 hrs, Volume= 2,394 cf
Outflow = 1.07 cfs @ 12.00 hrs, Volume= 2,394 cf, Atten= 7%, Lag= 2.5 min

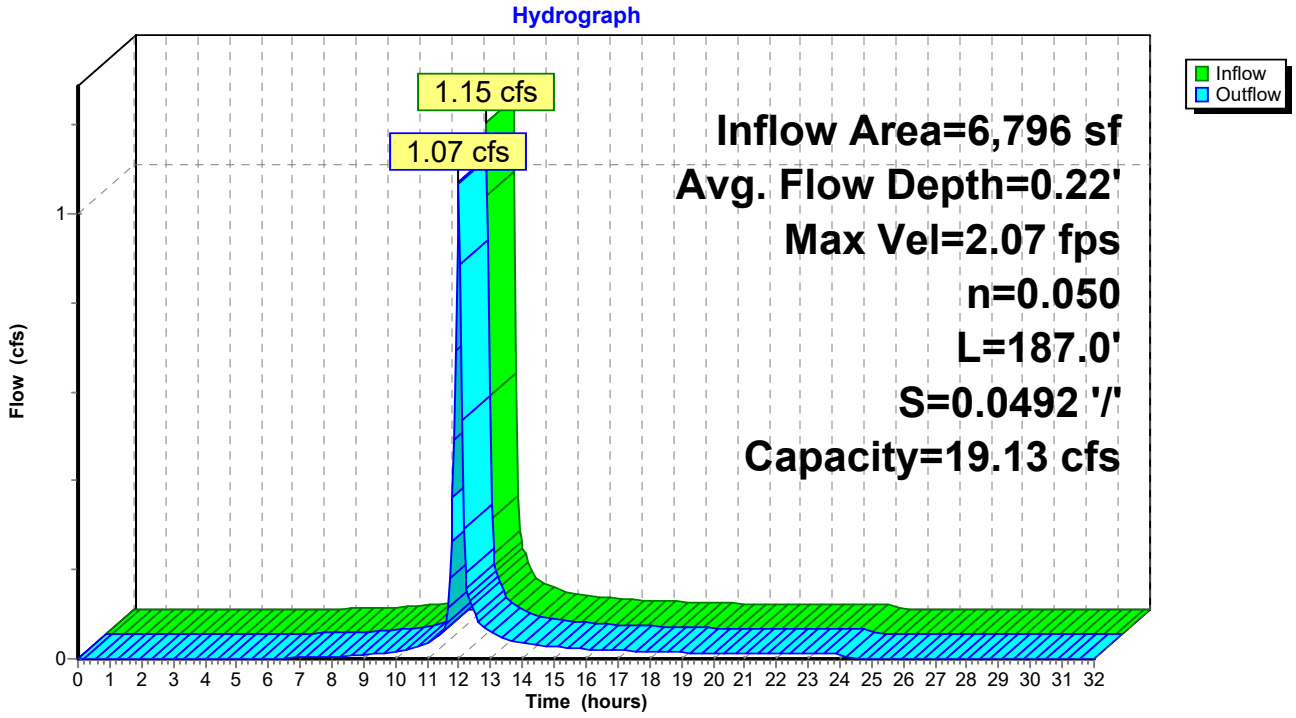
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.07 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 6.4 min

Peak Storage= 99 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



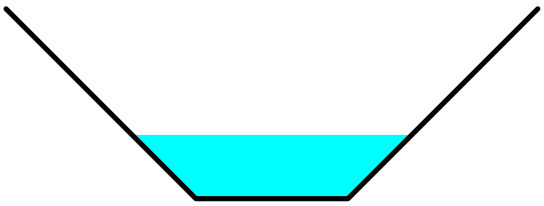
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 4.99" for 50-yr event
Inflow = 1.19 cfs @ 11.95 hrs, Volume= 2,593 cf
Outflow = 1.13 cfs @ 11.98 hrs, Volume= 2,593 cf, Atten= 5%, Lag= 1.6 min

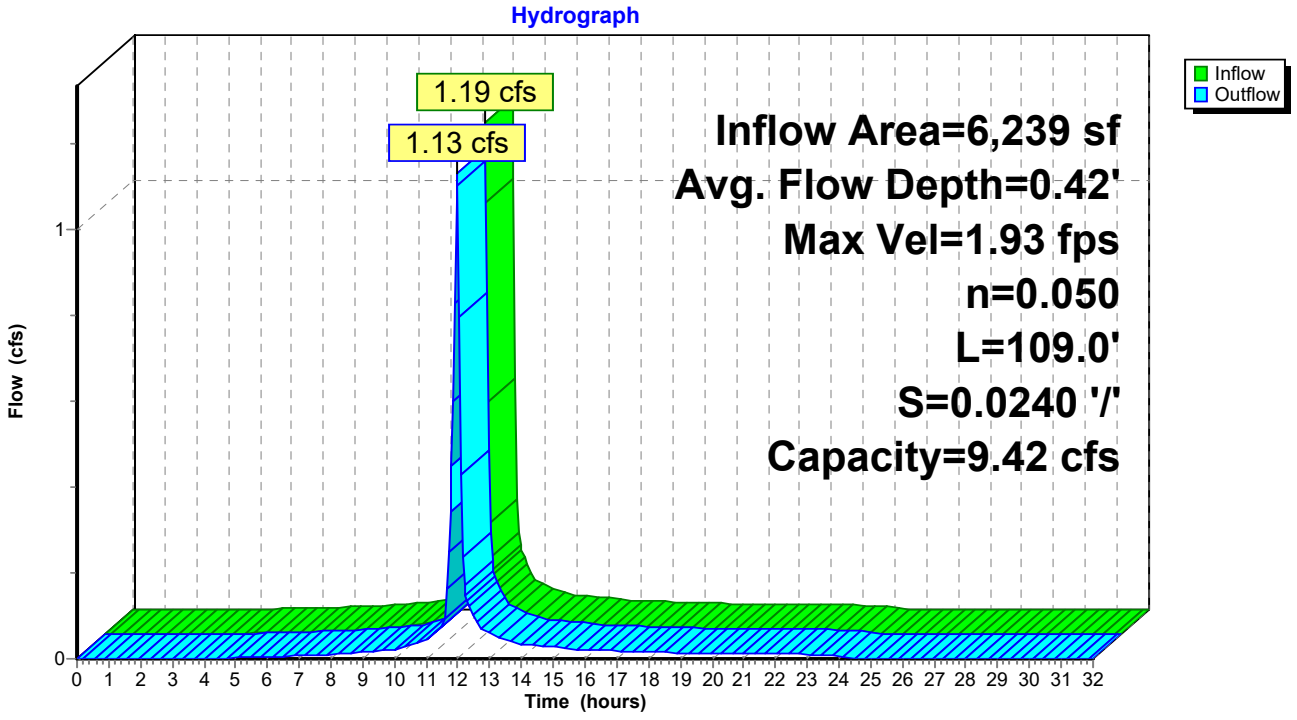
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.93 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 3.8 min

Peak Storage= 65 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 4.40" for 50-yr event
Inflow = 2.80 cfs @ 11.98 hrs, Volume= 6,314 cf
Outflow = 1.31 cfs @ 12.05 hrs, Volume= 5,395 cf, Atten= 53%, Lag= 4.0 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 1,094 cf
Primary = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,426.00' @ 12.05 hrs Surf.Area= 2,340 sf Storage= 2,044 cf

Plug-Flow detention time= 166.6 min calculated for 5,387 cf (85% of inflow)
Center-of-Mass det. time= 100.4 min (900.7 - 800.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

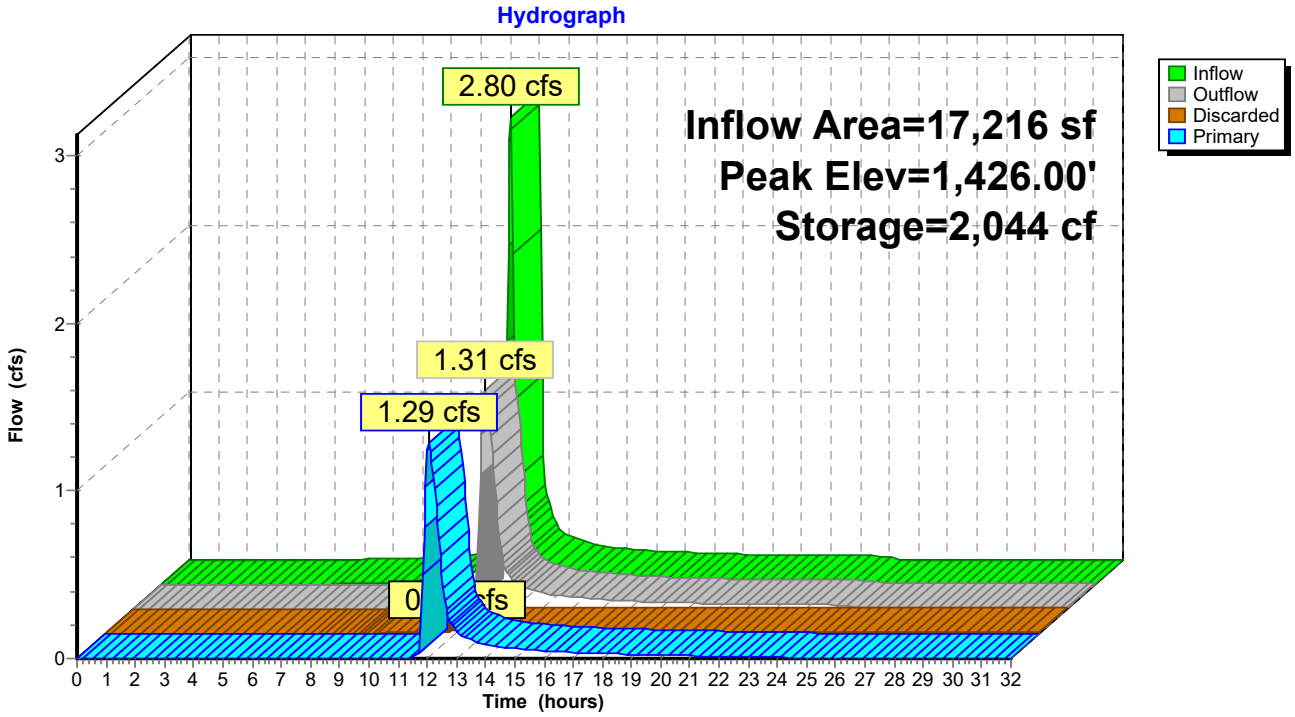
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=1,426.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.26 cfs @ 12.05 hrs HW=1,426.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.04 cfs @ 0.15 fps)
└**3=Culvert** (Inlet Controls 1.22 cfs @ 2.49 fps)

Pond 5P: Berm


Hydrograph
Inflow
Outflow
Discarded
Primary
2.80 cfs
1.31 cfs
1.29 cfs
Inflow Area=17,216 sf
Peak Elev=1,426.00'
Storage=2,044 cf
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.06'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.00" for 50-yr event
Inflow = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf
Outflow = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.05 hrs, Volume= 5 cf
Primary = 1.29 cfs @ 12.05 hrs, Volume= 4,296 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.06' @ 12.05 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 4,294 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (822.0 - 822.0)

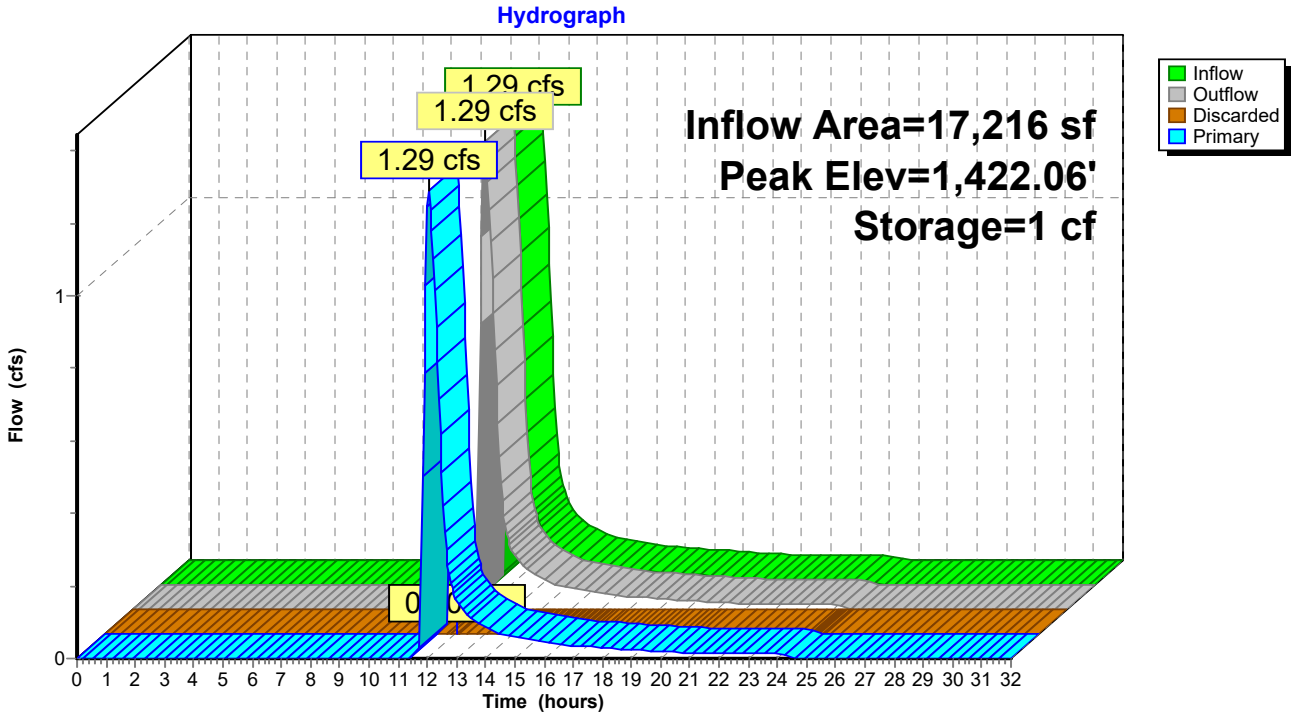
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.05 hrs HW=1,422.06' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=1.28 cfs @ 12.05 hrs HW=1,422.06' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.28 cfs @ 0.64 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=4.83"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.81 cfs 1,683 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=4.83"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.75 cfs 1,630 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=4.83"
Tc=5.0 min CN=78 Runoff=3.44 cfs 7,134 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=5.28"
Tc=5.0 min CN=82 Runoff=1.42 cfs 2,992 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=6.09"
Tc=5.0 min CN=89 Runoff=1.43 cfs 3,166 cf

Reach 10: DA Post w/ BMP Total Inflow=6.01 cfs 14,164 cf
Outflow=6.01 cfs 14,164 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.25' Max Vel=2.22 fps Inflow=1.42 cfs 2,992 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=1.32 cfs 2,992 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.47' Max Vel=2.04 fps Inflow=1.43 cfs 3,166 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=1.36 cfs 3,166 cf

Pond 5P: Berm Peak Elev=1,426.02' Storage=2,059 cf Inflow=3.44 cfs 7,841 cf
Discarded=0.02 cfs 1,132 cf Primary=1.85 cfs 5,405 cf Outflow=1.87 cfs 6,537 cf

Pond 6P: Level Spreader Peak Elev=1,422.07' Storage=1 cf Inflow=1.85 cfs 5,405 cf
Discarded=0.00 cfs 6 cf Primary=1.85 cfs 5,399 cf Outflow=1.85 cfs 5,405 cf

Total Runoff Area = 38,991 sf Runoff Volume = 16,605 cf Average Runoff Depth = 5.11"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

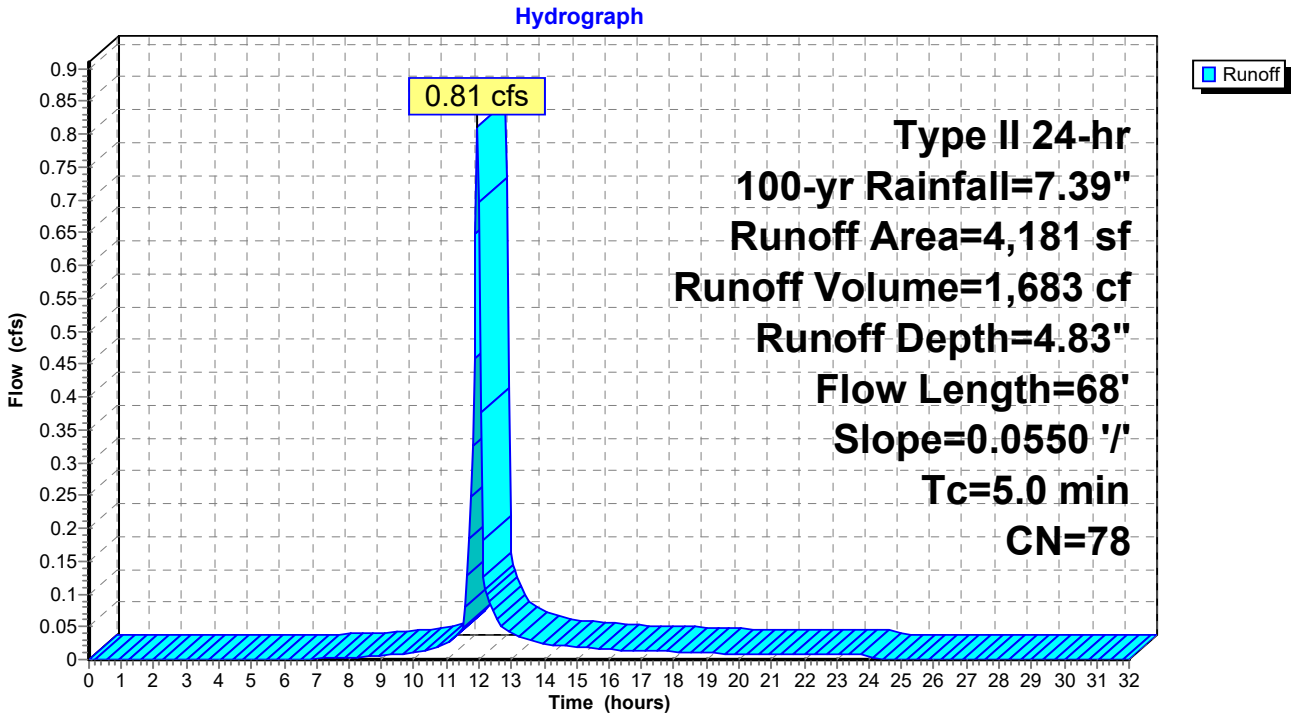
Runoff = 0.81 cfs @ 11.95 hrs, Volume= 1,683 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

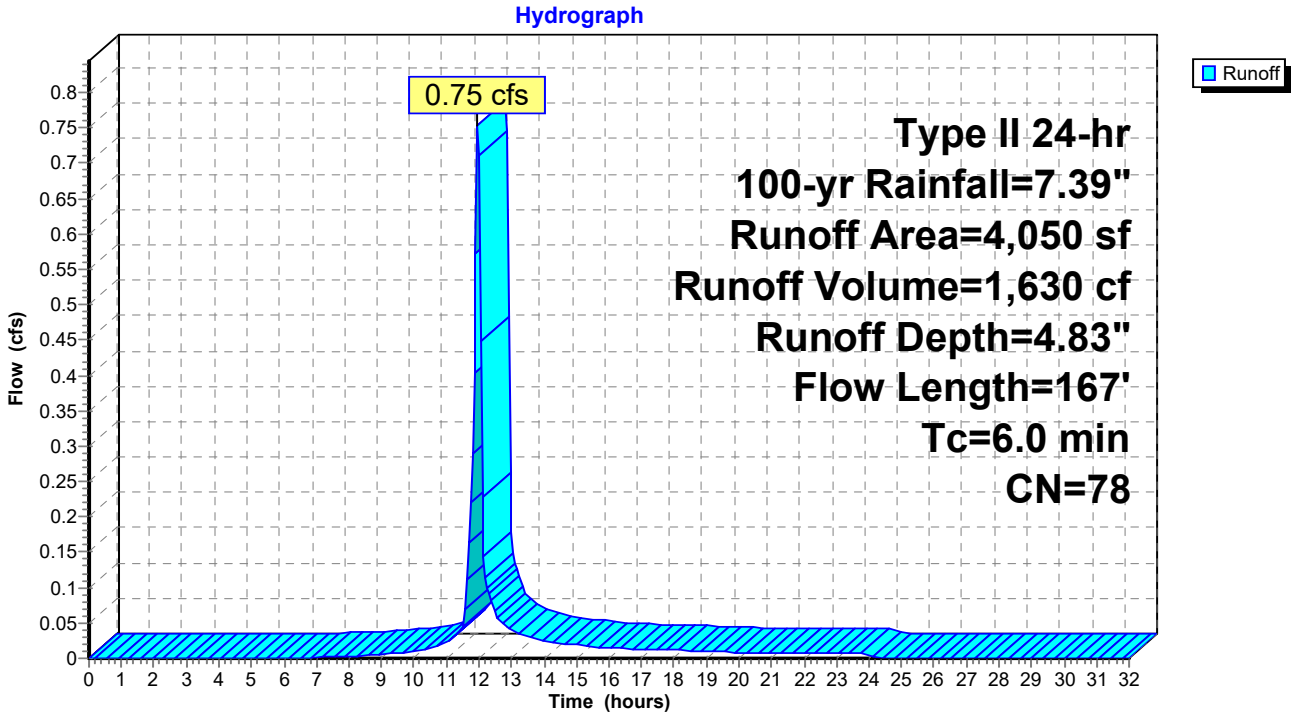
Runoff = 0.75 cfs @ 11.97 hrs, Volume= 1,630 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

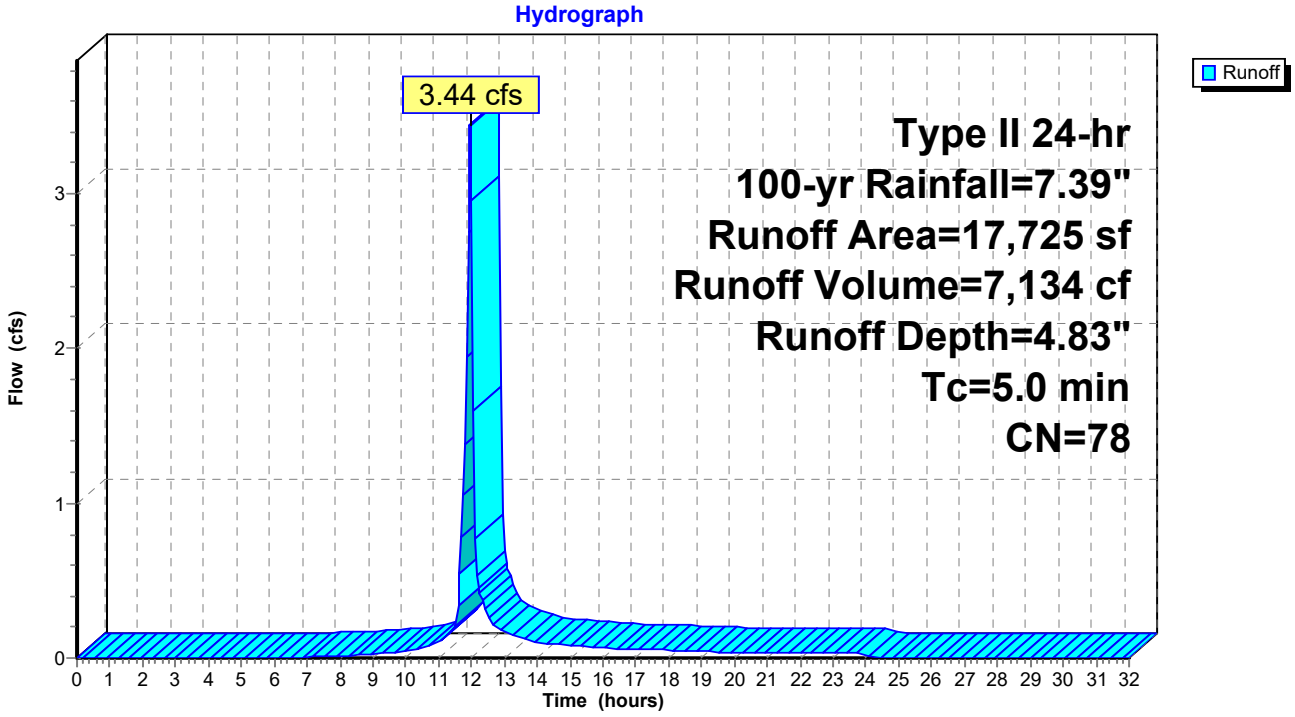
Runoff = 3.44 cfs @ 11.95 hrs, Volume= 7,134 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

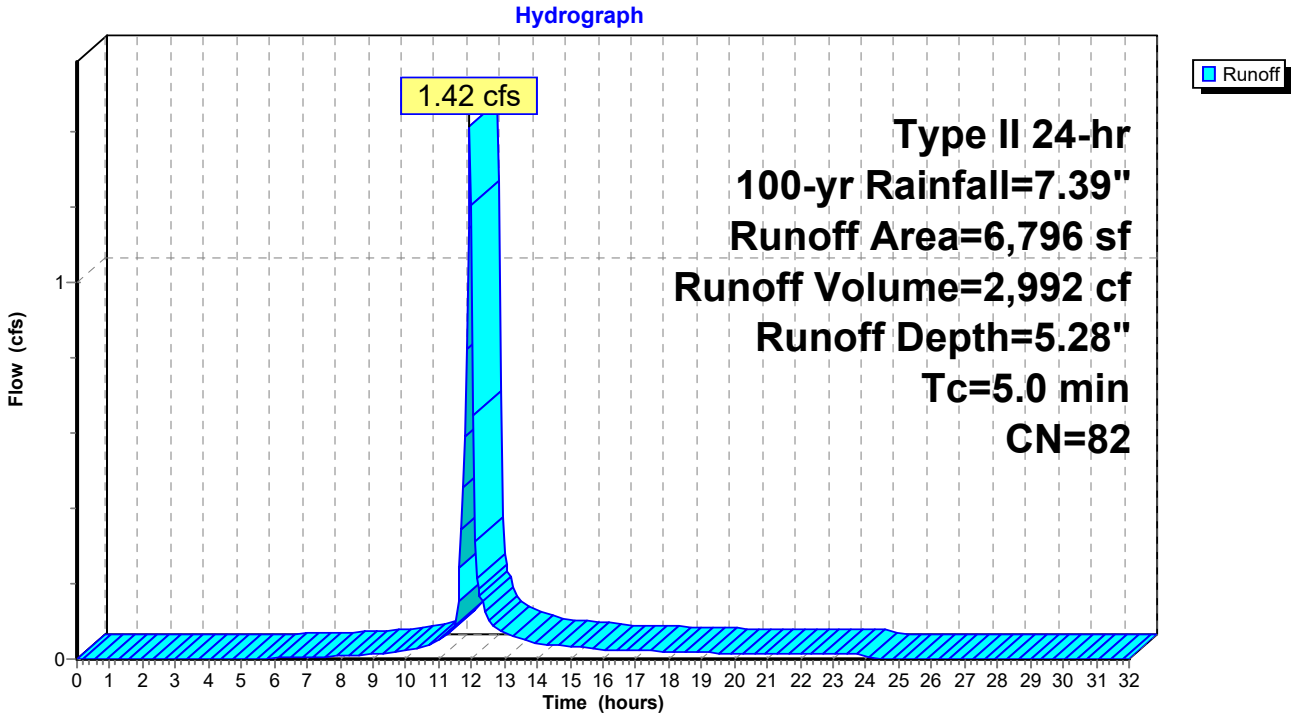
Runoff = 1.42 cfs @ 11.95 hrs, Volume= 2,992 cf, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

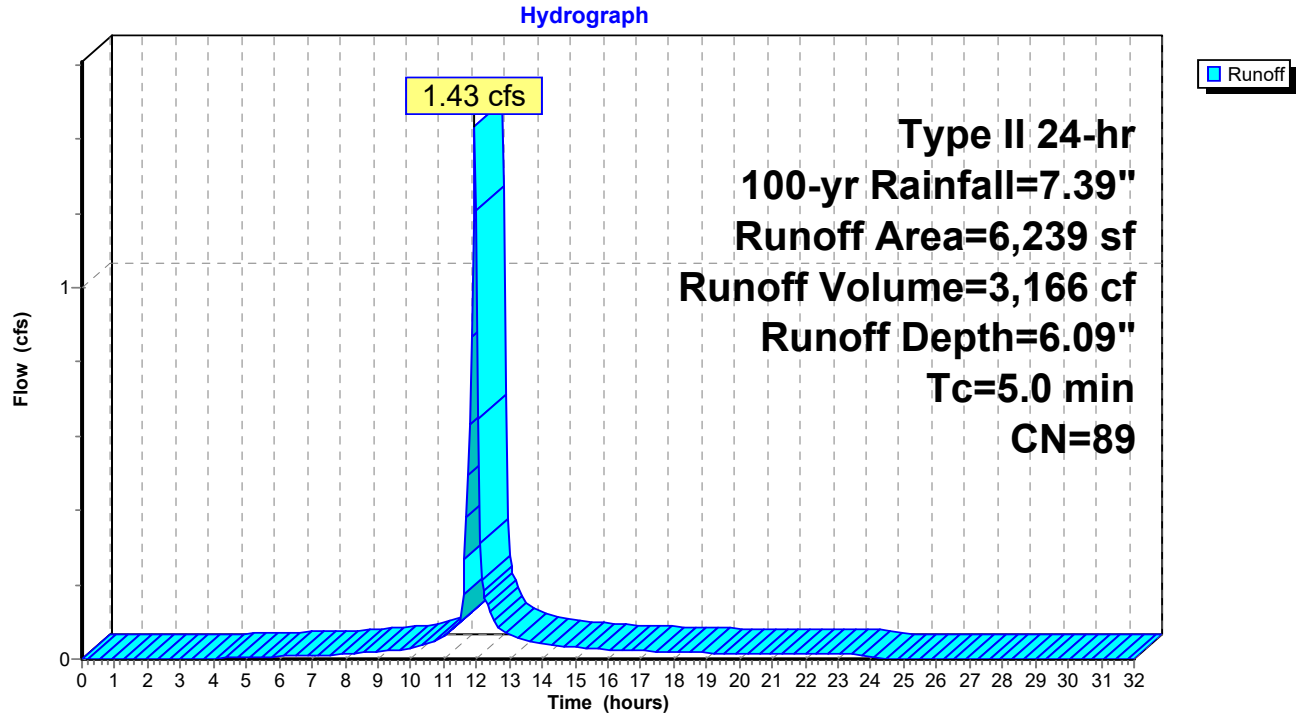
Runoff = 1.43 cfs @ 11.95 hrs, Volume= 3,166 cf, Depth= 6.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



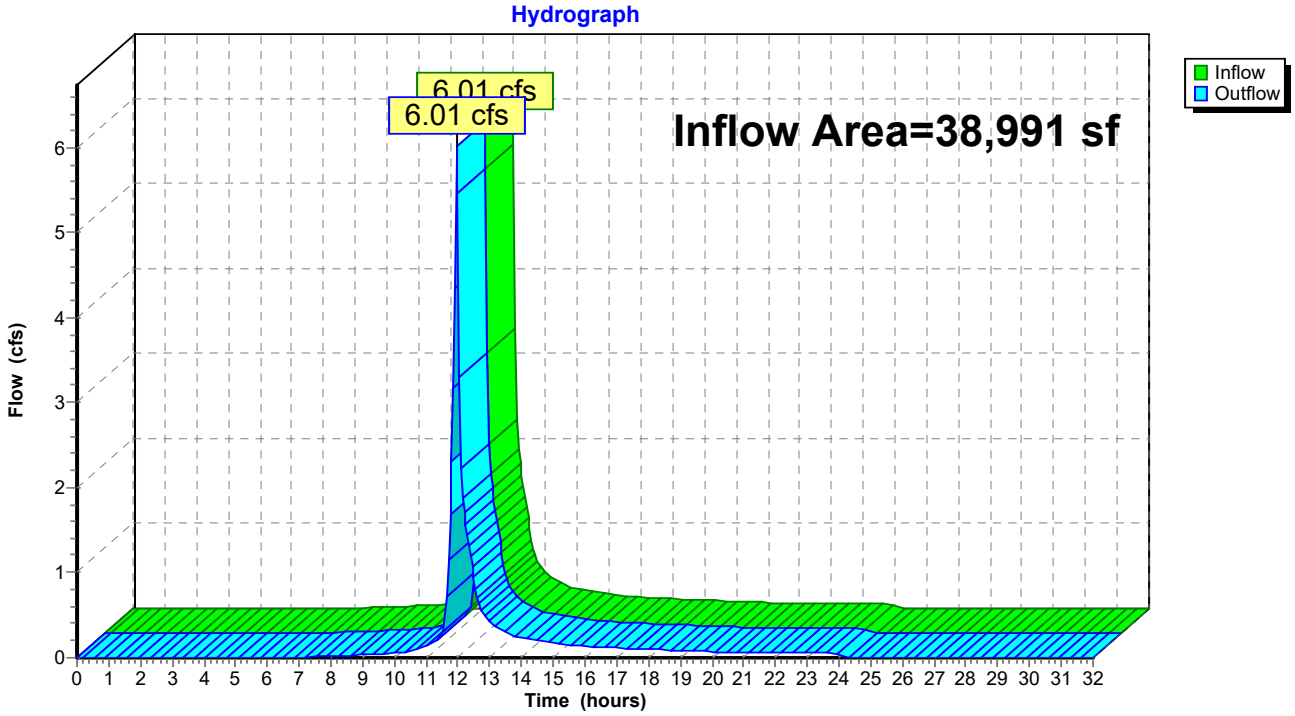
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 4.36" for 100-yr event
Inflow = 6.01 cfs @ 11.96 hrs, Volume= 14,164 cf
Outflow = 6.01 cfs @ 11.96 hrs, Volume= 14,164 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 5.28" for 100-yr event
Inflow = 1.42 cfs @ 11.95 hrs, Volume= 2,992 cf
Outflow = 1.32 cfs @ 11.99 hrs, Volume= 2,992 cf, Atten= 7%, Lag= 2.3 min

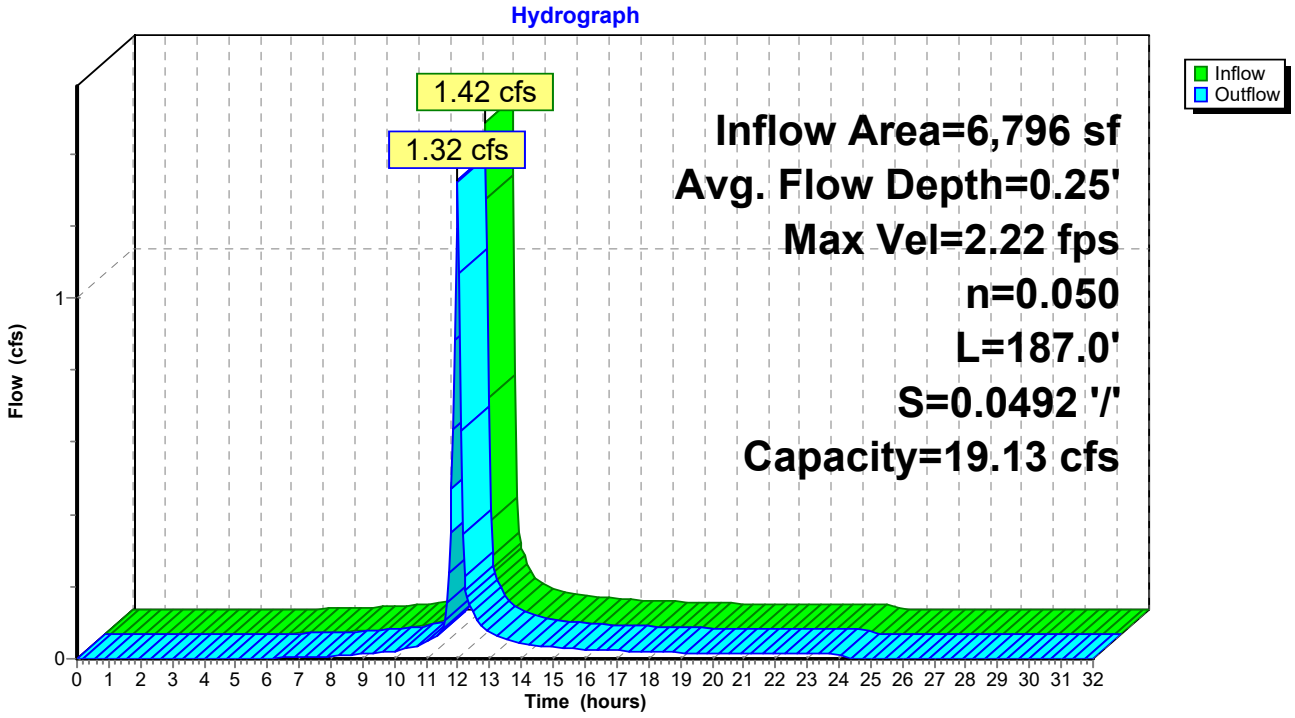
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 6.0 min

Peak Storage= 114 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



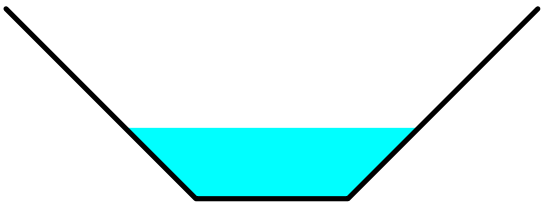
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 6.09" for 100-yr event
Inflow = 1.43 cfs @ 11.95 hrs, Volume= 3,166 cf
Outflow = 1.36 cfs @ 11.98 hrs, Volume= 3,166 cf, Atten= 5%, Lag= 1.6 min

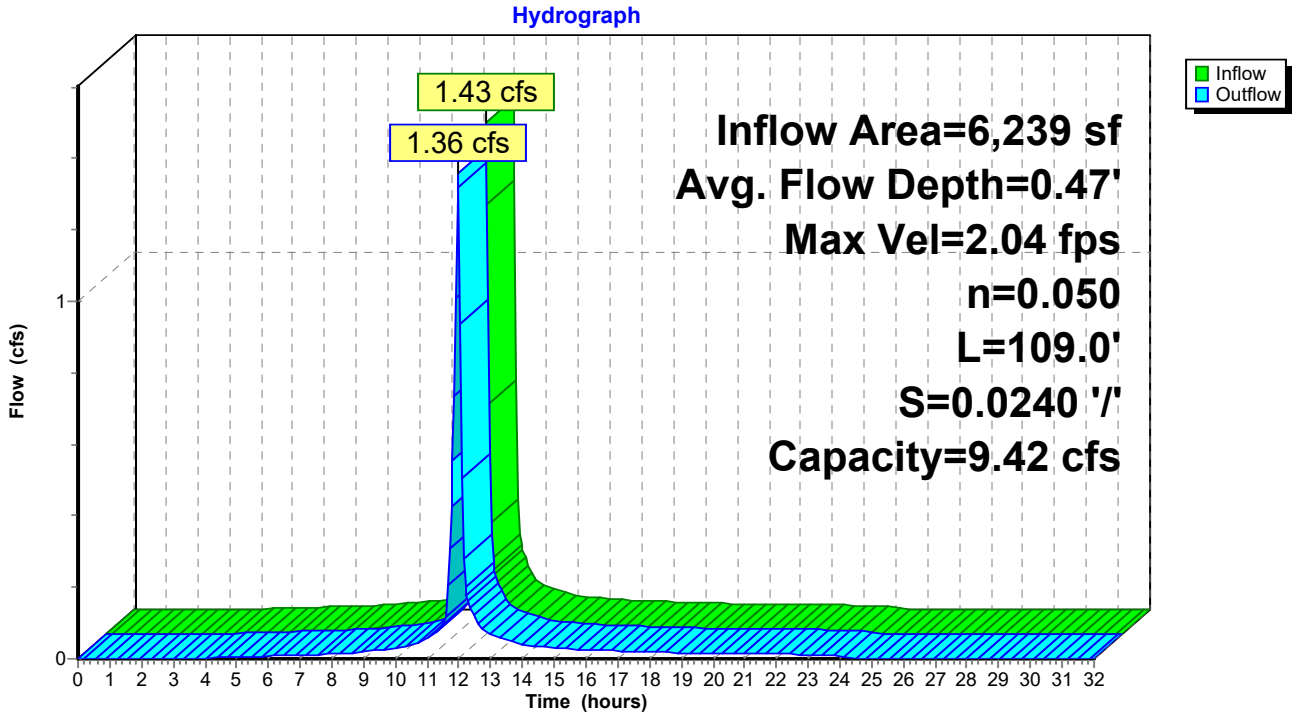
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 3.5 min

Peak Storage= 75 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

[93] Warning: Storage range exceeded by 0.01'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 5.47" for 100-yr event
Inflow = 3.44 cfs @ 11.98 hrs, Volume= 7,841 cf
Outflow = 1.87 cfs @ 11.98 hrs, Volume= 6,537 cf, Atten= 46%, Lag= 0.1 min
Discarded = 0.02 cfs @ 11.98 hrs, Volume= 1,132 cf
Primary = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,426.02' @ 11.98 hrs Surf.Area= 2,340 sf Storage= 2,059 cf

Plug-Flow detention time= 166.4 min calculated for 6,537 cf (83% of inflow)
Center-of-Mass det. time= 93.4 min (887.6 - 794.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

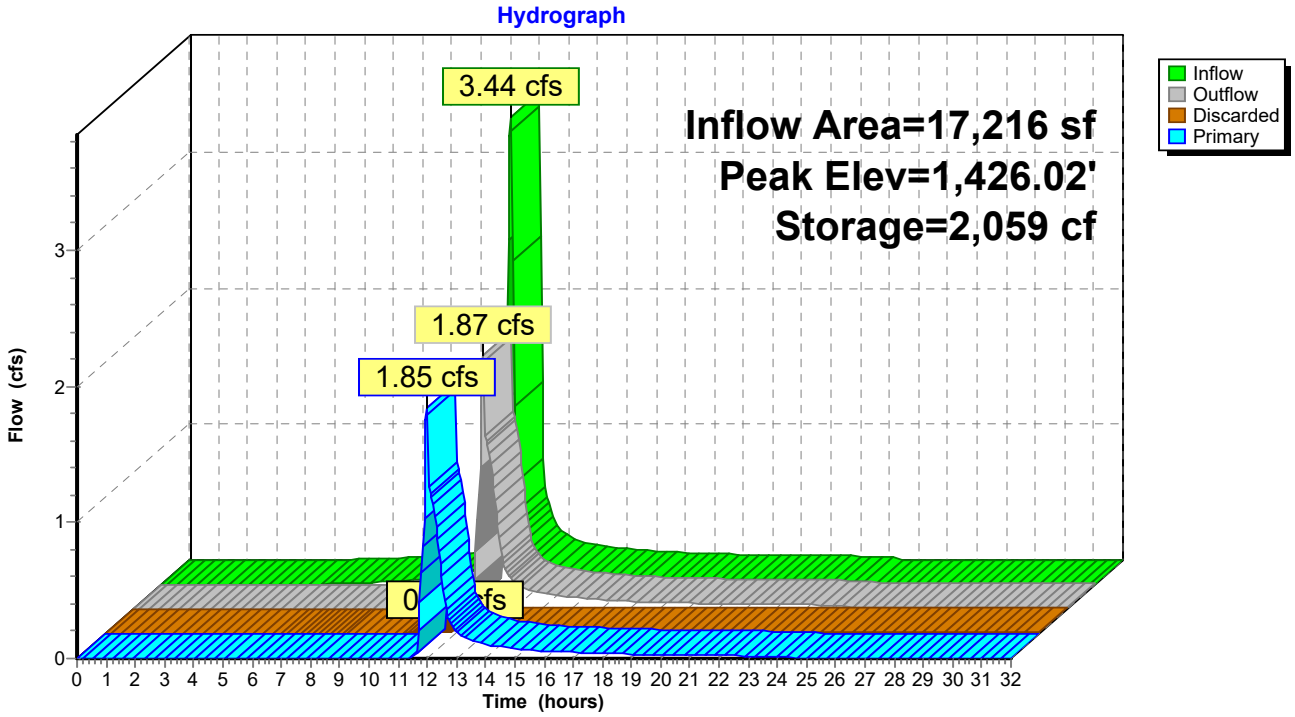
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 11.98 hrs HW=1,426.02' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.73 cfs @ 11.98 hrs HW=1,426.02' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.48 cfs @ 0.34 fps)
└**3=Culvert** (Inlet Controls 1.24 cfs @ 2.53 fps)

Pond 5P: Berm


Hydrograph
3.44 cfs
1.87 cfs
1.85 cfs
Inflow Area=17,216 sf
Peak Elev=1,426.02'
Storage=2,059 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.07'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.77" for 100-yr event
Inflow = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf
Outflow = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 6 cf
Primary = 1.85 cfs @ 11.98 hrs, Volume= 5,399 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.07' @ 11.98 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 5,397 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (824.0 - 824.0)

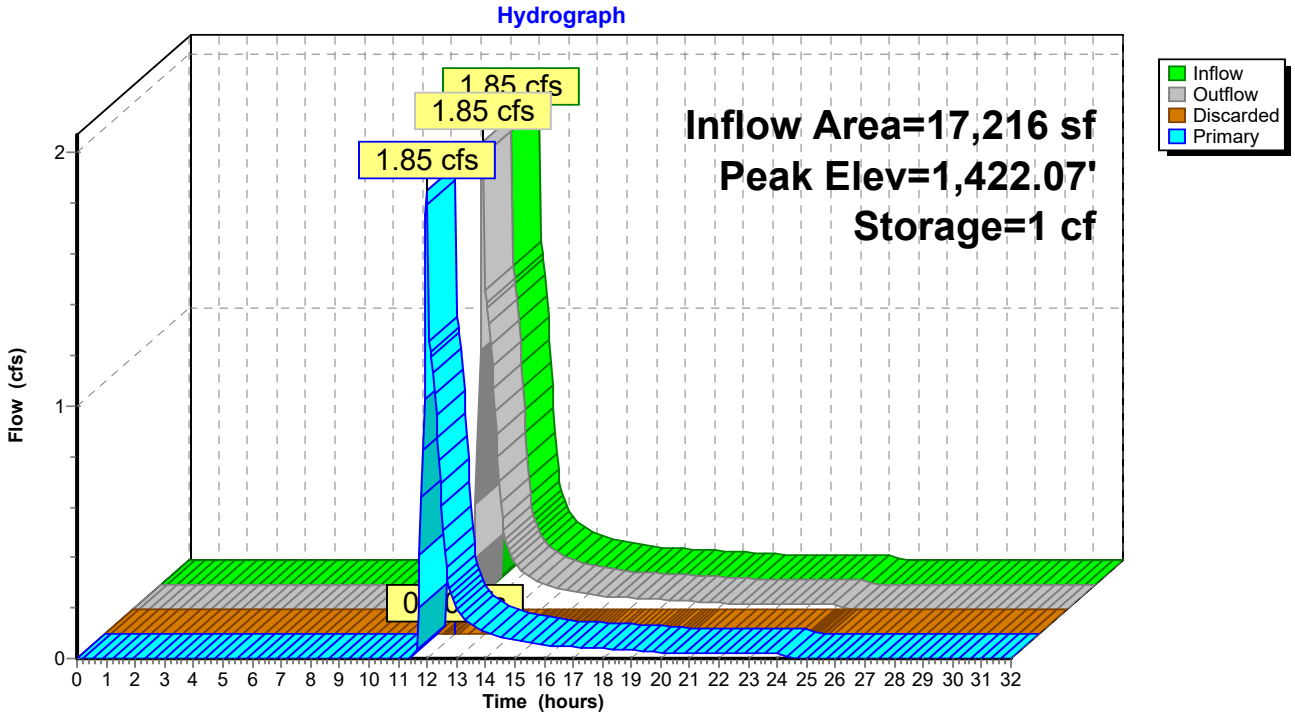
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

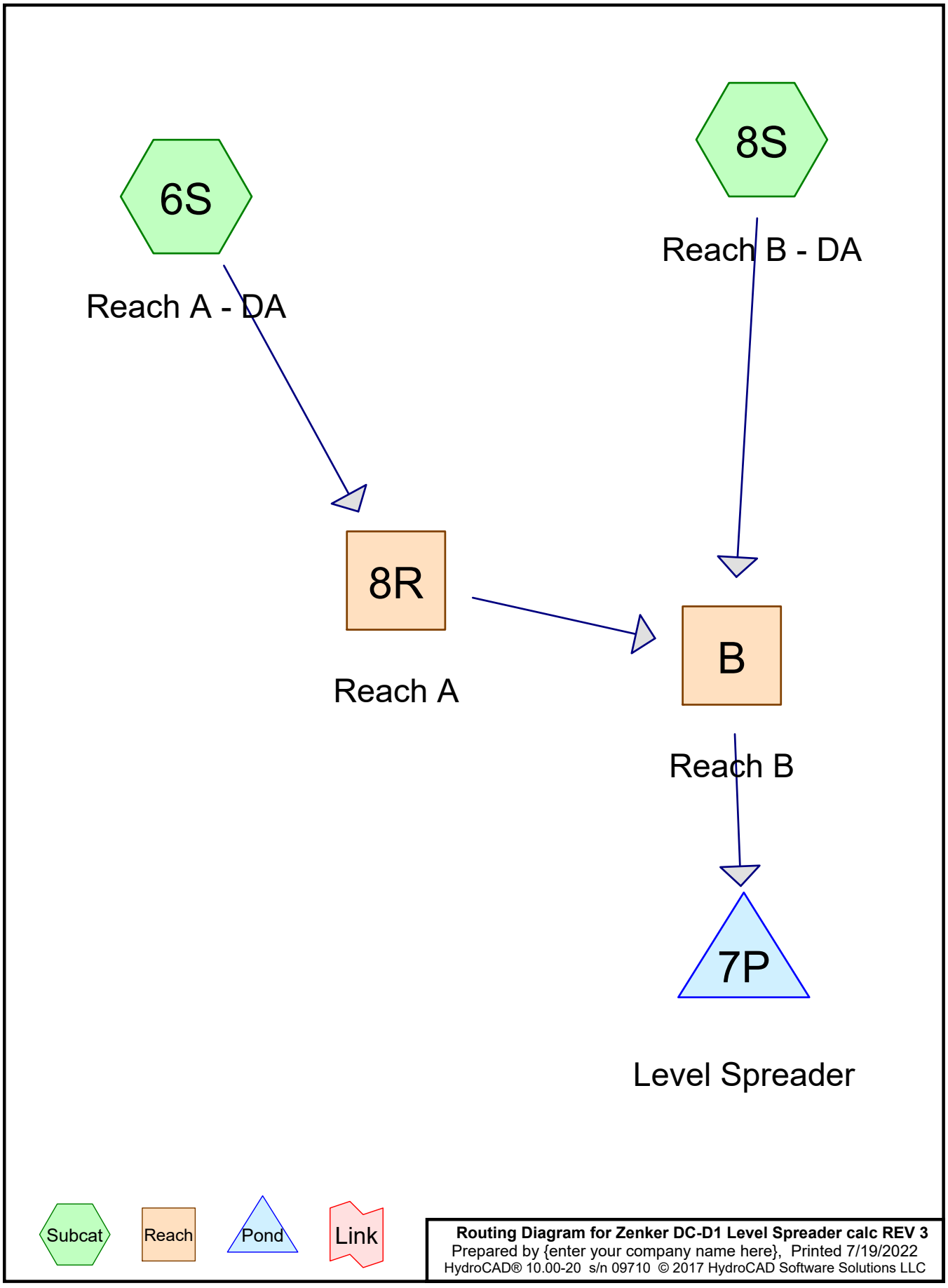
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=1,422.07' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=1.78 cfs @ 11.98 hrs HW=1,422.07' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.78 cfs @ 0.72 fps)

Pond 6P: Level Spreader





Routing Diagram for Zenker DC-D1 Level Spreader calc REV 3
Prepared by {enter your company name here}, Printed 7/19/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
17,725	78	Meadow, non-grazed, HSG D (6S, 8S)
17,725	**78**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
17,725	HSG D	6S, 8S
0	Other	
17,725		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	17,725	0	17,725	Meadow, non-grazed	
0	**0**	**0**	**17,725**	**0**	**17,725**	**TOTAL AREA**	

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=0.76"
Tc=5.0 min CN=78 Runoff=0.07 cfs 143 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=0.76"
Tc=5.0 min CN=78 Runoff=0.48 cfs 982 cf

Reach 8R: Reach A Avg. Flow Depth=0.09' Max Vel=0.71 fps Inflow=0.07 cfs 143 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.06 cfs 143 cf

Reach B: Reach B Avg. Flow Depth=0.36' Max Vel=1.09 fps Inflow=0.53 cfs 1,126 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=0.51 cfs 1,126 cf

Pond 7P: Level Spreader Peak Elev=1,431.05' Storage=49 cf Inflow=0.51 cfs 1,126 cf
Outflow=0.49 cfs 1,081 cf

Total Runoff Area = 17,725 sf Runoff Volume = 1,126 cf Average Runoff Depth = 0.76"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

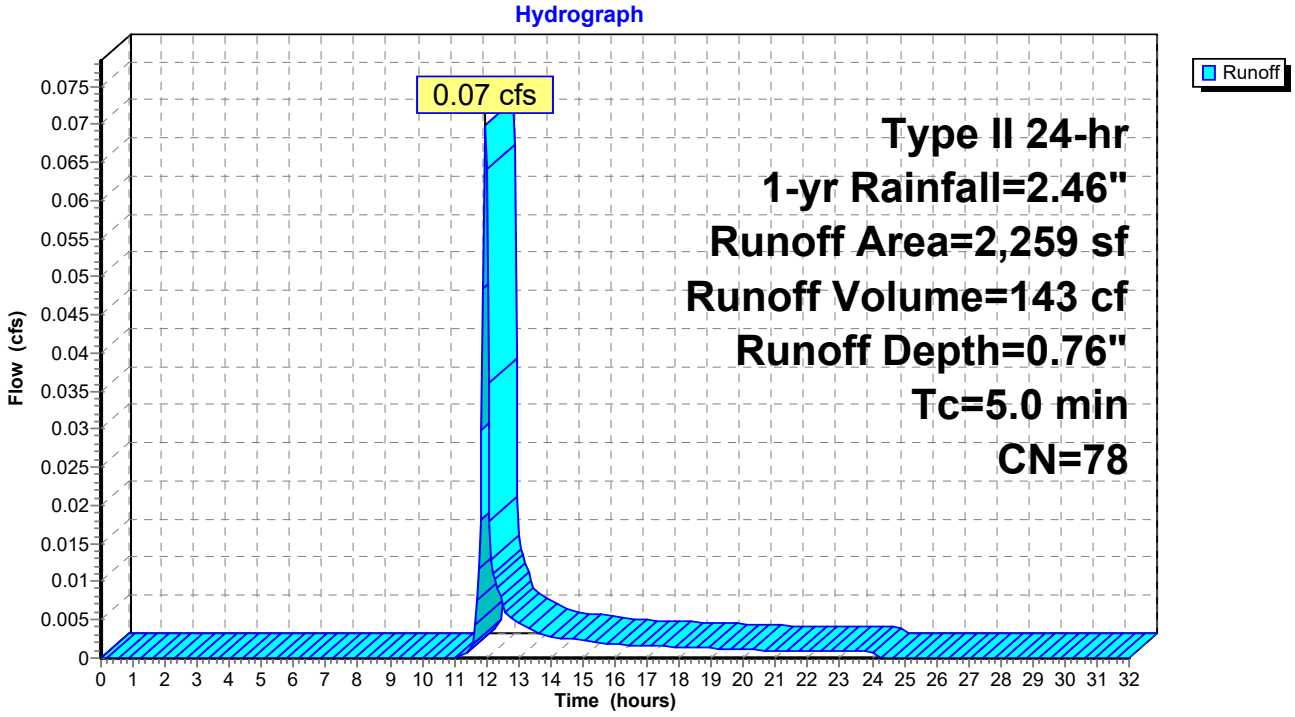
Runoff = 0.07 cfs @ 11.97 hrs, Volume= 143 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

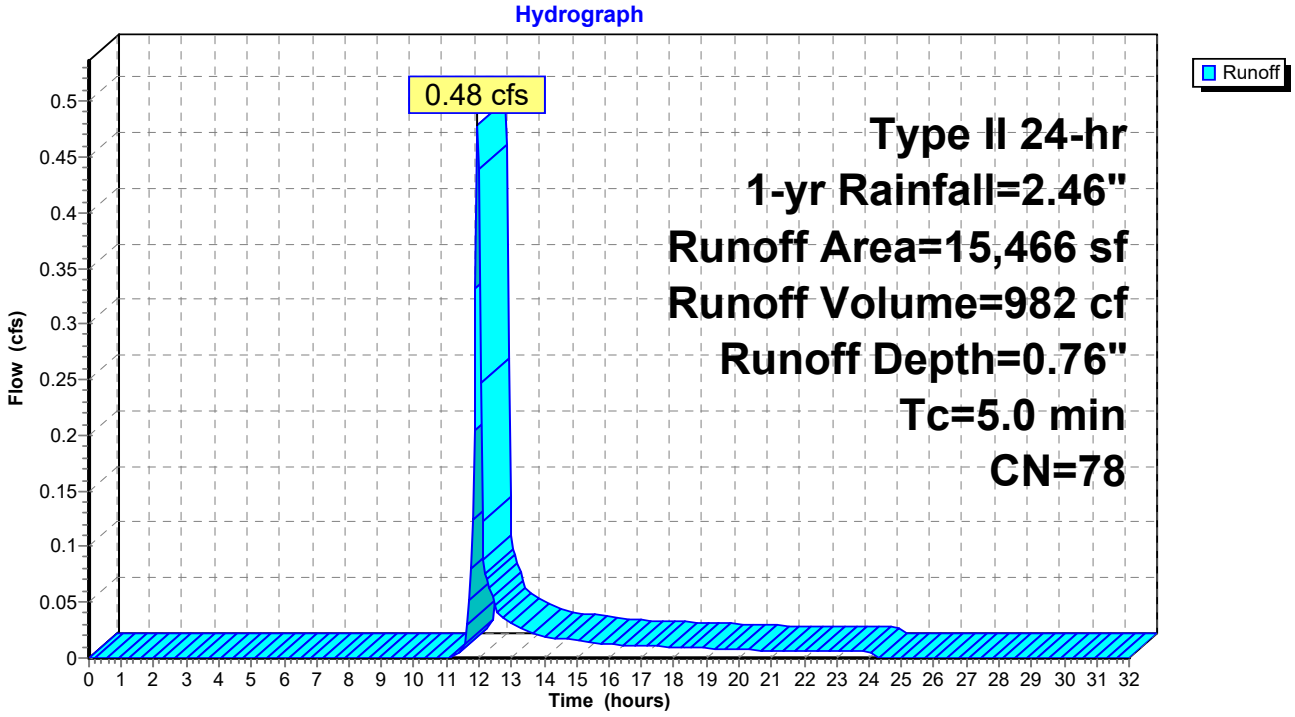
Runoff = 0.48 cfs @ 11.97 hrs, Volume= 982 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



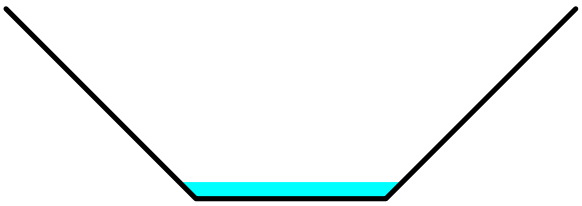
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.07 cfs @ 11.97 hrs, Volume= 143 cf
Outflow = 0.06 cfs @ 12.01 hrs, Volume= 143 cf, Atten= 8%, Lag= 2.6 min

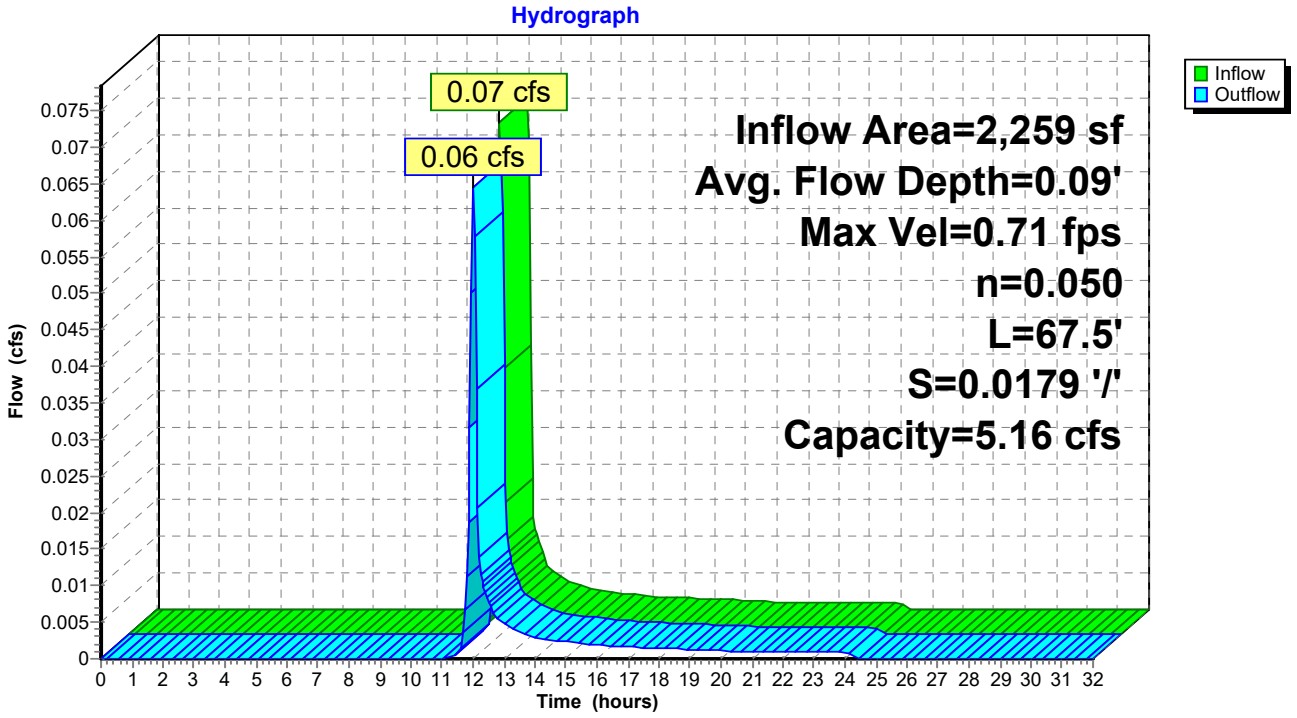
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 5.4 min

Peak Storage= 6 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

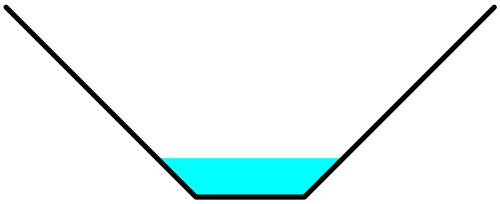
[63] Warning: Exceeded Reach 8R INLET depth by 0.27' @ 12.00 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.53 cfs @ 11.97 hrs, Volume= 1,126 cf
Outflow = 0.51 cfs @ 12.00 hrs, Volume= 1,126 cf, Atten= 4%, Lag= 1.5 min

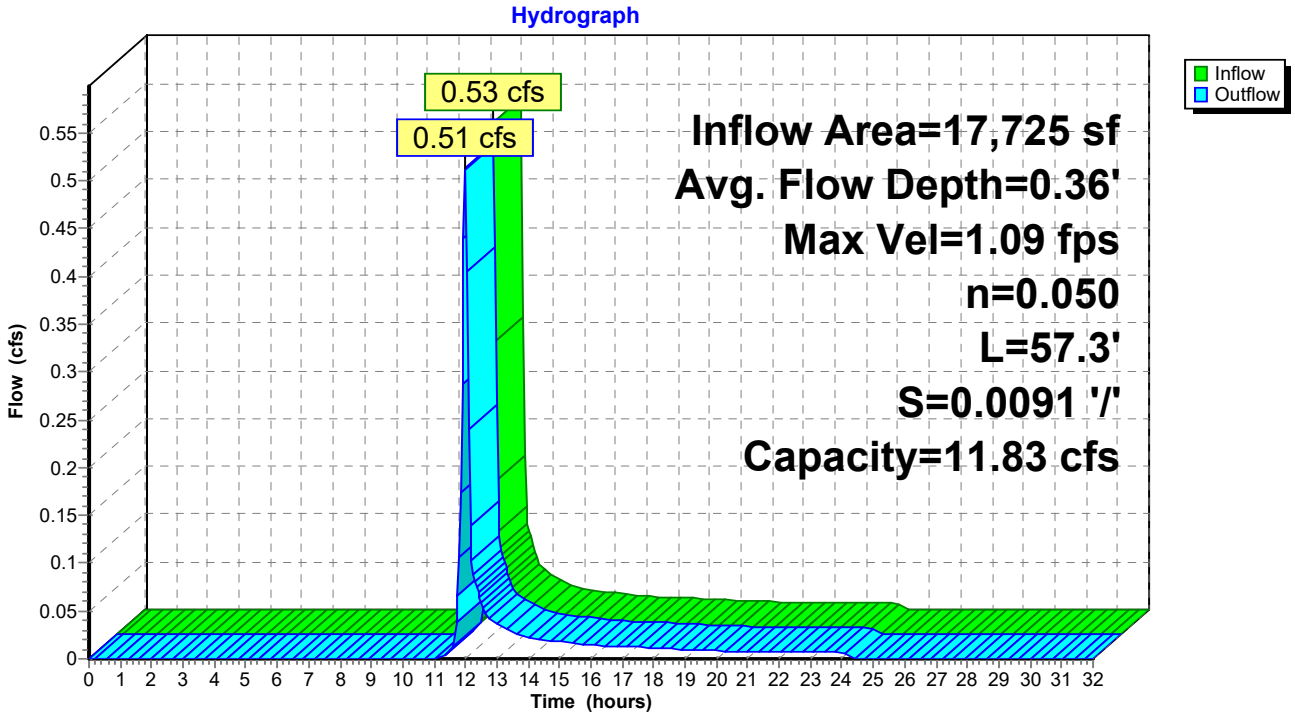
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.09 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.33 fps, Avg. Travel Time= 2.9 min

Peak Storage= 28 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 0.76" for 1-yr event
Inflow = 0.51 cfs @ 12.00 hrs, Volume= 1,126 cf
Outflow = 0.49 cfs @ 11.99 hrs, Volume= 1,081 cf, Atten= 4%, Lag= 0.0 min
Primary = 0.49 cfs @ 11.99 hrs, Volume= 1,081 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.05' @ 11.99 hrs Surf.Area= 90 sf Storage= 49 cf

Plug-Flow detention time= 29.3 min calculated for 1,081 cf (96% of inflow)
Center-of-Mass det. time= 7.0 min (871.2 - 864.2)

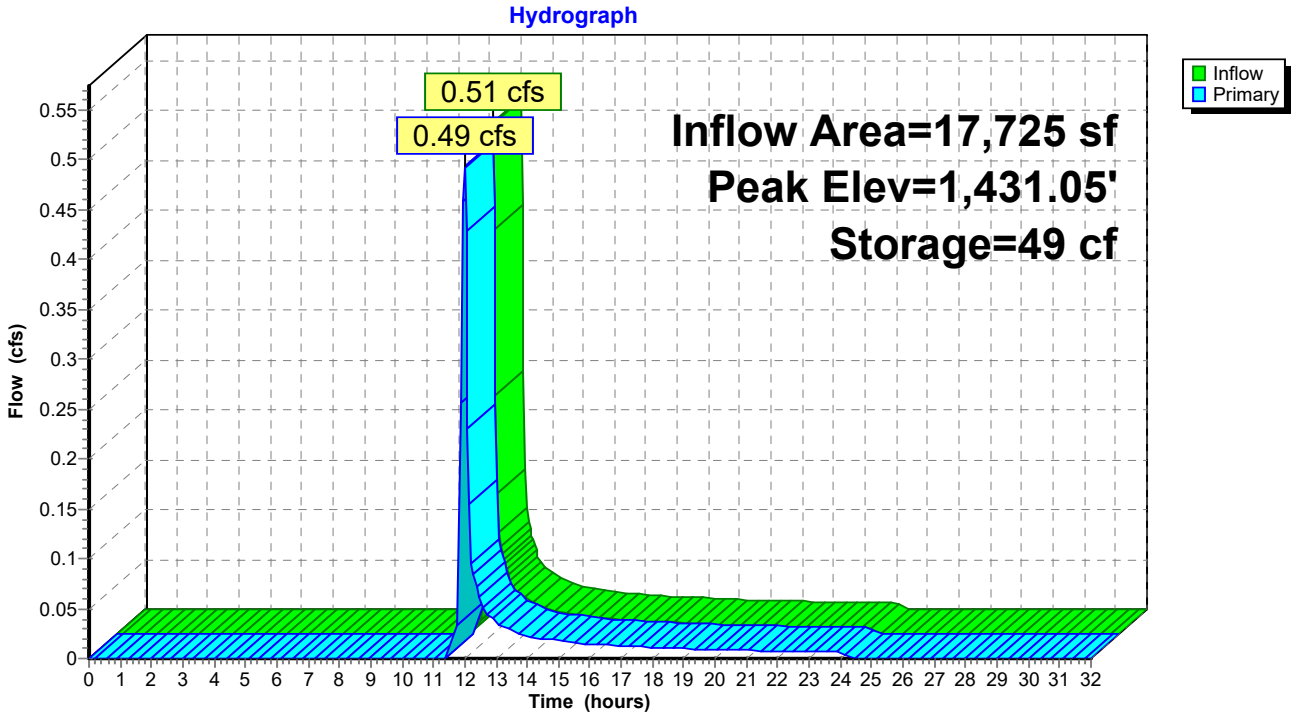
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.48 cfs @ 11.99 hrs HW=1,431.05' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.48 cfs @ 0.70 fps)

Pond 7P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=1.09"
Tc=5.0 min CN=78 Runoff=0.10 cfs 206 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=1.09"
Tc=5.0 min CN=78 Runoff=0.70 cfs 1,409 cf

Reach 8R: Reach A Avg. Flow Depth=0.11' Max Vel=0.81 fps Inflow=0.10 cfs 206 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.09 cfs 206 cf

Reach B: Reach B Avg. Flow Depth=0.44' Max Vel=1.21 fps Inflow=0.78 cfs 1,615 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=0.75 cfs 1,615 cf

Pond 7P: Level Spreader Peak Elev=1,431.06' Storage=50 cf Inflow=0.75 cfs 1,615 cf
Outflow=0.74 cfs 1,570 cf

Total Runoff Area = 17,725 sf Runoff Volume = 1,615 cf Average Runoff Depth = 1.09"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

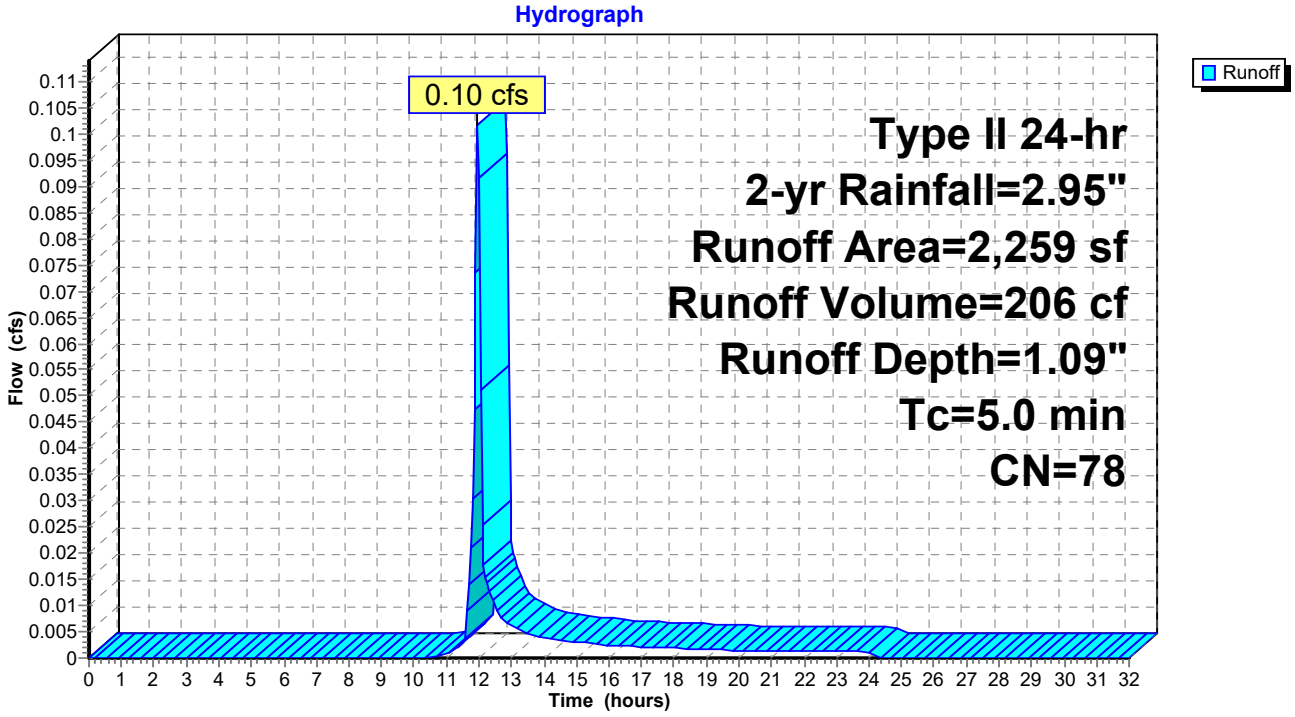
Runoff = 0.10 cfs @ 11.96 hrs, Volume= 206 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

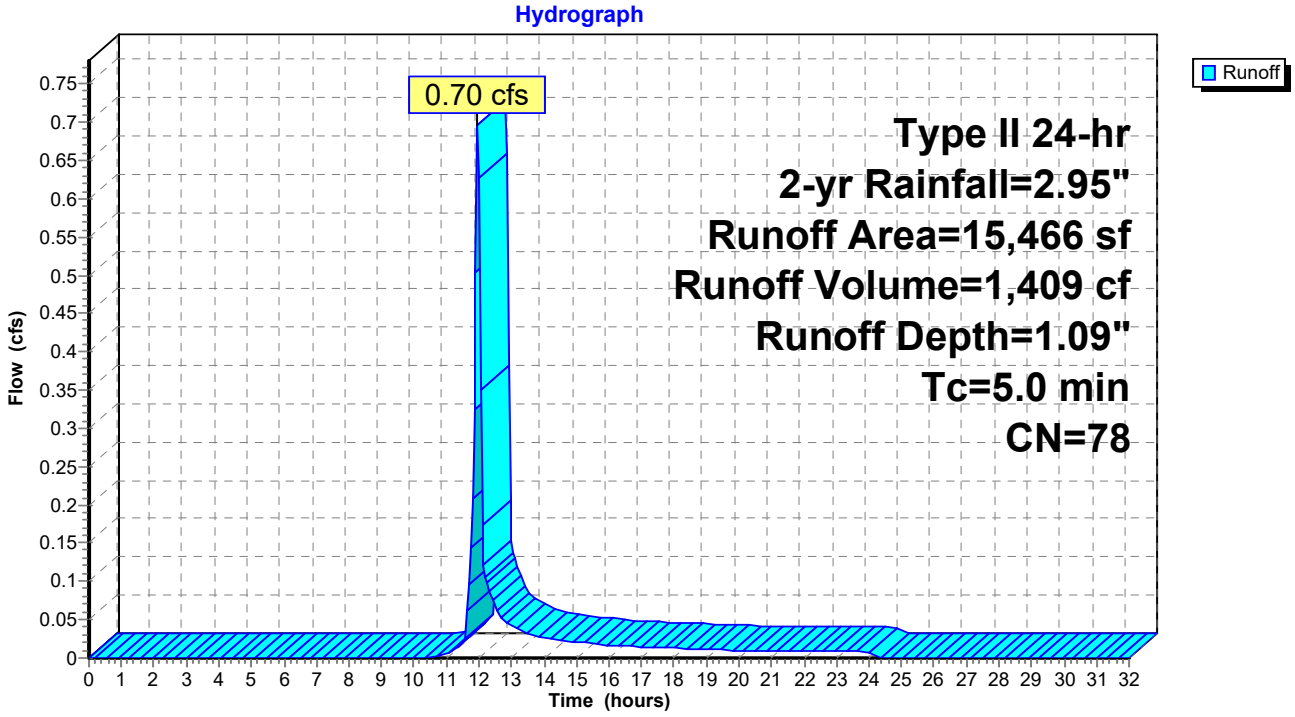
Runoff = 0.70 cfs @ 11.96 hrs, Volume= 1,409 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



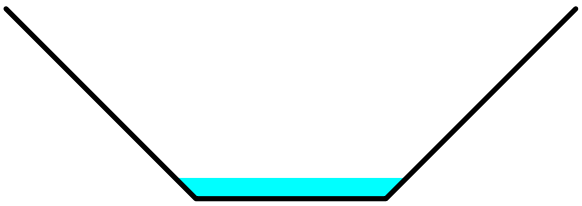
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.10 cfs @ 11.96 hrs, Volume= 206 cf
Outflow = 0.09 cfs @ 12.00 hrs, Volume= 206 cf, Atten= 7%, Lag= 2.3 min

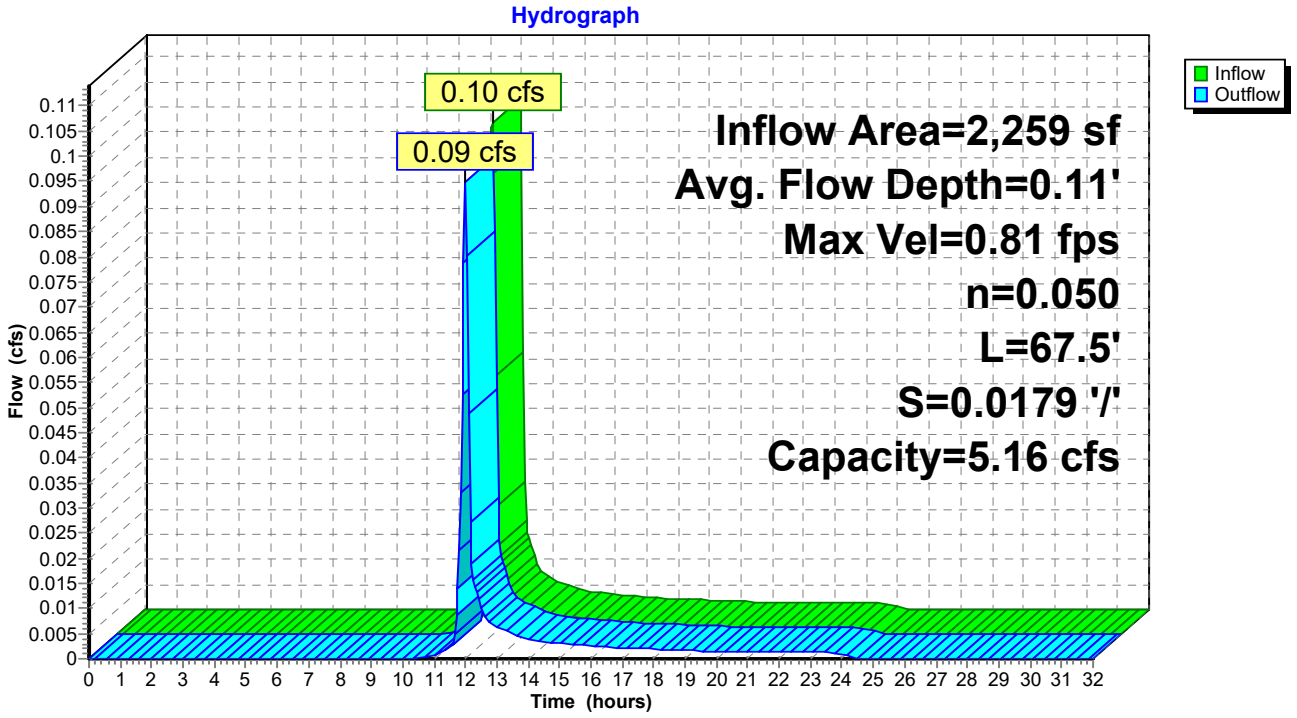
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.81 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.22 fps, Avg. Travel Time= 5.0 min

Peak Storage= 8 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

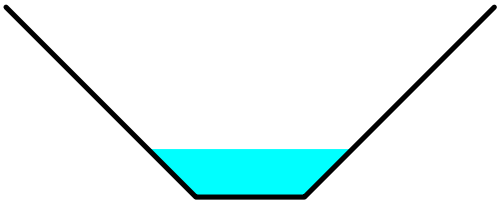
[63] Warning: Exceeded Reach 8R INLET depth by 0.33' @ 12.00 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.78 cfs @ 11.97 hrs, Volume= 1,615 cf
Outflow = 0.75 cfs @ 11.99 hrs, Volume= 1,615 cf, Atten= 4%, Lag= 1.4 min

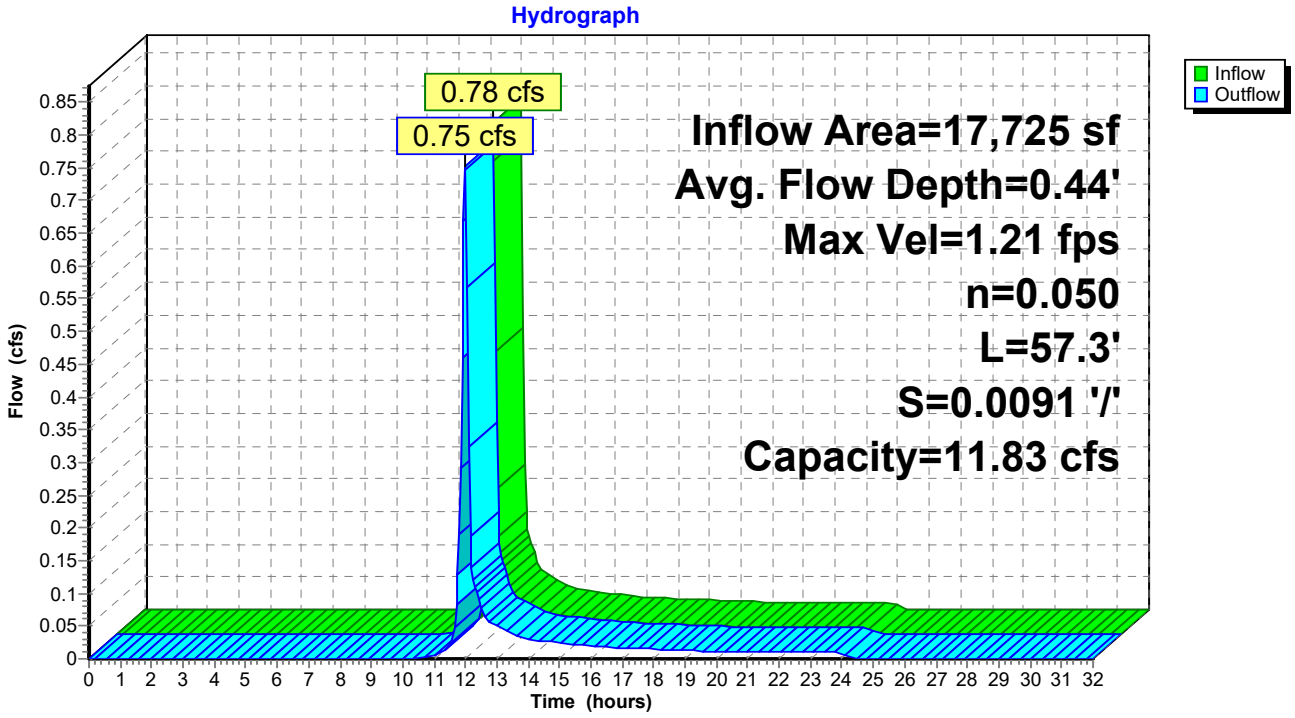
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.21 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.36 fps, Avg. Travel Time= 2.6 min

Peak Storage= 36 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 0.75 cfs @ 11.99 hrs, Volume= 1,615 cf
Outflow = 0.74 cfs @ 11.99 hrs, Volume= 1,570 cf, Atten= 1%, Lag= 0.0 min
Primary = 0.74 cfs @ 11.99 hrs, Volume= 1,570 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.06' @ 11.99 hrs Surf.Area= 90 sf Storage= 50 cf

Plug-Flow detention time= 21.1 min calculated for 1,570 cf (97% of inflow)
Center-of-Mass det. time= 5.0 min (857.7 - 852.7)

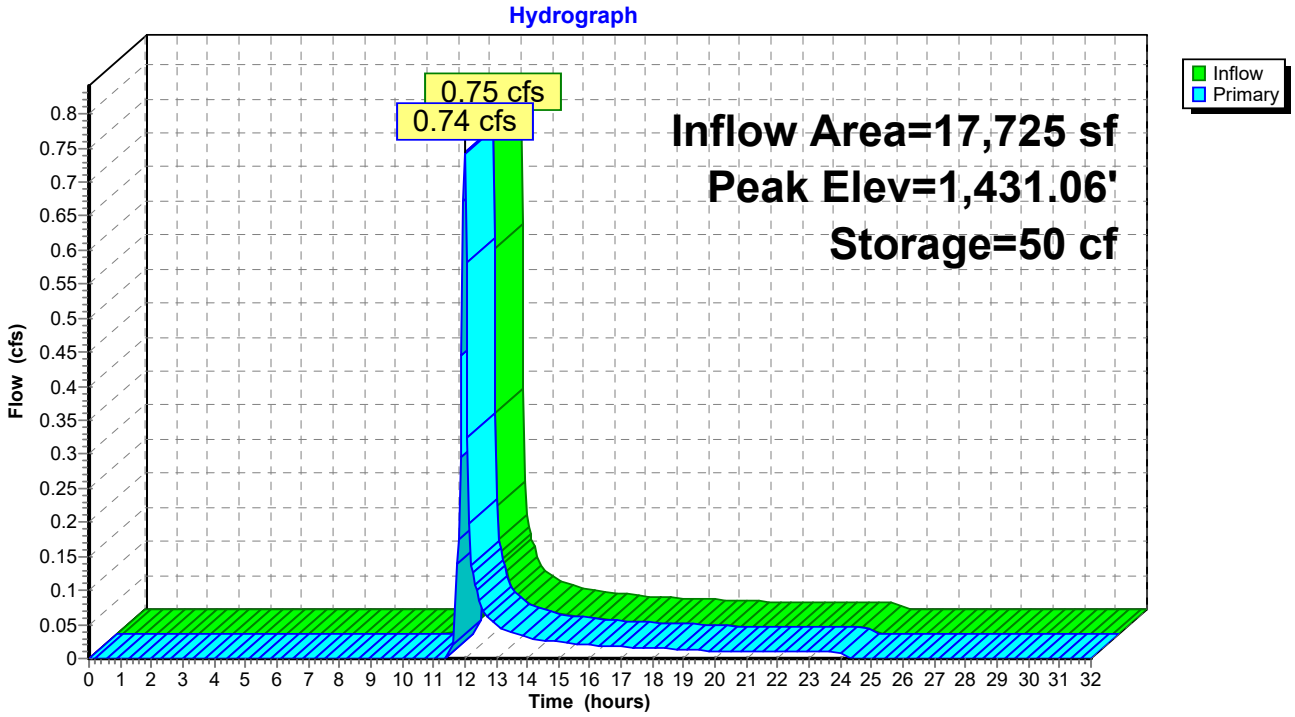
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.73 cfs @ 11.99 hrs HW=1,431.06' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.73 cfs @ 0.81 fps)

Pond 7P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=2.13"
Tc=5.0 min CN=78 Runoff=0.20 cfs 401 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=2.13"
Tc=5.0 min CN=78 Runoff=1.36 cfs 2,744 cf

Reach 8R: Reach A Avg. Flow Depth=0.16' Max Vel=1.01 fps Inflow=0.20 cfs 401 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.19 cfs 401 cf

Reach B: Reach B Avg. Flow Depth=0.63' Max Vel=1.45 fps Inflow=1.53 cfs 3,144 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=1.48 cfs 3,144 cf

Pond 7P: Level Spreader Peak Elev=1,431.10' Storage=54 cf Inflow=1.48 cfs 3,144 cf
Outflow=1.48 cfs 3,099 cf

Total Runoff Area = 17,725 sf Runoff Volume = 3,144 cf Average Runoff Depth = 2.13"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

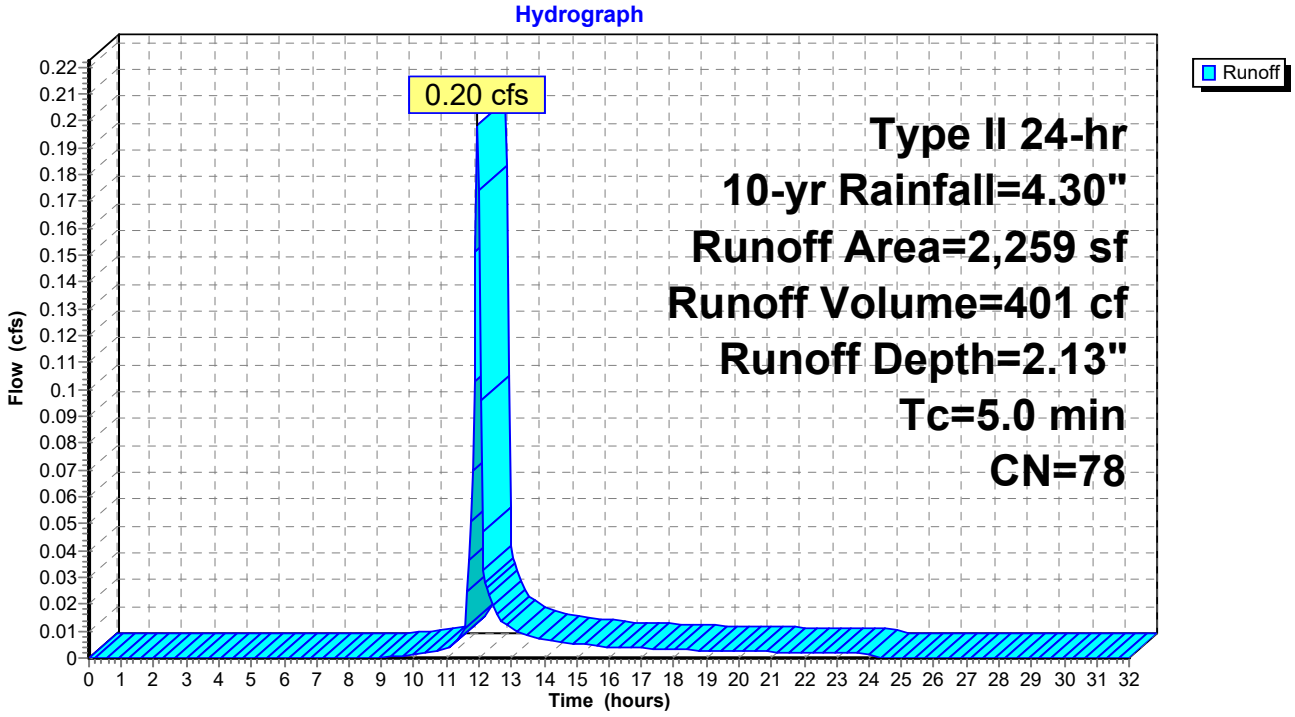
Runoff = 0.20 cfs @ 11.96 hrs, Volume= 401 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

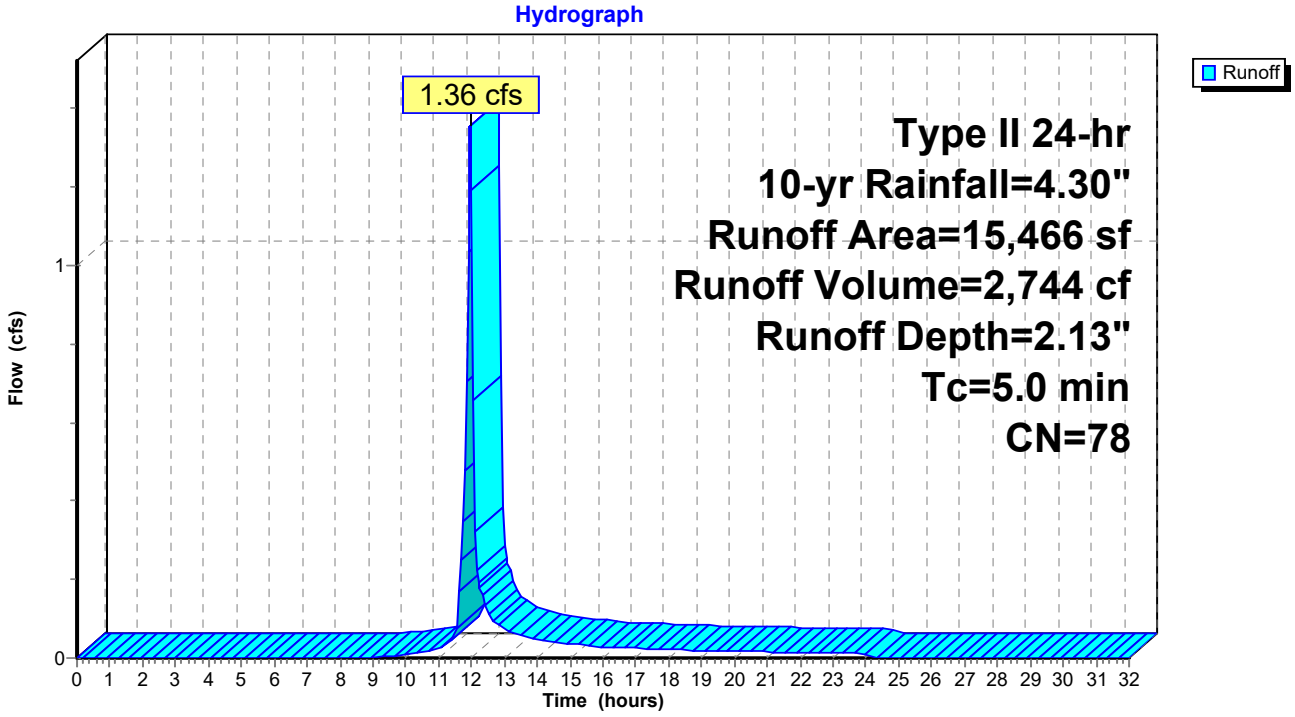
Runoff = 1.36 cfs @ 11.96 hrs, Volume= 2,744 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



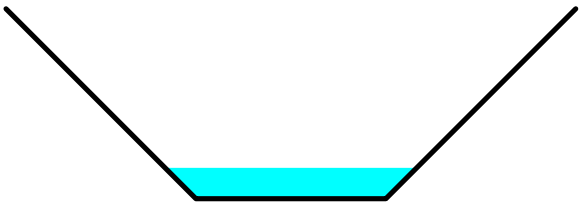
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 0.20 cfs @ 11.96 hrs, Volume= 401 cf
Outflow = 0.19 cfs @ 11.99 hrs, Volume= 401 cf, Atten= 6%, Lag= 1.9 min

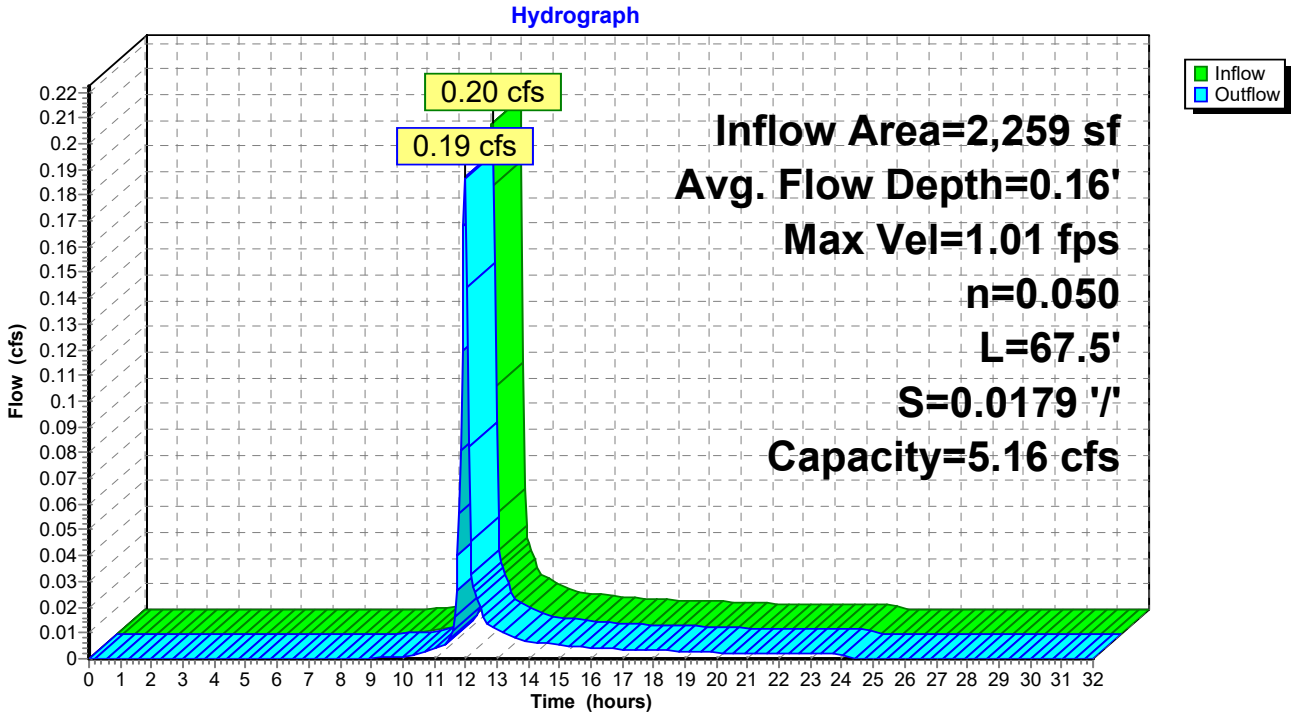
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.01 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 4.3 min

Peak Storage= 13 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

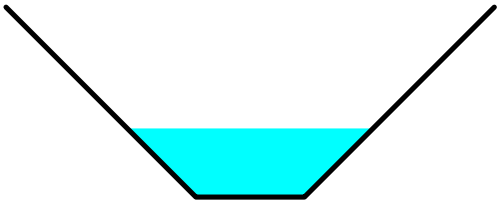
[63] Warning: Exceeded Reach 8R INLET depth by 0.46' @ 11.95 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.53 cfs @ 11.96 hrs, Volume= 3,144 cf
Outflow = 1.48 cfs @ 11.98 hrs, Volume= 3,144 cf, Atten= 4%, Lag= 1.2 min

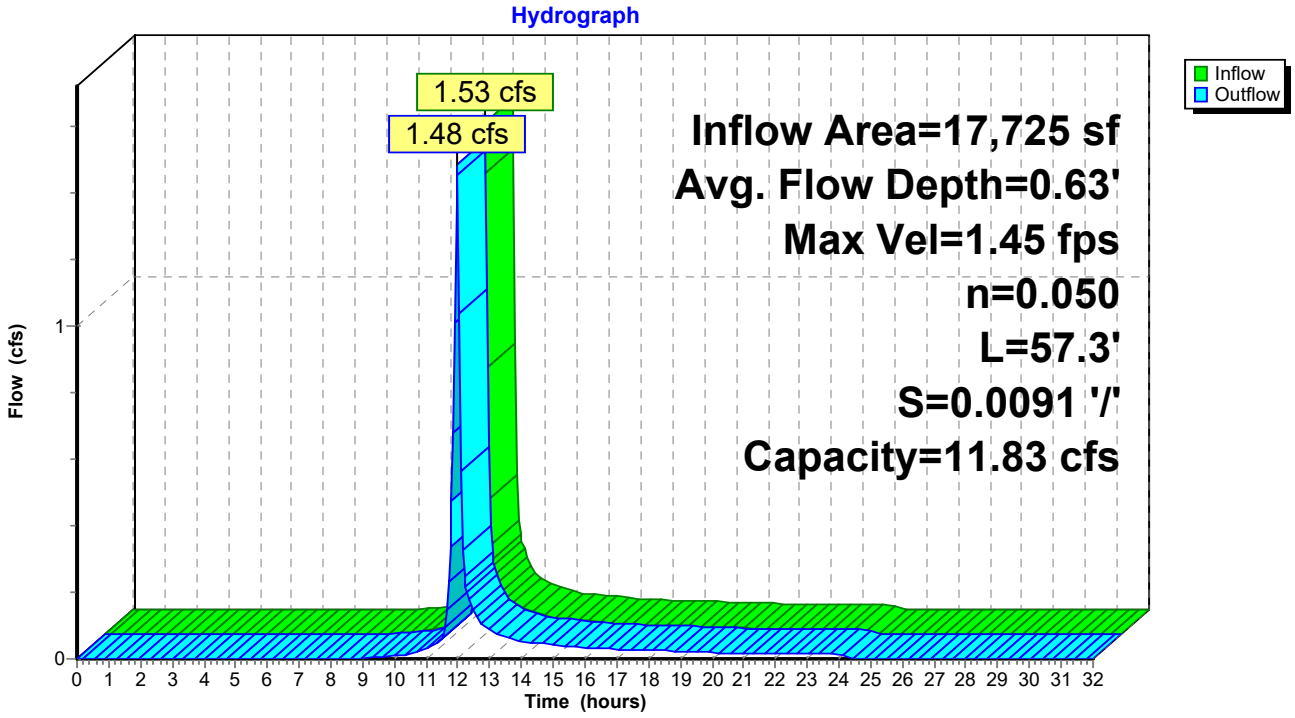
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.45 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 2.2 min

Peak Storage= 59 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 1.48 cfs @ 11.98 hrs, Volume= 3,144 cf
Outflow = 1.48 cfs @ 11.98 hrs, Volume= 3,099 cf, Atten= 0%, Lag= 0.1 min
Primary = 1.48 cfs @ 11.98 hrs, Volume= 3,099 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.10' @ 11.98 hrs Surf.Area= 90 sf Storage= 54 cf

Plug-Flow detention time= 12.0 min calculated for 3,094 cf (98% of inflow)
Center-of-Mass det. time= 3.5 min (836.1 - 832.6)

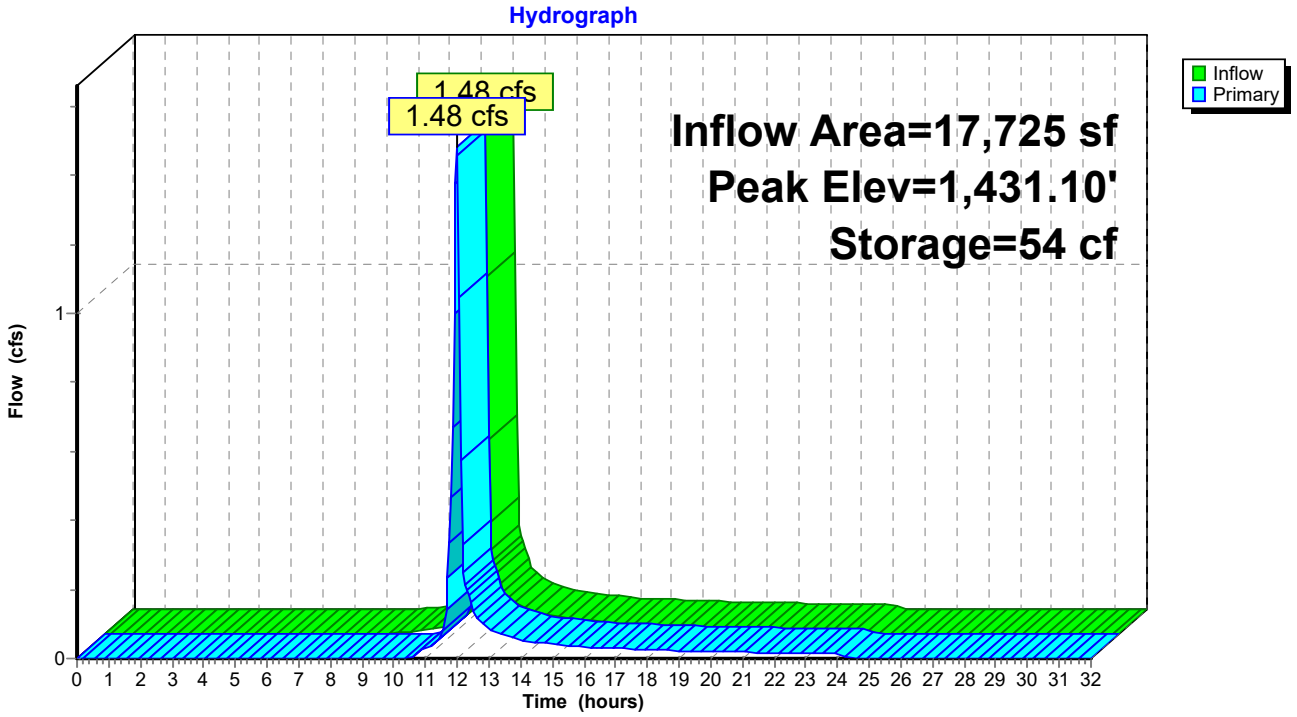
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=1.42 cfs @ 11.98 hrs HW=1,431.09' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.42 cfs @ 1.02 fps)

Pond 7P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=2.99"
Tc=5.0 min CN=78 Runoff=0.28 cfs 562 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=2.99"
Tc=5.0 min CN=78 Runoff=1.89 cfs 3,848 cf

Reach 8R: Reach A Avg. Flow Depth=0.20' Max Vel=1.13 fps Inflow=0.28 cfs 562 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.26 cfs 562 cf

Reach B: Reach B Avg. Flow Depth=0.75' Max Vel=1.58 fps Inflow=2.14 cfs 4,410 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=2.07 cfs 4,410 cf

Pond 7P: Level Spreader Peak Elev=1,431.12' Storage=56 cf Inflow=2.07 cfs 4,410 cf
Outflow=2.07 cfs 4,365 cf

Total Runoff Area = 17,725 sf Runoff Volume = 4,410 cf Average Runoff Depth = 2.99"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

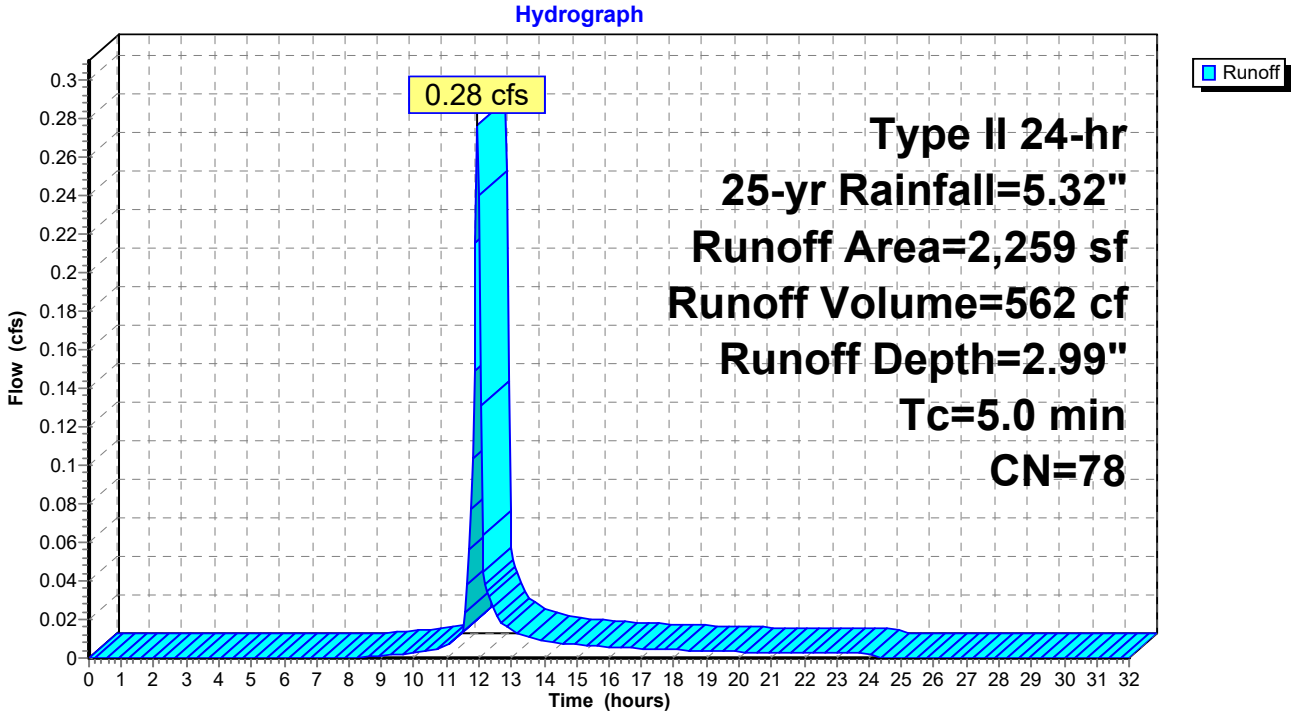
Runoff = 0.28 cfs @ 11.96 hrs, Volume= 562 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

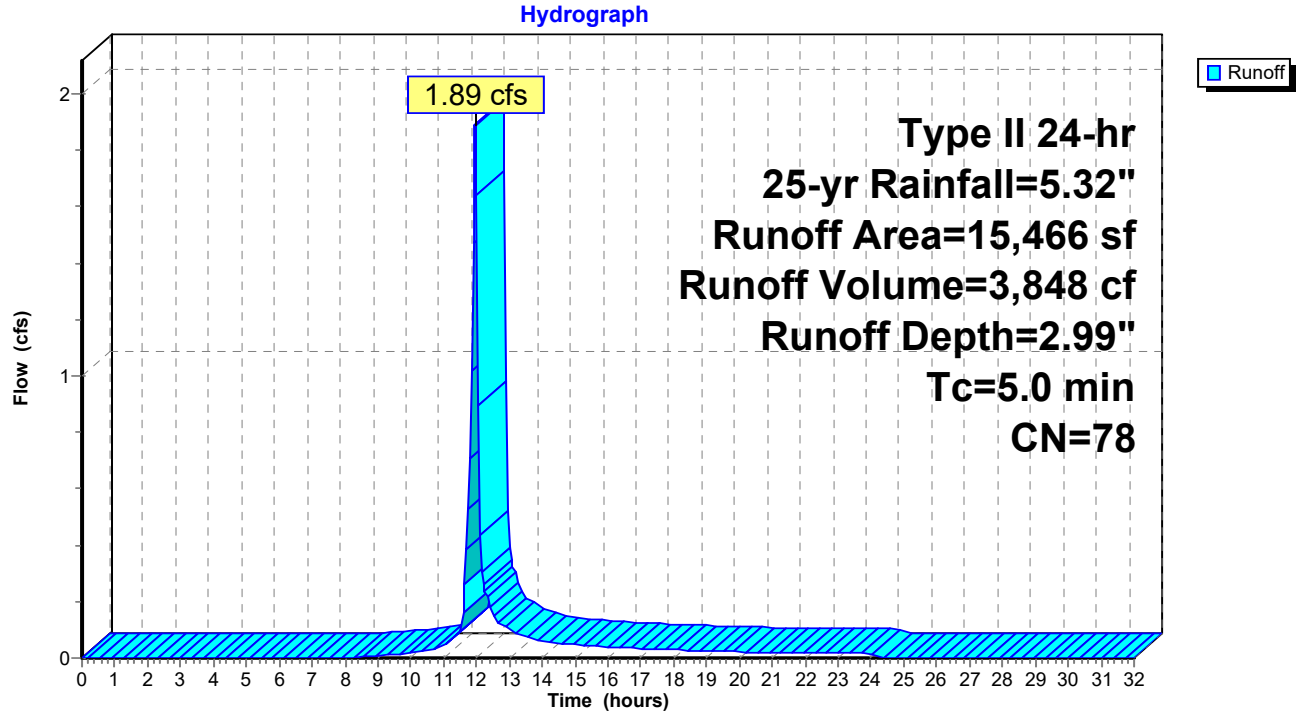
Runoff = 1.89 cfs @ 11.96 hrs, Volume= 3,848 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



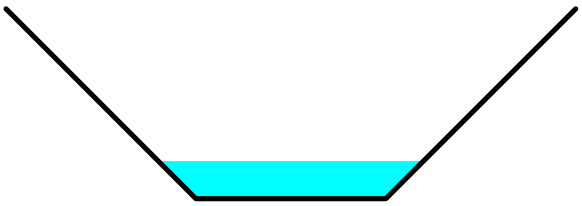
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 2.99" for 25-yr event
Inflow = 0.28 cfs @ 11.96 hrs, Volume= 562 cf
Outflow = 0.26 cfs @ 11.99 hrs, Volume= 562 cf, Atten= 5%, Lag= 1.7 min

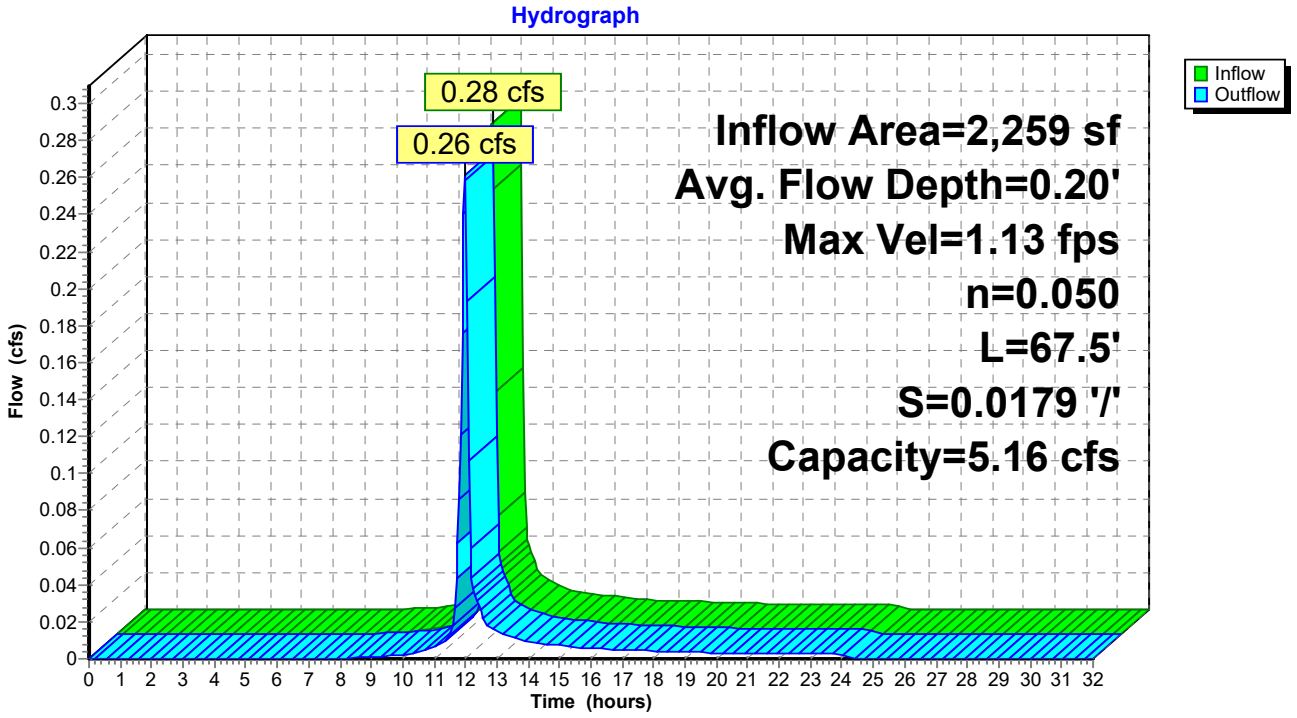
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.13 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 4.0 min

Peak Storage= 16 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

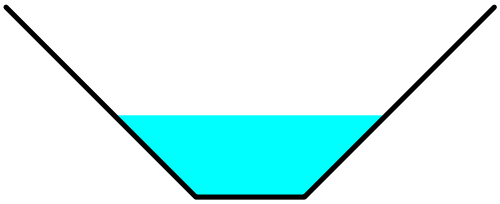
[63] Warning: Exceeded Reach 8R INLET depth by 0.55' @ 11.95 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 2.99" for 25-yr event
Inflow = 2.14 cfs @ 11.96 hrs, Volume= 4,410 cf
Outflow = 2.07 cfs @ 11.98 hrs, Volume= 4,410 cf, Atten= 3%, Lag= 1.2 min

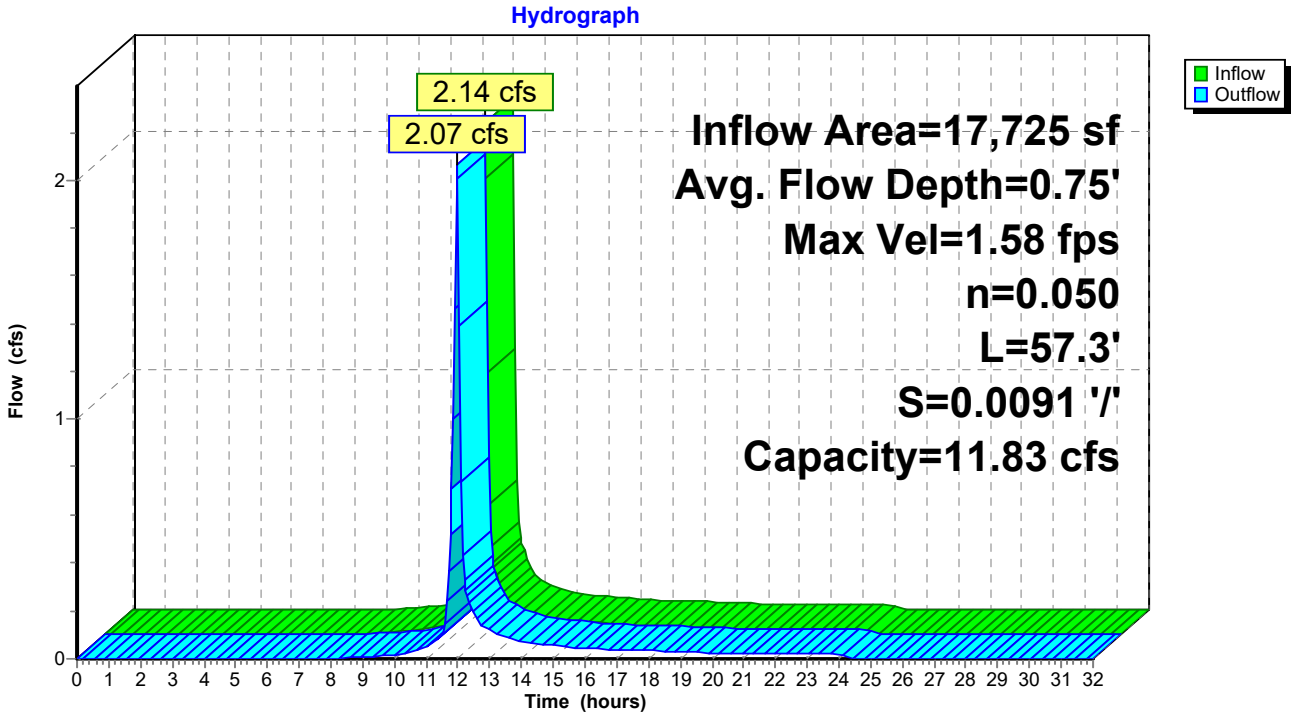
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.58 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 2.1 min

Peak Storage= 76 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 2.99" for 25-yr event
Inflow = 2.07 cfs @ 11.98 hrs, Volume= 4,410 cf
Outflow = 2.07 cfs @ 11.98 hrs, Volume= 4,365 cf, Atten= 0%, Lag= 0.1 min
Primary = 2.07 cfs @ 11.98 hrs, Volume= 4,365 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.12' @ 11.98 hrs Surf.Area= 90 sf Storage= 56 cf

Plug-Flow detention time= 9.4 min calculated for 4,365 cf (99% of inflow)
Center-of-Mass det. time= 3.1 min (825.7 - 822.7)

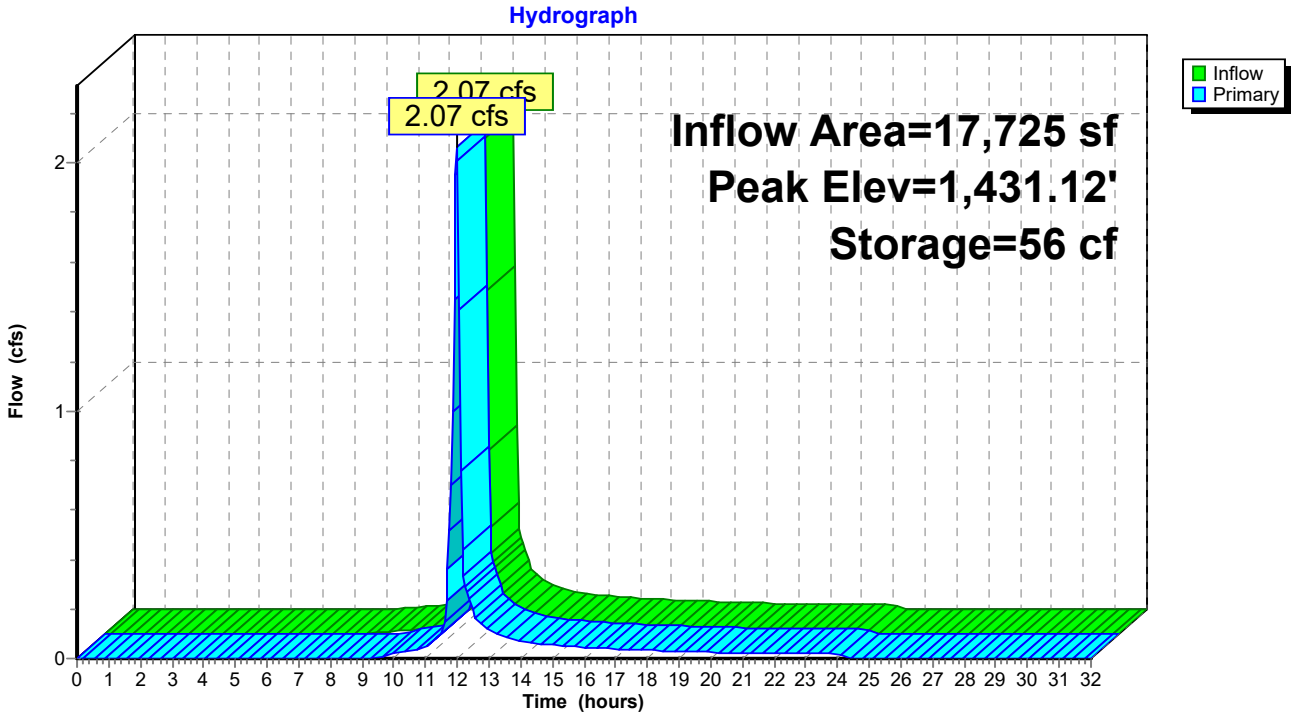
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=1.98 cfs @ 11.98 hrs HW=1,431.12' (Free Discharge)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.98 cfs @ 1.14 fps)

Pond 7P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=3.81"
Tc=5.0 min CN=78 Runoff=0.35 cfs 717 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=3.81"
Tc=5.0 min CN=78 Runoff=2.39 cfs 4,910 cf

Reach 8R: Reach A Avg. Flow Depth=0.23' Max Vel=1.21 fps Inflow=0.35 cfs 717 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.33 cfs 717 cf

Reach B: Reach B Avg. Flow Depth=0.85' Max Vel=1.69 fps Inflow=2.71 cfs 5,627 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=2.62 cfs 5,627 cf

Pond 7P: Level Spreader Peak Elev=1,431.14' Storage=58 cf Inflow=2.62 cfs 5,627 cf
Outflow=2.62 cfs 5,582 cf

Total Runoff Area = 17,725 sf Runoff Volume = 5,627 cf Average Runoff Depth = 3.81"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

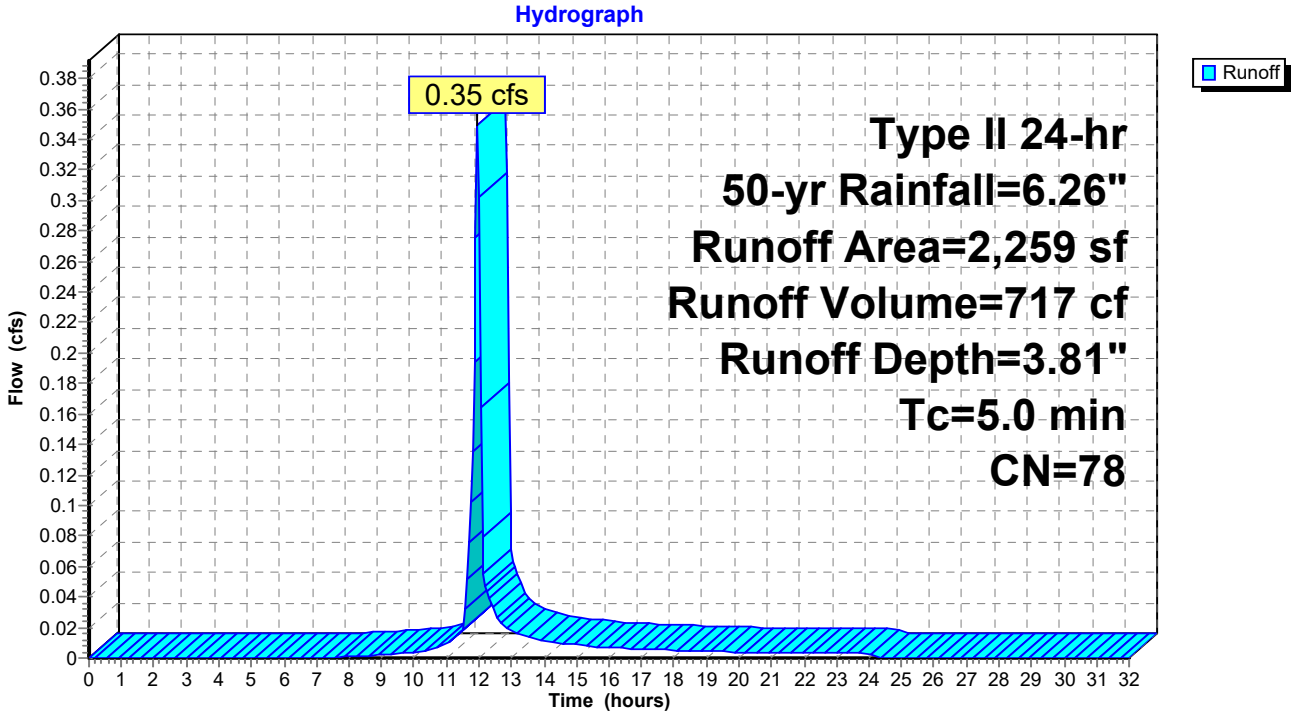
Runoff = 0.35 cfs @ 11.96 hrs, Volume= 717 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

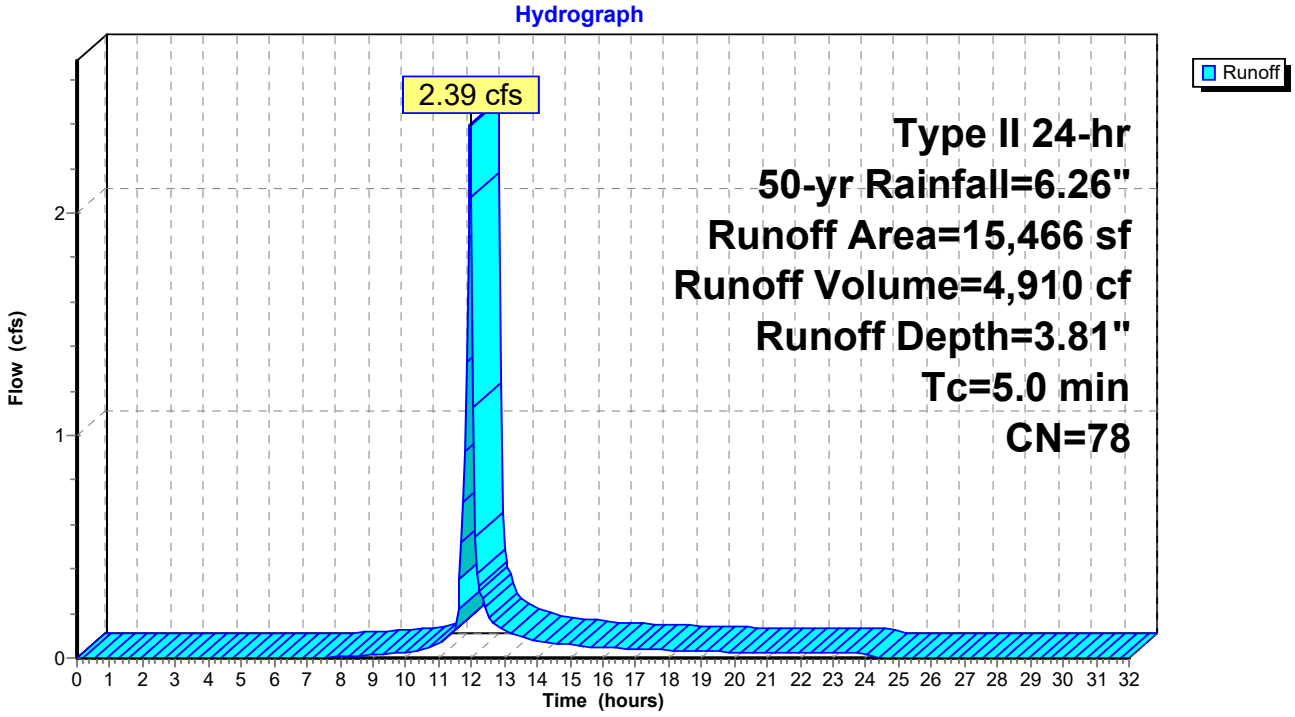
Runoff = 2.39 cfs @ 11.96 hrs, Volume= 4,910 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



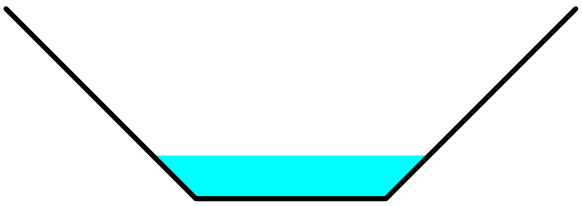
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 3.81" for 50-yr event
Inflow = 0.35 cfs @ 11.96 hrs, Volume= 717 cf
Outflow = 0.33 cfs @ 11.98 hrs, Volume= 717 cf, Atten= 5%, Lag= 1.6 min

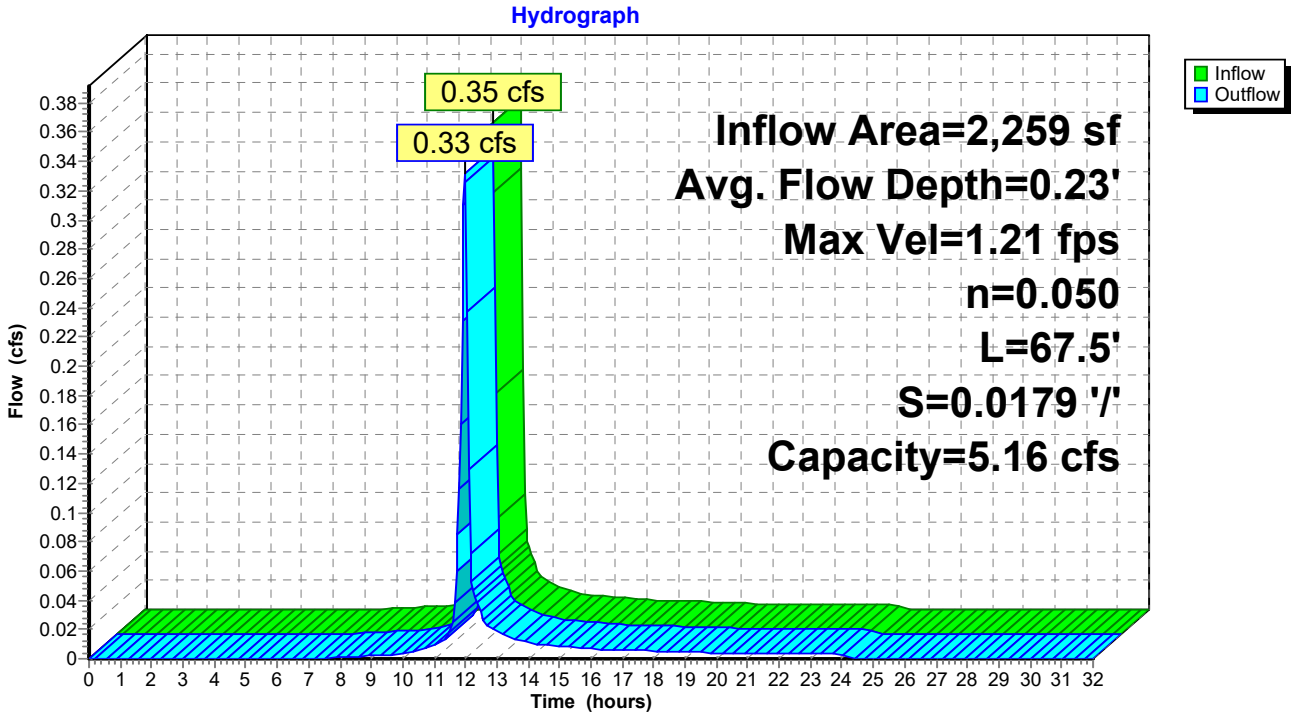
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.21 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 3.7 min

Peak Storage= 19 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

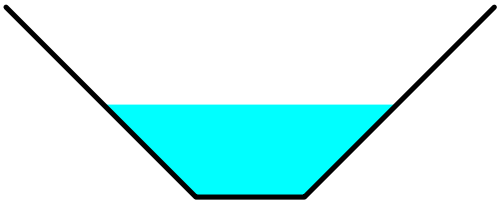
[63] Warning: Exceeded Reach 8R INLET depth by 0.62' @ 11.95 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 3.81" for 50-yr event
Inflow = 2.71 cfs @ 11.96 hrs, Volume= 5,627 cf
Outflow = 2.62 cfs @ 11.98 hrs, Volume= 5,627 cf, Atten= 3%, Lag= 1.1 min

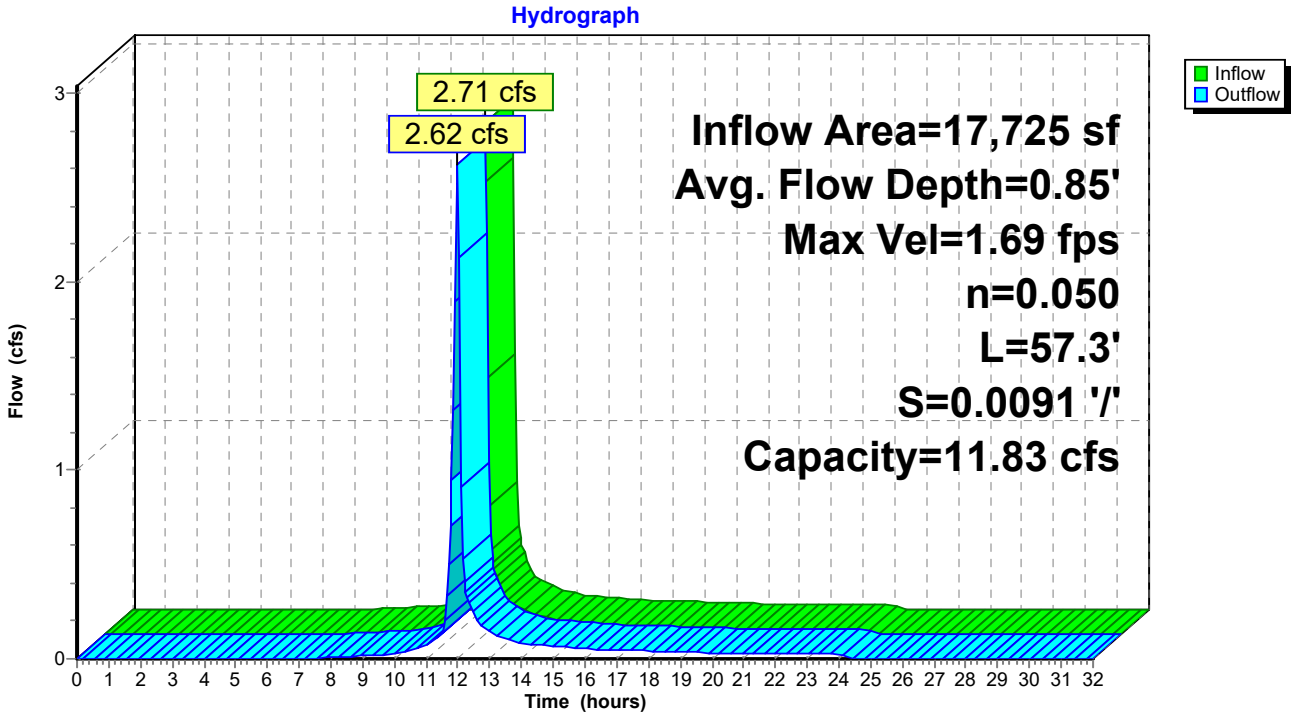
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.69 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 2.0 min

Peak Storage= 90 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.85'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 3.81" for 50-yr event
Inflow = 2.62 cfs @ 11.98 hrs, Volume= 5,627 cf
Outflow = 2.62 cfs @ 11.98 hrs, Volume= 5,582 cf, Atten= 0%, Lag= 0.1 min
Primary = 2.62 cfs @ 11.98 hrs, Volume= 5,582 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.14' @ 11.98 hrs Surf.Area= 90 sf Storage= 58 cf

Plug-Flow detention time= 7.8 min calculated for 5,582 cf (99% of inflow)
Center-of-Mass det. time= 2.7 min (818.3 - 815.6)

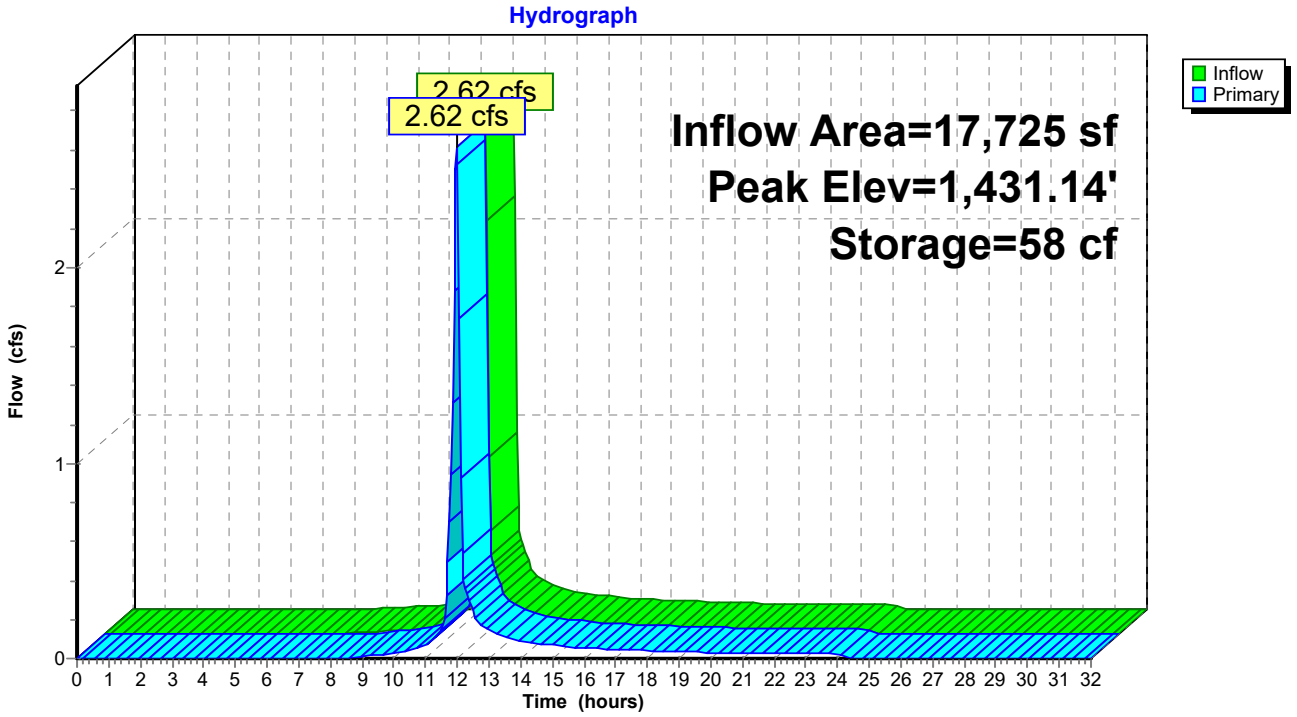
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=2.51 cfs @ 11.98 hrs HW=1,431.14' (Free Discharge)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 2.51 cfs @ 1.24 fps)

Pond 7P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Reach A - DA Runoff Area=2,259 sf 0.00% Impervious Runoff Depth=4.83"
Tc=5.0 min CN=78 Runoff=0.44 cfs 909 cf

Subcatchment 8S: Reach B - DA Runoff Area=15,466 sf 0.00% Impervious Runoff Depth=4.83"
Tc=5.0 min CN=78 Runoff=3.00 cfs 6,225 cf

Reach 8R: Reach A Avg. Flow Depth=0.26' Max Vel=1.30 fps Inflow=0.44 cfs 909 cf
n=0.050 L=67.5' S=0.0179 '/' Capacity=5.16 cfs Outflow=0.42 cfs 909 cf

Reach B: Reach B Avg. Flow Depth=0.96' Max Vel=1.79 fps Inflow=3.40 cfs 7,134 cf
n=0.050 L=57.3' S=0.0091 '/' Capacity=11.83 cfs Outflow=3.26 cfs 7,134 cf

Pond 7P: Level Spreader Peak Elev=1,431.16' Storage=59 cf Inflow=3.26 cfs 7,134 cf
Outflow=3.26 cfs 7,089 cf

Total Runoff Area = 17,725 sf Runoff Volume = 7,134 cf Average Runoff Depth = 4.83"
100.00% Pervious = 17,725 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 6S: Reach A - DA

[49] Hint: Tc<2dt may require smaller dt

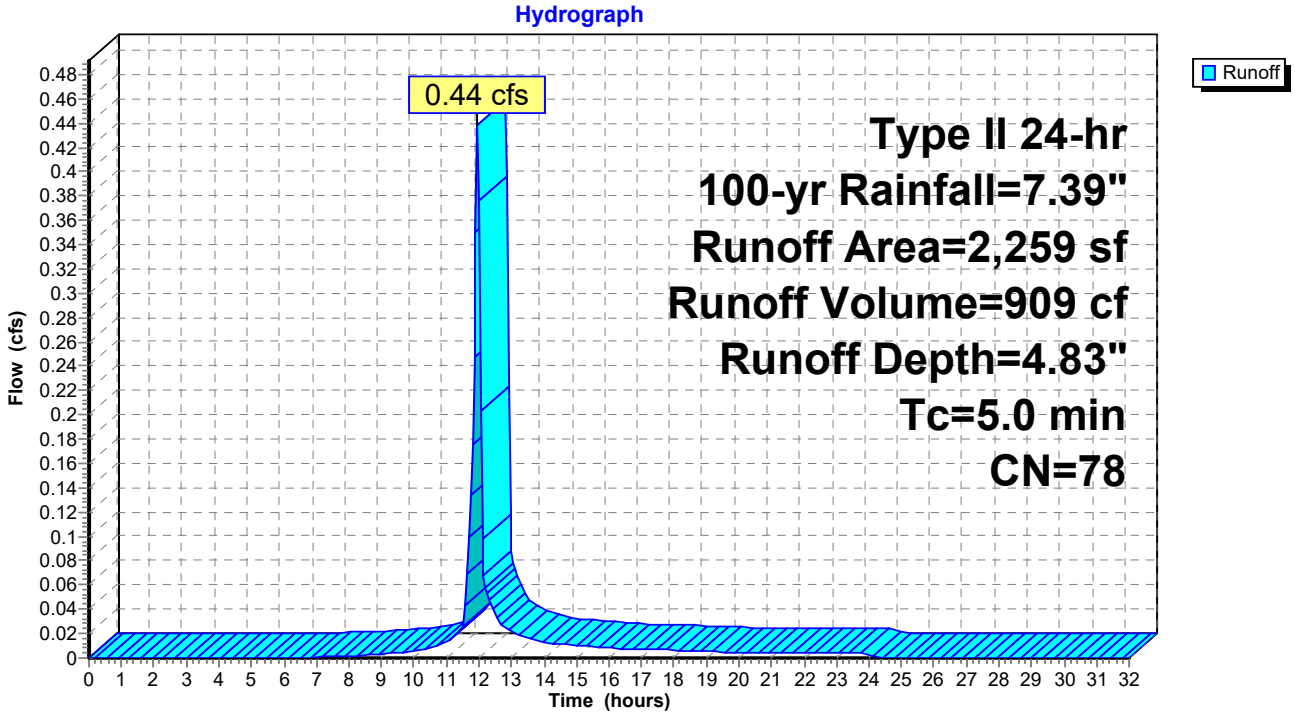
Runoff = 0.44 cfs @ 11.95 hrs, Volume= 909 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
2,259	78	Meadow, non-grazed, HSG D
2,259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: Reach A - DA



Summary for Subcatchment 8S: Reach B - DA

[49] Hint: Tc<2dt may require smaller dt

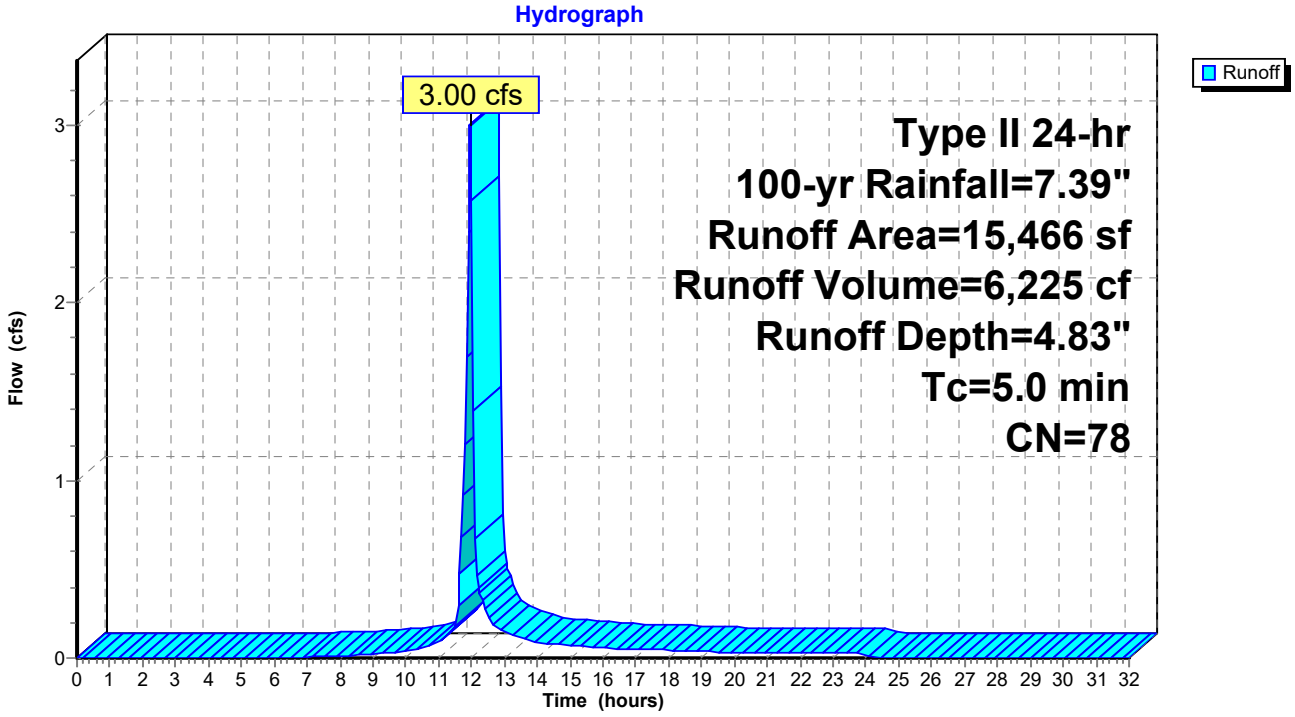
Runoff = 3.00 cfs @ 11.95 hrs, Volume= 6,225 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
15,466	78	Meadow, non-grazed, HSG D
15,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 8S: Reach B - DA



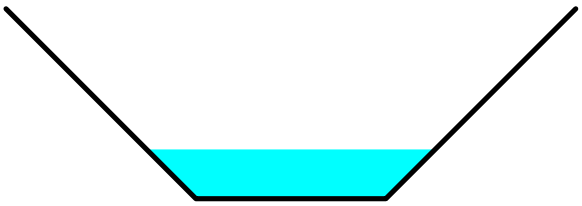
Summary for Reach 8R: Reach A

Inflow Area = 2,259 sf, 0.00% Impervious, Inflow Depth = 4.83" for 100-yr event
Inflow = 0.44 cfs @ 11.95 hrs, Volume= 909 cf
Outflow = 0.42 cfs @ 11.98 hrs, Volume= 909 cf, Atten= 5%, Lag= 1.5 min

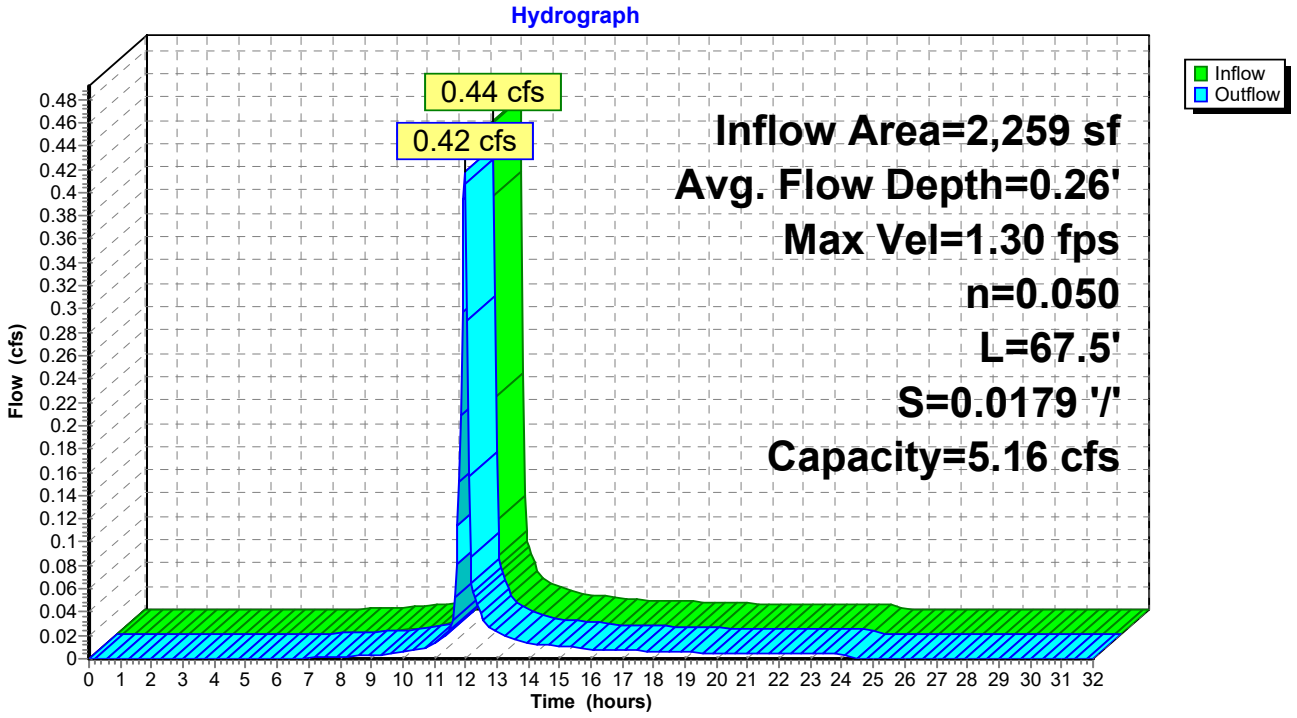
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.30 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 3.5 min

Peak Storage= 22 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 5.16 cfs

1.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.00'
Length= 67.5' Slope= 0.0179 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,430.79'



Reach 8R: Reach A



Summary for Reach B: Reach B

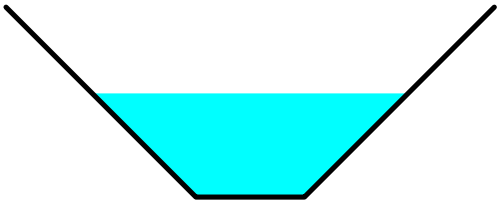
[63] Warning: Exceeded Reach 8R INLET depth by 0.69' @ 11.95 hrs

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 4.83" for 100-yr event
Inflow = 3.40 cfs @ 11.96 hrs, Volume= 7,134 cf
Outflow = 3.26 cfs @ 11.97 hrs, Volume= 7,134 cf, Atten= 4%, Lag= 1.0 min

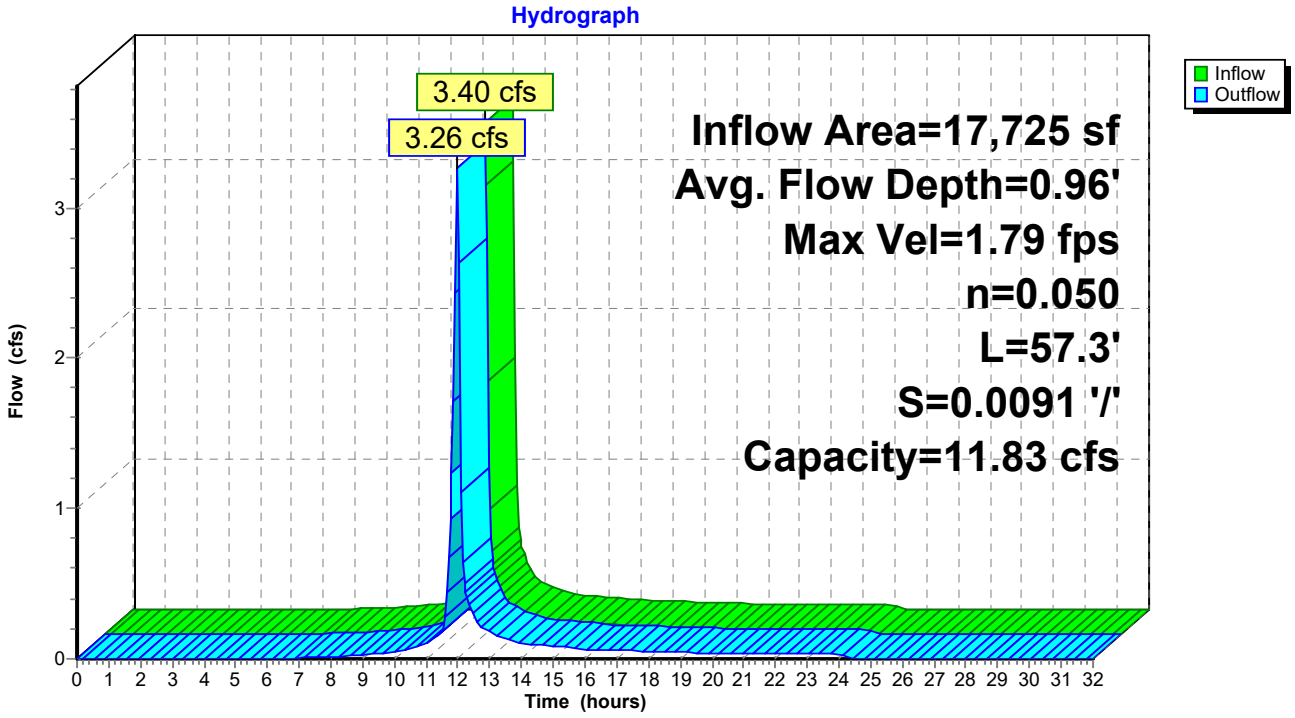
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.79 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 1.8 min

Peak Storage= 107 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 1.75' Flow Area= 4.8 sf, Capacity= 11.83 cfs

1.00' x 1.75' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 4.50'
Length= 57.3' Slope= 0.0091 '/'
Inlet Invert= 1,432.00', Outlet Invert= 1,431.48'



Reach B: Reach B



Summary for Pond 7P: Level Spreader

Inflow Area = 17,725 sf, 0.00% Impervious, Inflow Depth = 4.83" for 100-yr event
Inflow = 3.26 cfs @ 11.97 hrs, Volume= 7,134 cf
Outflow = 3.26 cfs @ 11.97 hrs, Volume= 7,089 cf, Atten= 0%, Lag= 0.1 min
Primary = 3.26 cfs @ 11.97 hrs, Volume= 7,089 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,431.16' @ 11.97 hrs Surf.Area= 90 sf Storage= 59 cf

Plug-Flow detention time= 6.3 min calculated for 7,078 cf (99% of inflow)
Center-of-Mass det. time= 2.5 min (811.2 - 808.7)

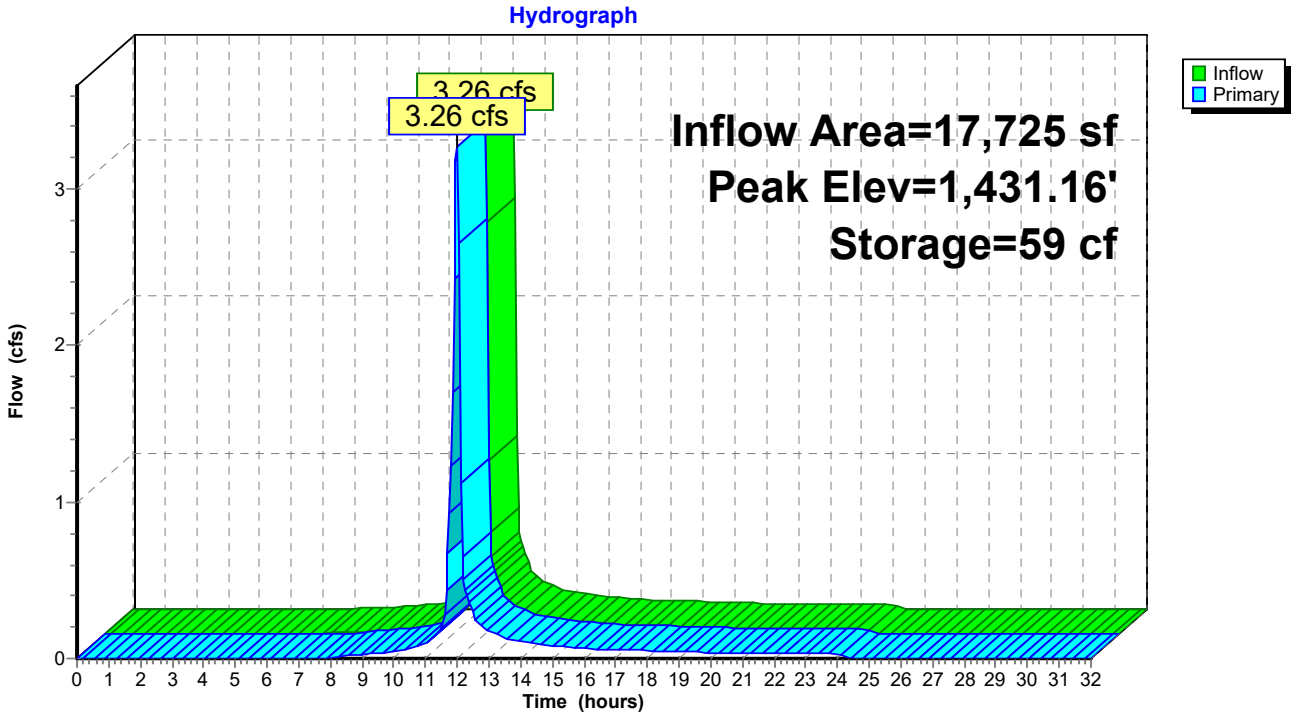
Volume	Invert	Avail.Storage	Storage Description
#1	1,430.00'	135 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,430.00	0	0	0
1,431.00	90	45	45
1,432.00	90	90	135

Device	Routing	Invert	Outlet Devices
#1	Primary	1,431.00'	**15.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=3.16 cfs @ 11.97 hrs HW=1,431.16' (Free Discharge)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 3.16 cfs @ 1.35 fps)

Pond 7P: Level Spreader



ATTACHMENT 4.13

BMP HYDROCAD REPORT – MLV-515RA30



Subcat Reach Pond Link

Routing Diagram for REA - Wyoming MLV_Pre&post - rev2
Prepared by Microsoft, Printed 2/24/2022
HydroCAD® 10.00-26 s/n 09711 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
424	30	20% Impervious as Meadow (1S)
223	76	Gravel roads, HSG A (2S)
7,580	91	Gravel roads, HSG D (2S)
3,828	98	Impervious (1S, 2S)
3,362	30	Meadow, non-grazed, HSG A (1S, 2S)
25,037	78	Meadow, non-grazed, HSG D (1S, 2S)
40,454	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
3,585	HSG A	1S, 2S
0	HSG B	
0	HSG C	
32,617	HSG D	1S, 2S
4,252	Other	1S, 2S
40,454		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	S N
0	0	0	0	424	424	20% Impervious as Meadow	
223	0	0	7,580	0	7,803	Gravel roads	
0	0	0	0	3,828	3,828	Impervious	
3,362	0	0	25,037	0	28,399	Meadow, non-grazed	
3,585	**0**	**0**	**32,617**	**4,252**	**40,454**	**TOTAL AREA**	

Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>0.40"
Flow Length=262' Tc=10.3 min CN=75 Runoff=0.28 cfs 670 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>0.63"
Flow Length=262' Tc=9.7 min CN=81 Runoff=0.48 cfs 1,055 cf

Total Runoff Area = 40,454 sf Runoff Volume = 1,725 cf Average Runoff Depth = 0.51"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

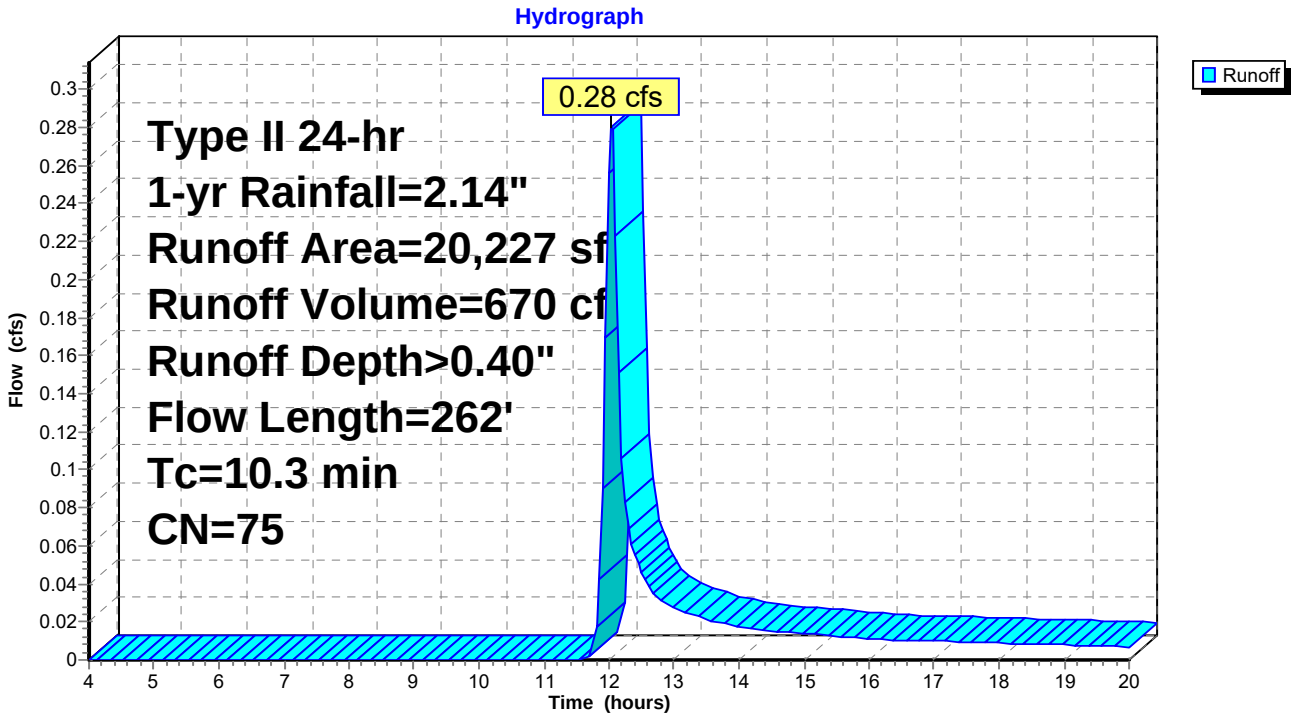
Runoff = 0.28 cfs @ 12.04 hrs, Volume= 670 cf, Depth> 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.14"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

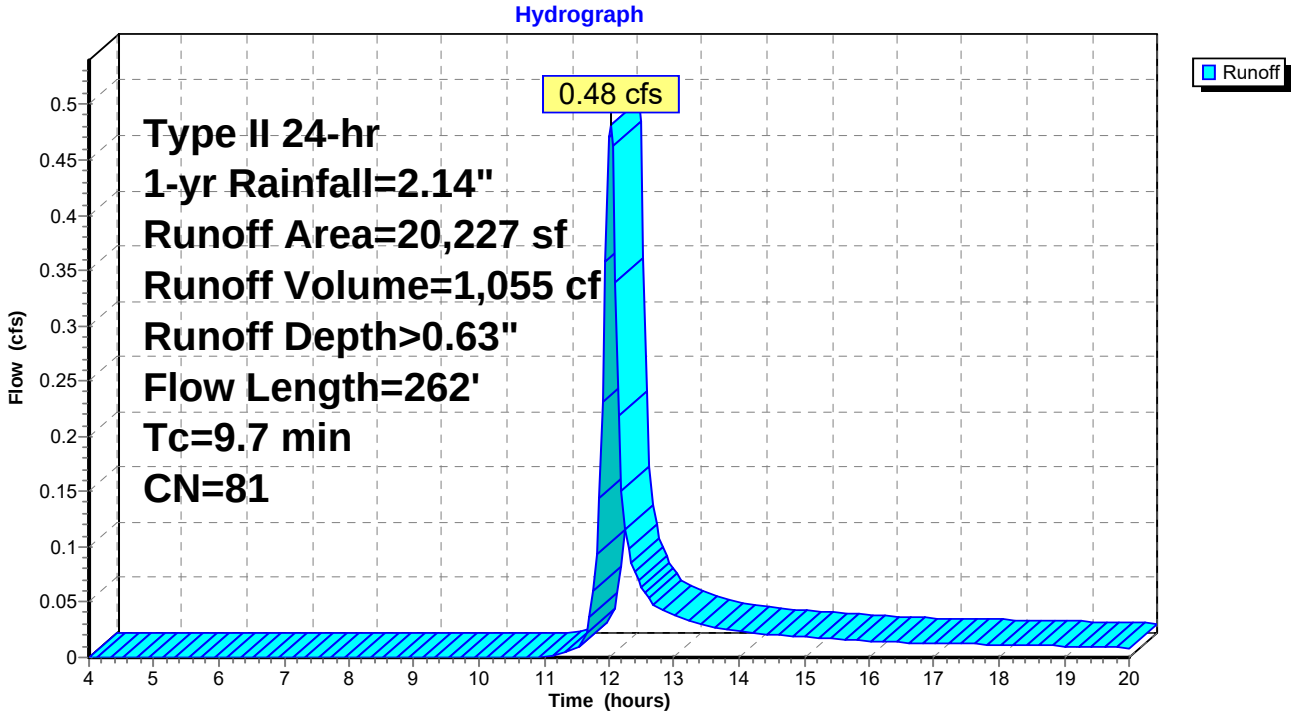
Runoff = 0.48 cfs @ 12.02 hrs, Volume= 1,055 cf, Depth> 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.14"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>0.62"
Flow Length=262' Tc=10.3 min CN=75 Runoff=0.46 cfs 1,040 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>0.90"
Flow Length=262' Tc=9.7 min CN=81 Runoff=0.70 cfs 1,520 cf

Total Runoff Area = 40,454 sf Runoff Volume = 2,560 cf Average Runoff Depth = 0.76"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

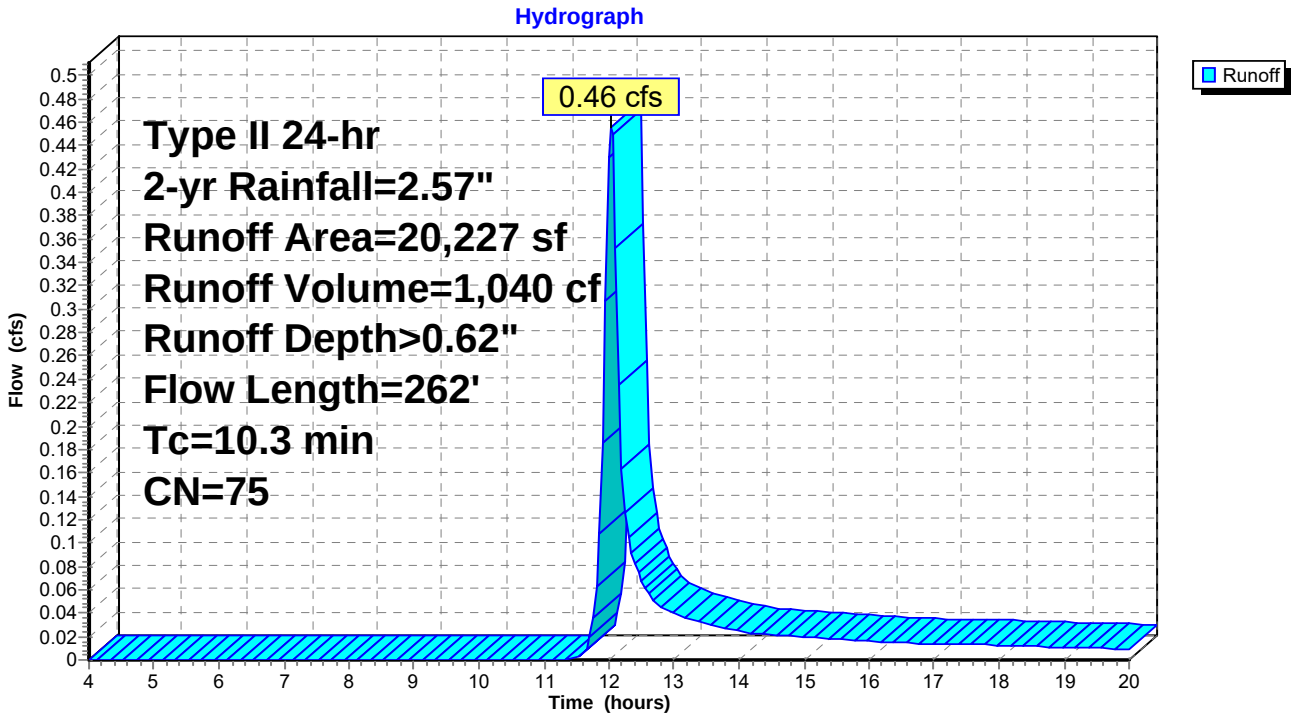
Runoff = 0.46 cfs @ 12.03 hrs, Volume= 1,040 cf, Depth> 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.57"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

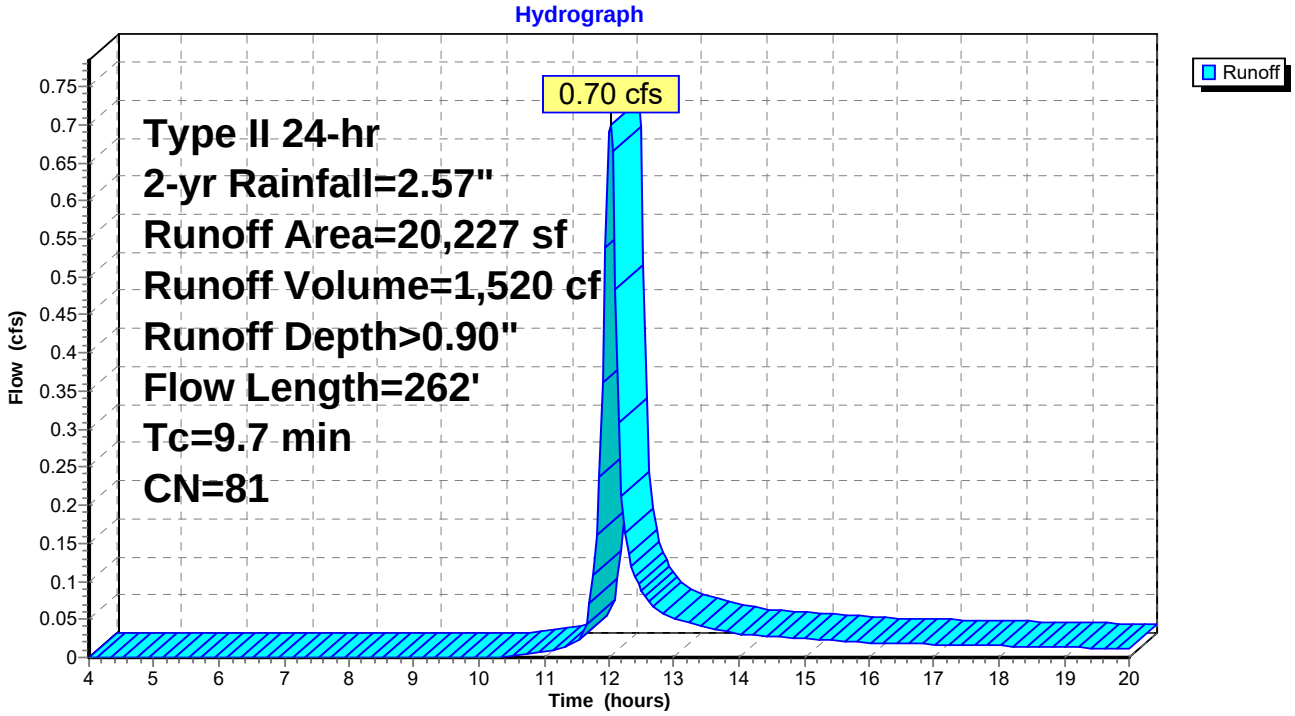
Runoff = 0.70 cfs @ 12.02 hrs, Volume= 1,520 cf, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.57"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>1.33"
Flow Length=262' Tc=10.3 min CN=75 Runoff=1.01 cfs 2,247 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>1.74"
Flow Length=262' Tc=9.7 min CN=81 Runoff=1.35 cfs 2,941 cf

Total Runoff Area = 40,454 sf Runoff Volume = 5,189 cf Average Runoff Depth = 1.54"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

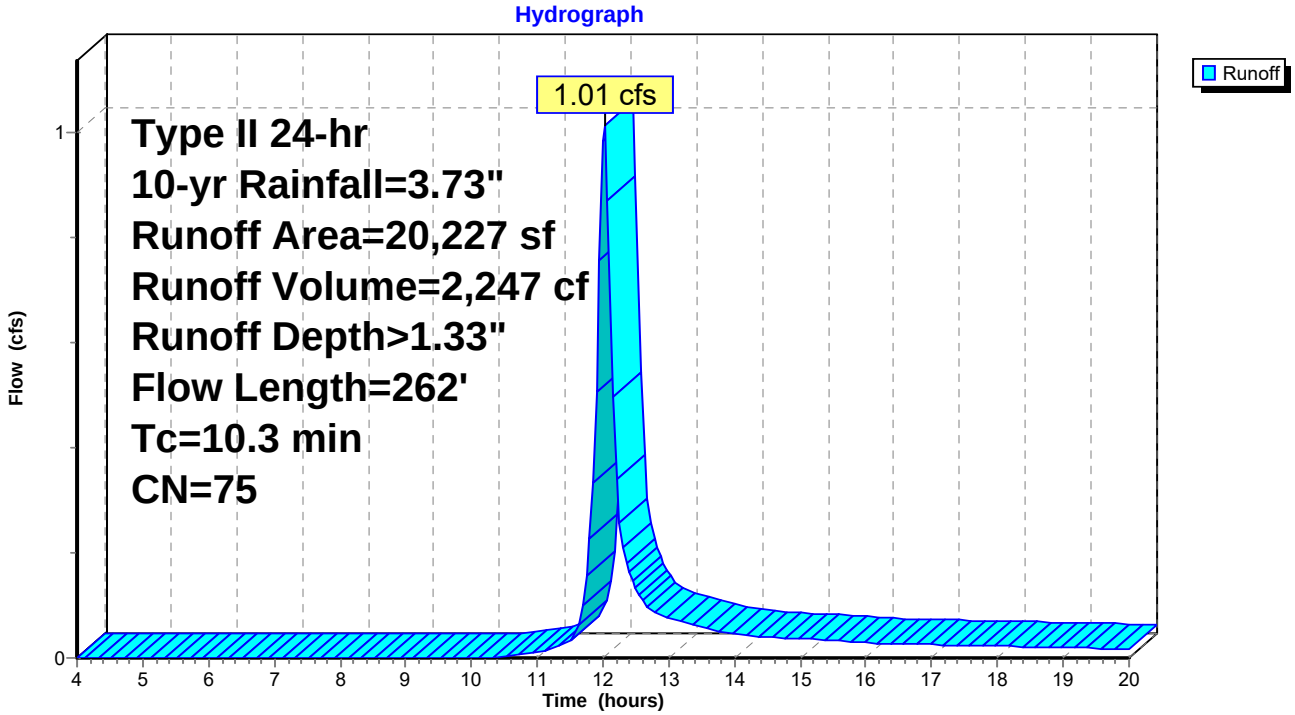
Runoff = 1.01 cfs @ 12.03 hrs, Volume= 2,247 cf, Depth> 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.73"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

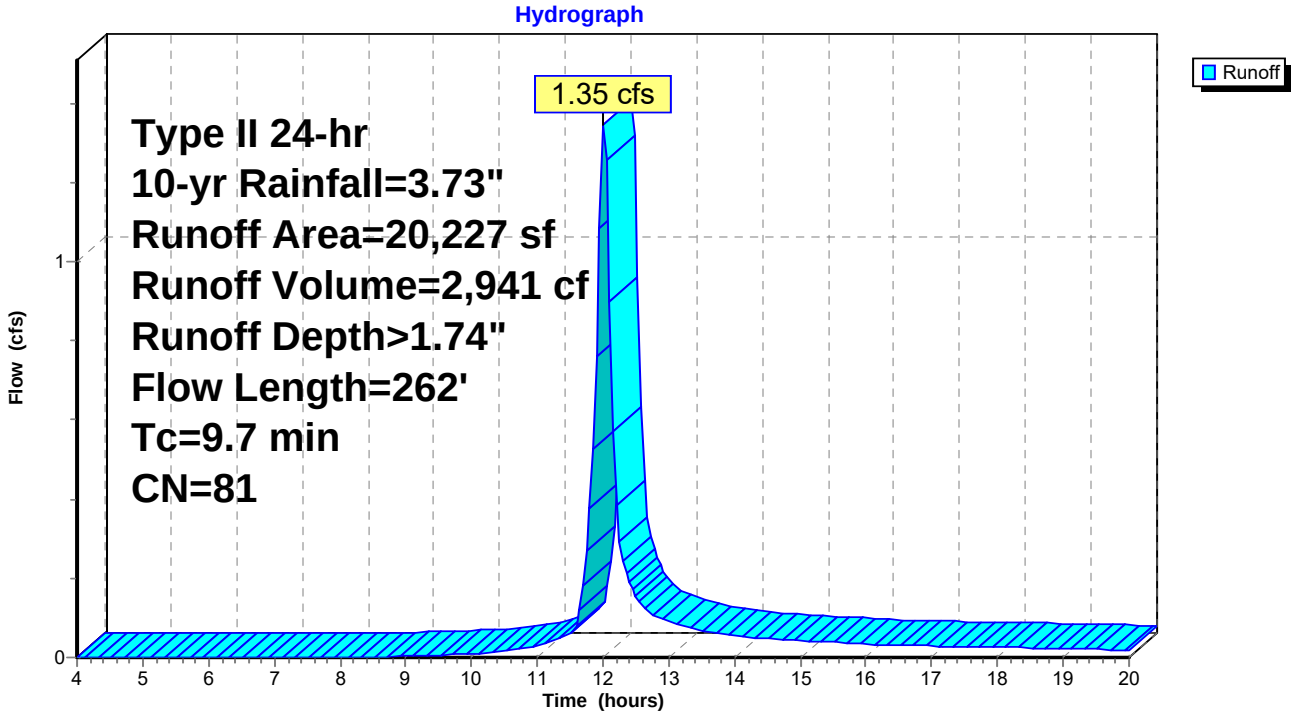
Runoff = 1.35 cfs @ 12.01 hrs, Volume= 2,941 cf, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.73"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>1.94"
Flow Length=262' Tc=10.3 min CN=75 Runoff=1.47 cfs 3,274 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>2.43"
Flow Length=262' Tc=9.7 min CN=81 Runoff=1.86 cfs 4,095 cf

Total Runoff Area = 40,454 sf Runoff Volume = 7,369 cf Average Runoff Depth = 2.19"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

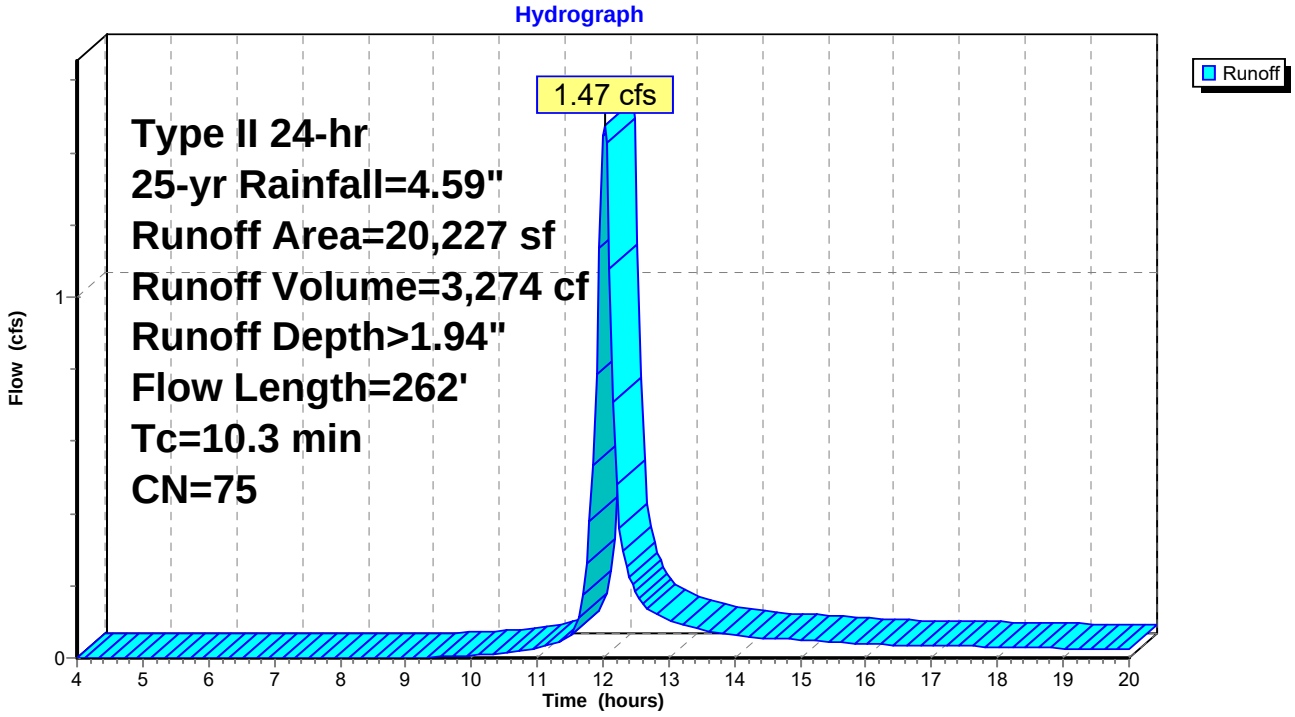
Runoff = 1.47 cfs @ 12.02 hrs, Volume= 3,274 cf, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.59"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

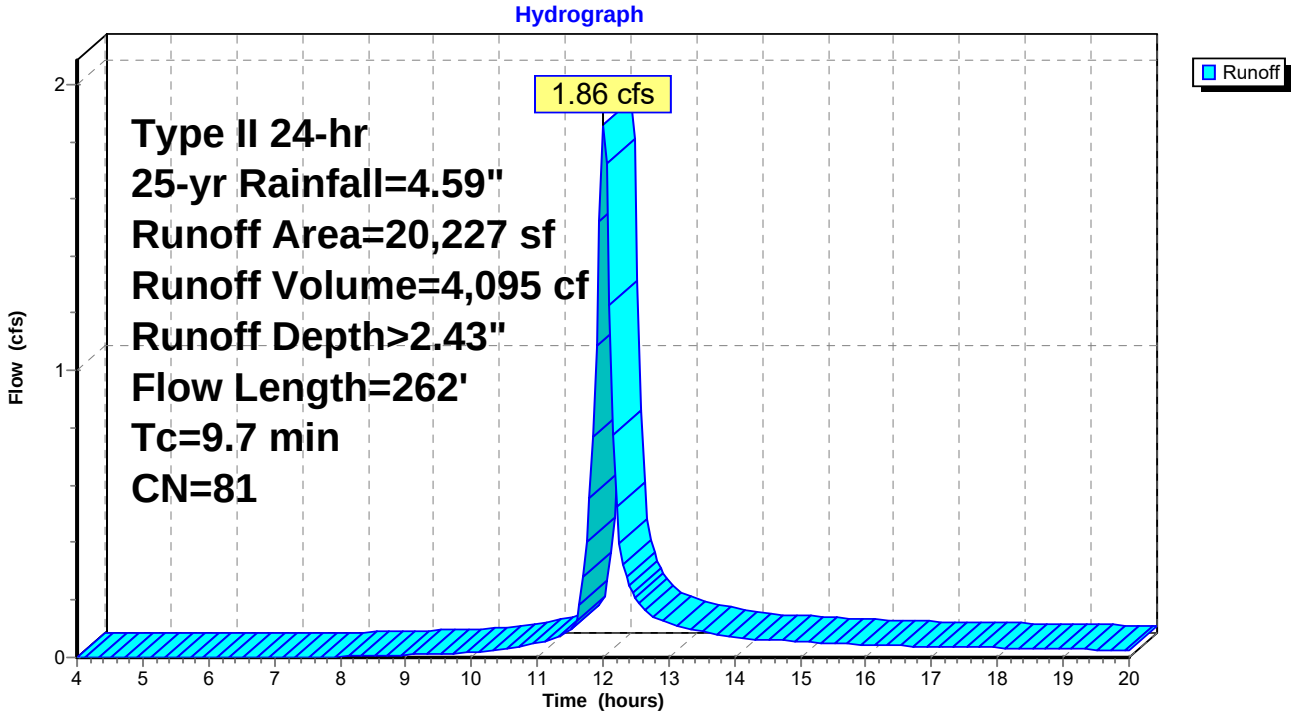
Runoff = 1.86 cfs @ 12.01 hrs, Volume= 4,095 cf, Depth> 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.59"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>2.55"
Flow Length=262' Tc=10.3 min CN=75 Runoff=1.93 cfs 4,295 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>3.09"
Flow Length=262' Tc=9.7 min CN=81 Runoff=2.35 cfs 5,215 cf

Total Runoff Area = 40,454 sf Runoff Volume = 9,510 cf Average Runoff Depth = 2.82"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

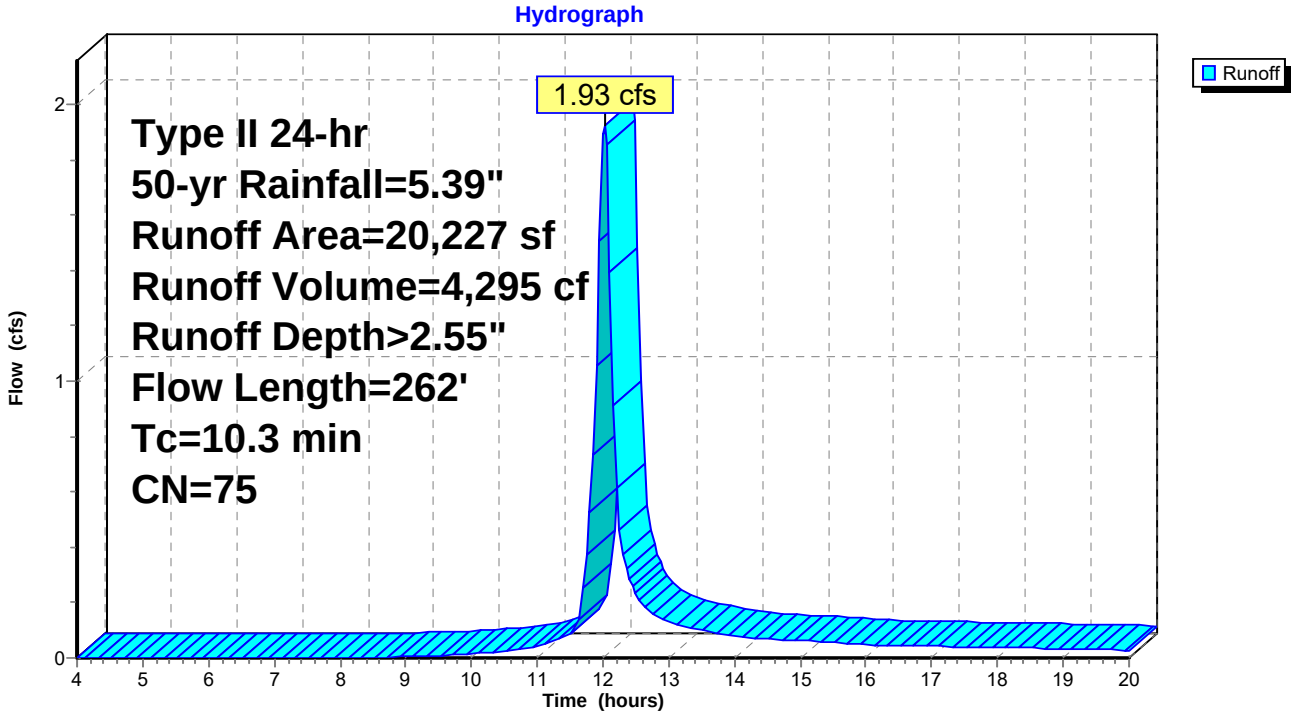
Runoff = 1.93 cfs @ 12.02 hrs, Volume= 4,295 cf, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.39"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

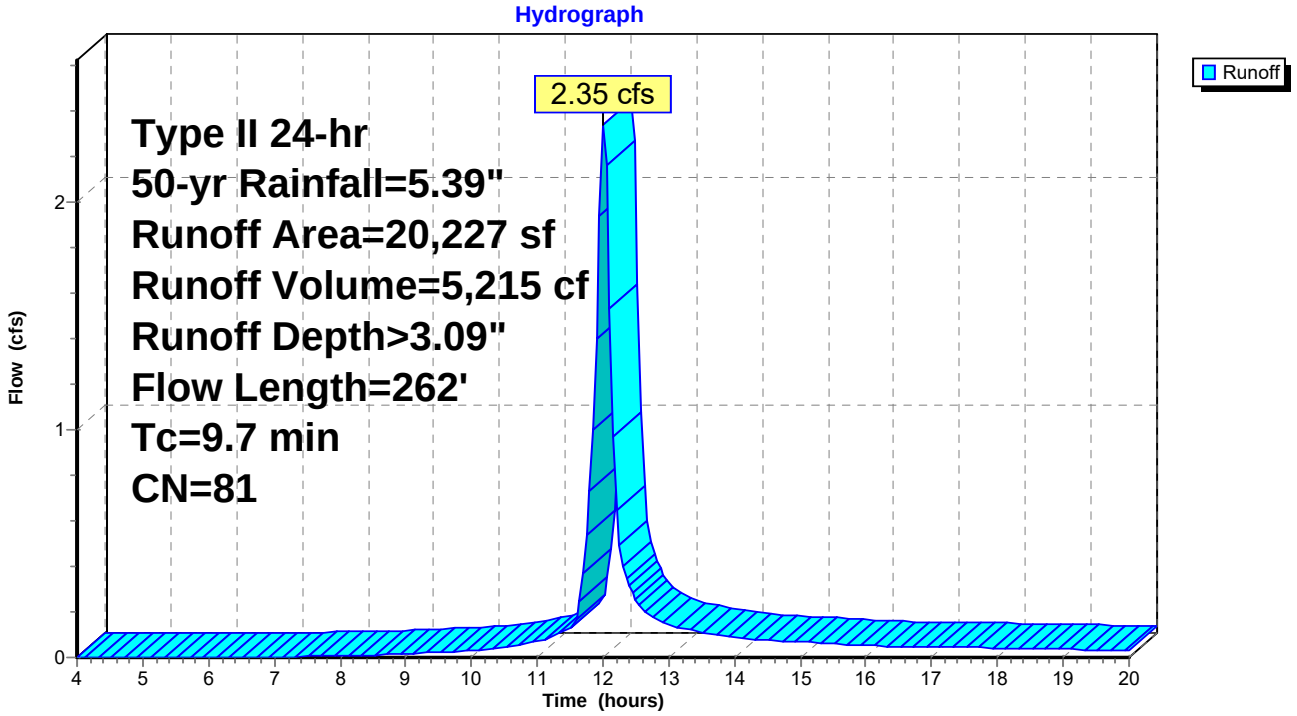
Runoff = 2.35 cfs @ 12.01 hrs, Volume= 5,215 cf, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.39"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: PRE Runoff Area=20,227 sf 8.40% Impervious Runoff Depth>3.30"
Flow Length=262' Tc=10.3 min CN=75 Runoff=2.48 cfs 5,567 cf

Subcatchment2S: POST Runoff Area=20,227 sf 10.53% Impervious Runoff Depth>3.91"
Flow Length=262' Tc=9.7 min CN=81 Runoff=2.93 cfs 6,585 cf

Total Runoff Area = 40,454 sf Runoff Volume = 12,152 cf Average Runoff Depth = 3.60"
90.54% Pervious = 36,626 sf 9.46% Impervious = 3,828 sf

Summary for Subcatchment 1S: PRE

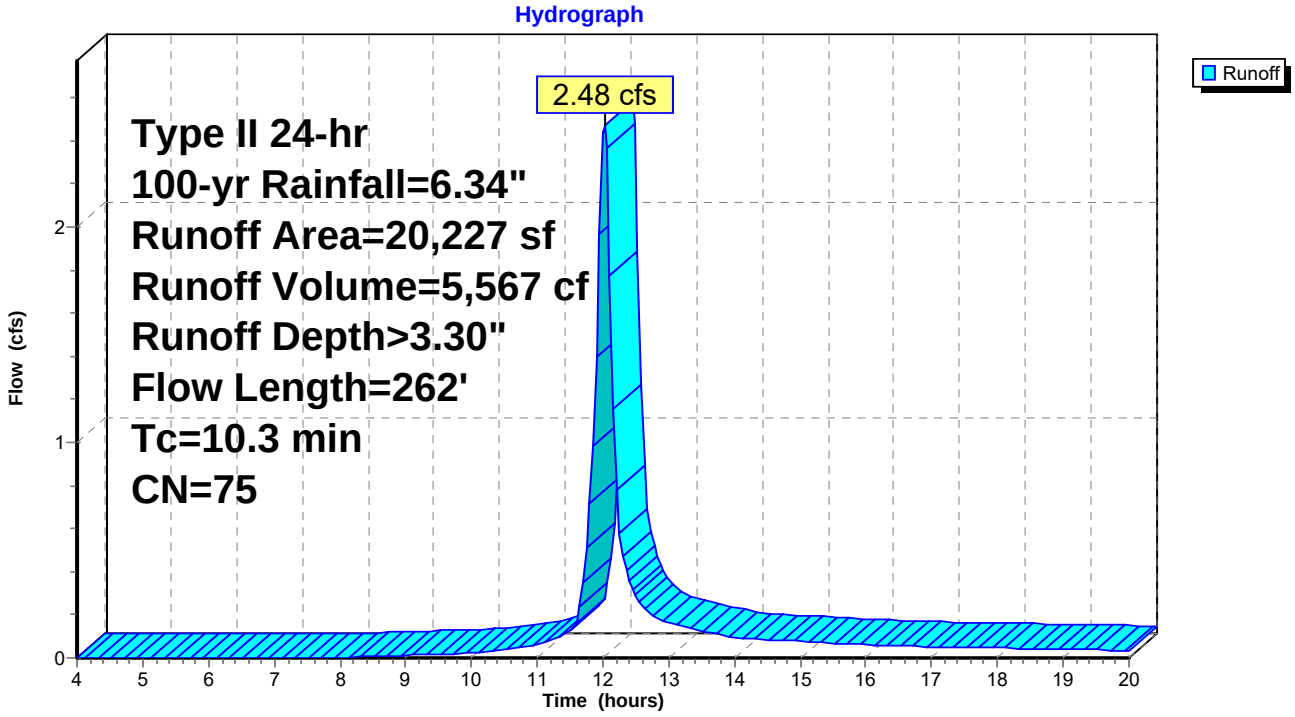
Runoff = 2.48 cfs @ 12.02 hrs, Volume= 5,567 cf, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	1,699	98	Impervious
*	424	30	20% Impervious as Meadow
	1,683	30	Meadow, non-grazed, HSG A
	16,421	78	Meadow, non-grazed, HSG D
	20,227	75	Weighted Average
	18,528		91.60% Pervious Area
	1,699		8.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
1.0	162	0.1480	2.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.3	262	Total			

Subcatchment 1S: PRE



Summary for Subcatchment 2S: POST

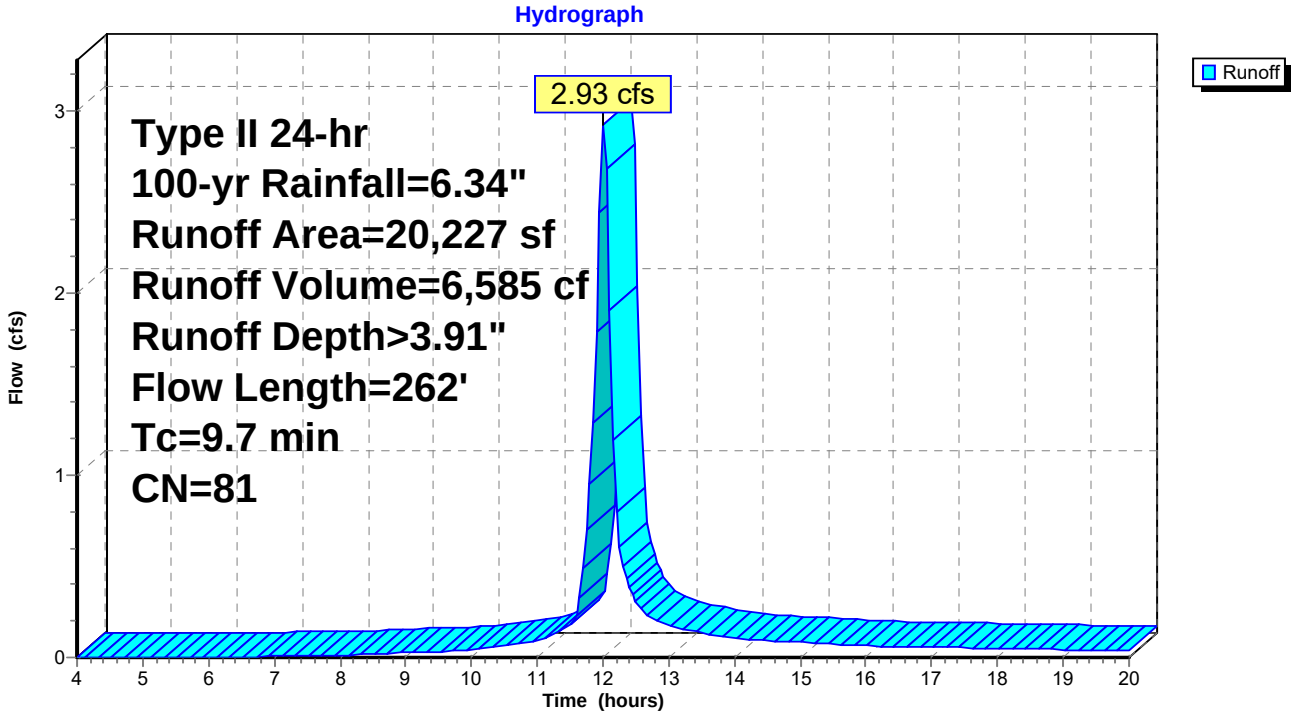
Runoff = 2.93 cfs @ 12.01 hrs, Volume= 6,585 cf, Depth> 3.91"

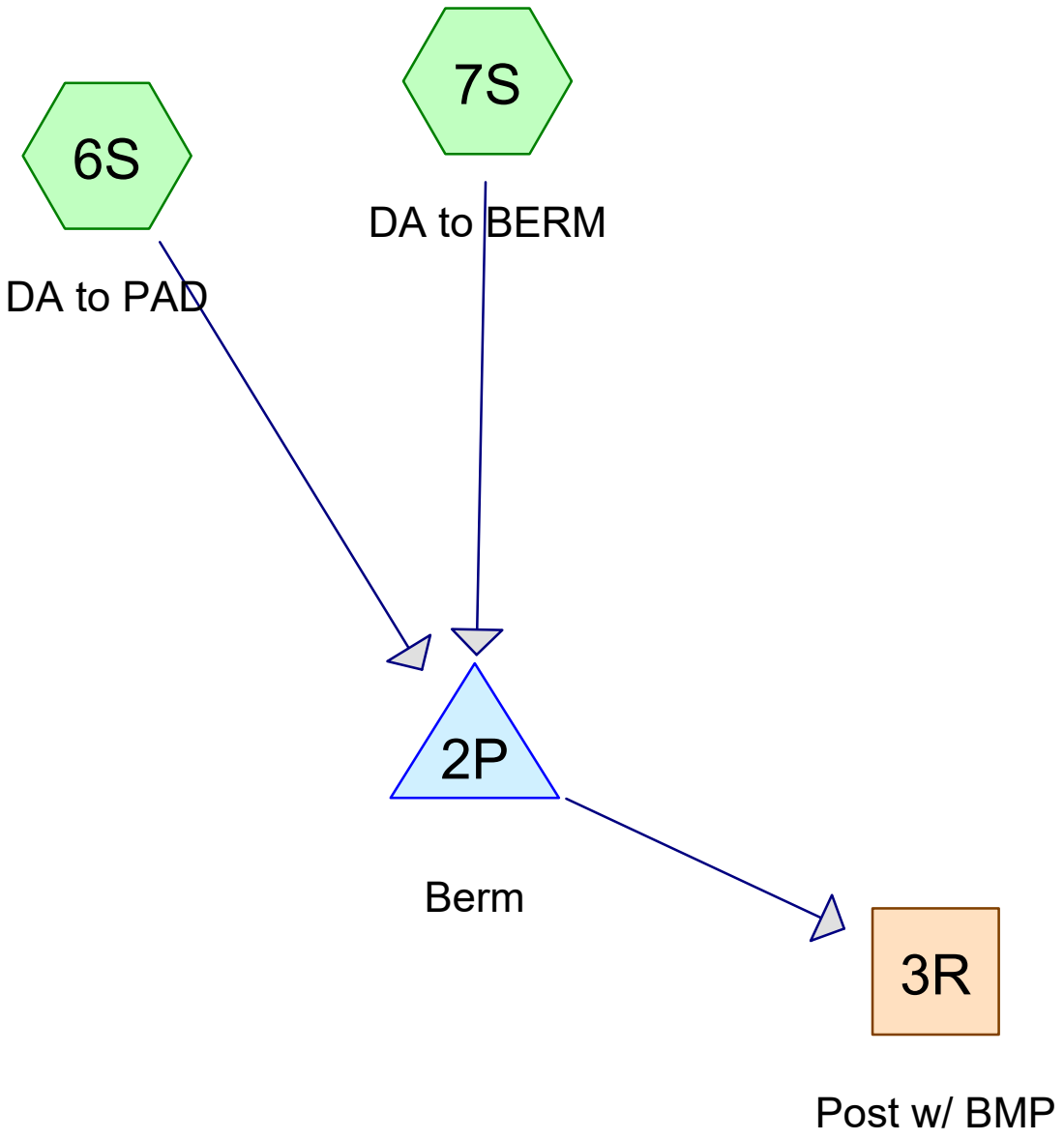
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	2,129	98	Impervious
	223	76	Gravel roads, HSG A
	7,580	91	Gravel roads, HSG D
	1,679	30	Meadow, non-grazed, HSG A
	8,616	78	Meadow, non-grazed, HSG D
	20,227	81	Weighted Average
	18,098		89.47% Pervious Area
	2,129		10.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.57"
0.4	162	0.1480	6.19		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	262	Total			

Subcatchment 2S: POST





Subcat Reach Pond Link

Routing Diagram for REA - Wyoming MLV_PostwBMP - Berm_rev2
Prepared by Microsoft, Printed 2/24/2022
HydroCAD® 10.00-26 s/n 09711 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
223	76	Gravel roads, HSG A (7S)
7,899	91	Gravel roads, HSG D (6S, 7S)
1,679	30	Meadow, non-grazed, HSG A (6S, 7S)
8,616	78	Meadow, non-grazed, HSG D (6S, 7S)
1,810	98	Paved roads w/curbs & sewers, HSG A (6S, 7S)
20,227	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
3,712	HSG A	6S, 7S
0	HSG B	
0	HSG C	
16,515	HSG D	6S, 7S
0	Other	
20,227		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
223	0	0	7,899	0	8,122	Gravel roads
1,679	0	0	8,616	0	10,295	Meadow, non-grazed
1,810	0	0	0	0	1,810	Paved roads w/curbs & sewers
3,712	**0**	**0**	**16,515**	**0**	**20,227**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>0.84"
Flow Length=130' Tc=1.3 min CN=84 Runoff=0.37 cfs 628 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>0.61"
Flow Length=140' Tc=1.8 min CN=79 Runoff=0.33 cfs 570 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=563.45' Storage=659 cf Inflow=0.69 cfs 1,199 cf
Outflow=0.02 cfs 730 cf

Total Runoff Area = 20,227 sf Runoff Volume = 1,199 cf Average Runoff Depth = 0.71"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

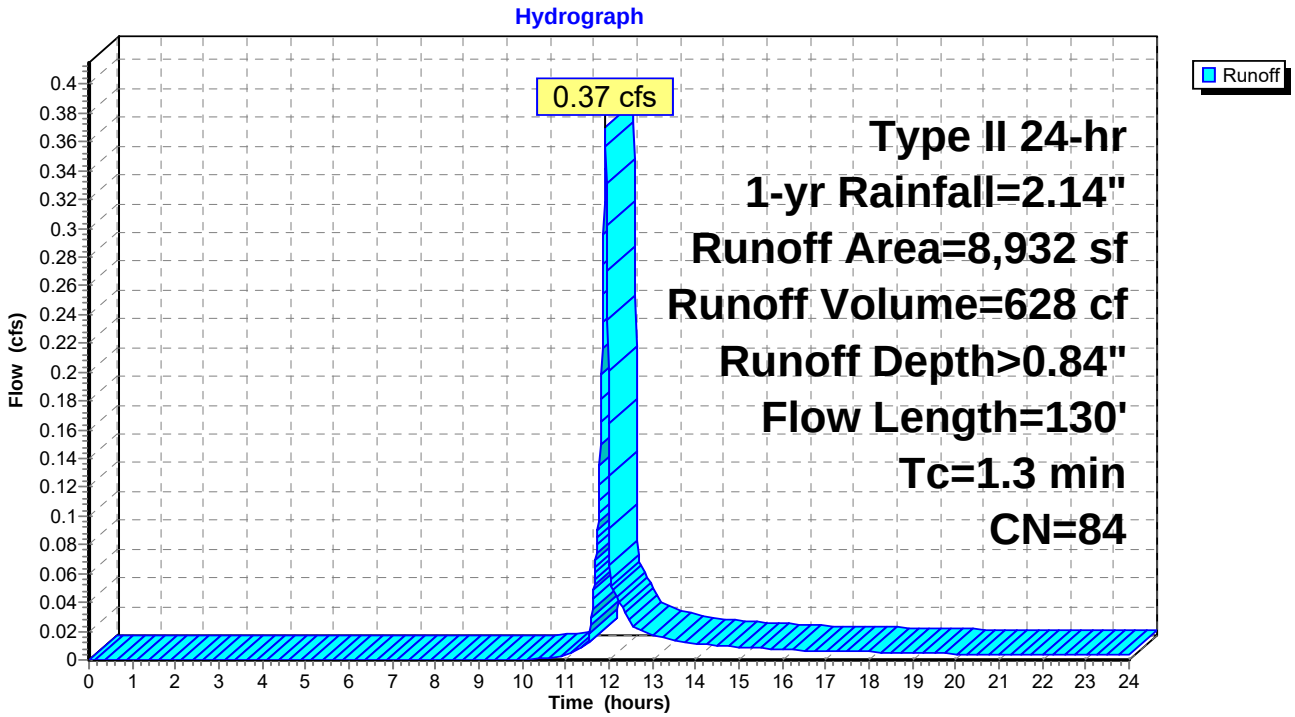
Runoff = 0.37 cfs @ 11.92 hrs, Volume= 628 cf, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.14"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

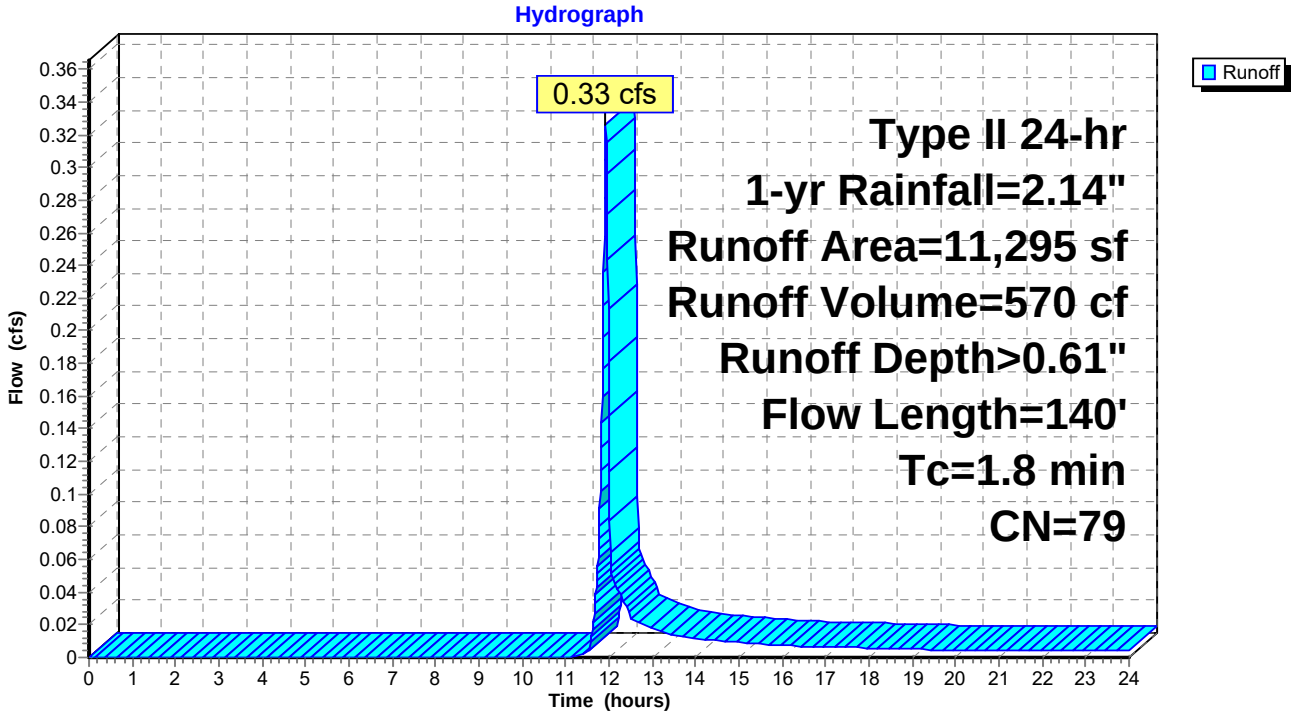
Runoff = 0.33 cfs @ 11.93 hrs, Volume= 570 cf, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.14"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 1-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 0.71" for 1-yr event
Inflow = 0.69 cfs @ 11.92 hrs, Volume= 1,199 cf
Outflow = 0.02 cfs @ 15.35 hrs, Volume= 730 cf, Atten= 98%, Lag= 205.6 min
Discarded = 0.02 cfs @ 15.35 hrs, Volume= 730 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 563.45' @ 15.35 hrs Surf.Area= 1,762 sf Storage= 659 cf

Plug-Flow detention time= 337.0 min calculated for 730 cf (61% of inflow)
Center-of-Mass det. time= 210.2 min (1,062.1 - 851.8)

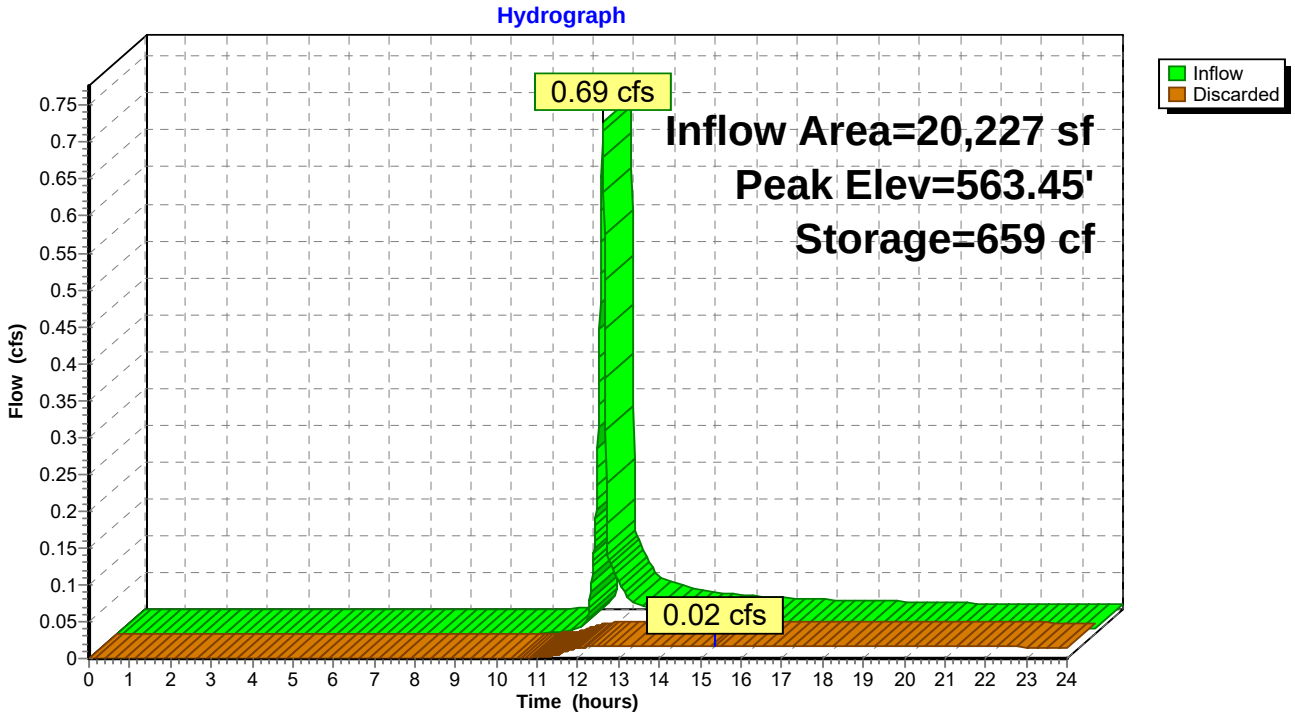
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

Discarded OutFlow Max=0.02 cfs @ 15.35 hrs HW=563.45' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Pond 2P: Berm


Hydrograph
0.69 cfs
0.02 cfs
Inflow Area=20,227 sf
Peak Elev=563.45'
Storage=659 cf
Inflow
Discarded
Flow (cfs)
Time (hours)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>1.17"
Flow Length=130' Tc=1.3 min CN=84 Runoff=0.51 cfs 871 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>0.88"
Flow Length=140' Tc=1.8 min CN=79 Runoff=0.48 cfs 832 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=563.64' Storage=1,013 cf Inflow=0.99 cfs 1,703 cf
Outflow=0.02 cfs 880 cf

Total Runoff Area = 20,227 sf Runoff Volume = 1,703 cf Average Runoff Depth = 1.01"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

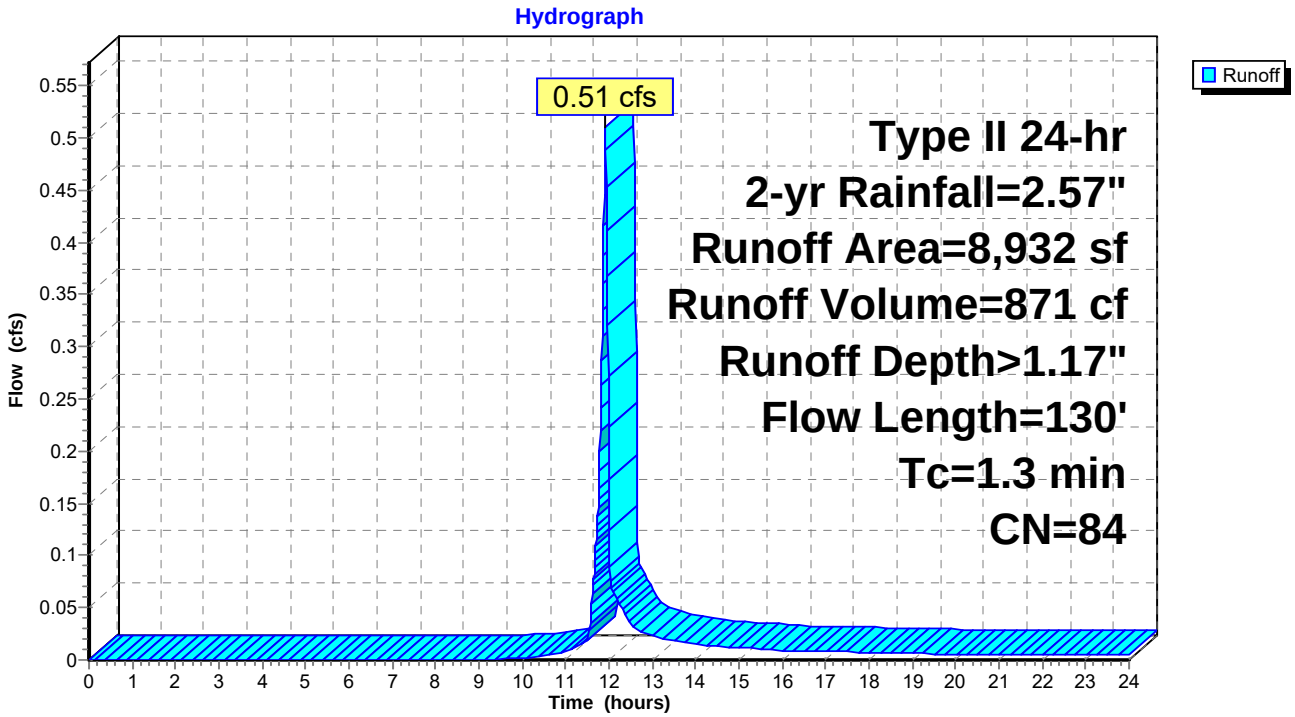
Runoff = 0.51 cfs @ 11.92 hrs, Volume= 871 cf, Depth> 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.57"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

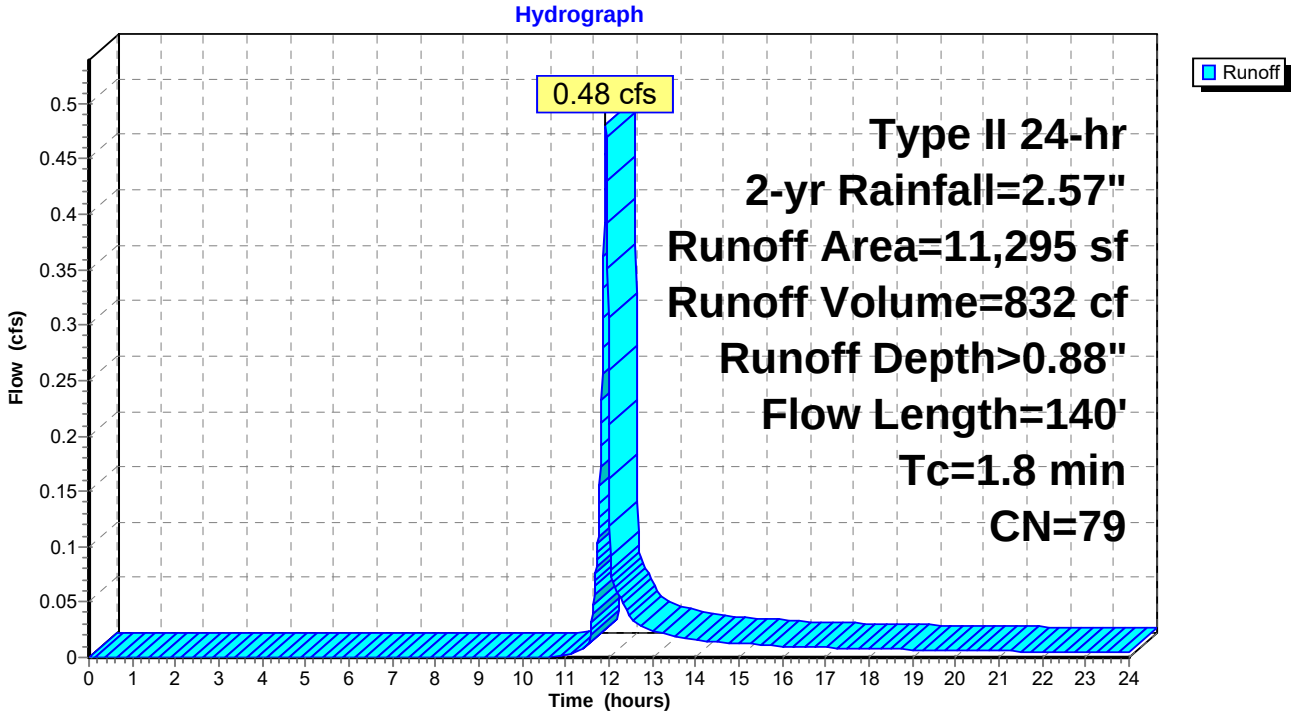
Runoff = 0.48 cfs @ 11.93 hrs, Volume= 832 cf, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.57"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 2-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 1.01" for 2-yr event
Inflow = 0.99 cfs @ 11.92 hrs, Volume= 1,703 cf
Outflow = 0.02 cfs @ 15.84 hrs, Volume= 880 cf, Atten= 98%, Lag= 235.0 min
Discarded = 0.02 cfs @ 15.84 hrs, Volume= 880 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 563.64' @ 15.84 hrs Surf.Area= 2,019 sf Storage= 1,013 cf

Plug-Flow detention time= 346.4 min calculated for 879 cf (52% of inflow)
Center-of-Mass det. time= 217.0 min (1,058.4 - 841.3)

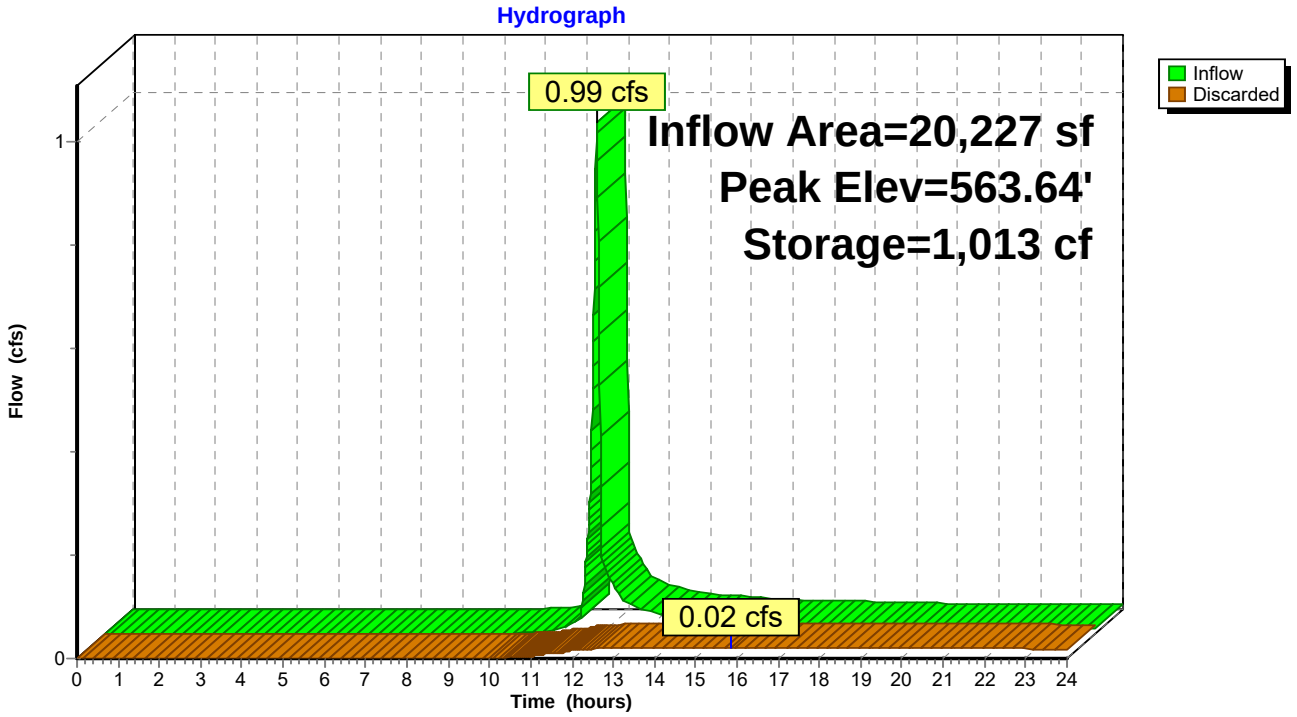
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

Discarded OutFlow Max=0.02 cfs @ 15.84 hrs HW=563.64' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Pond 2P: Berm


Hydrograph
0.99 cfs
Inflow Area=20,227 sf
Peak Elev=563.64'
Storage=1,013 cf
0.02 cfs
Inflow
Discarded
Flow (cfs)
Time (hours)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>2.13"
Flow Length=130' Tc=1.3 min CN=84 Runoff=0.91 cfs 1,589 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>1.75"
Flow Length=140' Tc=1.8 min CN=79 Runoff=0.95 cfs 1,643 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=564.12' Storage=2,129 cf Inflow=1.85 cfs 3,232 cf
Outflow=0.03 cfs 1,304 cf

Total Runoff Area = 20,227 sf Runoff Volume = 3,232 cf Average Runoff Depth = 1.92"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

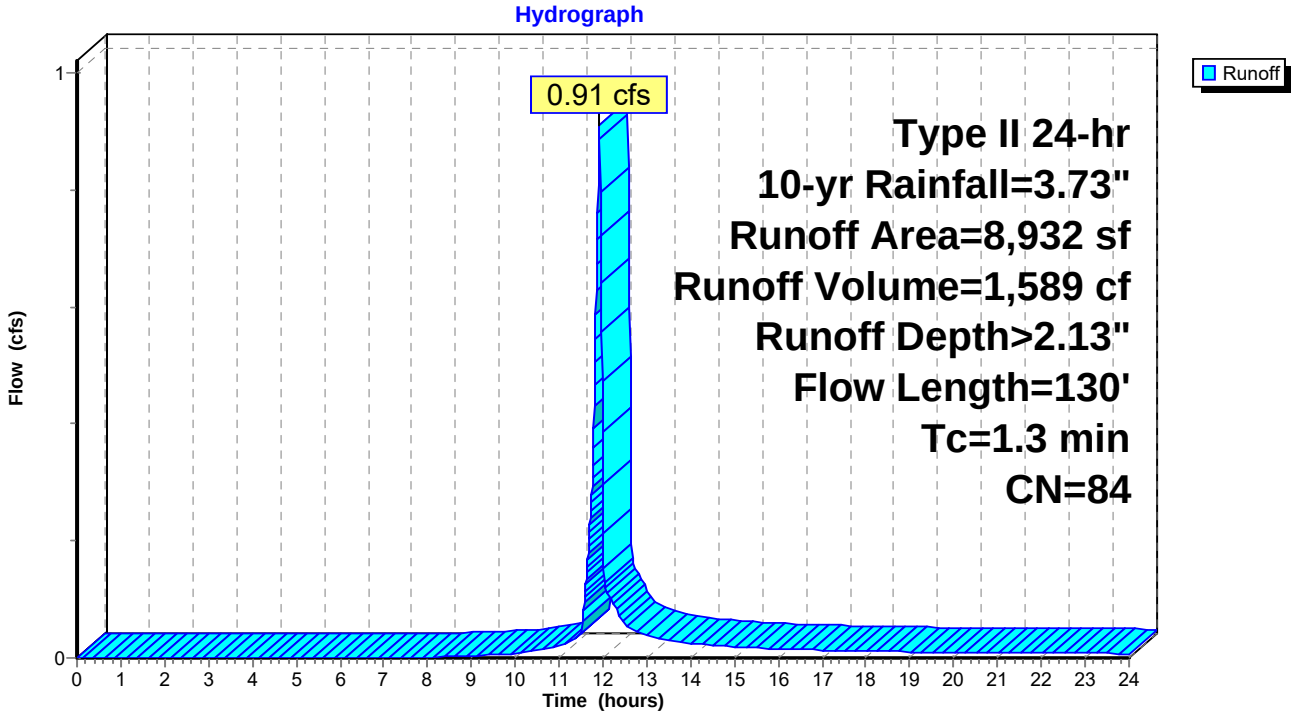
Runoff = 0.91 cfs @ 11.92 hrs, Volume= 1,589 cf, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.73"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

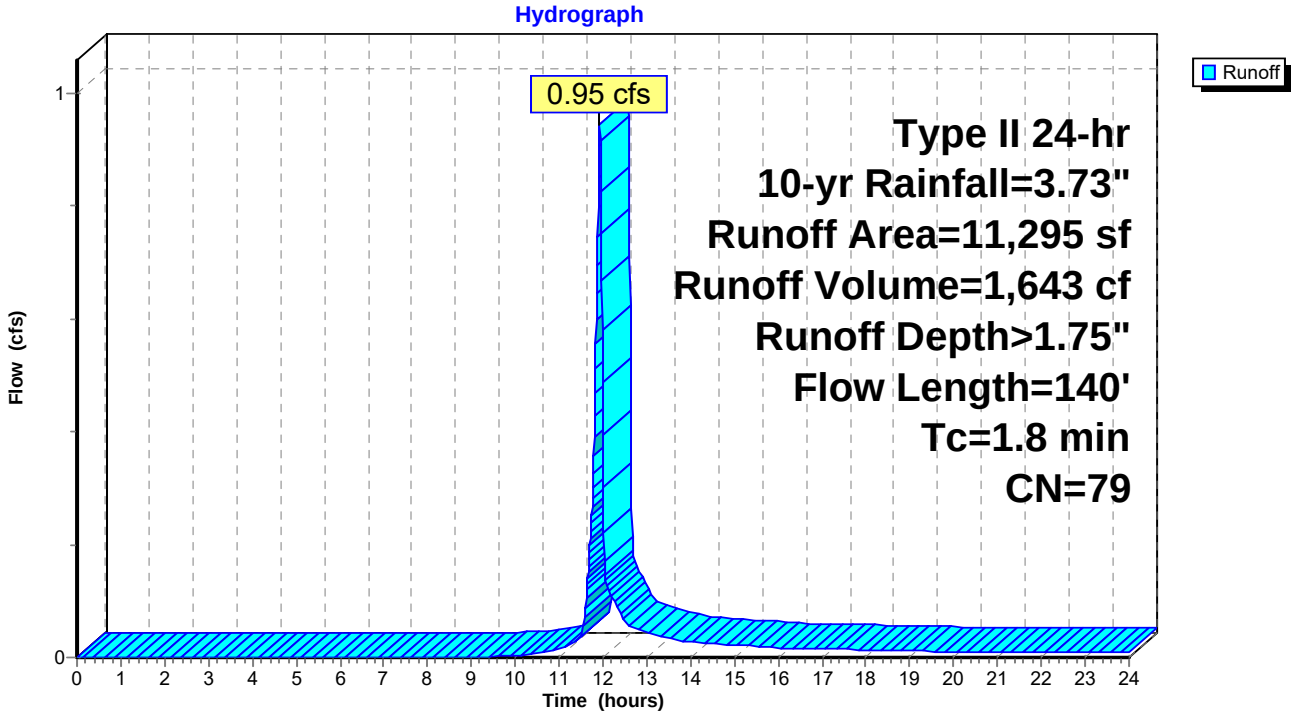
Runoff = 0.95 cfs @ 11.92 hrs, Volume= 1,643 cf, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.73"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 10-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 1.92" for 10-yr event
Inflow = 1.85 cfs @ 11.92 hrs, Volume= 3,232 cf
Outflow = 0.03 cfs @ 17.04 hrs, Volume= 1,304 cf, Atten= 98%, Lag= 307.4 min
Discarded = 0.03 cfs @ 17.04 hrs, Volume= 1,304 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 564.12' @ 17.04 hrs Surf.Area= 2,747 sf Storage= 2,129 cf

Plug-Flow detention time= 348.8 min calculated for 1,304 cf (40% of inflow)
Center-of-Mass det. time= 224.3 min (1,047.3 - 823.0)

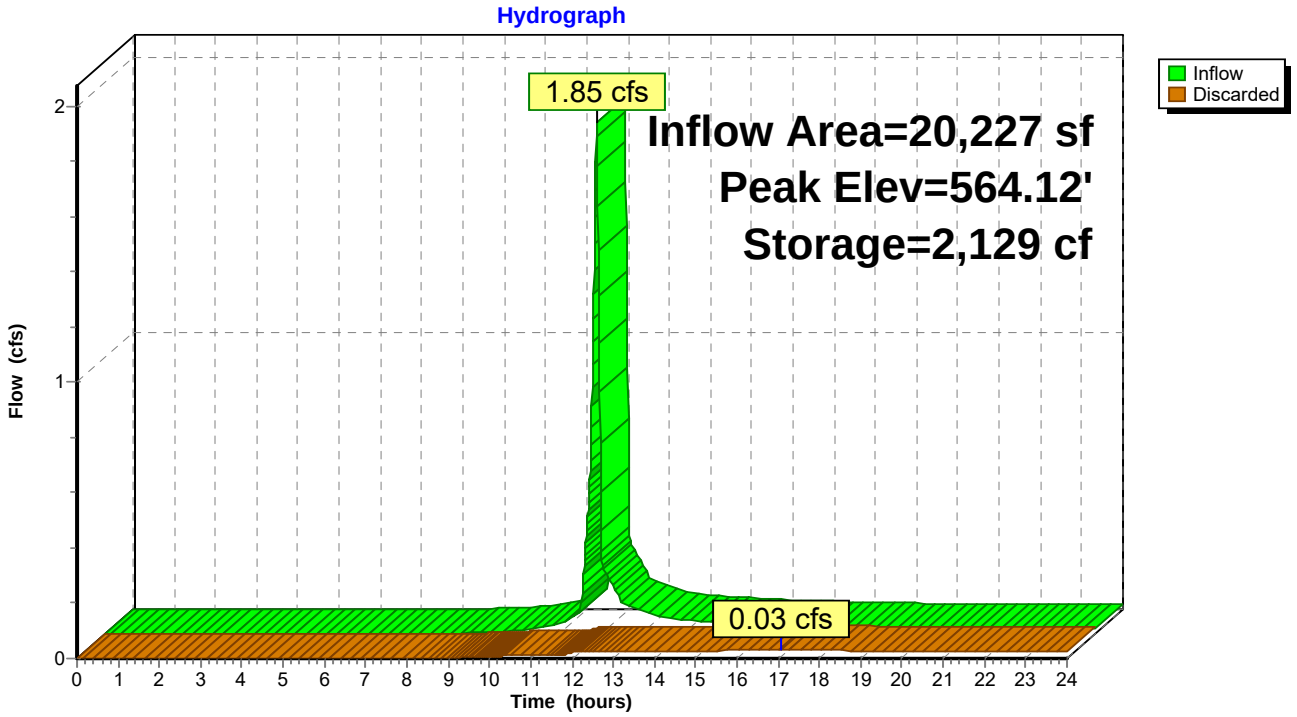
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

Discarded OutFlow Max=0.03 cfs @ 17.04 hrs HW=564.12' (Free Discharge)
└**1=Exfiltration** (Controls 0.03 cfs)

Pond 2P: Berm


Hydrograph
1.85 cfs
Inflow Area=20,227 sf
Peak Elev=564.12'
Storage=2,129 cf
0.03 cfs
Inflow
Discarded
Flow (cfs)
Time (hours)
0
1
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>2.90"
Flow Length=130' Tc=1.3 min CN=84 Runoff=1.22 cfs 2,156 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>2.45"
Flow Length=140' Tc=1.8 min CN=79 Runoff=1.31 cfs 2,307 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=564.42' Storage=3,042 cf Inflow=2.52 cfs 4,464 cf
Outflow=0.04 cfs 1,655 cf

Total Runoff Area = 20,227 sf Runoff Volume = 4,464 cf Average Runoff Depth = 2.65"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

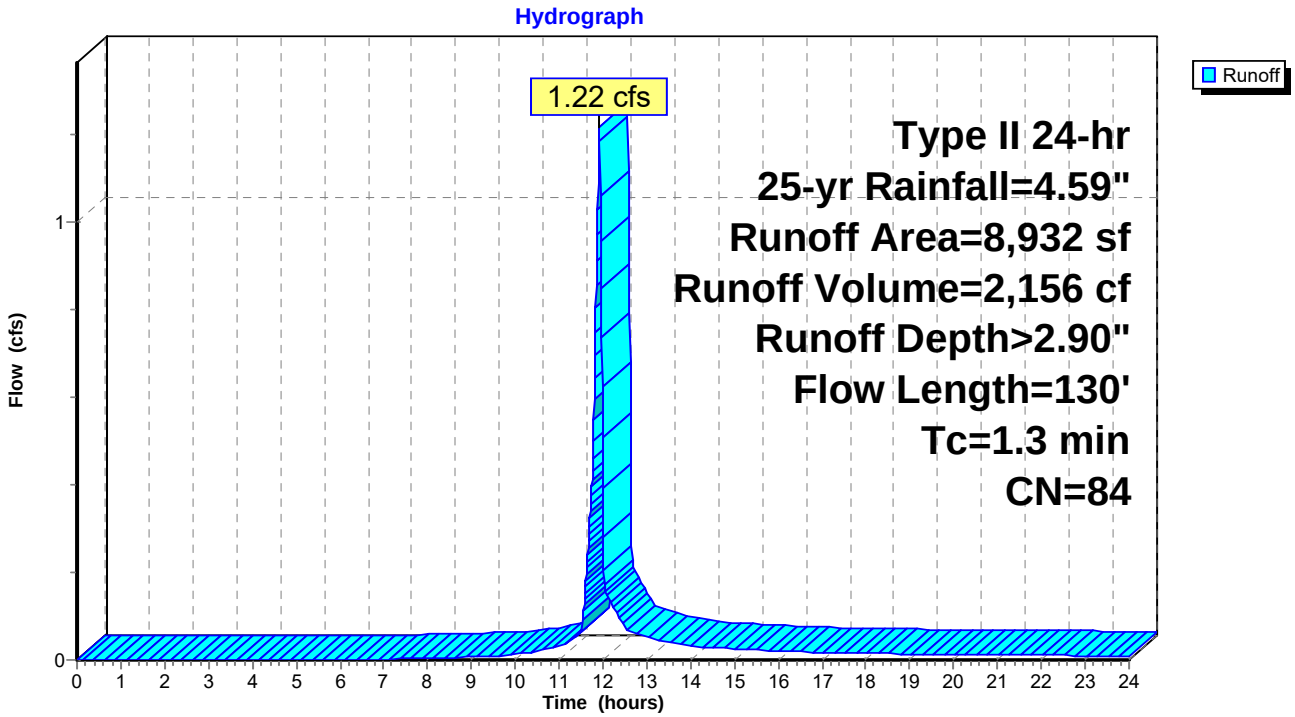
Runoff = 1.22 cfs @ 11.92 hrs, Volume= 2,156 cf, Depth> 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.59"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

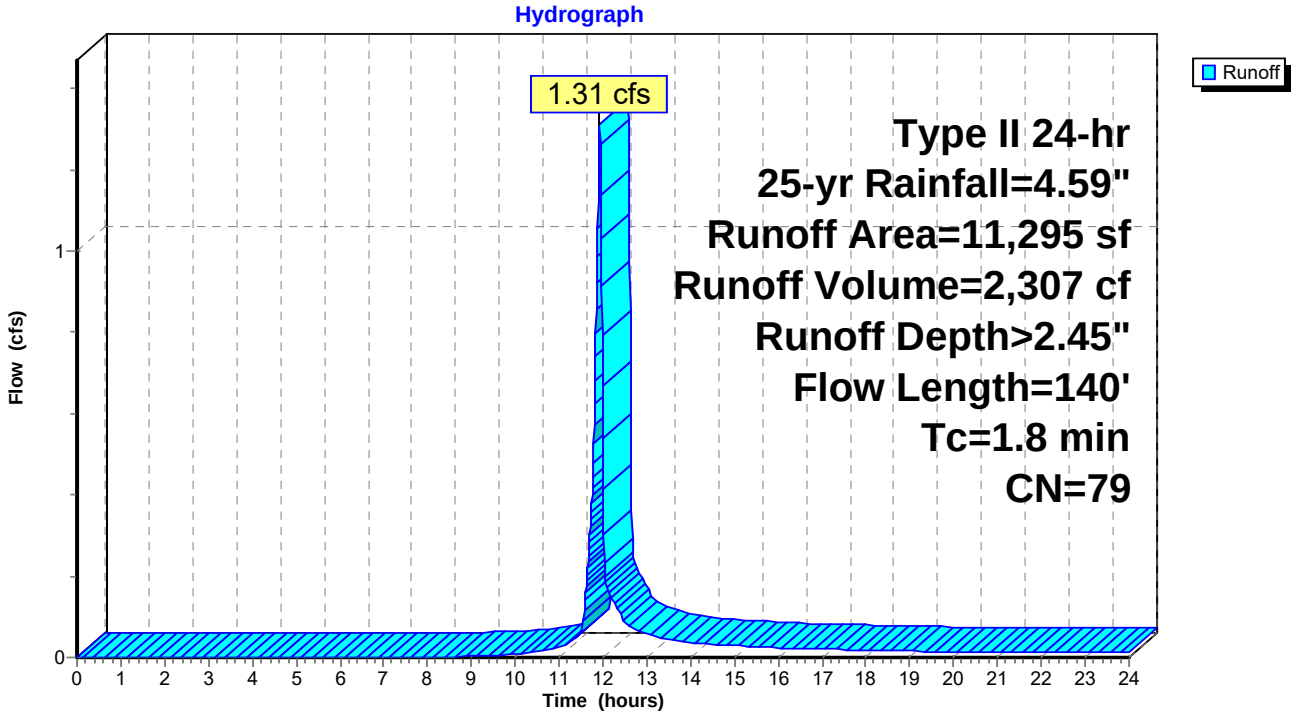
Runoff = 1.31 cfs @ 11.92 hrs, Volume= 2,307 cf, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.59"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 25-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 2.65" for 25-yr event
Inflow = 2.52 cfs @ 11.92 hrs, Volume= 4,464 cf
Outflow = 0.04 cfs @ 17.39 hrs, Volume= 1,655 cf, Atten= 99%, Lag= 328.2 min
Discarded = 0.04 cfs @ 17.39 hrs, Volume= 1,655 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 564.42' @ 17.39 hrs Surf.Area= 3,356 sf Storage= 3,042 cf

Plug-Flow detention time= 351.2 min calculated for 1,654 cf (37% of inflow)
Center-of-Mass det. time= 227.4 min (1,041.4 - 814.0)

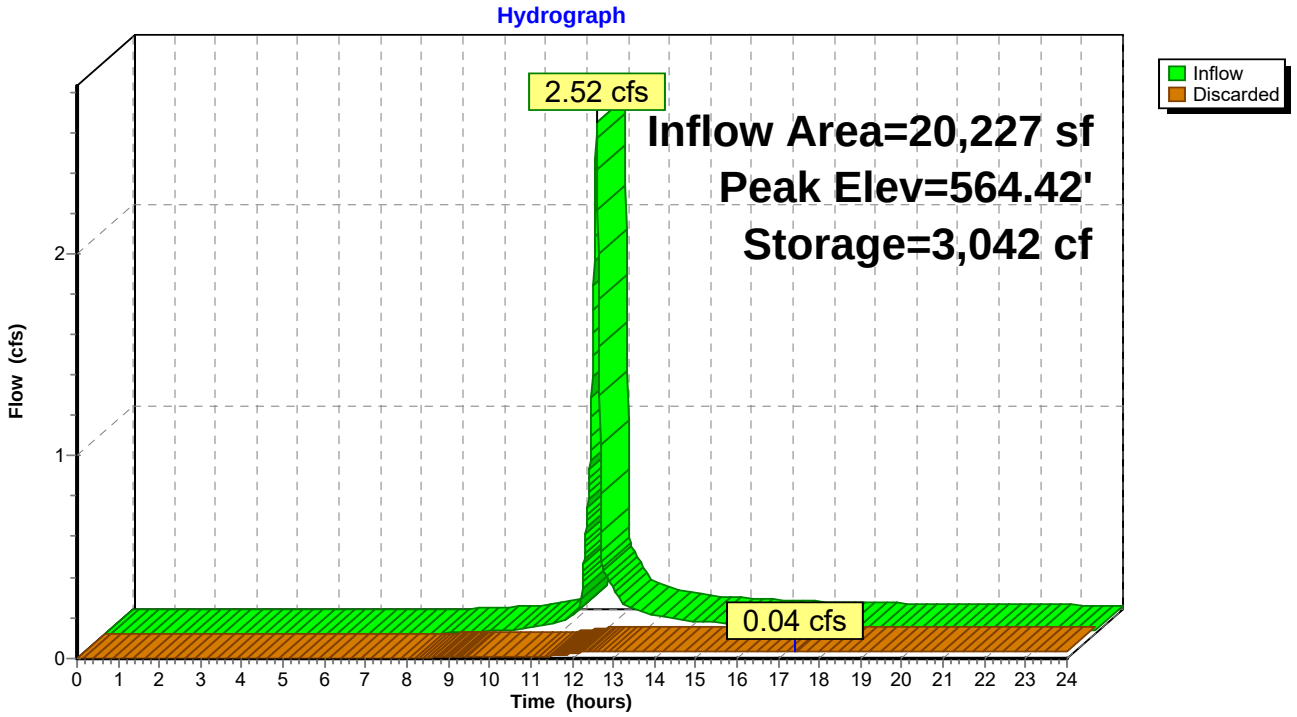
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

Discarded OutFlow Max=0.04 cfs @ 17.39 hrs HW=564.42' (Free Discharge)
1=Exfiltration (Controls 0.04 cfs)

Pond 2P: Berm


Hydrograph
2.52 cfs
Inflow Area=20,227 sf
Peak Elev=564.42'
Storage=3,042 cf
0.04 cfs
Inflow
Discarded
Flow (cfs)
Time (hours)
0
1
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>3.63"
Flow Length=130' Tc=1.3 min CN=84 Runoff=1.50 cfs 2,701 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>3.14"
Flow Length=140' Tc=1.8 min CN=79 Runoff=1.66 cfs 2,955 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=564.67' Storage=3,948 cf Inflow=3.16 cfs 5,655 cf
Outflow=0.04 cfs 1,962 cf

Total Runoff Area = 20,227 sf Runoff Volume = 5,655 cf Average Runoff Depth = 3.36"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

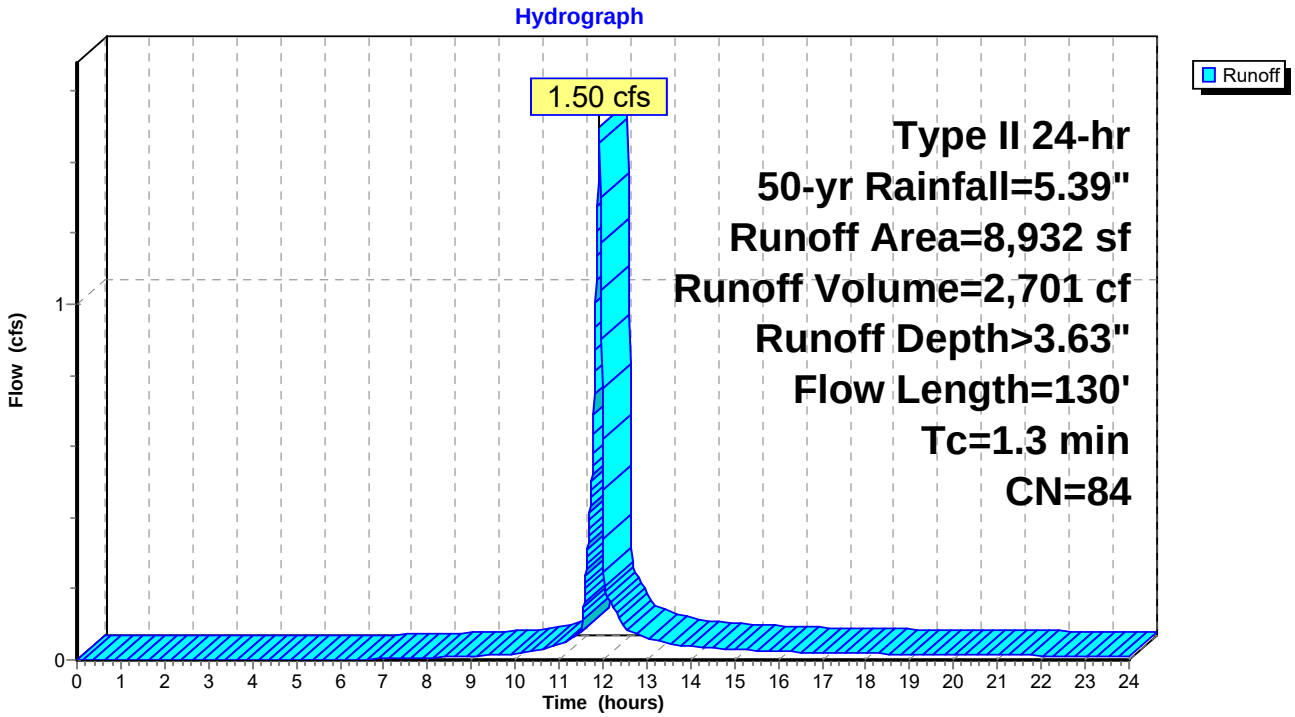
Runoff = 1.50 cfs @ 11.92 hrs, Volume= 2,701 cf, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-yr Rainfall=5.39"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

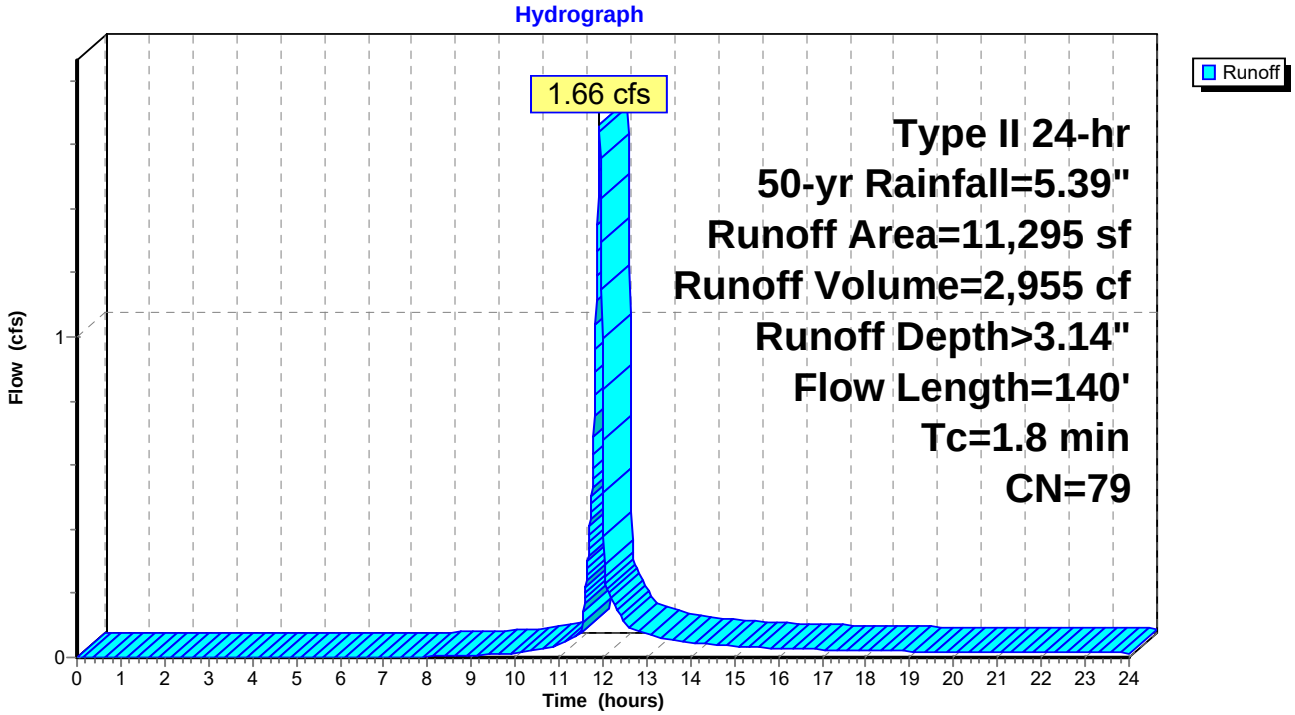
Runoff = 1.66 cfs @ 11.92 hrs, Volume= 2,955 cf, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-yr Rainfall=5.39"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 50-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 3.36" for 50-yr event
Inflow = 3.16 cfs @ 11.92 hrs, Volume= 5,655 cf
Outflow = 0.04 cfs @ 17.66 hrs, Volume= 1,962 cf, Atten= 99%, Lag= 344.7 min
Discarded = 0.04 cfs @ 17.66 hrs, Volume= 1,962 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 564.67' @ 17.66 hrs Surf.Area= 3,868 sf Storage= 3,948 cf

Plug-Flow detention time= 355.1 min calculated for 1,961 cf (35% of inflow)
Center-of-Mass det. time= 229.8 min (1,037.1 - 807.3)

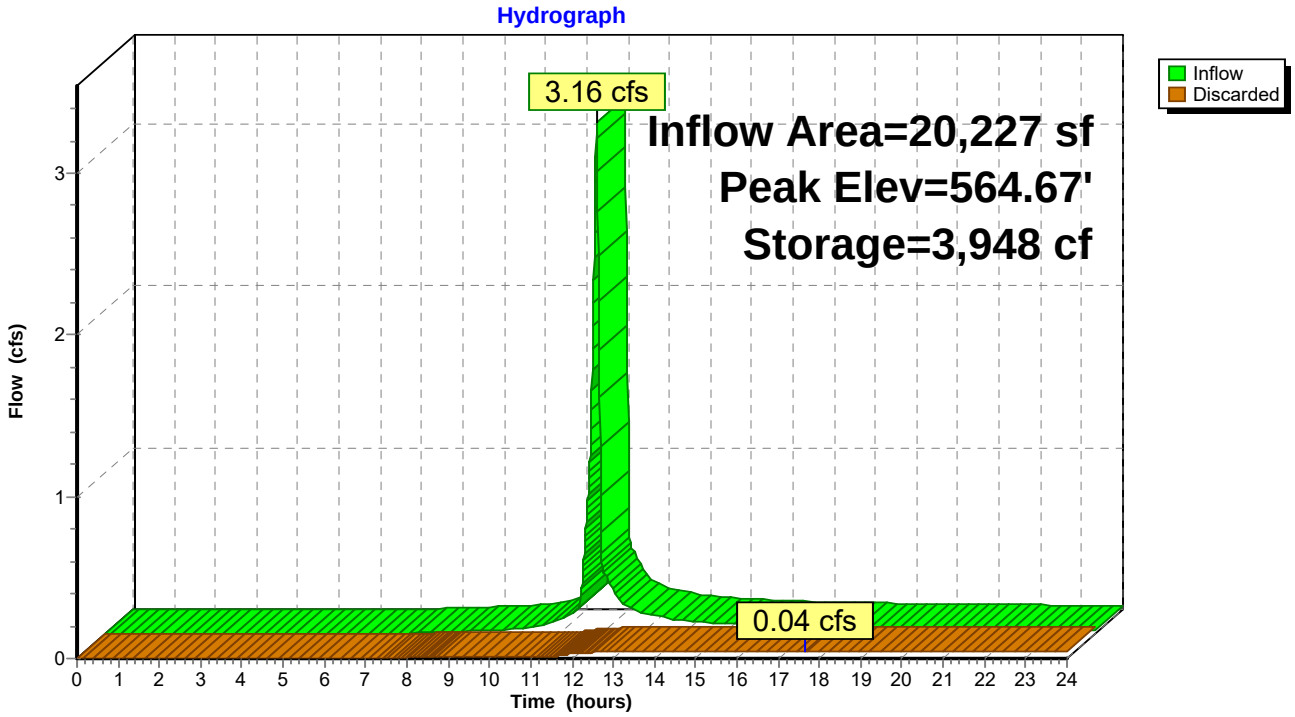
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

Discarded OutFlow Max=0.04 cfs @ 17.66 hrs HW=564.67' (Free Discharge)
1=Exfiltration (Controls 0.04 cfs)

Pond 2P: Berm


Hydrograph
3.16 cfs
Inflow Area=20,227 sf
Peak Elev=564.67'
Storage=3,948 cf
0.04 cfs
Inflow
Discarded
Flow (cfs)
Time (hours)
0 1 2 3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: DA to PAD Runoff Area=8,932 sf 15.54% Impervious Runoff Depth>4.51"
Flow Length=130' Tc=1.3 min CN=84 Runoff=1.84 cfs 3,360 cf

Subcatchment 7S: DA to BERM Runoff Area=11,295 sf 3.74% Impervious Runoff Depth>3.98"
Flow Length=140' Tc=1.8 min CN=79 Runoff=2.08 cfs 3,749 cf

Reach 3R: Post w/ BMP

Pond 2P: Berm Peak Elev=564.94' Storage=5,076 cf Inflow=3.92 cfs 7,110 cf
Outflow=0.05 cfs 2,307 cf

Total Runoff Area = 20,227 sf Runoff Volume = 7,110 cf Average Runoff Depth = 4.22"
91.05% Pervious = 18,417 sf 8.95% Impervious = 1,810 sf

Summary for Subcatchment 6S: DA to PAD

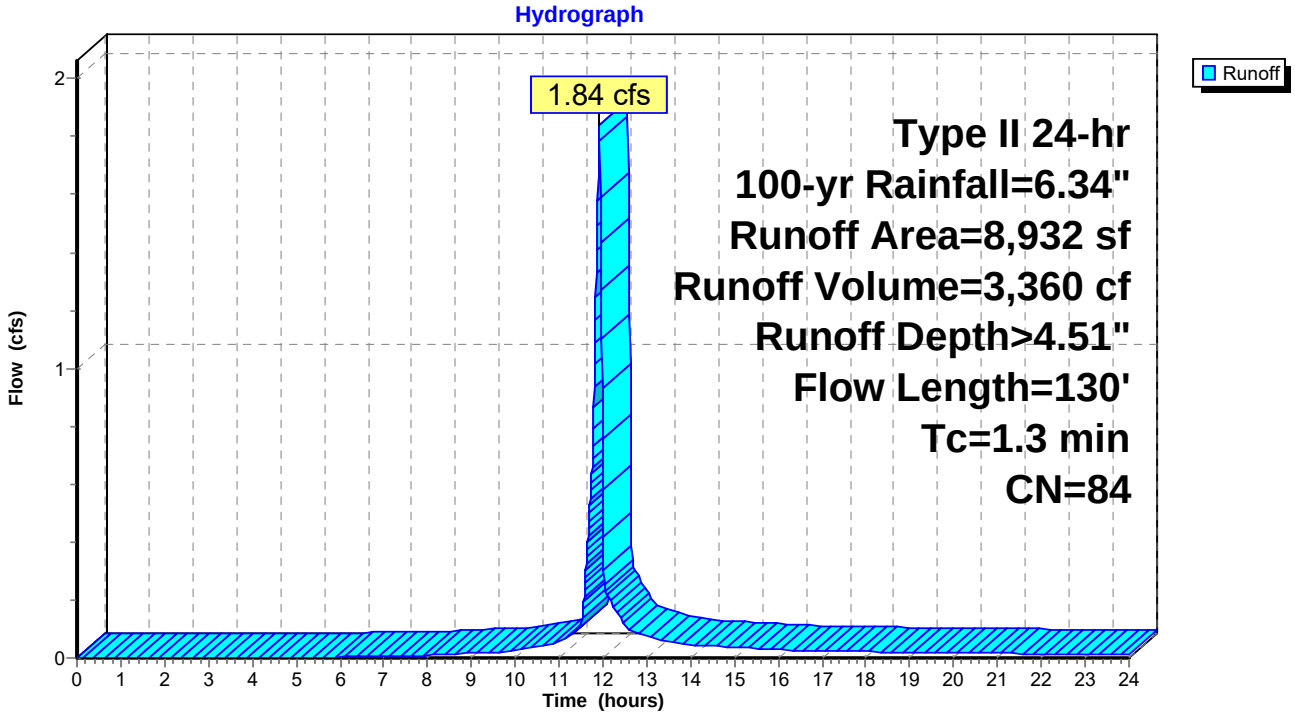
Runoff = 1.84 cfs @ 11.92 hrs, Volume= 3,360 cf, Depth> 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.34"

Area (sf)	CN	Description
5,546	91	Gravel roads, HSG D
1,001	78	Meadow, non-grazed, HSG D
997	30	Meadow, non-grazed, HSG A
1,388	98	Paved roads w/curbs & sewers, HSG A
8,932	84	Weighted Average
7,544		84.46% Pervious Area
1,388		15.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0300	1.45		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.2	30	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total			

Subcatchment 6S: DA to PAD



Summary for Subcatchment 7S: DA to BERM

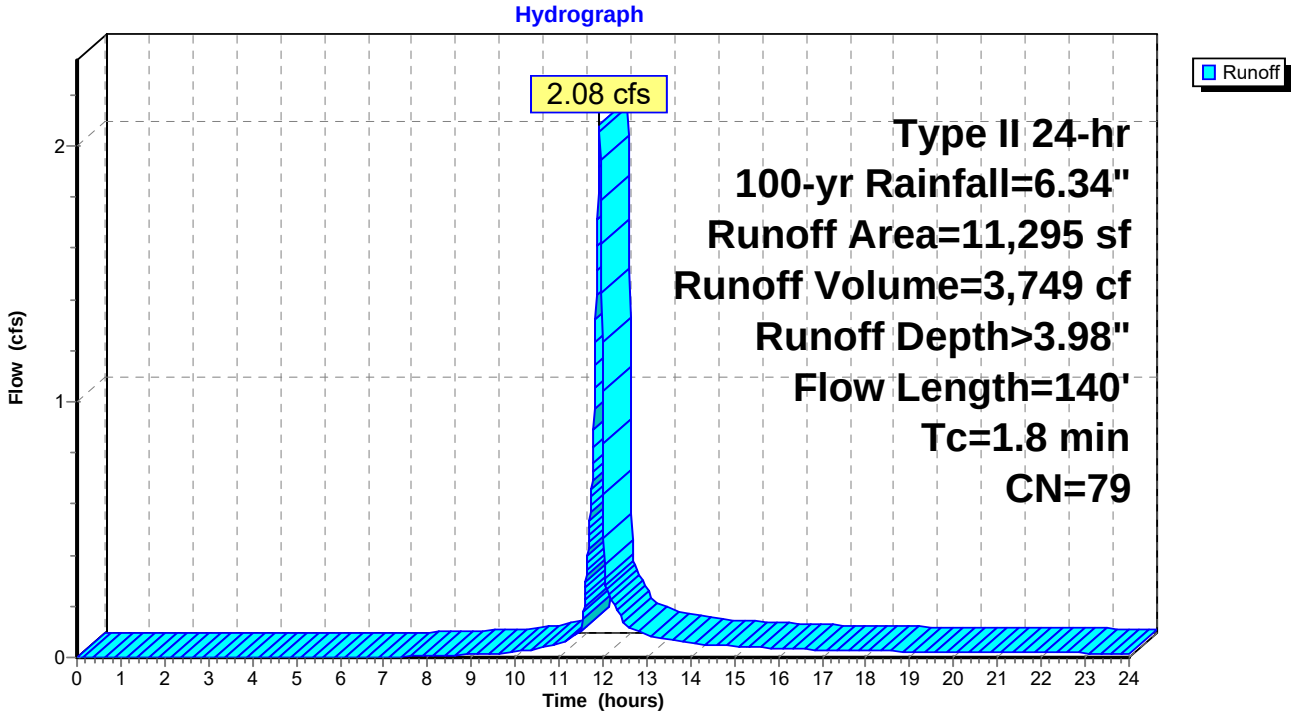
Runoff = 2.08 cfs @ 11.92 hrs, Volume= 3,749 cf, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.34"

Area (sf)	CN	Description
682	30	Meadow, non-grazed, HSG A
422	98	Paved roads w/curbs & sewers, HSG A
223	76	Gravel roads, HSG A
7,615	78	Meadow, non-grazed, HSG D
2,353	91	Gravel roads, HSG D
11,295	79	Weighted Average
10,873		96.26% Pervious Area
422		3.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.57"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	140	Total			

Subcatchment 7S: DA to BERM



Summary for Reach 3R: Post w/ BMP

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

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth = 0.00" for 100-yr event

Routing by Stor-Ind+Trans method

Summary for Pond 2P: Berm

Inflow Area = 20,227 sf, 8.95% Impervious, Inflow Depth > 4.22" for 100-yr event
Inflow = 3.92 cfs @ 11.92 hrs, Volume= 7,110 cf
Outflow = 0.05 cfs @ 17.94 hrs, Volume= 2,307 cf, Atten= 99%, Lag= 361.3 min
Discarded = 0.05 cfs @ 17.94 hrs, Volume= 2,307 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 564.94' @ 17.94 hrs Surf.Area= 4,422 sf Storage= 5,076 cf

Plug-Flow detention time= 360.5 min calculated for 2,306 cf (32% of inflow)
Center-of-Mass det. time= 231.9 min (1,032.7 - 800.9)

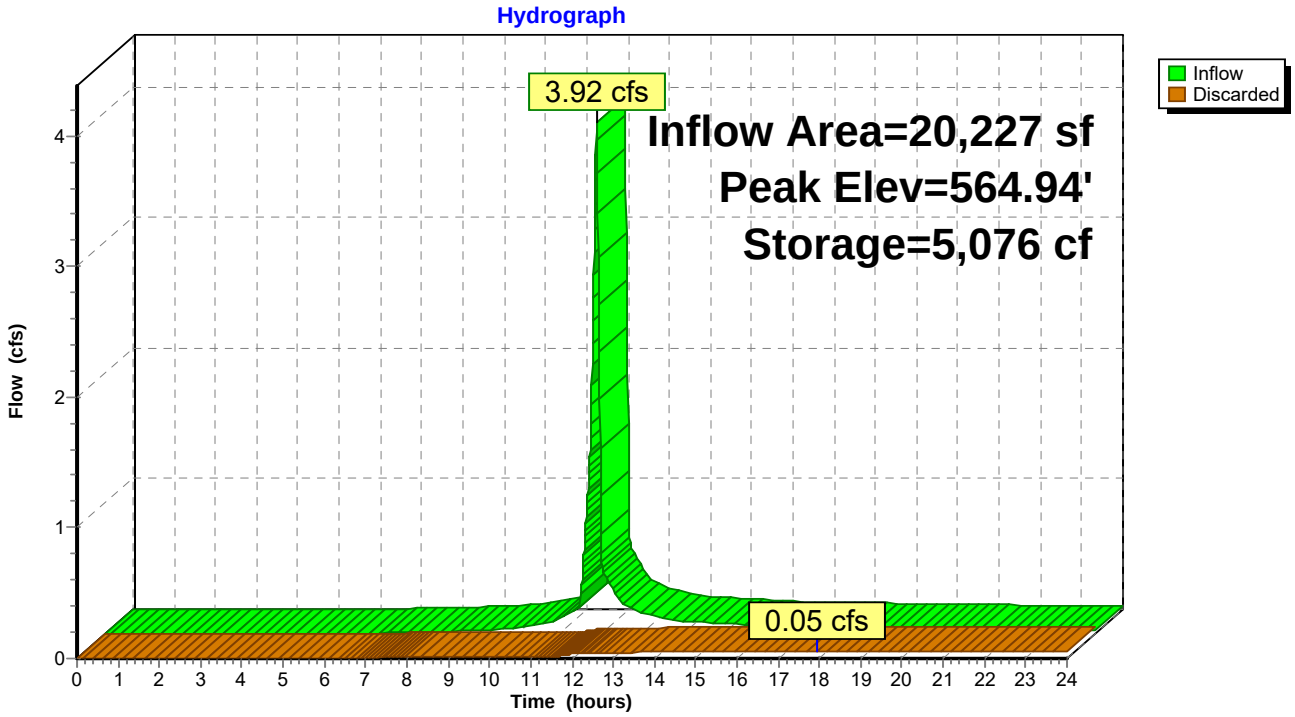
Volume	Invert	Avail.Storage	Storage Description
#1	563.00'	5,354 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
563.00	1,137	0	0
564.00	2,511	1,824	1,824
565.00	4,548	3,530	5,354

Device	Routing	Invert	Outlet Devices
#1	Discarded	563.00'	**0.380 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 559.00'

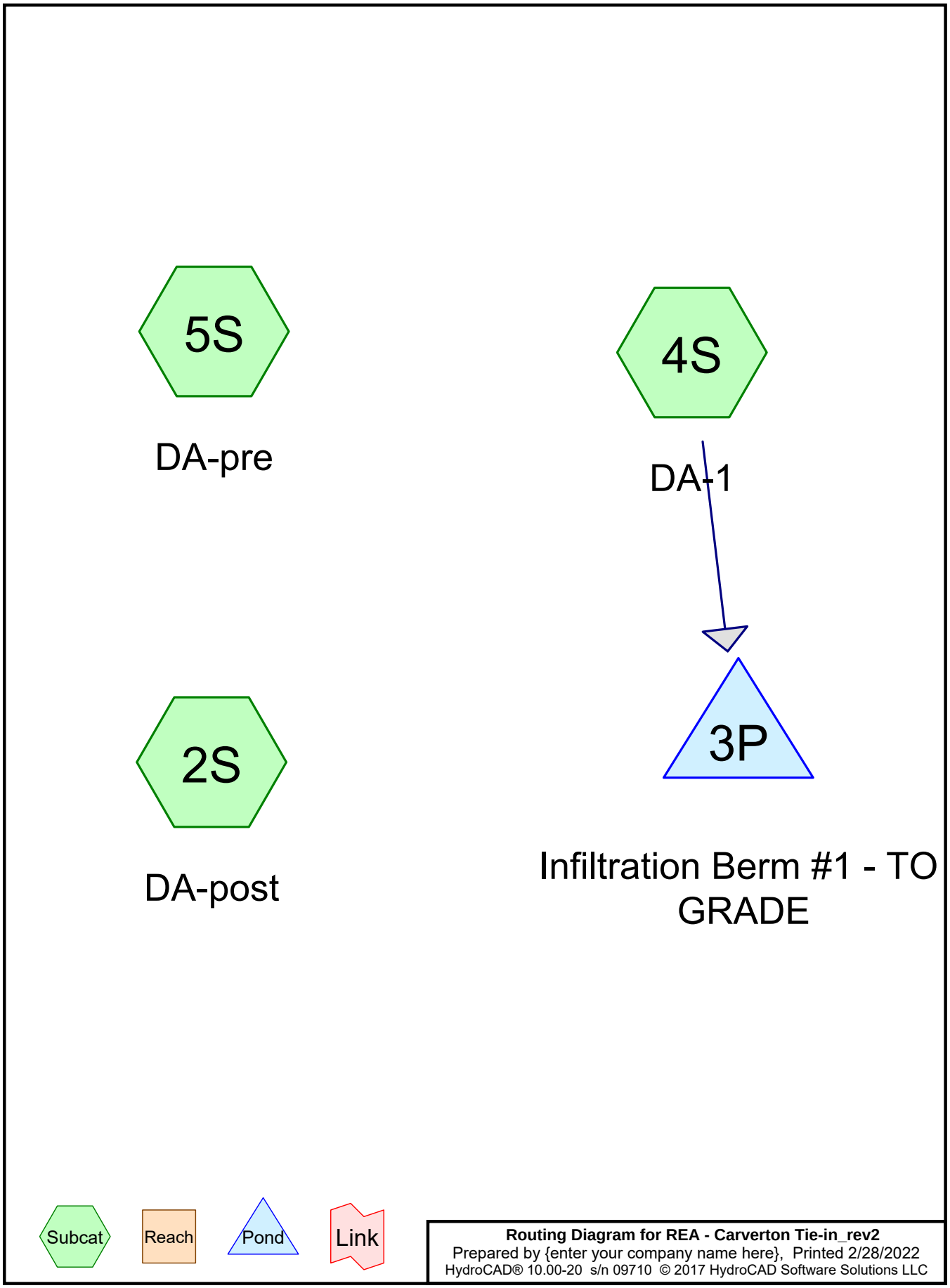
Discarded OutFlow Max=0.05 cfs @ 17.94 hrs HW=564.94' (Free Discharge)
1=Exfiltration (Controls 0.05 cfs)

Pond 2P: Berm


Hydrograph
3.92 cfs
Inflow Area=20,227 sf
Peak Elev=564.94'
Storage=5,076 cf
0.05 cfs
Inflow
Discarded
Flow (cfs)
Time (hours)
0 1 2 3 4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

ATTACHMENT 4.14

BMP HYDROCAD REPORT – CARVERTON TIE-IN



Routing Diagram for REA - Carverton Tie-in_rev2
Prepared by {enter your company name here}, Printed 2/28/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,501	78	20% Impervious as Meadow (5S)
348	79	50-75% Grass cover, Fair, HSG C (2S, 4S)
14,054	84	50-75% Grass cover, Fair, HSG D (2S, 4S)
2,439	98	Existing Gravel (5S)
4,878	98	Existing gravel (2S, 4S)
10,716	91	Gravel pad, HSG D (2S, 4S)
174	71	Meadow, non-grazed, HSG C (5S)
9,884	78	Meadow, non-grazed, HSG D (5S)
44,994	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
522	HSG C	2S, 4S, 5S
34,654	HSG D	2S, 4S, 5S
9,818	Other	2S, 4S, 5S
44,994		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	S N
0	0	0	0	2,501	2,501	20% Impervious as Meadow	
0	0	348	14,054	0	14,402	50-75% Grass cover, Fair	
0	0	0	0	2,439	2,439	Existing Gravel	
0	0	0	0	4,878	4,878	Existing gravel	
0	0	0	10,716	0	10,716	Gravel pad	
0	0	174	9,884	0	10,058	Meadow, non-grazed	
0	**0**	**522**	**34,654**	**9,818**	**44,994**	**TOTAL AREA**	

Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>1.09"
Flow Length=214' Tc=2.1 min CN=89 Runoff=0.76 cfs 1,363 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>1.09"
Flow Length=214' Tc=2.1 min CN=89 Runoff=0.76 cfs 1,363 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>0.65"
Flow Length=214' Tc=2.1 min CN=81 Runoff=0.49 cfs 816 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,399.01' Storage=806 cf Inflow=0.76 cfs 1,363 cf
Discarded=0.03 cfs 810 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 810 cf

Total Runoff Area = 44,994 sf Runoff Volume = 3,542 cf Average Runoff Depth = 0.94"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

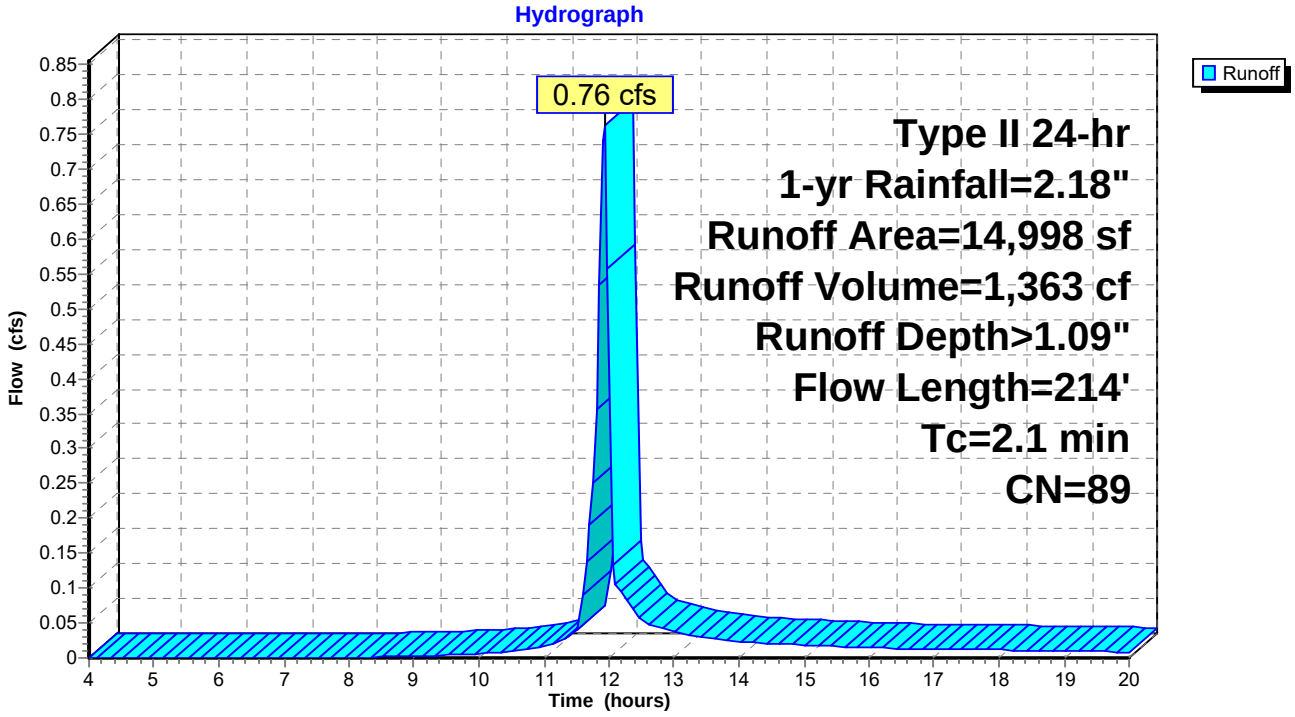
Runoff = 0.76 cfs @ 11.92 hrs, Volume= 1,363 cf, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.18"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

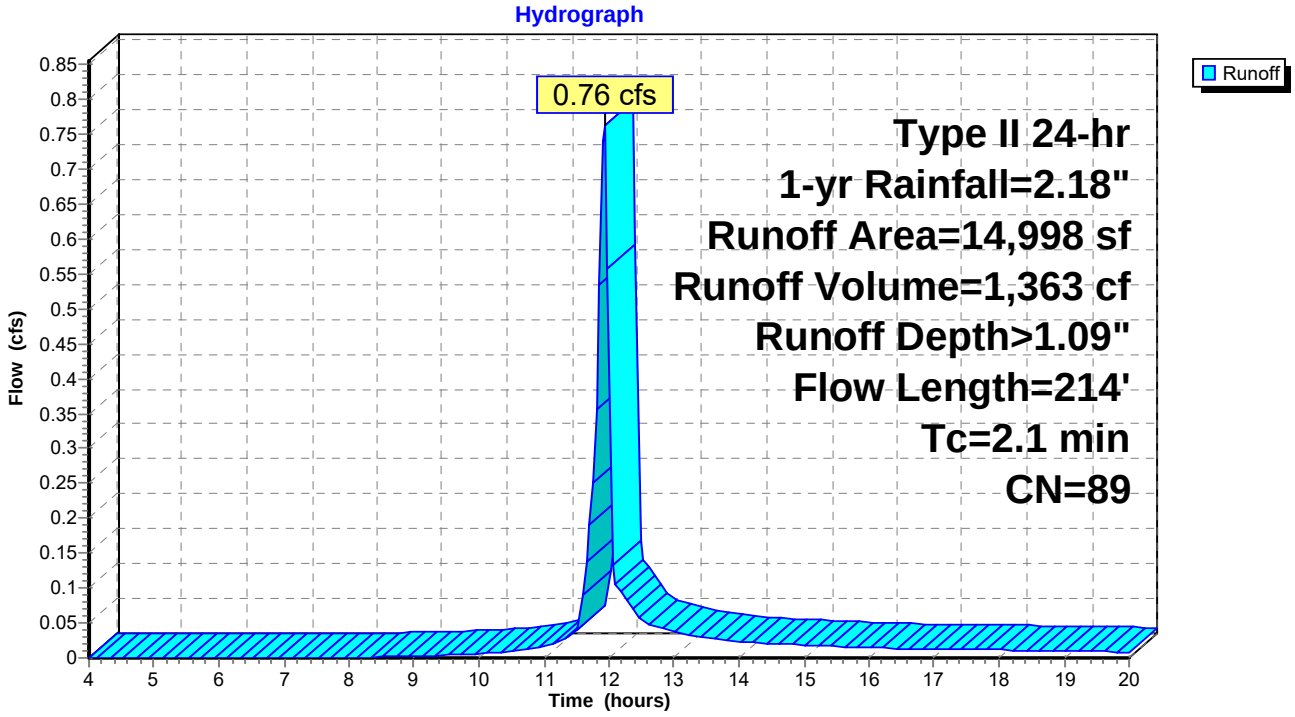
Runoff = 0.76 cfs @ 11.92 hrs, Volume= 1,363 cf, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.18"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

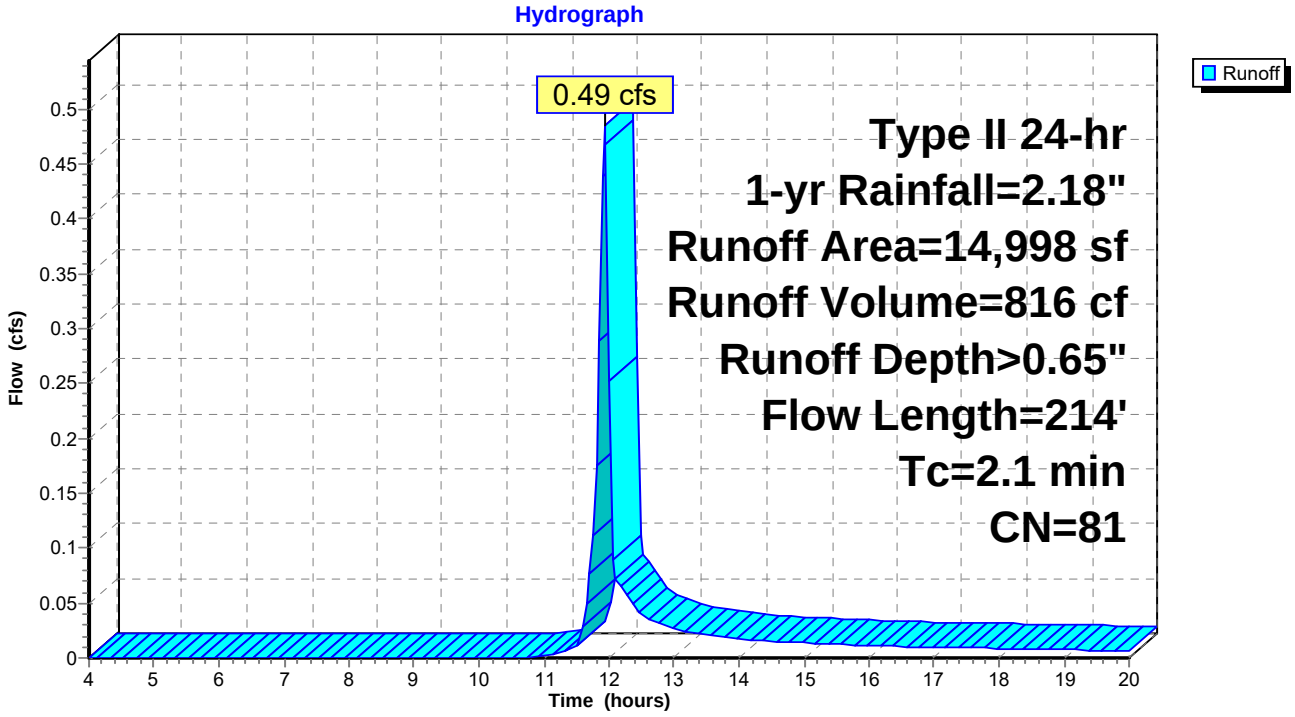
Runoff = 0.49 cfs @ 11.93 hrs, Volume= 816 cf, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.18"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 1.09" for 1-yr event
Inflow = 0.76 cfs @ 11.92 hrs, Volume= 1,363 cf
Outflow = 0.03 cfs @ 13.51 hrs, Volume= 810 cf, Atten= 96%, Lag= 95.2 min
Discarded = 0.03 cfs @ 13.51 hrs, Volume= 810 cf
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,399.01' @ 13.51 hrs Surf.Area= 1,250 sf Storage= 806 cf

Plug-Flow detention time= 222.2 min calculated for 810 cf (59% of inflow)
Center-of-Mass det. time= 146.0 min (926.2 - 780.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

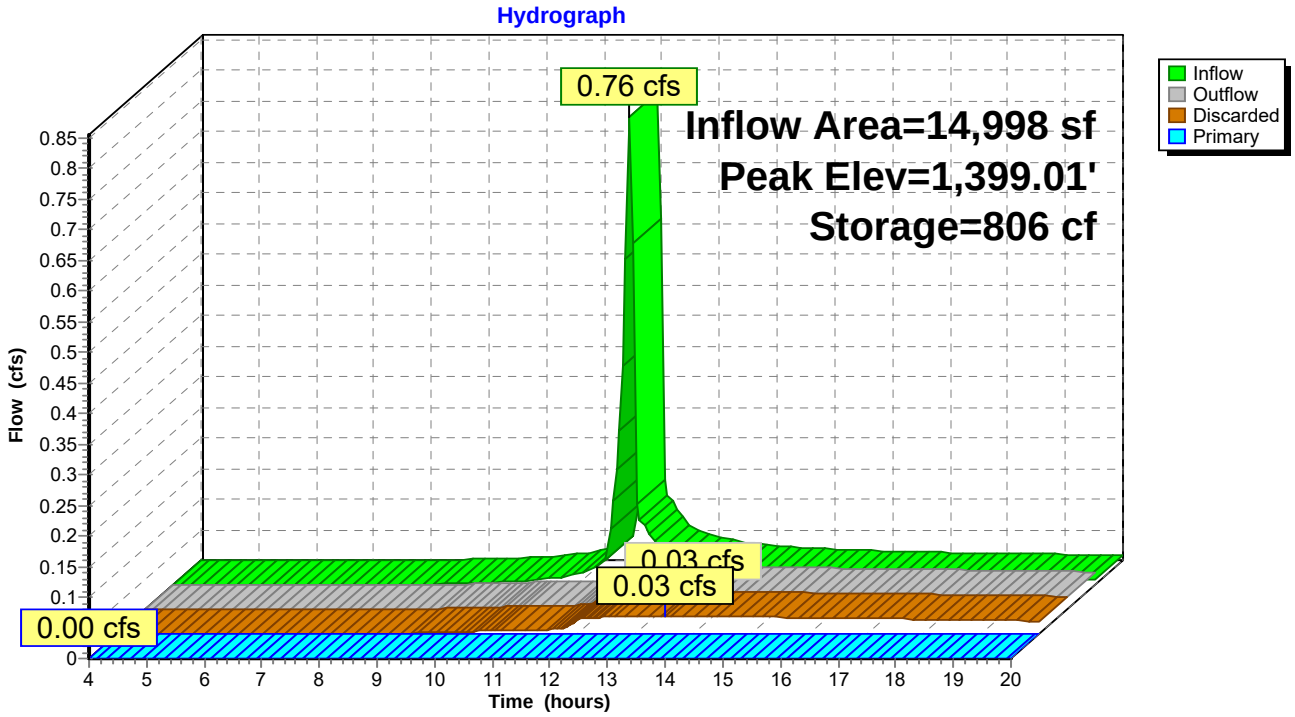
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.03 cfs @ 13.51 hrs HW=1,399.01' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=1,398.00' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltration Berm #1 - TO GRADE



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>1.44"
Flow Length=214' Tc=2.1 min CN=89 Runoff=0.99 cfs 1,801 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>1.44"
Flow Length=214' Tc=2.1 min CN=89 Runoff=0.99 cfs 1,801 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>0.93"
Flow Length=214' Tc=2.1 min CN=81 Runoff=0.69 cfs 1,164 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,399.20' Storage=1,105 cf Inflow=0.99 cfs 1,801 cf
Discarded=0.03 cfs 1,005 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 1,005 cf

Total Runoff Area = 44,994 sf Runoff Volume = 4,766 cf Average Runoff Depth = 1.27"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

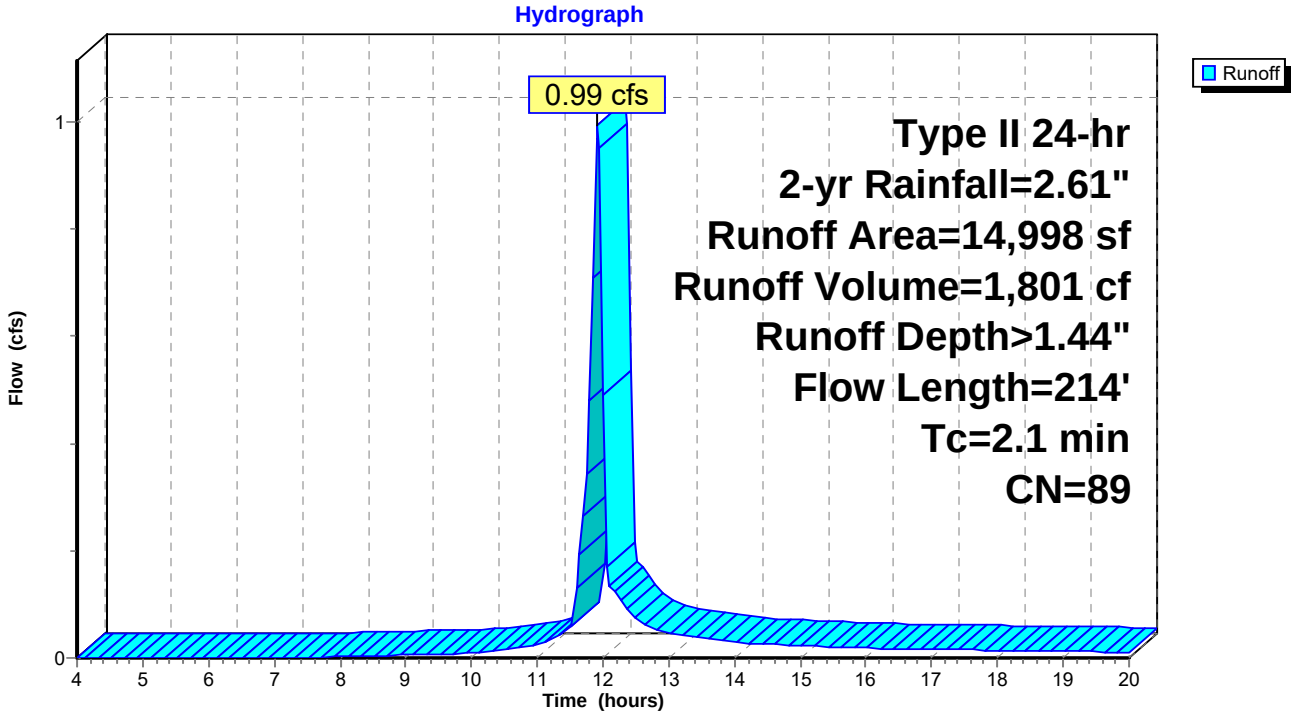
Runoff = 0.99 cfs @ 11.92 hrs, Volume= 1,801 cf, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.61"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

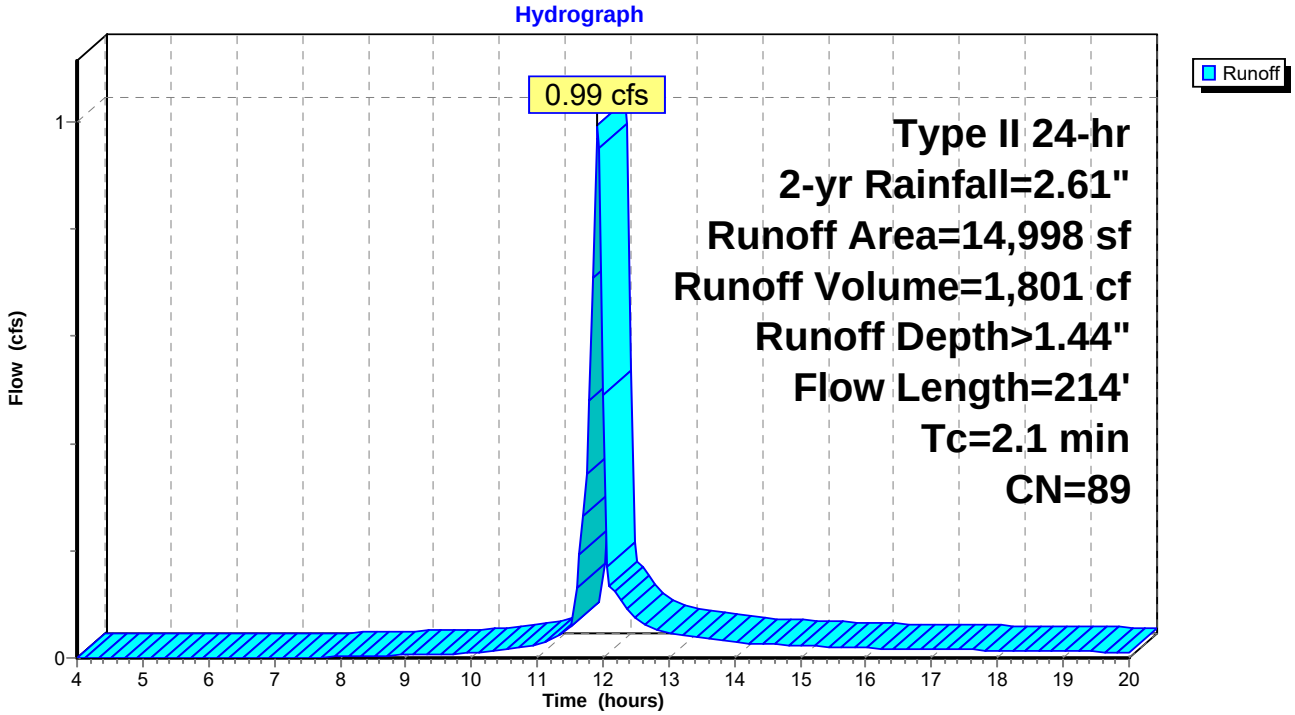
Runoff = 0.99 cfs @ 11.92 hrs, Volume= 1,801 cf, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.61"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

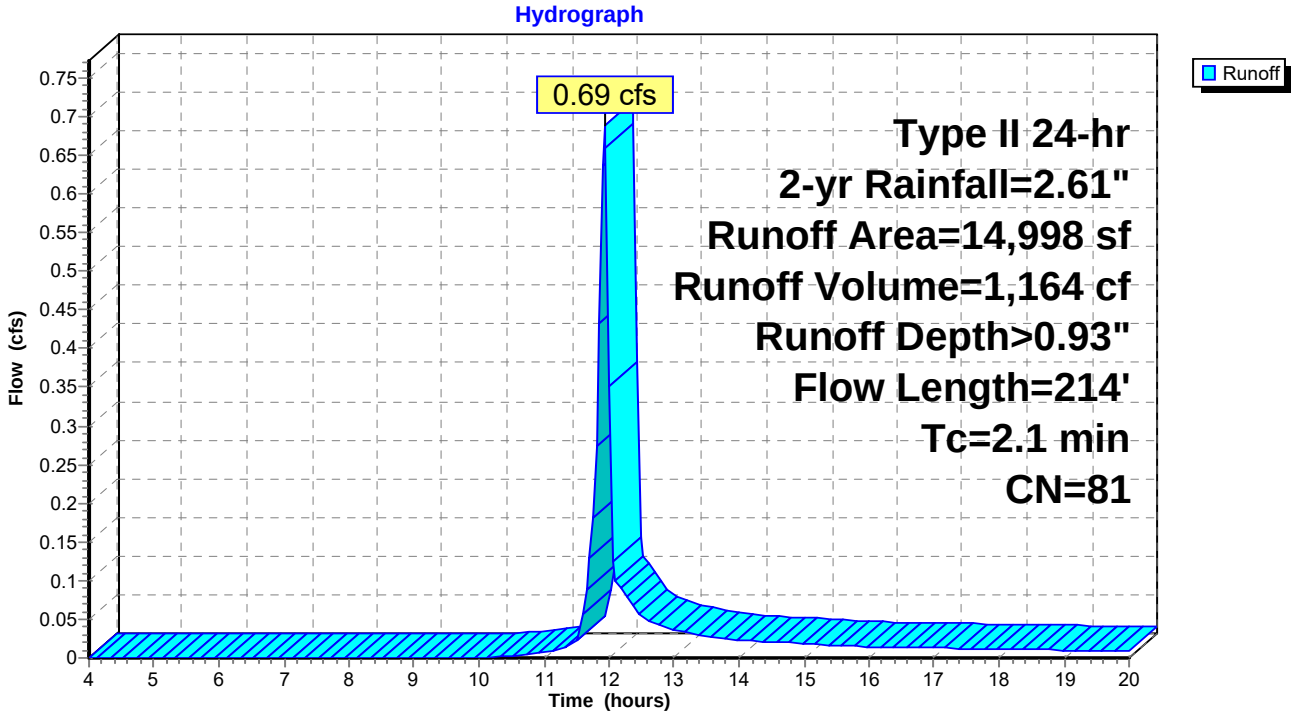
Runoff = 0.69 cfs @ 11.93 hrs, Volume= 1,164 cf, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.61"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 1.44" for 2-yr event
Inflow = 0.99 cfs @ 11.92 hrs, Volume= 1,801 cf
Outflow = 0.03 cfs @ 13.68 hrs, Volume= 1,005 cf, Atten= 97%, Lag= 105.6 min
Discarded = 0.03 cfs @ 13.68 hrs, Volume= 1,005 cf
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,399.20' @ 13.68 hrs Surf.Area= 1,416 sf Storage= 1,105 cf

Plug-Flow detention time= 229.4 min calculated for 1,005 cf (56% of inflow)
Center-of-Mass det. time= 152.8 min (926.9 - 774.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

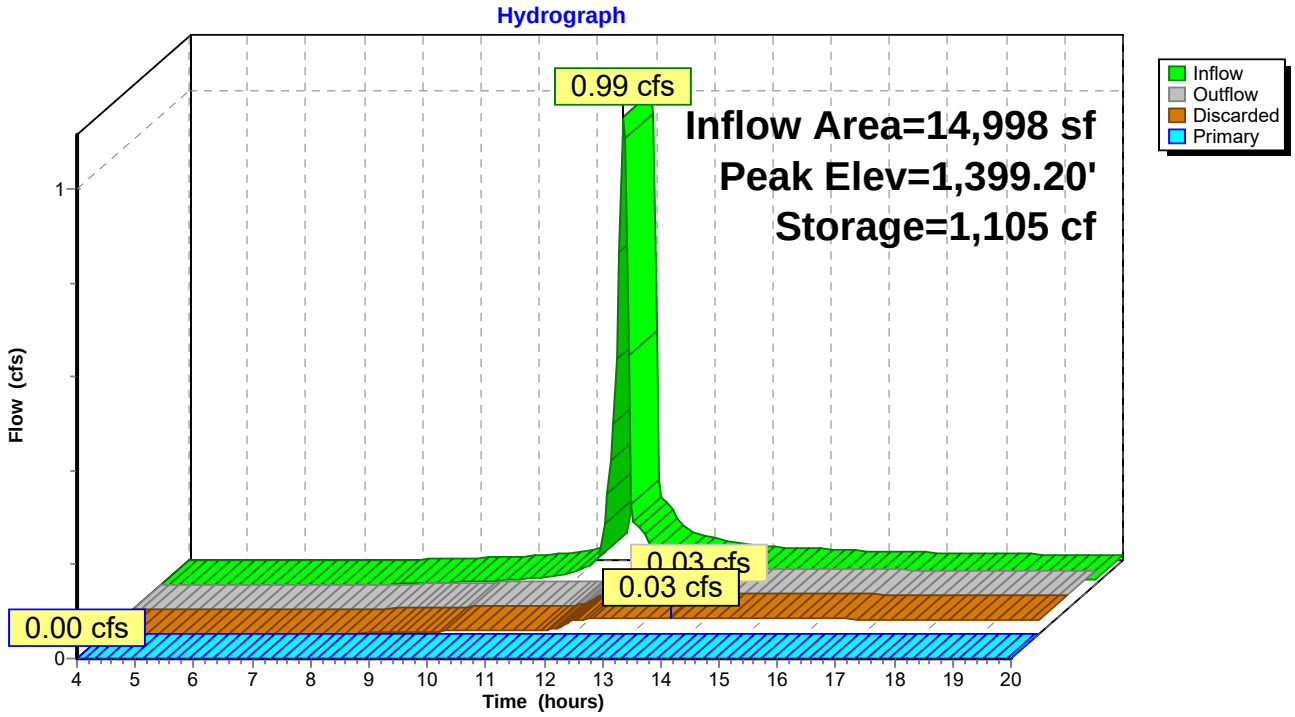
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.03 cfs @ 13.68 hrs HW=1,399.20' (Free Discharge)
└**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=1,398.00' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltration Berm #1 - TO GRADE



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>2.46"
Flow Length=214' Tc=2.1 min CN=89 Runoff=1.64 cfs 3,071 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>2.46"
Flow Length=214' Tc=2.1 min CN=89 Runoff=1.64 cfs 3,071 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>1.80"
Flow Length=214' Tc=2.1 min CN=81 Runoff=1.27 cfs 2,245 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,399.74' Storage=1,987 cf Inflow=1.64 cfs 3,071 cf
Discarded=0.05 cfs 1,497 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 1,497 cf

Total Runoff Area = 44,994 sf Runoff Volume = 8,386 cf Average Runoff Depth = 2.24"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

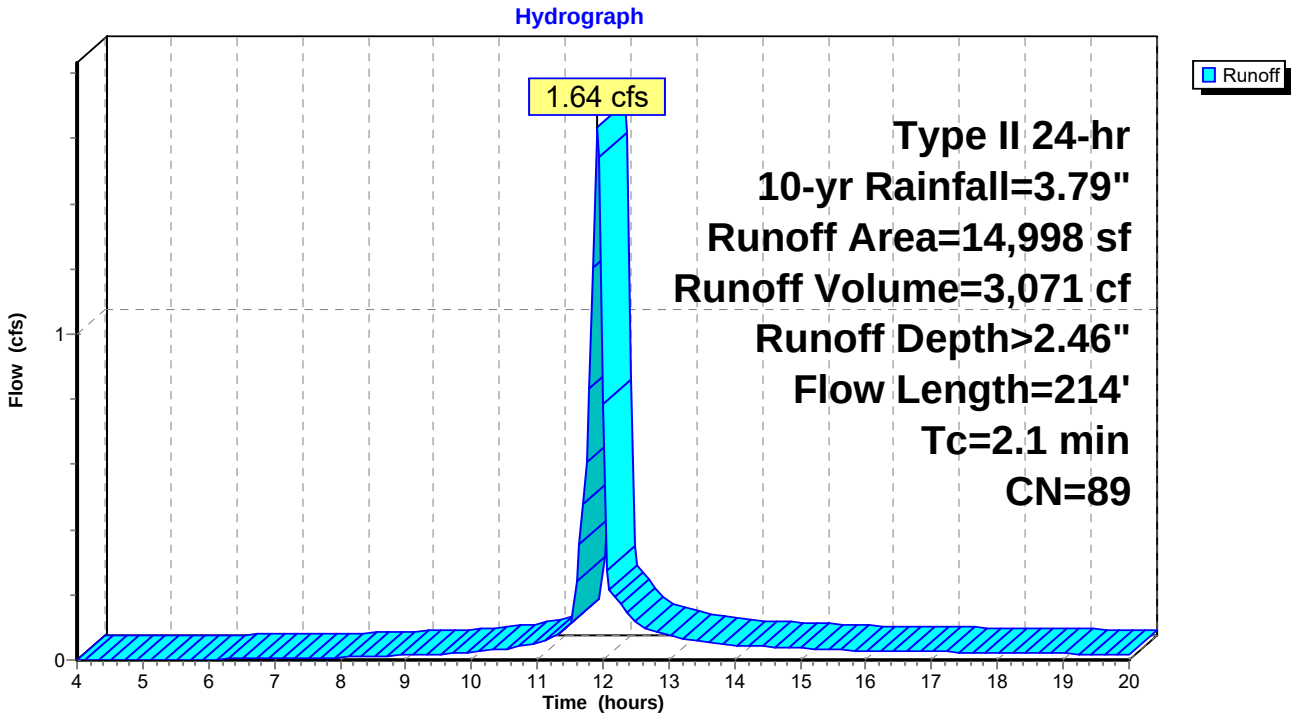
Runoff = 1.64 cfs @ 11.92 hrs, Volume= 3,071 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.79"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

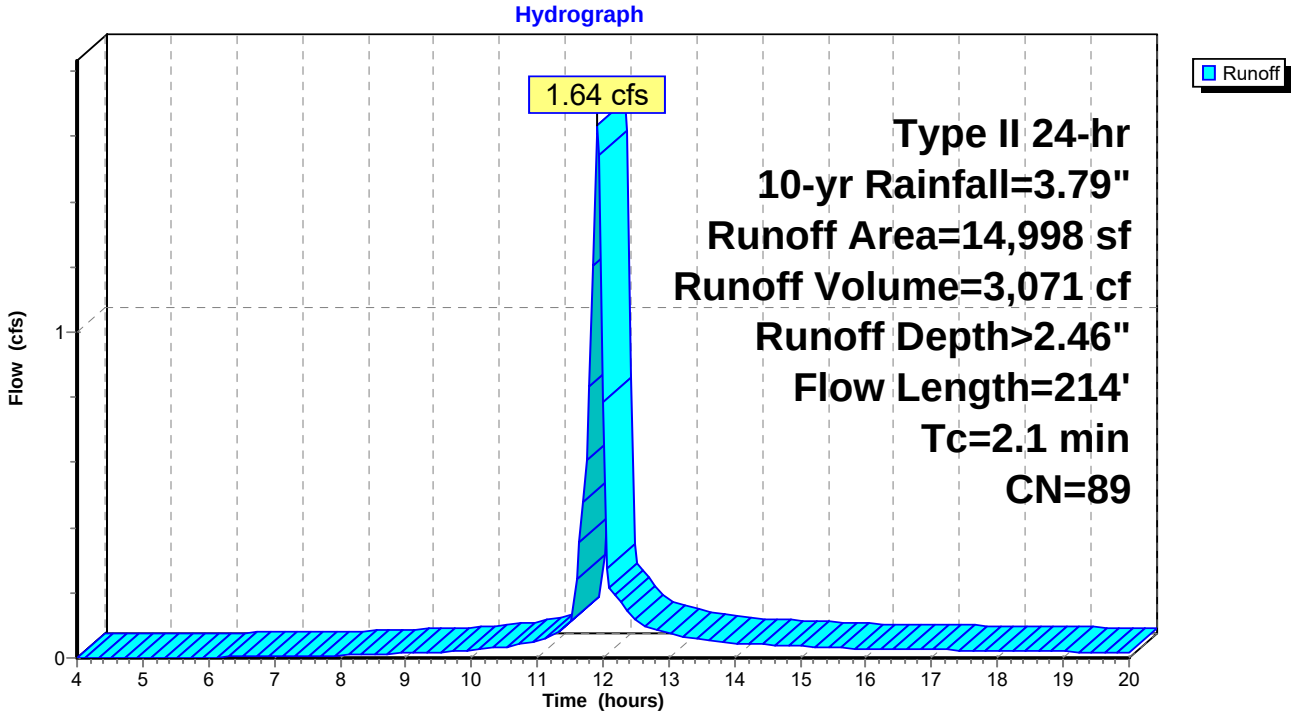
Runoff = 1.64 cfs @ 11.92 hrs, Volume= 3,071 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.79"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

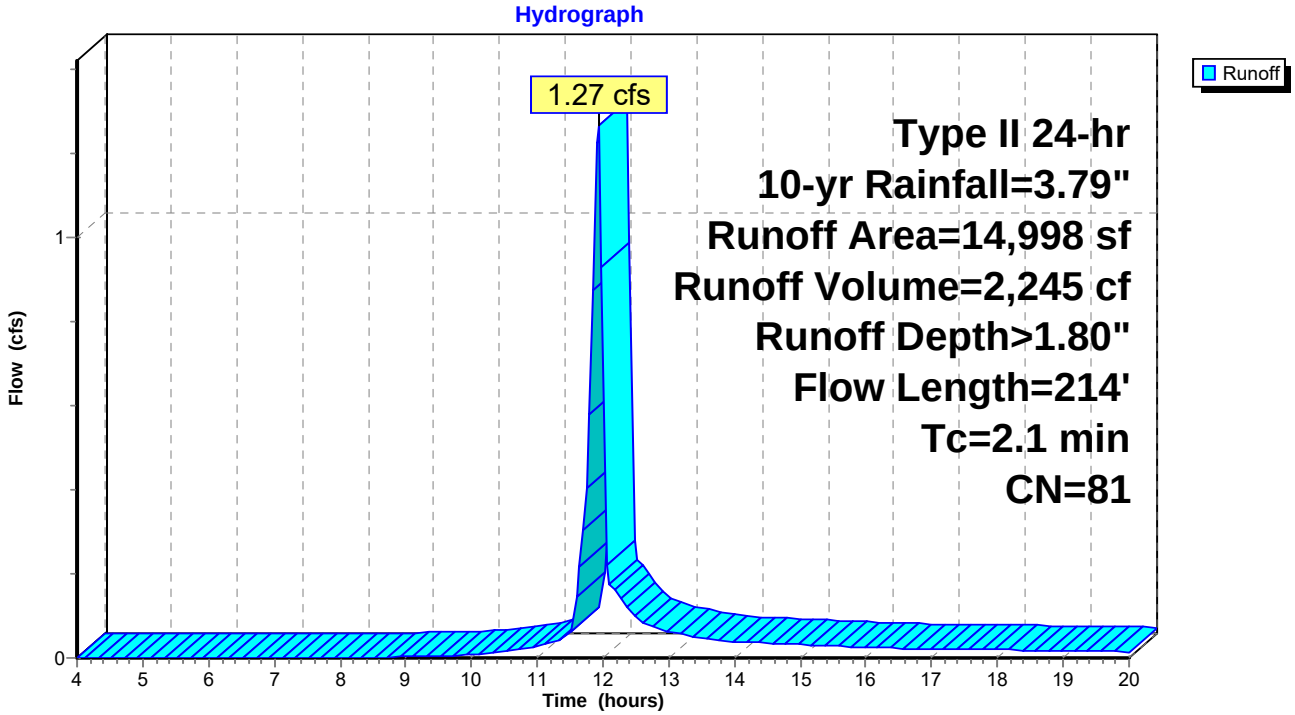
Runoff = 1.27 cfs @ 11.92 hrs, Volume= 2,245 cf, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.79"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 2.46" for 10-yr event
Inflow = 1.64 cfs @ 11.92 hrs, Volume= 3,071 cf
Outflow = 0.05 cfs @ 13.84 hrs, Volume= 1,497 cf, Atten= 97%, Lag= 115.2 min
Discarded = 0.05 cfs @ 13.84 hrs, Volume= 1,497 cf
Primary = 0.00 cfs @ 4.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,399.74' @ 13.84 hrs Surf.Area= 1,907 sf Storage= 1,987 cf

Plug-Flow detention time= 235.7 min calculated for 1,497 cf (49% of inflow)
Center-of-Mass det. time= 155.3 min (917.1 - 761.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

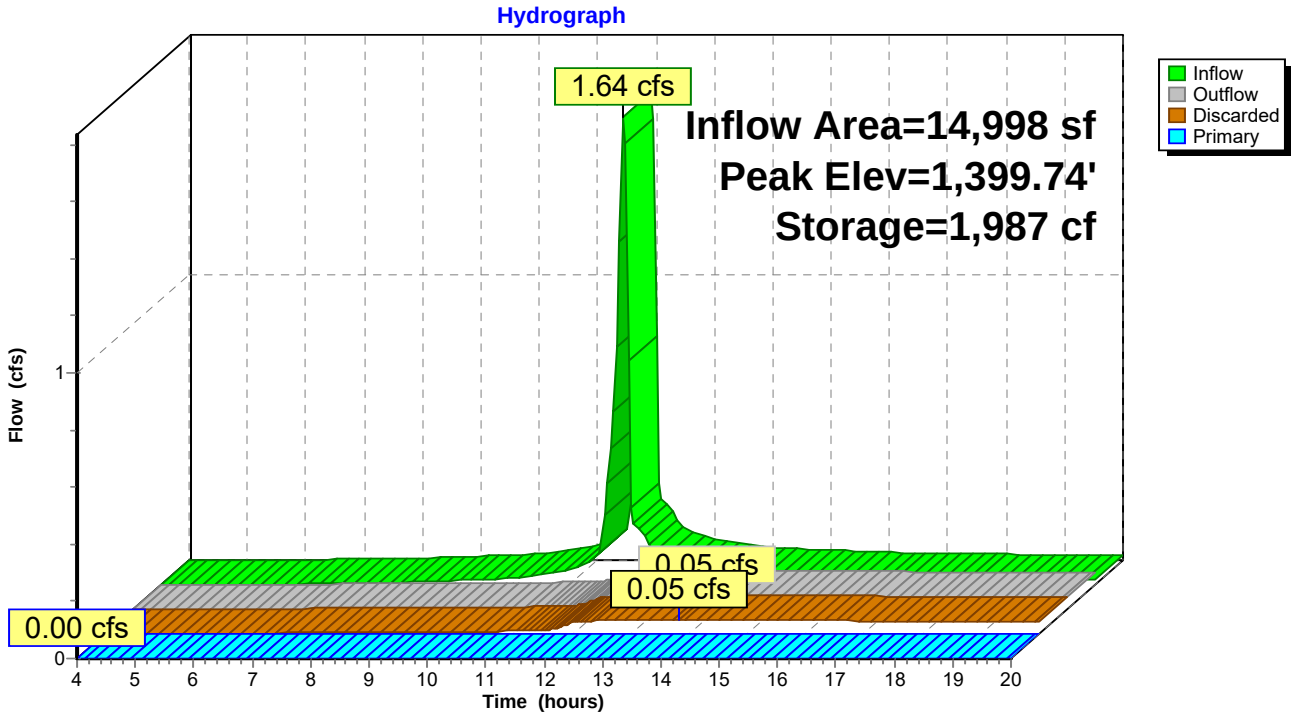
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.05 cfs @ 13.84 hrs HW=1,399.74' (Free Discharge)
└**2=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 4.00 hrs HW=1,398.00' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltration Berm #1 - TO GRADE



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>3.24"
Flow Length=214' Tc=2.1 min CN=89 Runoff=2.12 cfs 4,054 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>3.24"
Flow Length=214' Tc=2.1 min CN=89 Runoff=2.12 cfs 4,054 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>2.50"
Flow Length=214' Tc=2.1 min CN=81 Runoff=1.74 cfs 3,126 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,399.89' Storage=2,238 cf Inflow=2.12 cfs 4,054 cf
Discarded=0.05 cfs 1,678 cf Primary=0.30 cfs 559 cf Outflow=0.35 cfs 2,237 cf

Total Runoff Area = 44,994 sf Runoff Volume = 11,233 cf Average Runoff Depth = 3.00"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

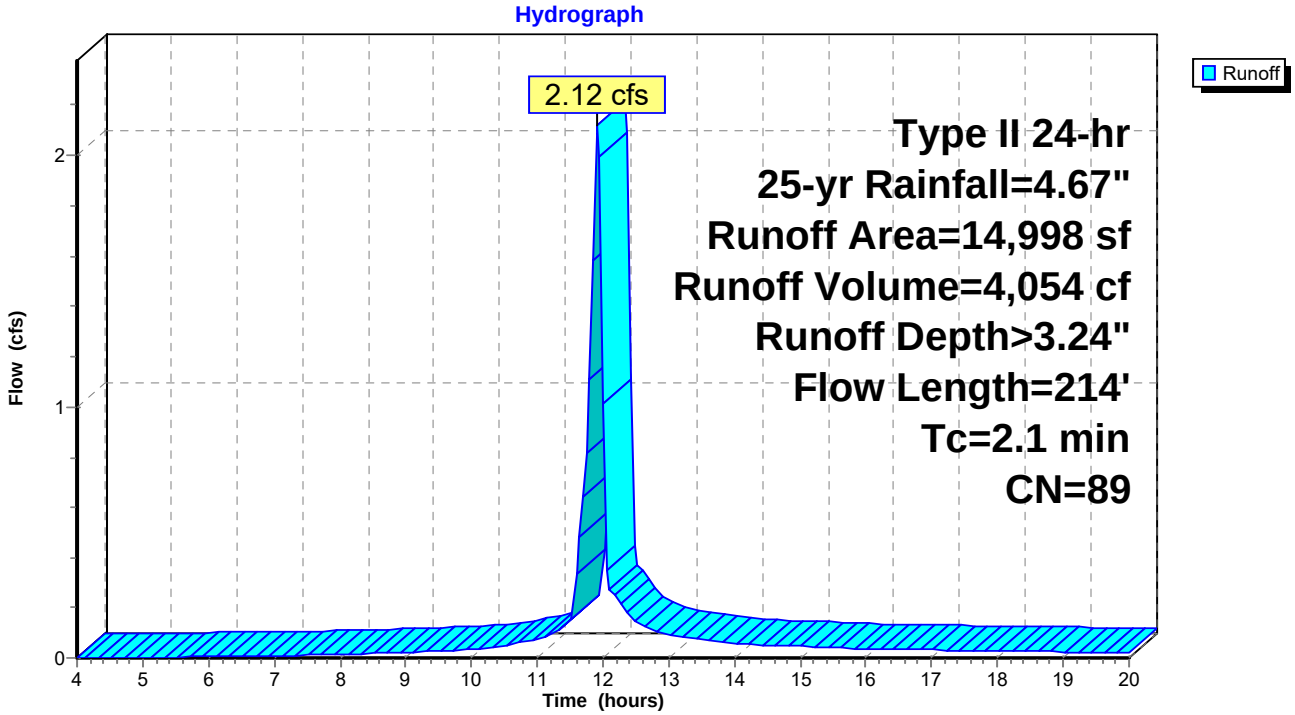
Runoff = 2.12 cfs @ 11.92 hrs, Volume= 4,054 cf, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.67"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

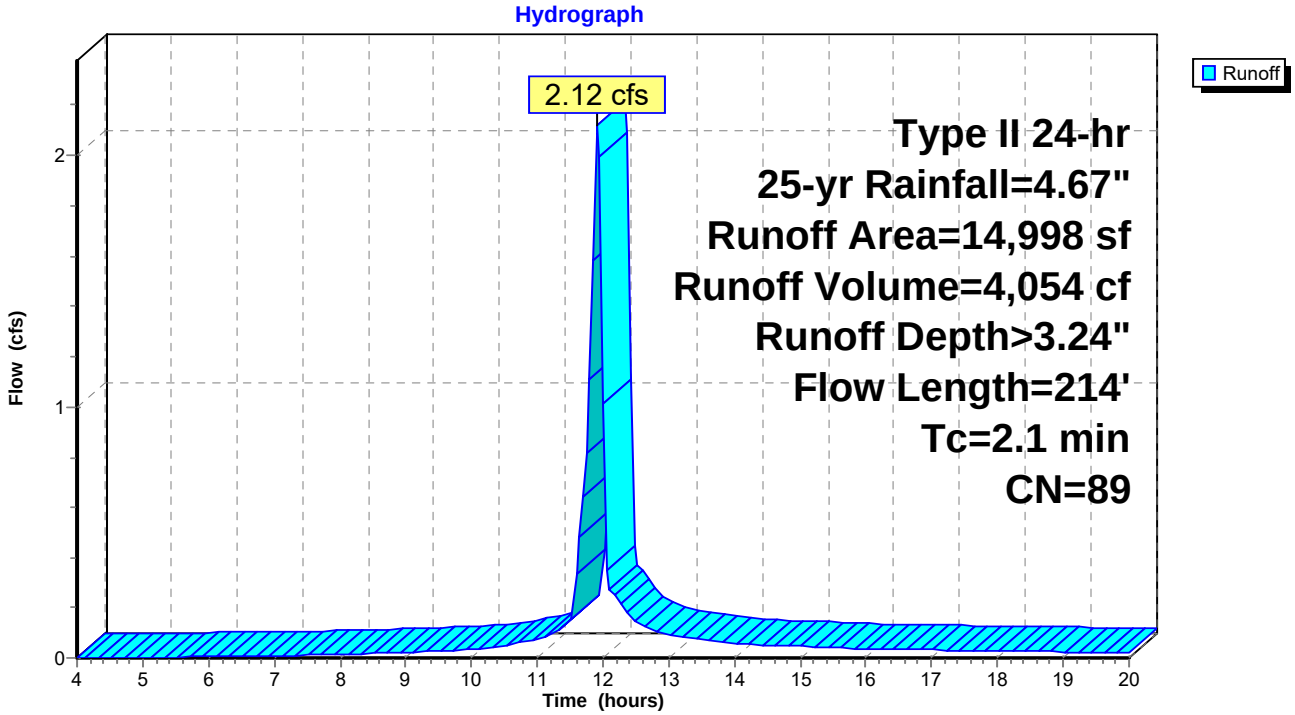
Runoff = 2.12 cfs @ 11.92 hrs, Volume= 4,054 cf, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.67"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

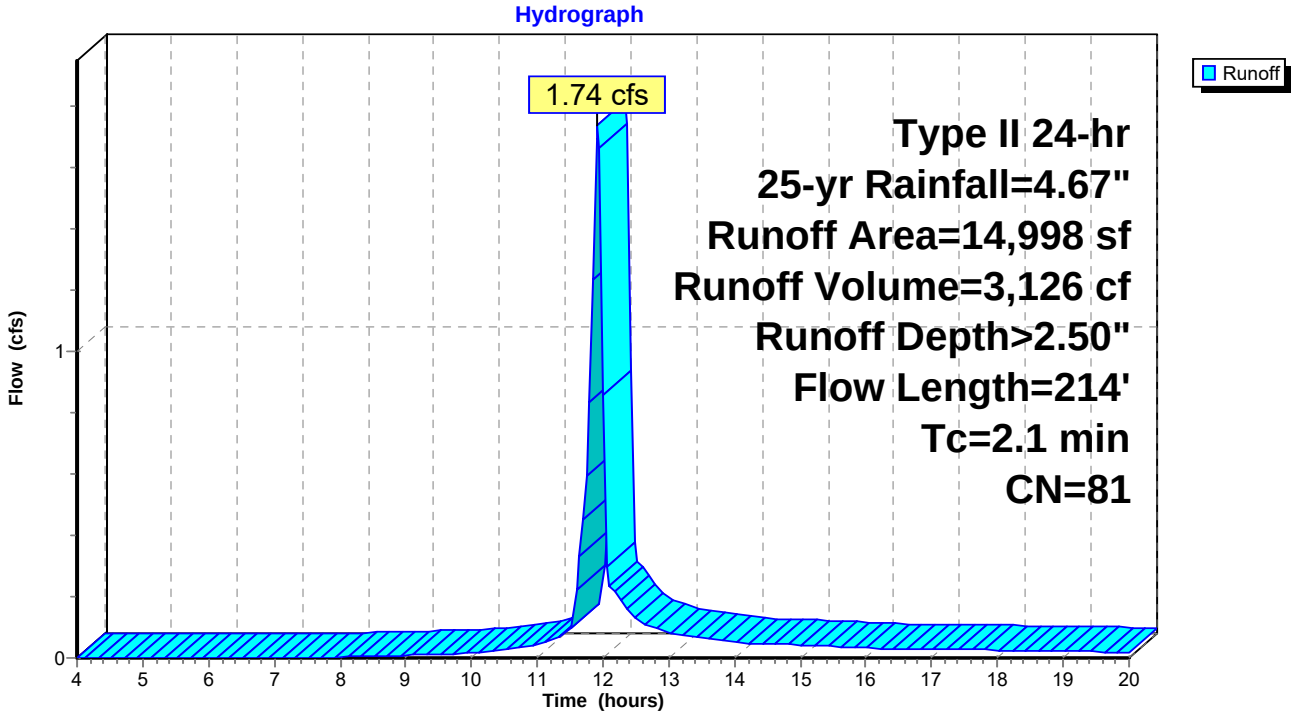
Runoff = 1.74 cfs @ 11.92 hrs, Volume= 3,126 cf, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.67"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 3.24" for 25-yr event
Inflow = 2.12 cfs @ 11.92 hrs, Volume= 4,054 cf
Outflow = 0.35 cfs @ 12.07 hrs, Volume= 2,237 cf, Atten= 83%, Lag= 9.4 min
Discarded = 0.05 cfs @ 12.05 hrs, Volume= 1,678 cf
Primary = 0.30 cfs @ 12.07 hrs, Volume= 559 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,399.89' @ 12.05 hrs Surf.Area= 2,037 sf Storage= 2,238 cf

Plug-Flow detention time= 189.2 min calculated for 2,230 cf (55% of inflow)
Center-of-Mass det. time= 113.4 min (868.6 - 755.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

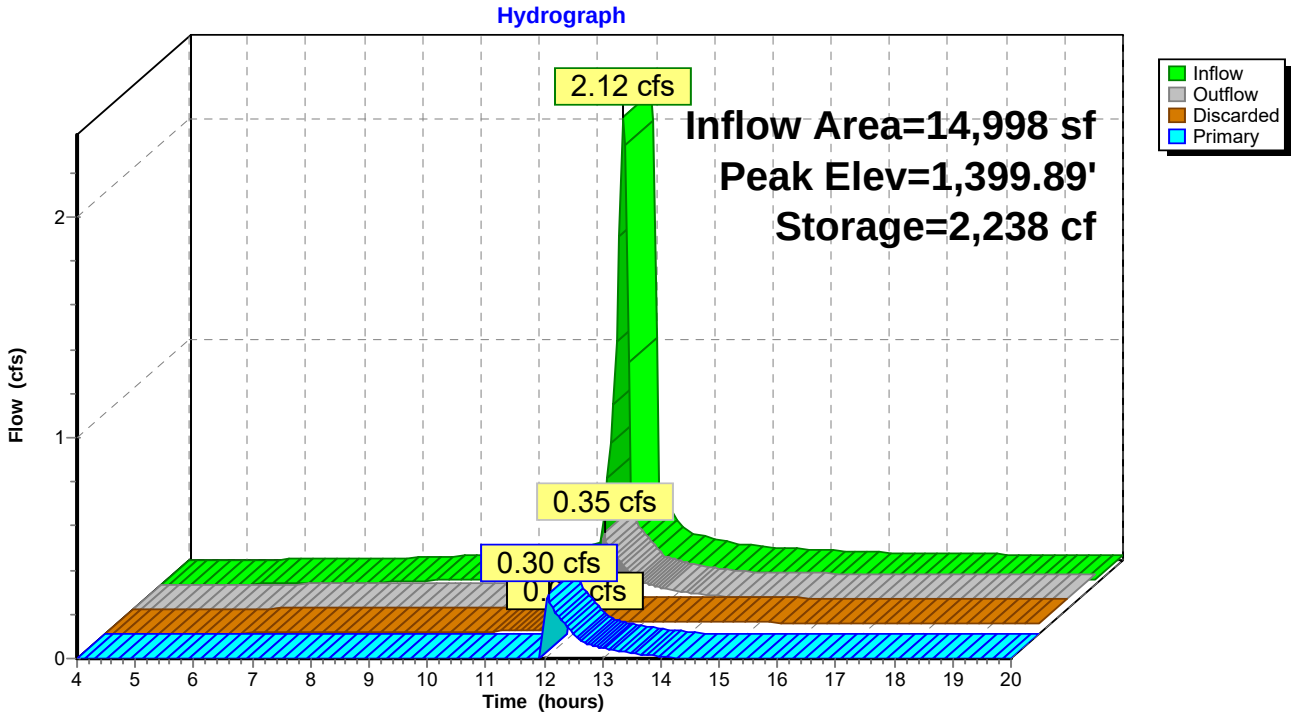
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.05 cfs @ 12.05 hrs HW=1,399.89' (Free Discharge)
└**2=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.26 cfs @ 12.07 hrs HW=1,399.89' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.26 cfs @ 0.48 fps)

Pond 3P: Infiltration Berm #1 - TO GRADE



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>3.98"
Flow Length=214' Tc=2.1 min CN=89 Runoff=2.56 cfs 4,974 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>3.98"
Flow Length=214' Tc=2.1 min CN=89 Runoff=2.56 cfs 4,974 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>3.18"
Flow Length=214' Tc=2.1 min CN=81 Runoff=2.17 cfs 3,971 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,399.96' Storage=2,401 cf Inflow=2.56 cfs 4,974 cf
Discarded=0.06 cfs 1,753 cf Primary=1.47 cfs 1,330 cf Outflow=1.53 cfs 3,083 cf

Total Runoff Area = 44,994 sf Runoff Volume = 13,918 cf Average Runoff Depth = 3.71"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

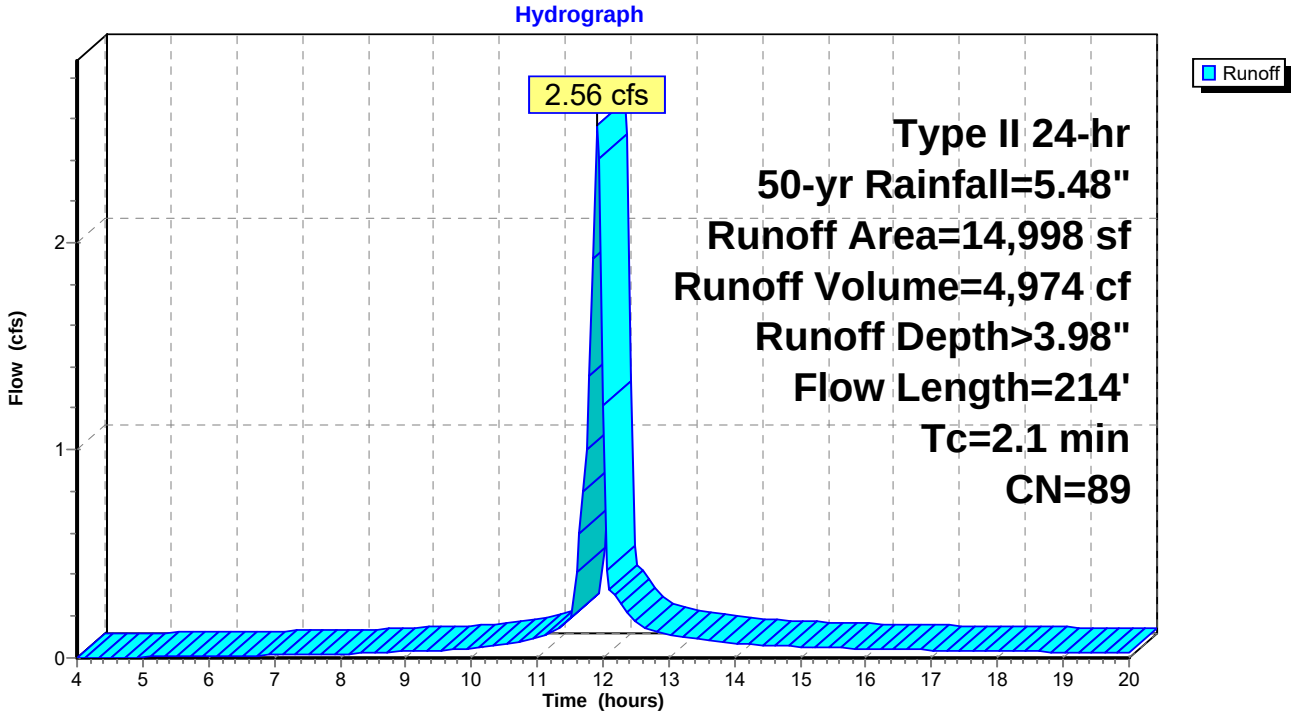
Runoff = 2.56 cfs @ 11.92 hrs, Volume= 4,974 cf, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.48"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

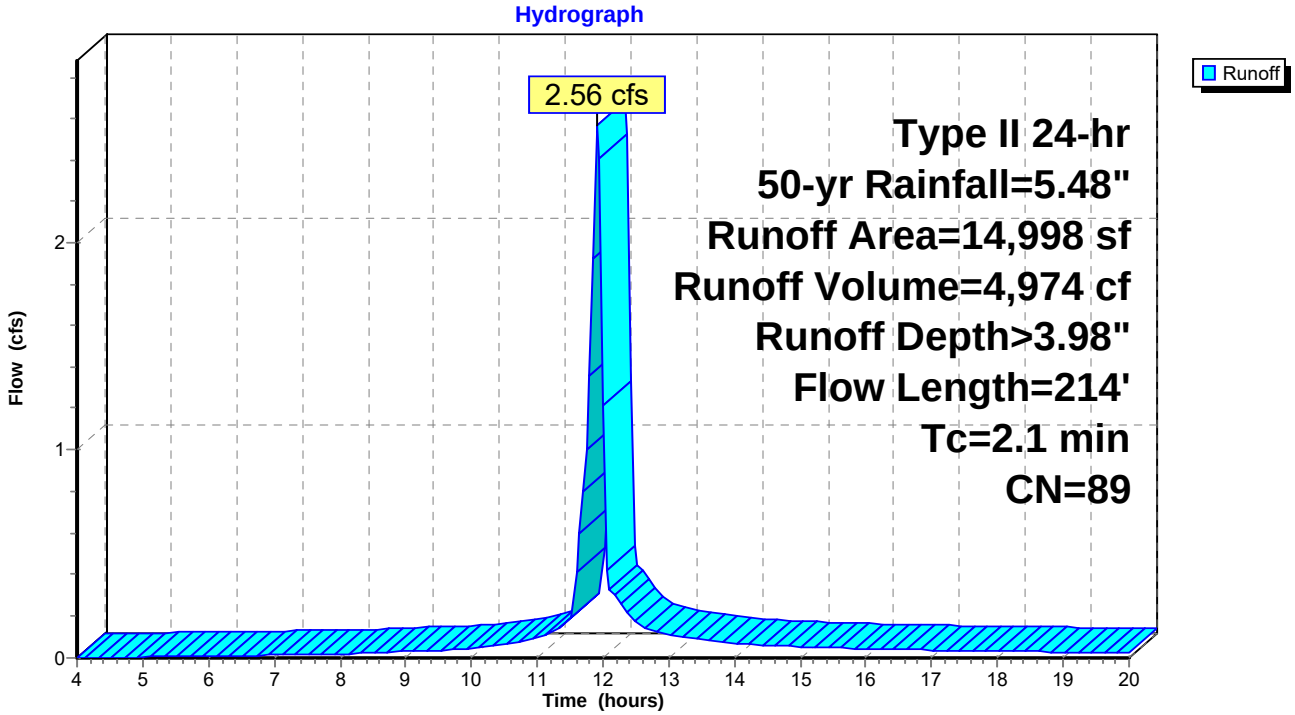
Runoff = 2.56 cfs @ 11.92 hrs, Volume= 4,974 cf, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.48"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

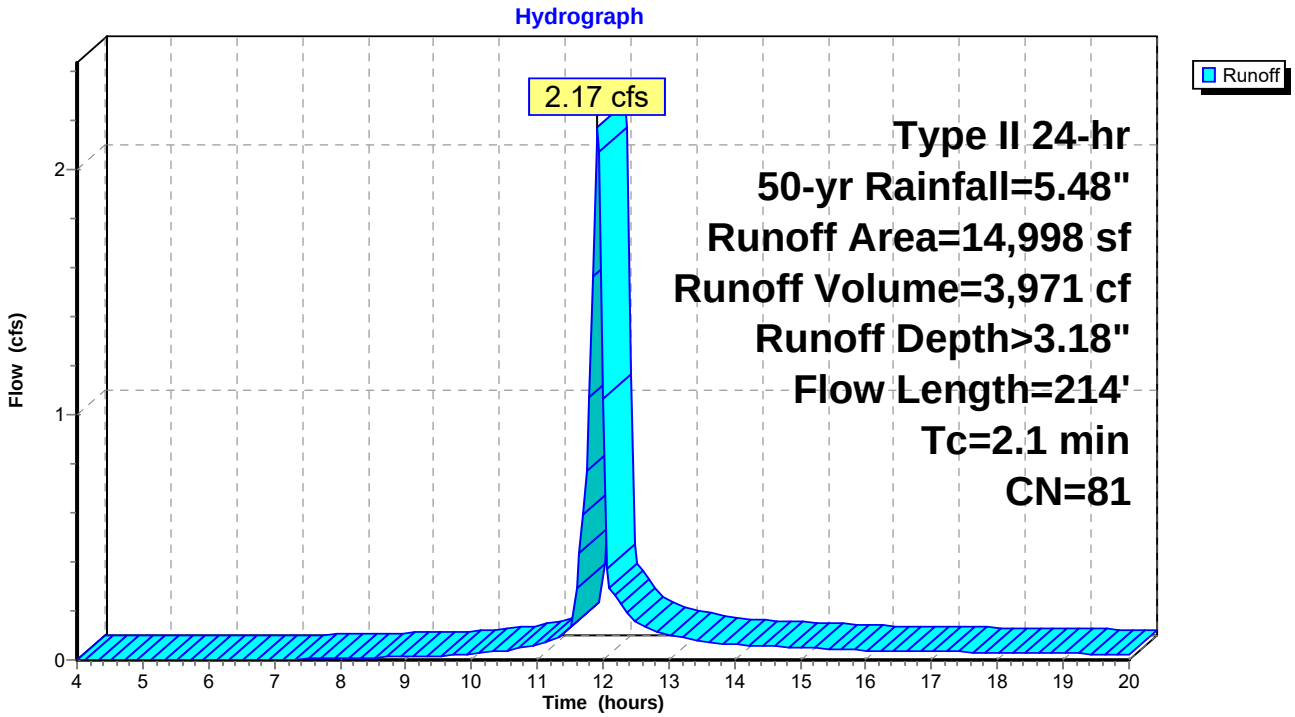
Runoff = 2.17 cfs @ 11.92 hrs, Volume= 3,971 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.48"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 3.98" for 50-yr event
Inflow = 2.56 cfs @ 11.92 hrs, Volume= 4,974 cf
Outflow = 1.53 cfs @ 12.00 hrs, Volume= 3,083 cf, Atten= 40%, Lag= 4.9 min
Discarded = 0.06 cfs @ 12.00 hrs, Volume= 1,753 cf
Primary = 1.47 cfs @ 12.00 hrs, Volume= 1,330 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,399.96' @ 12.00 hrs Surf.Area= 2,108 sf Storage= 2,401 cf

Plug-Flow detention time= 152.1 min calculated for 3,073 cf (62% of inflow)
Center-of-Mass det. time= 80.8 min (831.2 - 750.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

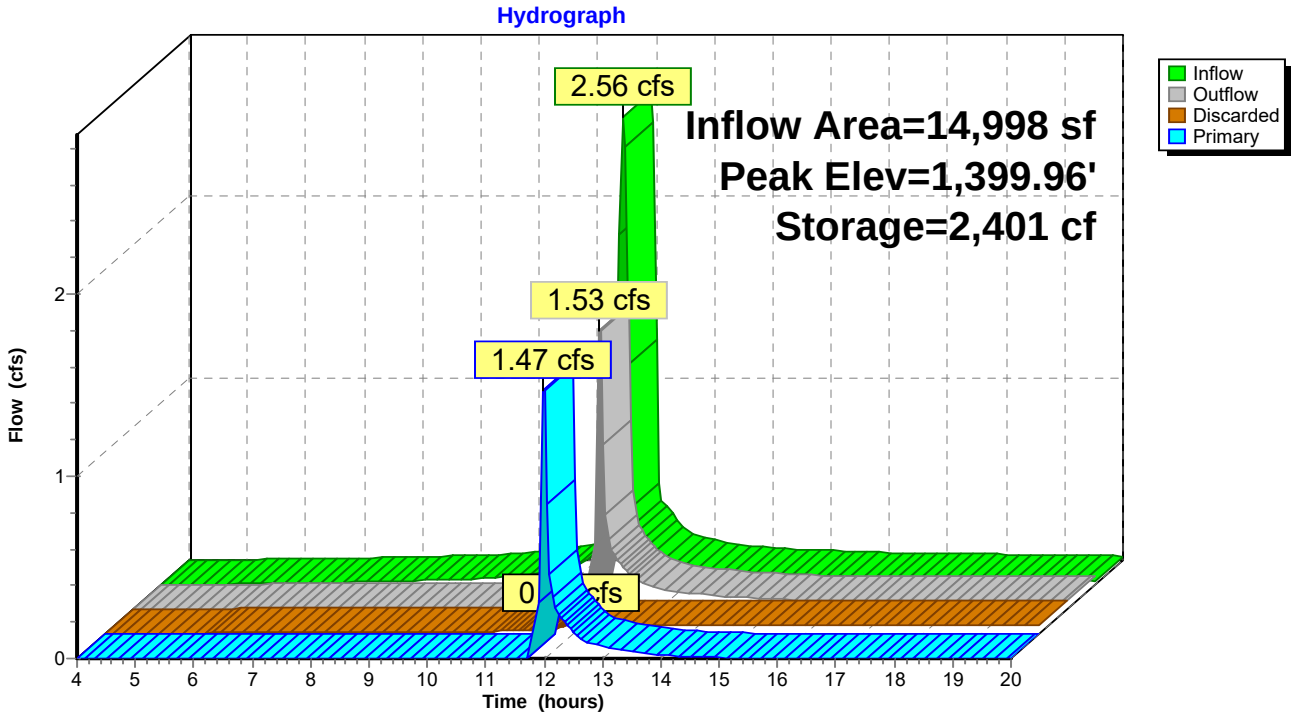
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.06 cfs @ 12.00 hrs HW=1,399.96' (Free Discharge)
└**2=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=1.45 cfs @ 12.00 hrs HW=1,399.96' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.45 cfs @ 0.85 fps)

Pond 3P: Infiltration Berm #1 - TO GRADE



Time span=4.00-20.00 hrs, dt=0.05 hrs, 321 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: DA-post Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>4.86"
Flow Length=214' Tc=2.1 min CN=89 Runoff=3.09 cfs 6,073 cf

Subcatchment 4S: DA-1 Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>4.86"
Flow Length=214' Tc=2.1 min CN=89 Runoff=3.09 cfs 6,073 cf

Subcatchment 5S: DA-pre Runoff Area=14,998 sf 16.26% Impervious Runoff Depth>4.00"
Flow Length=214' Tc=2.1 min CN=81 Runoff=2.70 cfs 5,003 cf

Pond 3P: Infiltration Berm #1 - TO GRADE Peak Elev=1,400.01' Storage=2,475 cf Inflow=3.09 cfs 6,073 cf
Discarded=0.06 cfs 1,832 cf Primary=2.50 cfs 2,199 cf Outflow=2.55 cfs 4,032 cf

Total Runoff Area = 44,994 sf Runoff Volume = 17,149 cf Average Runoff Depth = 4.57"
83.74% Pervious = 37,677 sf 16.26% Impervious = 7,317 sf

Summary for Subcatchment 2S: DA-post

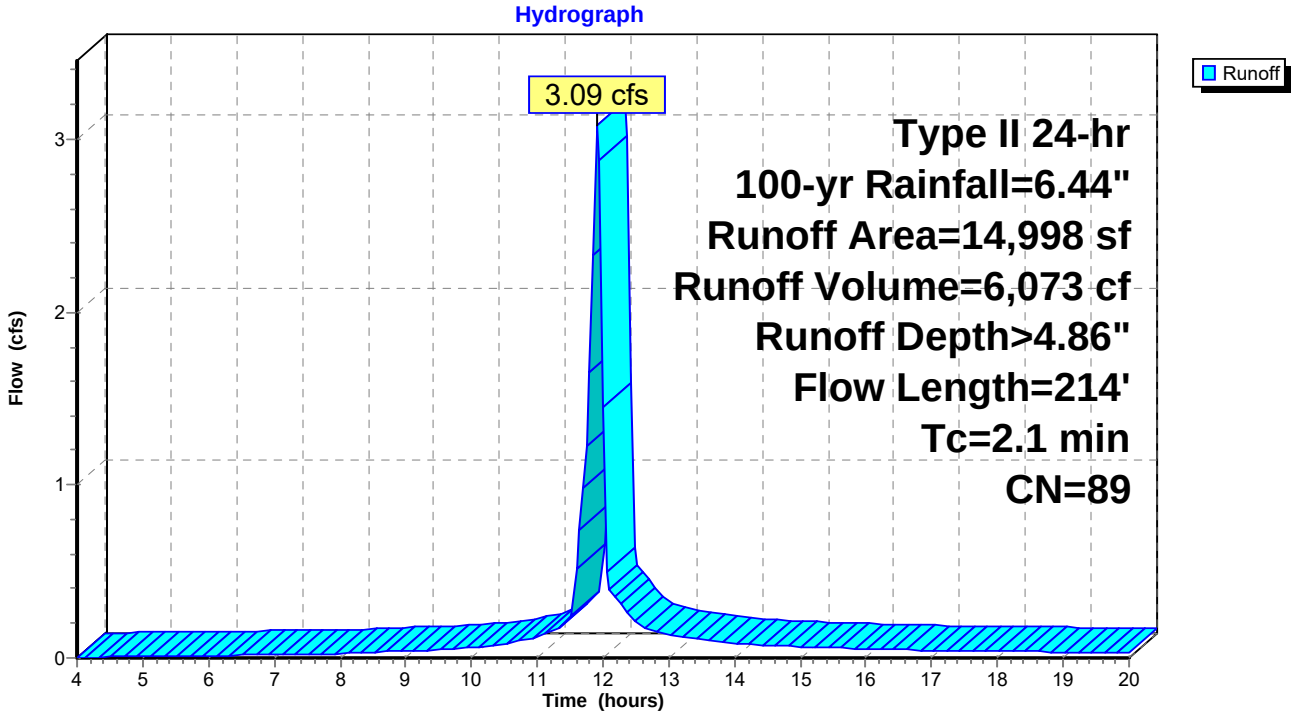
Runoff = 3.09 cfs @ 11.92 hrs, Volume= 6,073 cf, Depth> 4.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=6.44"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 2S: DA-post



Summary for Subcatchment 4S: DA-1

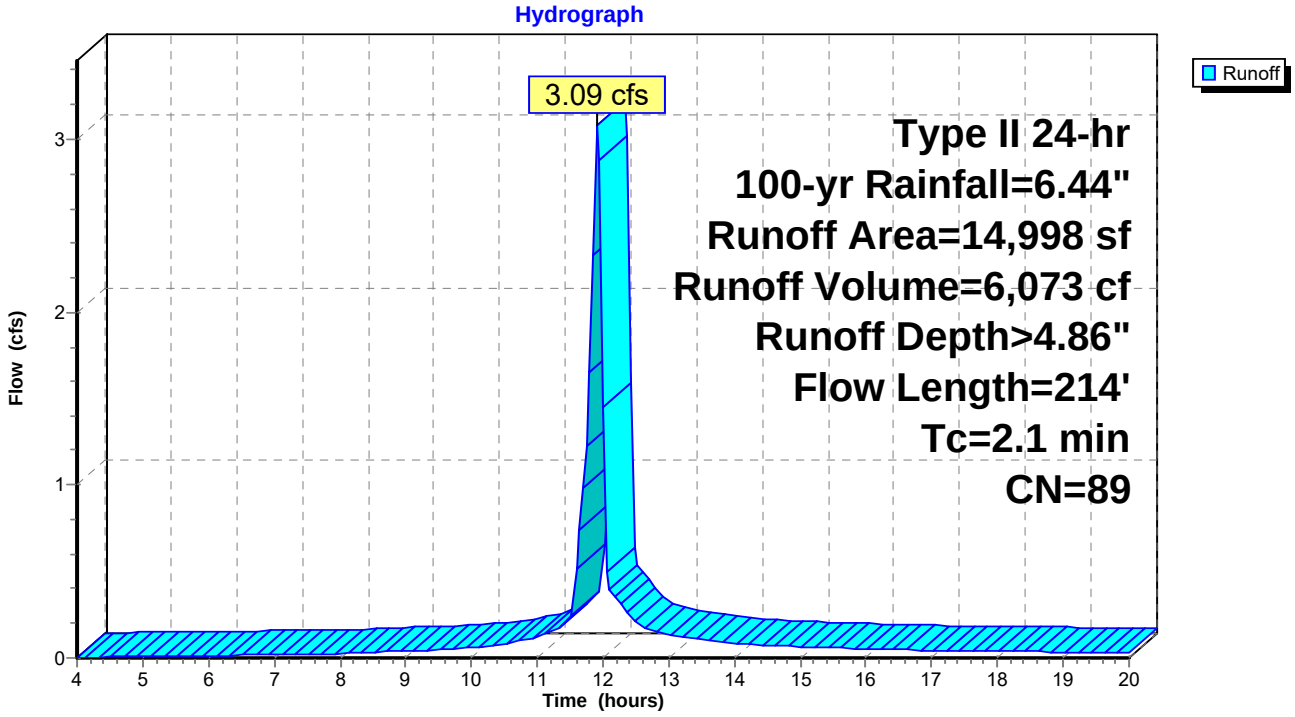
Runoff = 3.09 cfs @ 11.92 hrs, Volume= 6,073 cf, Depth> 4.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=6.44"

	Area (sf)	CN	Description
*	2,439	98	Existing gravel
*	5,358	91	Gravel pad, HSG D
	7,027	84	50-75% Grass cover, Fair, HSG D
	174	79	50-75% Grass cover, Fair, HSG C
	14,998	89	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.55		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.61"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 4S: DA-1



Summary for Subcatchment 5S: DA-pre

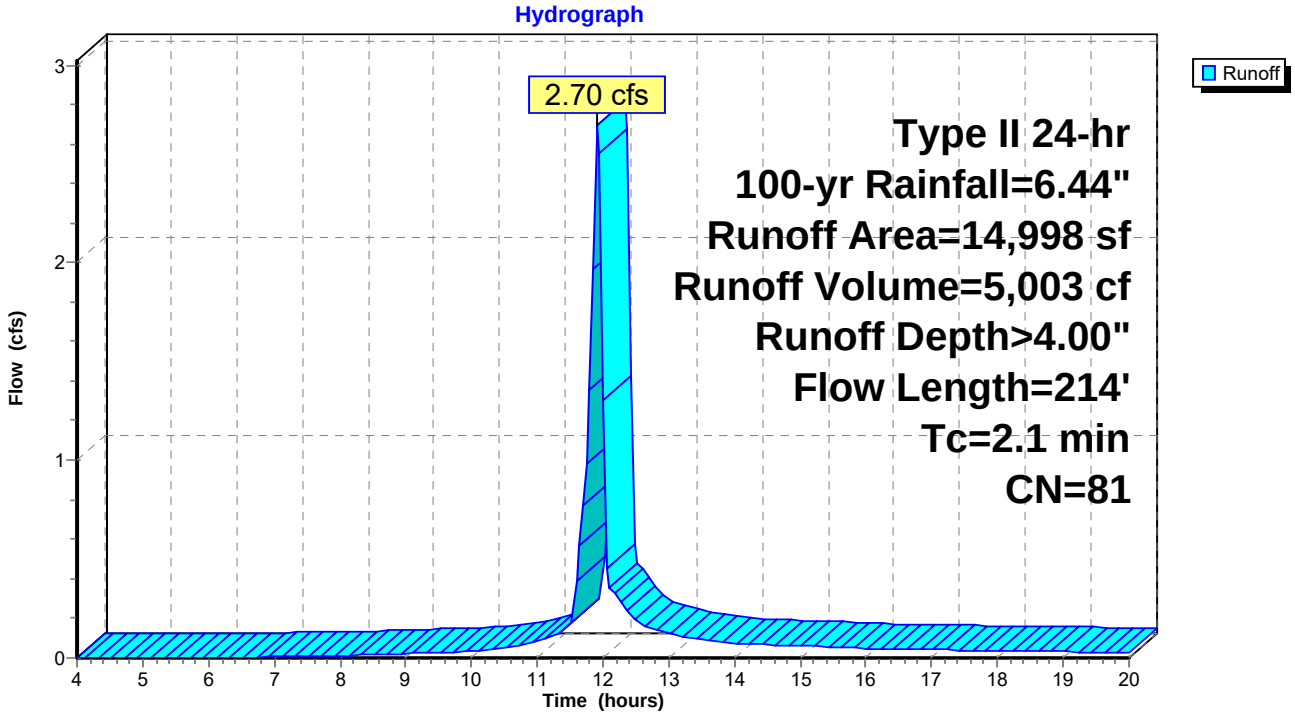
Runoff = 2.70 cfs @ 11.92 hrs, Volume= 5,003 cf, Depth> 4.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=6.44"

	Area (sf)	CN	Description
	9,884	78	Meadow, non-grazed, HSG D
*	2,439	98	Existing Gravel
	174	71	Meadow, non-grazed, HSG C
*	2,501	78	20% Impervious as Meadow
	14,998	81	Weighted Average
	12,559		83.74% Pervious Area
	2,439		16.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0350	1.54		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.0	114	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	214	Total			

Subcatchment 5S: DA-pre



Summary for Pond 3P: Infiltration Berm #1 - TO GRADE

Inflow Area = 14,998 sf, 16.26% Impervious, Inflow Depth > 4.86" for 100-yr event
Inflow = 3.09 cfs @ 11.92 hrs, Volume= 6,073 cf
Outflow = 2.55 cfs @ 11.96 hrs, Volume= 4,032 cf, Atten= 17%, Lag= 2.5 min
Discarded = 0.06 cfs @ 11.96 hrs, Volume= 1,832 cf
Primary = 2.50 cfs @ 11.96 hrs, Volume= 2,199 cf

Routing by Stor-Ind method, Time Span= 4.00-20.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 1,400.01' @ 11.96 hrs Surf.Area= 2,140 sf Storage= 2,475 cf

Plug-Flow detention time= 130.7 min calculated for 4,019 cf (66% of inflow)
Center-of-Mass det. time= 62.4 min (808.3 - 745.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	2,475 cf	**Custom Stage Data (Prismatic)**Listed below

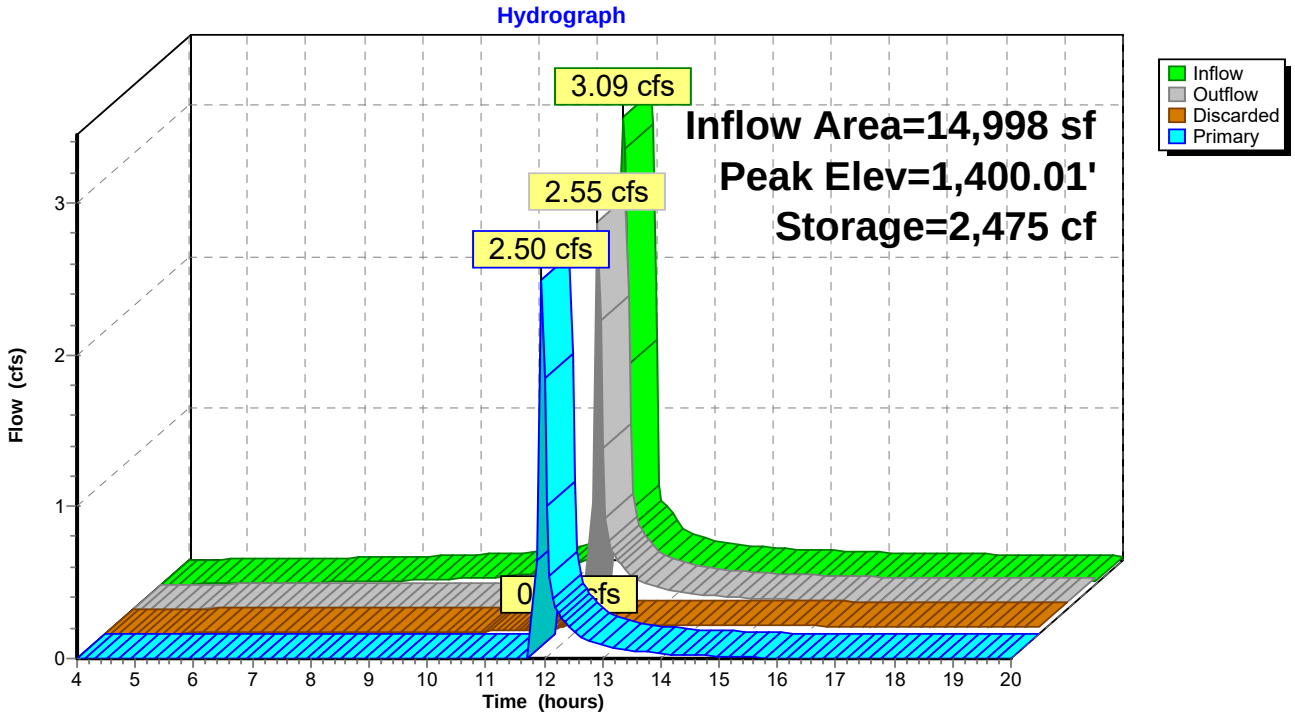
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	333	0	0
1,399.00	1,238	786	786
1,399.85	2,005	1,378	2,164
1,400.00	2,140	311	2,475

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.00'	**103.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,398.00'	**0.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,396.20'
#3	Primary	1,399.85'	**15.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.06 cfs @ 11.96 hrs HW=1,400.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.06 cfs)

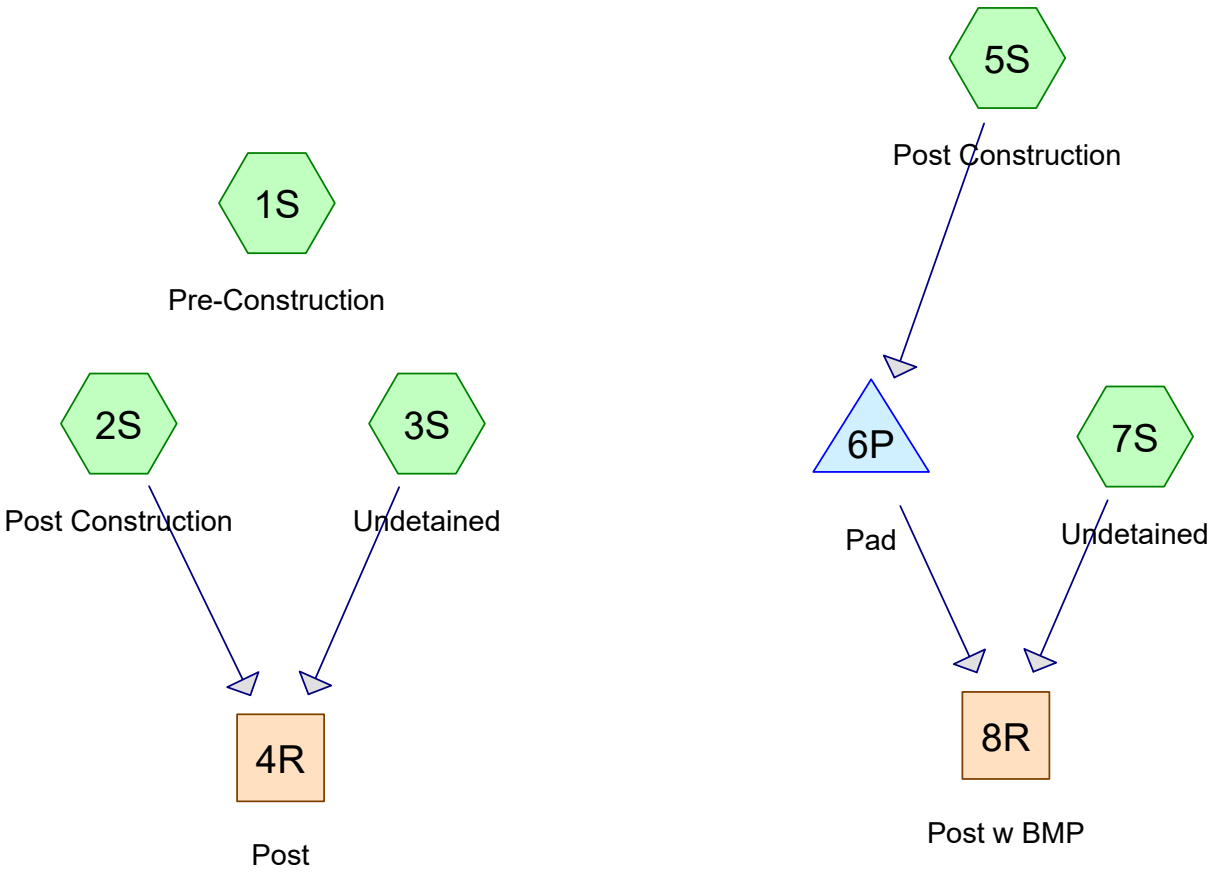
Primary OutFlow Max=2.25 cfs @ 11.96 hrs HW=1,400.00' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.09 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 2.24 cfs @ 0.99 fps)

Pond 3P: Infiltration Berm #1 - TO GRADE



ATTACHMENT 4.15

BMP HYDROCAD REPORT – LOWER DEMUNDS REL TIE-IN



Subcat Reach Pond Link

Routing Diagram for Lower Demunds - Pre, Post, Post w BMP_Rev 2
Prepared by {enter your company name here}, Printed 2/25/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C
Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,621	98	Gravel (3S, 7S)
11,510	98	Gravel roads, HSG D (2S, 5S)
3,016	78	Meadow, non-grazed, HSG D (1S)
4,050	77	Woods, Good, HSG D (1S)
21,197	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
18,576	HSG D	1S, 2S, 5S
2,621	Other	3S, 7S
21,197		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	0	2,621	2,621	Gravel	
0	0	0	11,510	0	11,510	Gravel roads	
0	0	0	3,016	0	3,016	Meadow, non-grazed	
0	0	0	4,050	0	4,050	Woods, Good	
0	**0**	**0**	**18,576**	**2,621**	**21,197**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>1.00"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.15 cfs 587 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>2.67"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.44 cfs 1,280 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>2.67"
Tc=0.0 min CN=98 Runoff=0.10 cfs 292 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>2.67"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.44 cfs 1,280 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>2.67"
Tc=5.0 min CN=98 Runoff=0.09 cfs 291 cf

Reach 4R: Post Inflow=0.55 cfs 1,571 cf
Outflow=0.55 cfs 1,571 cf

Reach 8R: Post w BMP Inflow=0.09 cfs 291 cf
Outflow=0.09 cfs 291 cf

Pond 6P: Pad Peak Elev=1,275.90' Storage=646 cf Inflow=0.44 cfs 1,280 cf
Discarded=0.04 cfs 1,177 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,177 cf

Total Runoff Area = 21,197 sf Runoff Volume = 3,730 cf Average Runoff Depth = 2.11"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

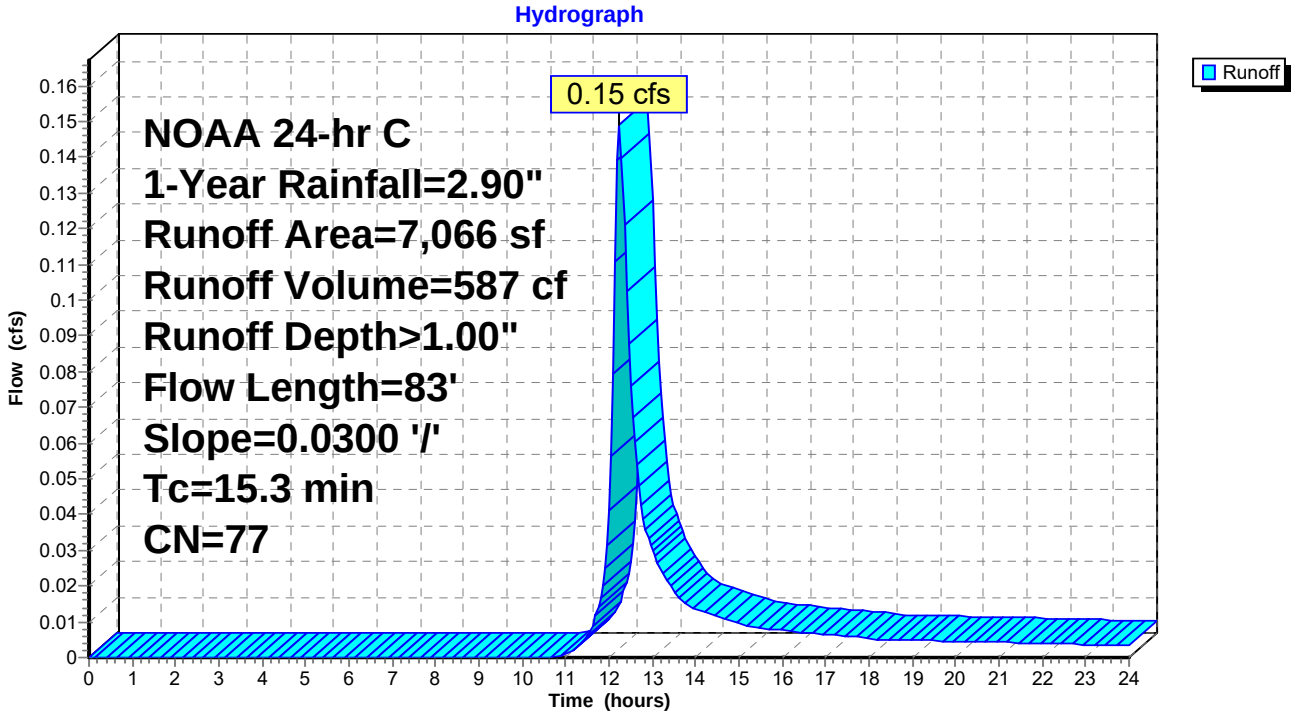
Runoff = 0.15 cfs @ 12.25 hrs, Volume= 587 cf, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

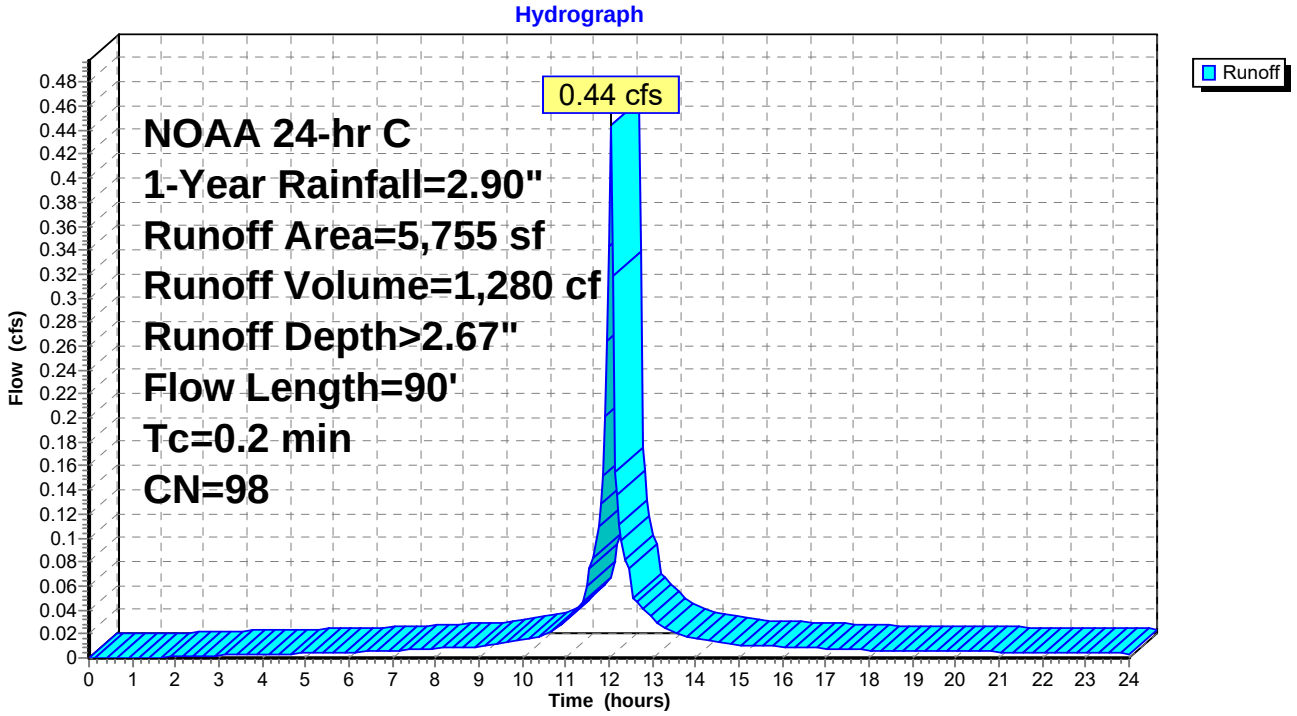
Runoff = 0.44 cfs @ 12.05 hrs, Volume= 1,280 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



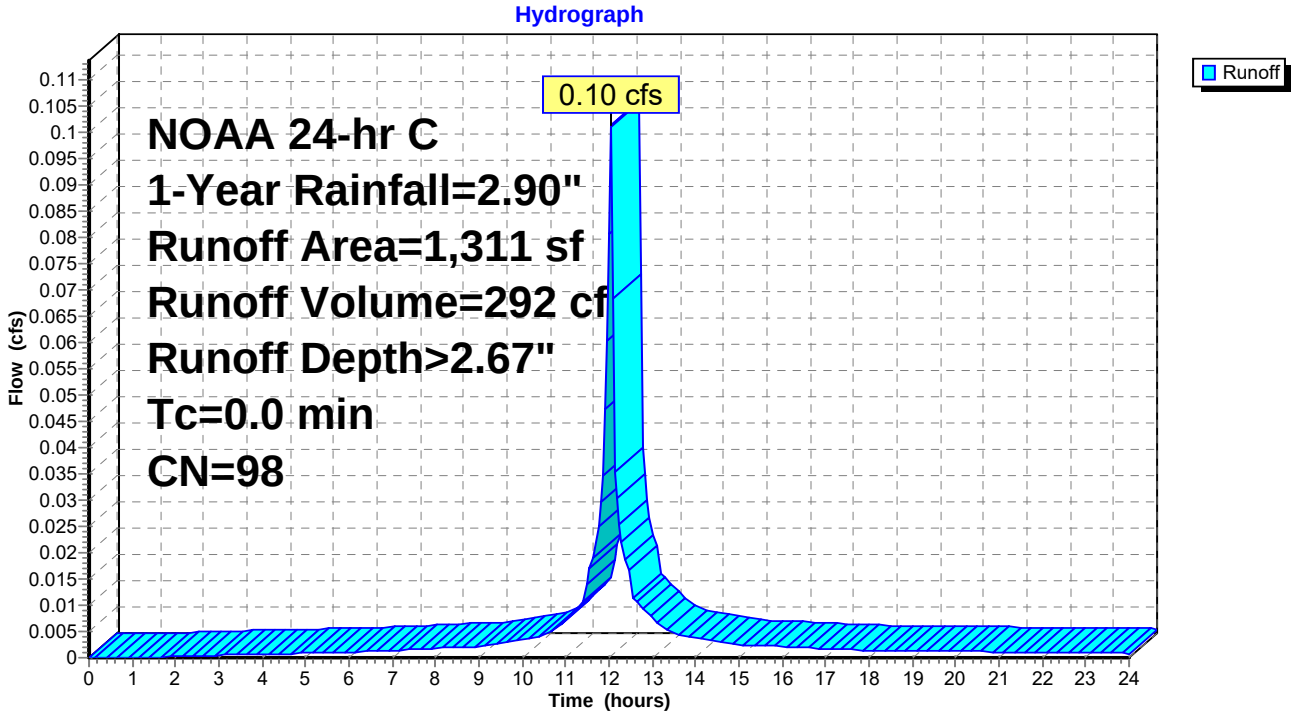
Summary for Subcatchment 3S: Undetained

Runoff = 0.10 cfs @ 12.04 hrs, Volume= 292 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

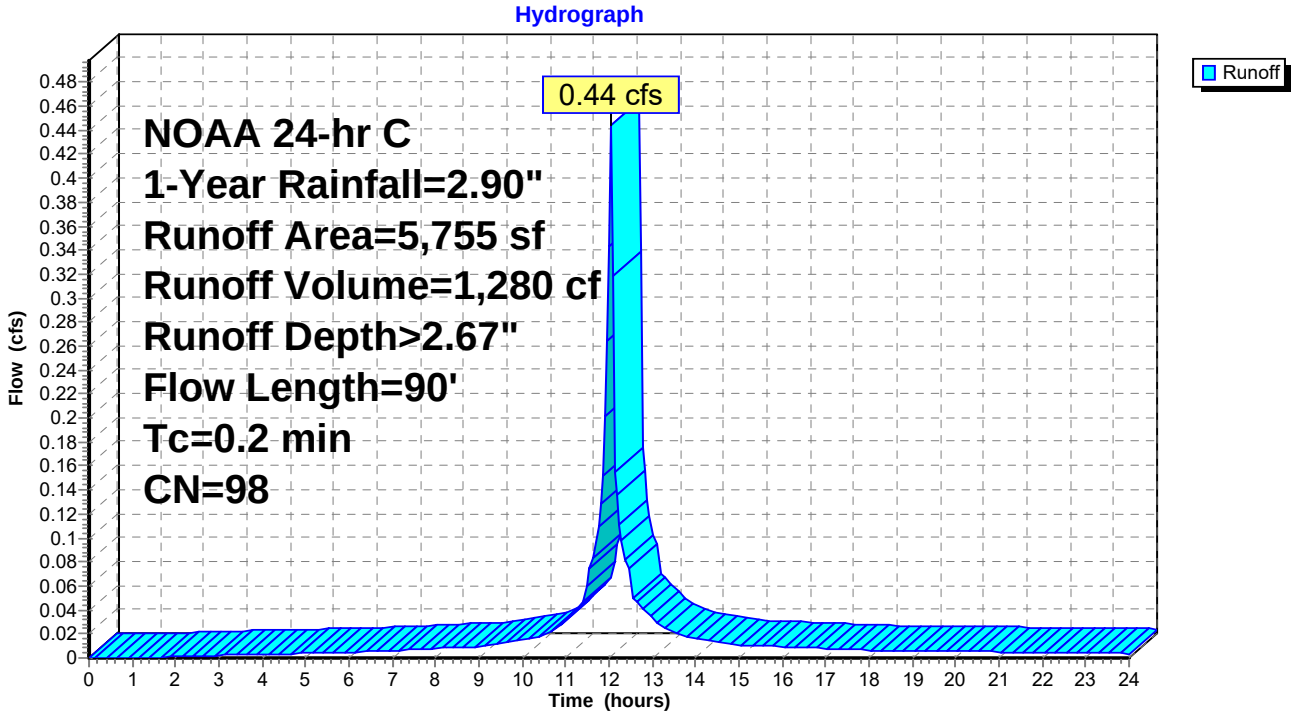
Runoff = 0.44 cfs @ 12.05 hrs, Volume= 1,280 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

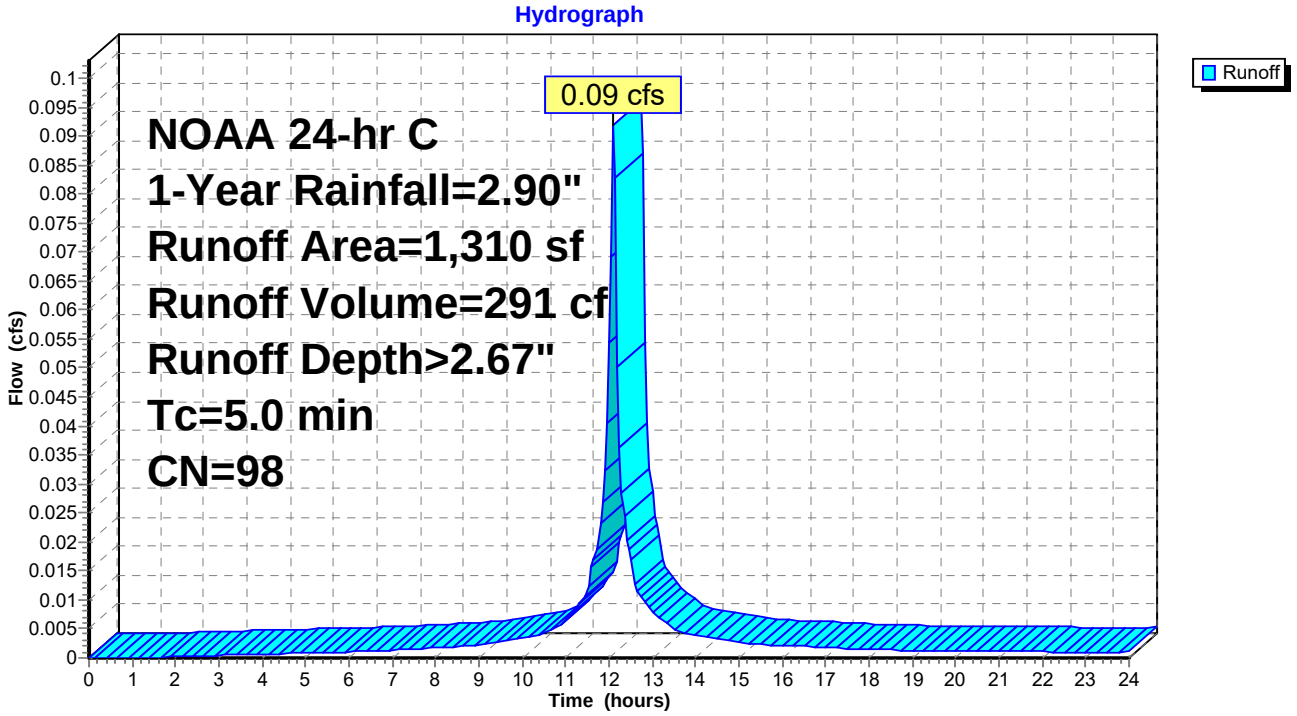
Runoff = 0.09 cfs @ 12.11 hrs, Volume= 291 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

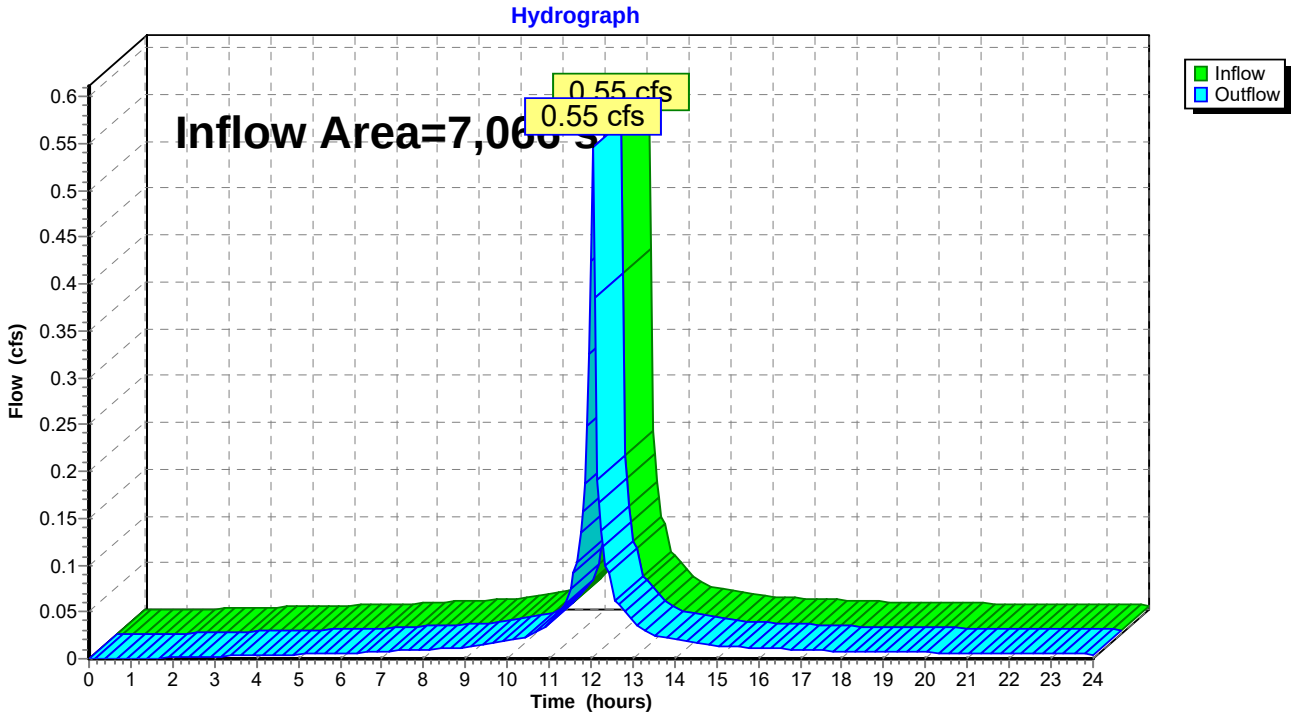


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 2.67" for 1-Year event
Inflow = 0.55 cfs @ 12.05 hrs, Volume= 1,571 cf
Outflow = 0.55 cfs @ 12.05 hrs, Volume= 1,571 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

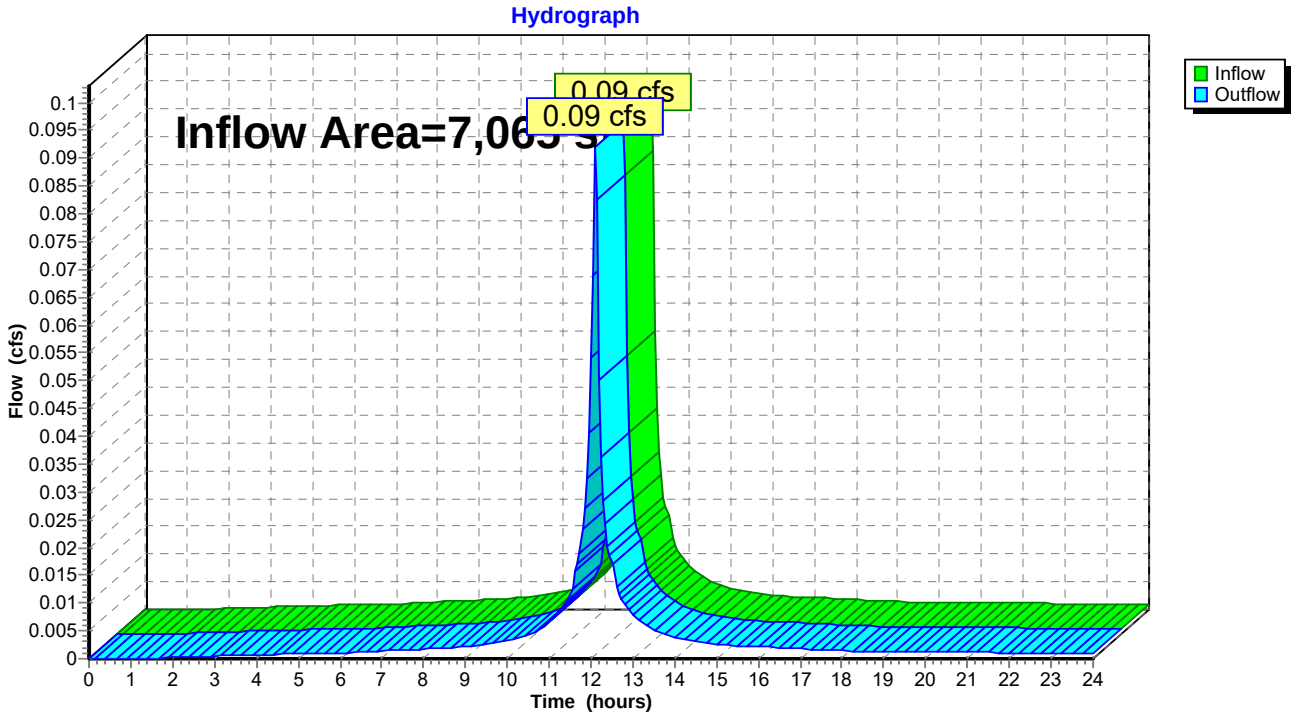


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 0.49" for 1-Year event
Inflow = 0.09 cfs @ 12.11 hrs, Volume= 291 cf
Outflow = 0.09 cfs @ 12.11 hrs, Volume= 291 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 2.67" for 1-Year event
Inflow = 0.44 cfs @ 12.05 hrs, Volume= 1,280 cf
Outflow = 0.04 cfs @ 12.91 hrs, Volume= 1,177 cf, Atten= 92%, Lag= 51.7 min
Discarded = 0.04 cfs @ 12.91 hrs, Volume= 1,177 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,275.90' @ 12.91 hrs Surf.Area= 3,058 sf Storage= 646 cf

Plug-Flow detention time= 226.2 min calculated for 1,177 cf (92% of inflow)
Center-of-Mass det. time= 182.3 min (936.6 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

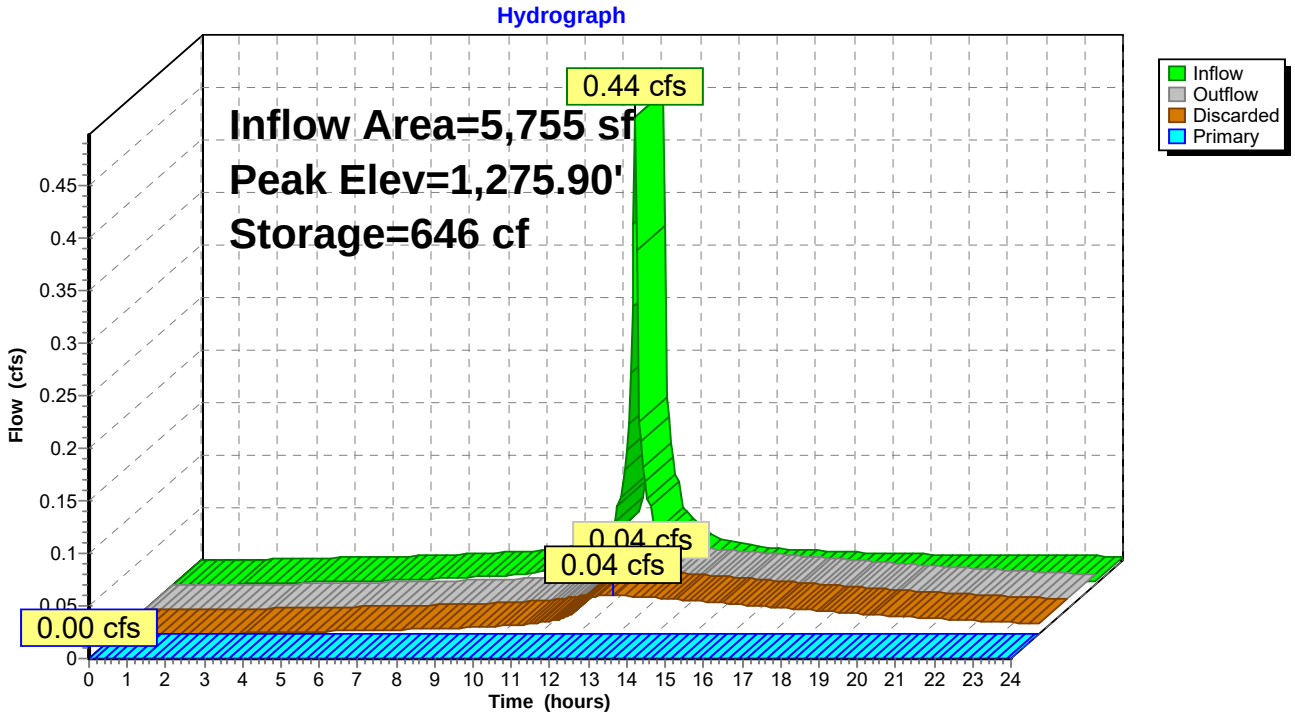
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.04 cfs @ 12.91 hrs HW=1,275.90' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
Inflow
Outflow
Discarded
Primary
0.44 cfs
Inflow Area=5,755 sf
Peak Elev=1,275.90'
Storage=646 cf
0.04 cfs
0.04 cfs
0.00 cfs
Flow (cfs)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (hours)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>1.35"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.21 cfs 795 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>3.17"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.52 cfs 1,519 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>3.17"
Tc=0.0 min CN=98 Runoff=0.12 cfs 346 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>3.17"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.52 cfs 1,519 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>3.16"
Tc=5.0 min CN=98 Runoff=0.11 cfs 345 cf

Reach 4R: Post Inflow=0.64 cfs 1,865 cf
Outflow=0.64 cfs 1,865 cf

Reach 8R: Post w BMP Inflow=0.11 cfs 345 cf
Outflow=0.11 cfs 345 cf

Pond 6P: Pad Peak Elev=1,276.00' Storage=775 cf Inflow=0.52 cfs 1,519 cf
Discarded=0.04 cfs 1,381 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,381 cf

Total Runoff Area = 21,197 sf Runoff Volume = 4,524 cf Average Runoff Depth = 2.56"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

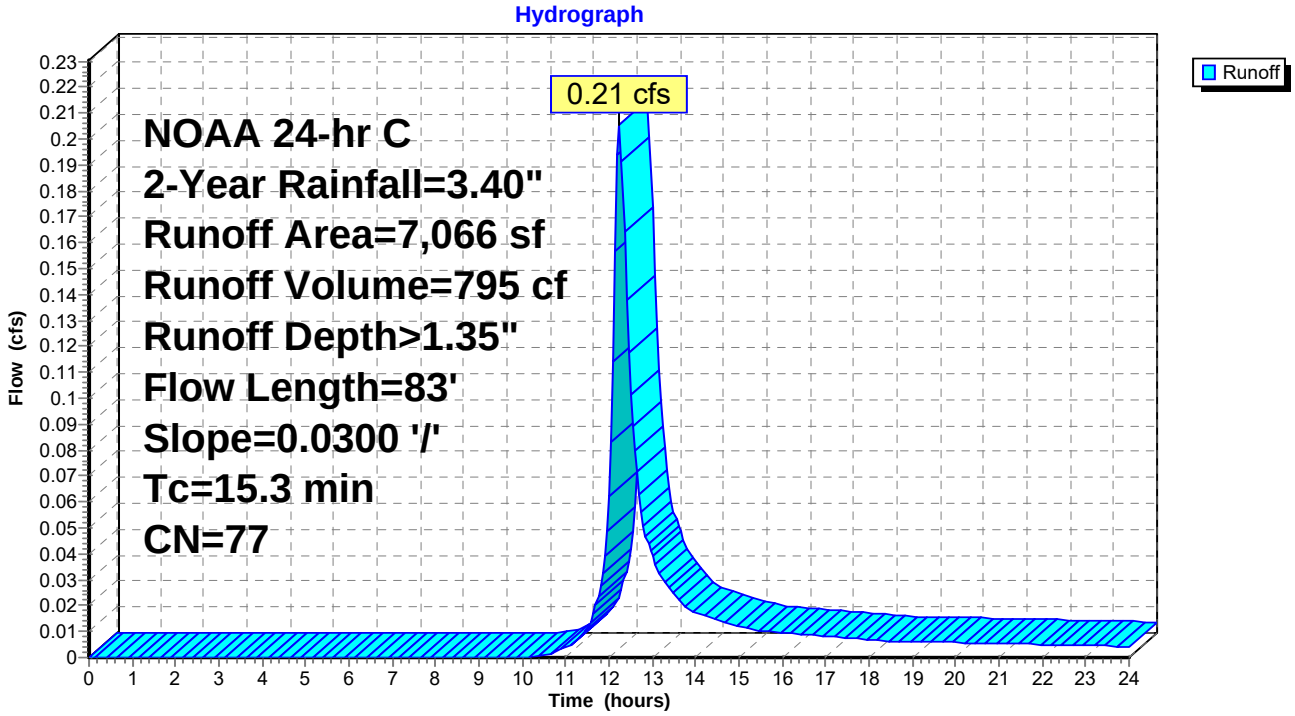
Runoff = 0.21 cfs @ 12.25 hrs, Volume= 795 cf, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

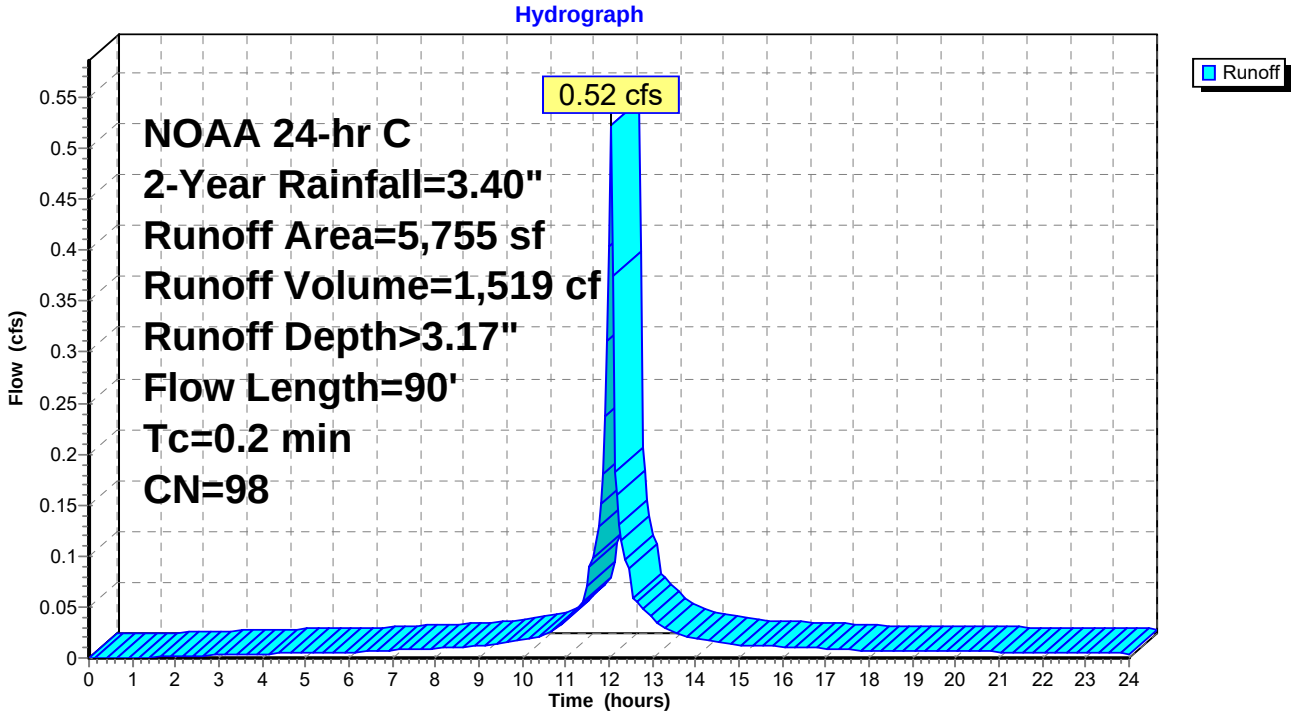
Runoff = 0.52 cfs @ 12.05 hrs, Volume= 1,519 cf, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



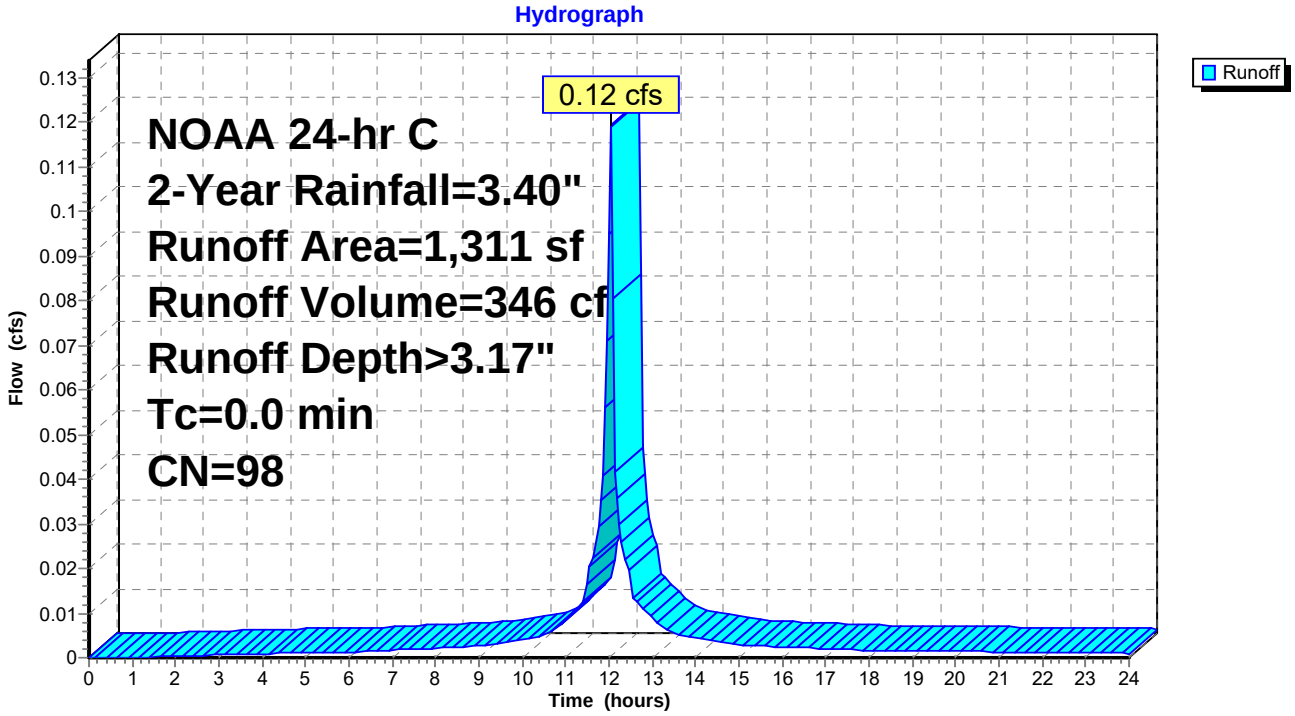
Summary for Subcatchment 3S: Undetained

Runoff = 0.12 cfs @ 12.04 hrs, Volume= 346 cf, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

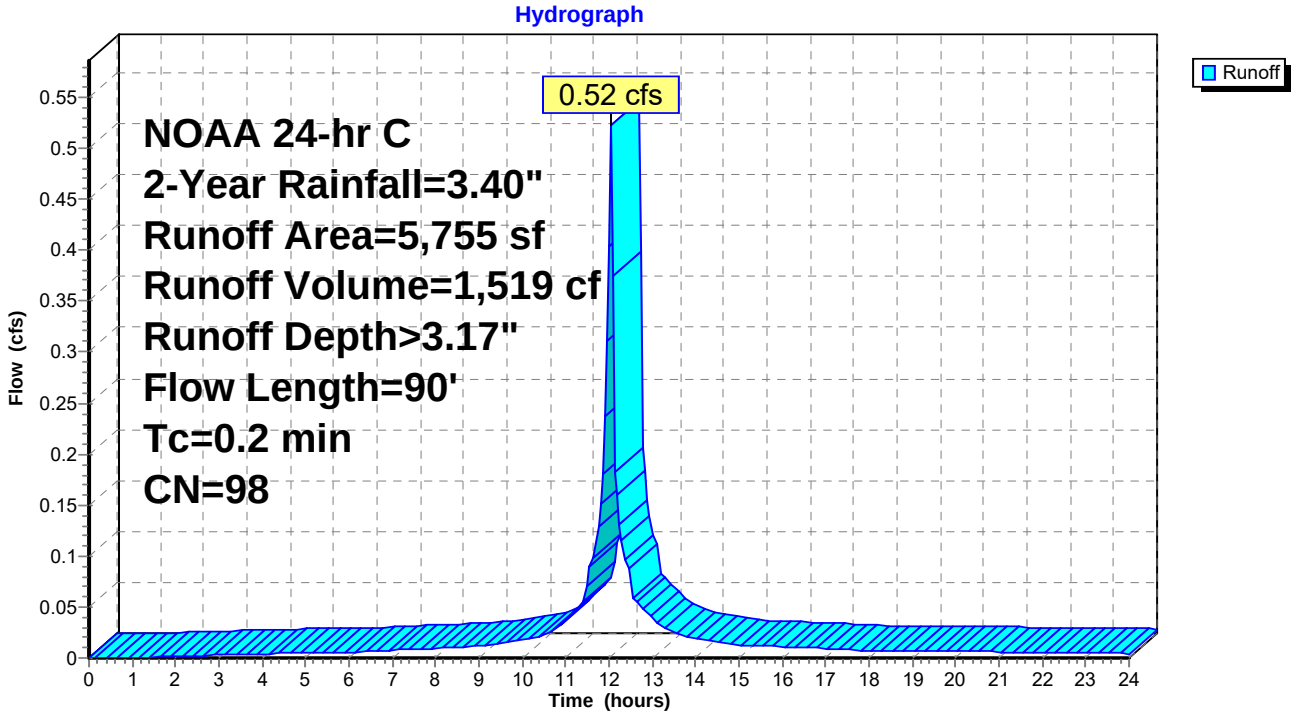
Runoff = 0.52 cfs @ 12.05 hrs, Volume= 1,519 cf, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

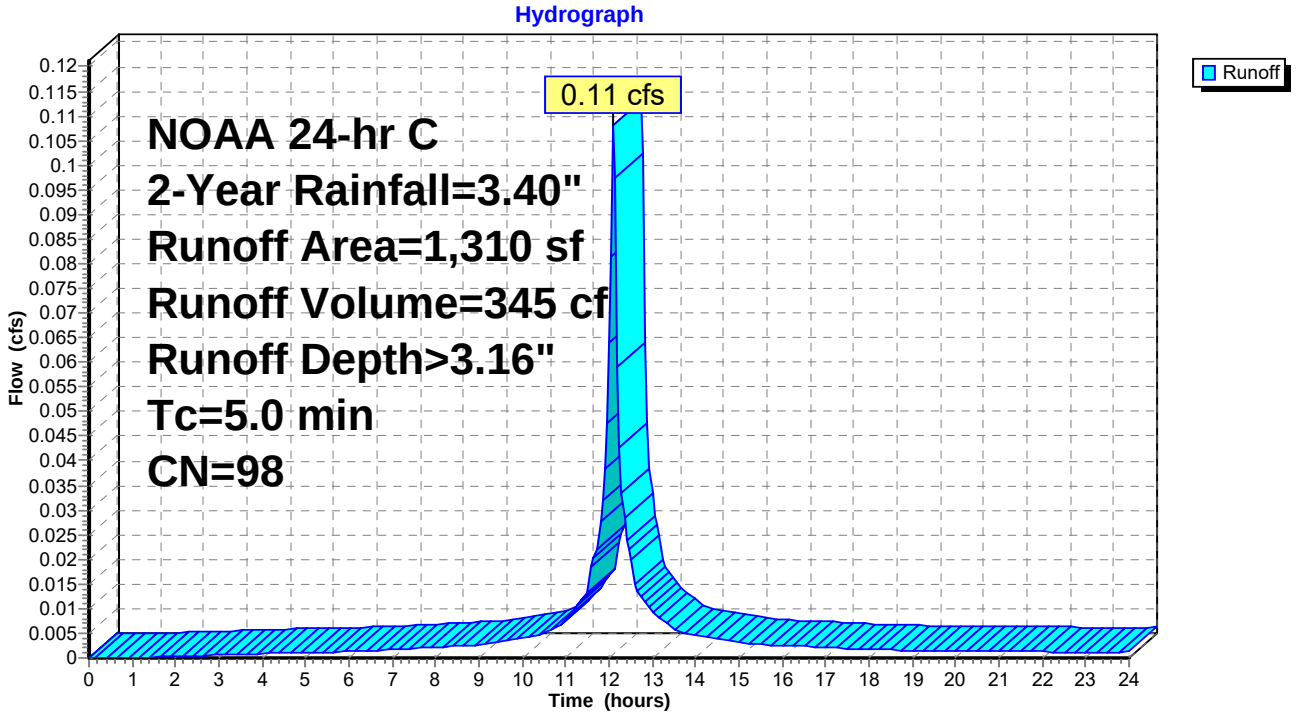
Runoff = 0.11 cfs @ 12.11 hrs, Volume= 345 cf, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

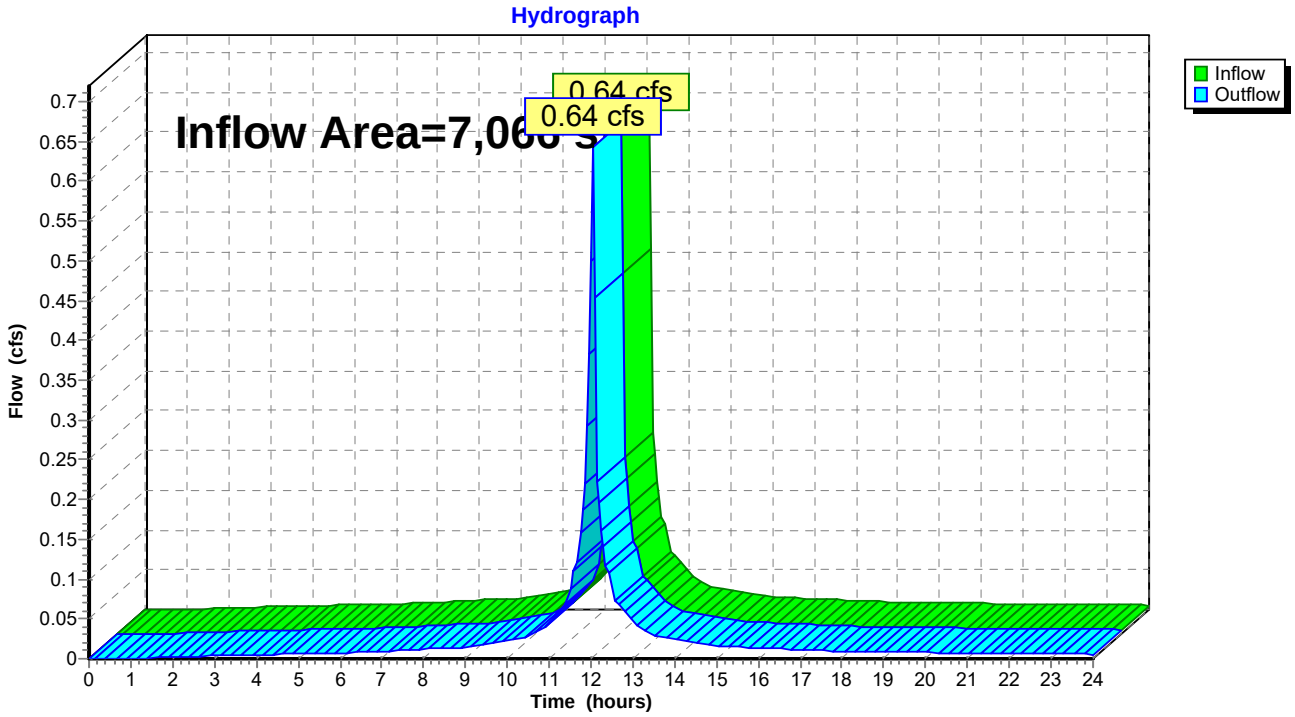


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 3.17" for 2-Year event
Inflow = 0.64 cfs @ 12.05 hrs, Volume= 1,865 cf
Outflow = 0.64 cfs @ 12.05 hrs, Volume= 1,865 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

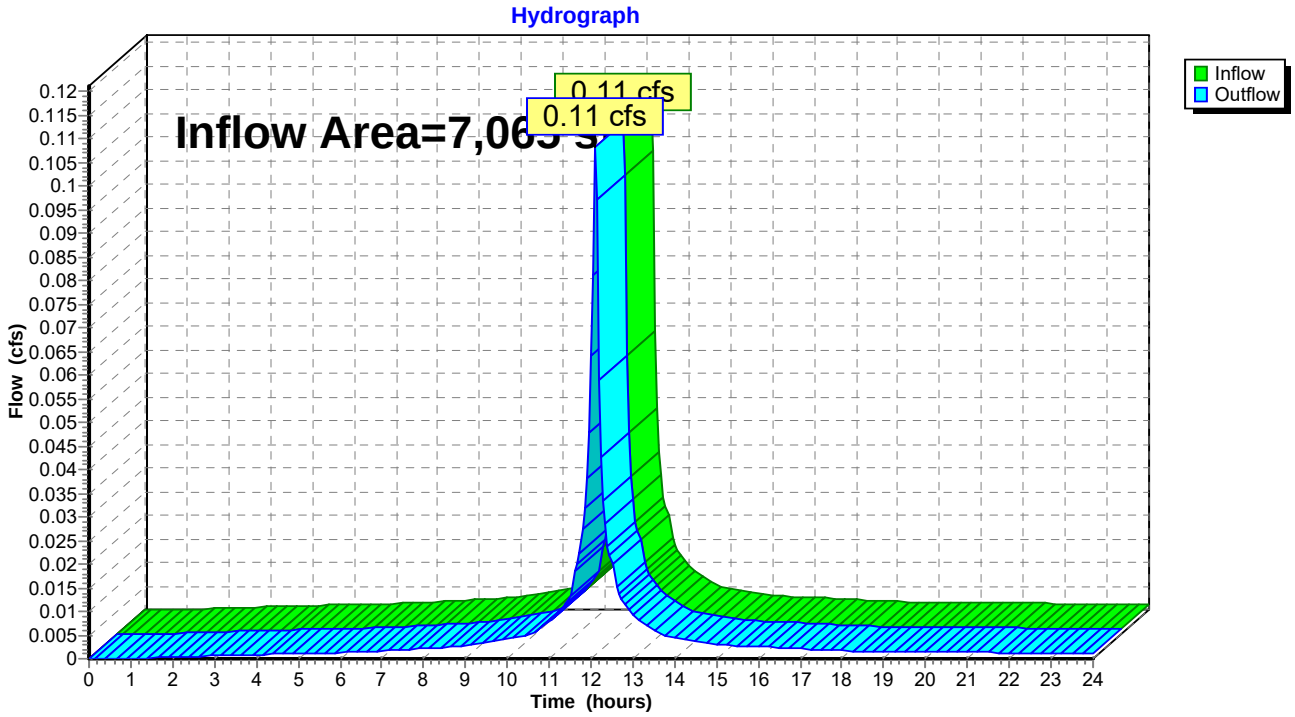


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 0.59" for 2-Year event
Inflow = 0.11 cfs @ 12.11 hrs, Volume= 345 cf
Outflow = 0.11 cfs @ 12.11 hrs, Volume= 345 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 3.17" for 2-Year event
Inflow = 0.52 cfs @ 12.05 hrs, Volume= 1,519 cf
Outflow = 0.04 cfs @ 12.94 hrs, Volume= 1,381 cf, Atten= 92%, Lag= 53.6 min
Discarded = 0.04 cfs @ 12.94 hrs, Volume= 1,381 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.00' @ 12.94 hrs Surf.Area= 3,339 sf Storage= 775 cf

Plug-Flow detention time= 235.7 min calculated for 1,381 cf (91% of inflow)
Center-of-Mass det. time= 187.4 min (938.3 - 750.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

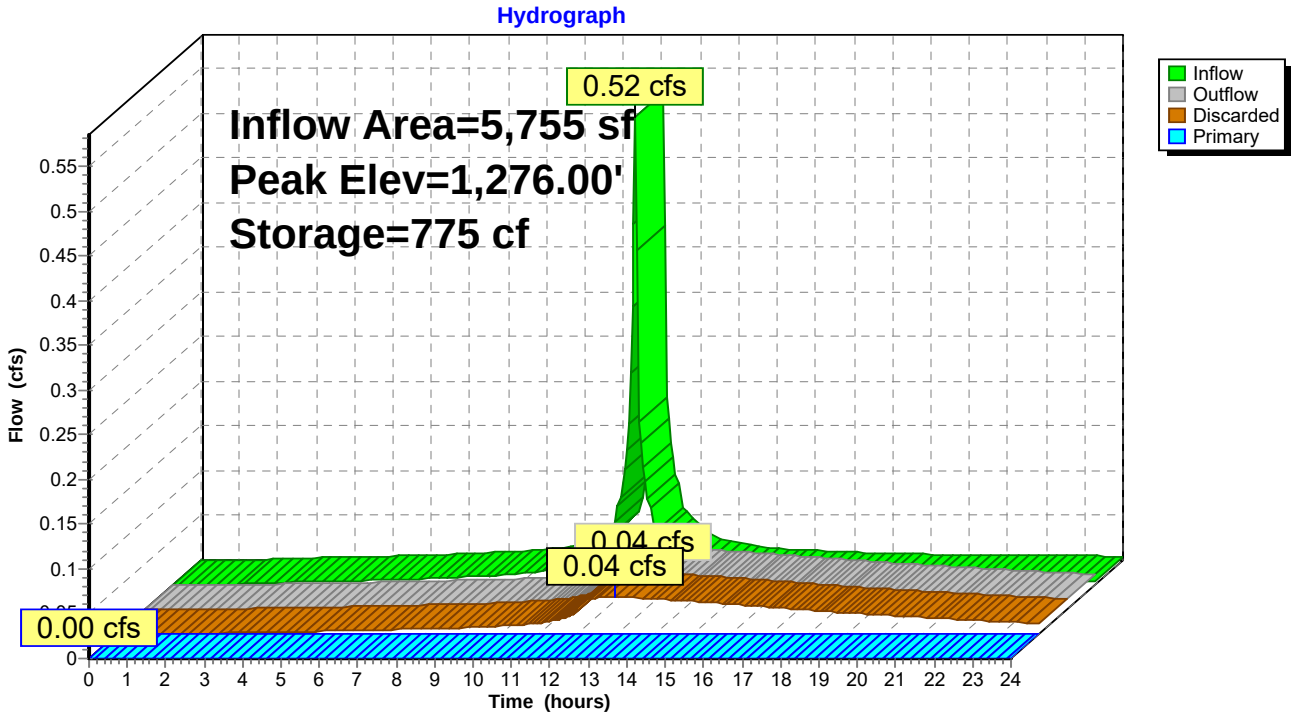
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.04 cfs @ 12.94 hrs HW=1,276.00' (Free Discharge)
2=Exfiltration (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
Inflow
Outflow
Discarded
Primary
0.52 cfs
Inflow Area=5,755 sf
Peak Elev=1,276.00'
Storage=775 cf
0.04 cfs
0.04 cfs
0.00 cfs
Flow (cfs)
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (hours)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>2.04"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.31 cfs 1,202 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>4.06"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.66 cfs 1,949 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>4.06"
Tc=0.0 min CN=98 Runoff=0.15 cfs 444 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>4.06"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.66 cfs 1,949 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>4.06"
Tc=5.0 min CN=98 Runoff=0.14 cfs 443 cf

Reach 4R: Post Inflow=0.82 cfs 2,393 cf
Outflow=0.82 cfs 2,393 cf

Reach 8R: Post w BMP Inflow=0.14 cfs 443 cf
Outflow=0.14 cfs 443 cf

Pond 6P: Pad Peak Elev=1,276.17' Storage=1,024 cf Inflow=0.66 cfs 1,949 cf
Discarded=0.04 cfs 1,726 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,726 cf

Total Runoff Area = 21,197 sf Runoff Volume = 5,988 cf Average Runoff Depth = 3.39"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

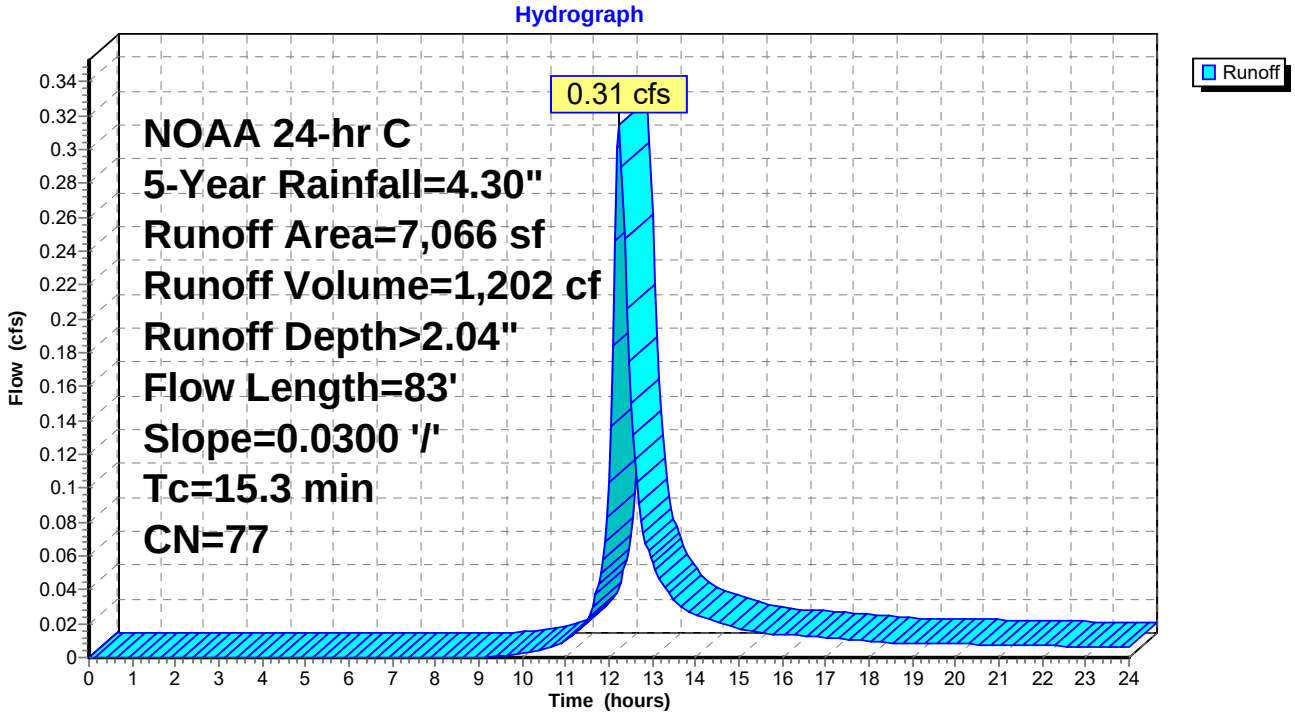
Runoff = 0.31 cfs @ 12.24 hrs, Volume= 1,202 cf, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

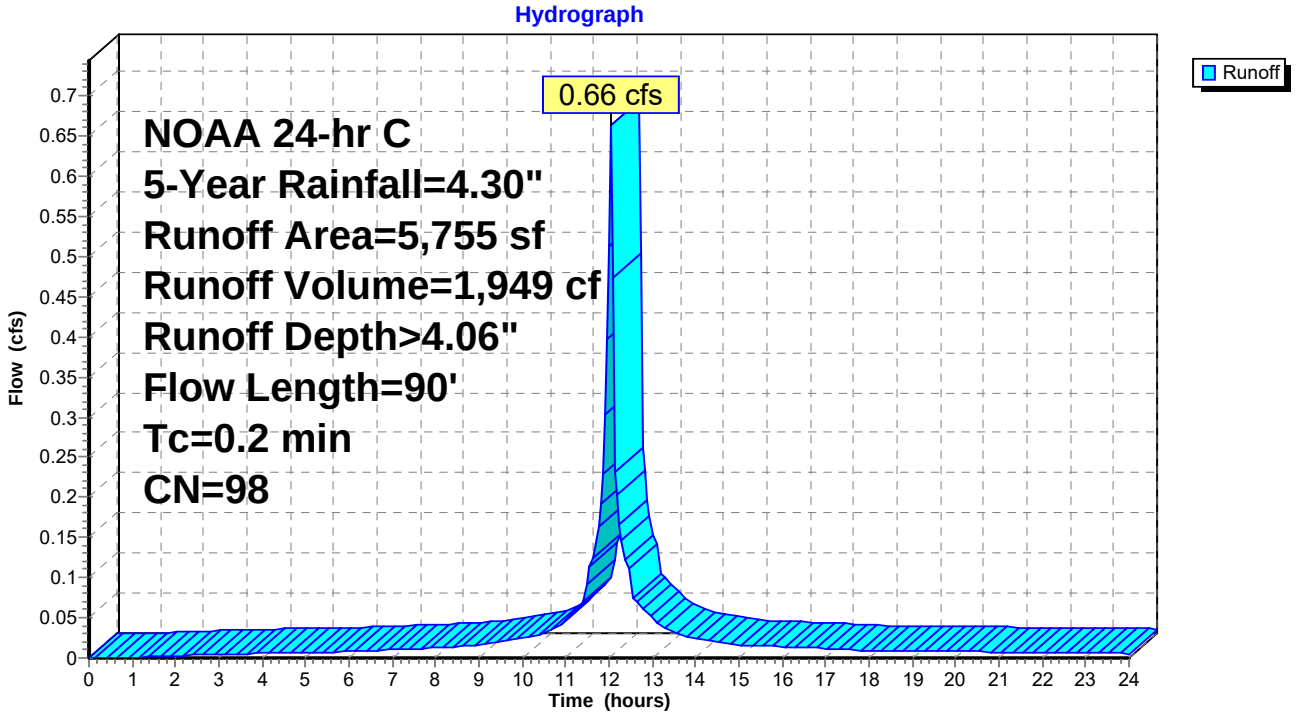
Runoff = 0.66 cfs @ 12.05 hrs, Volume= 1,949 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



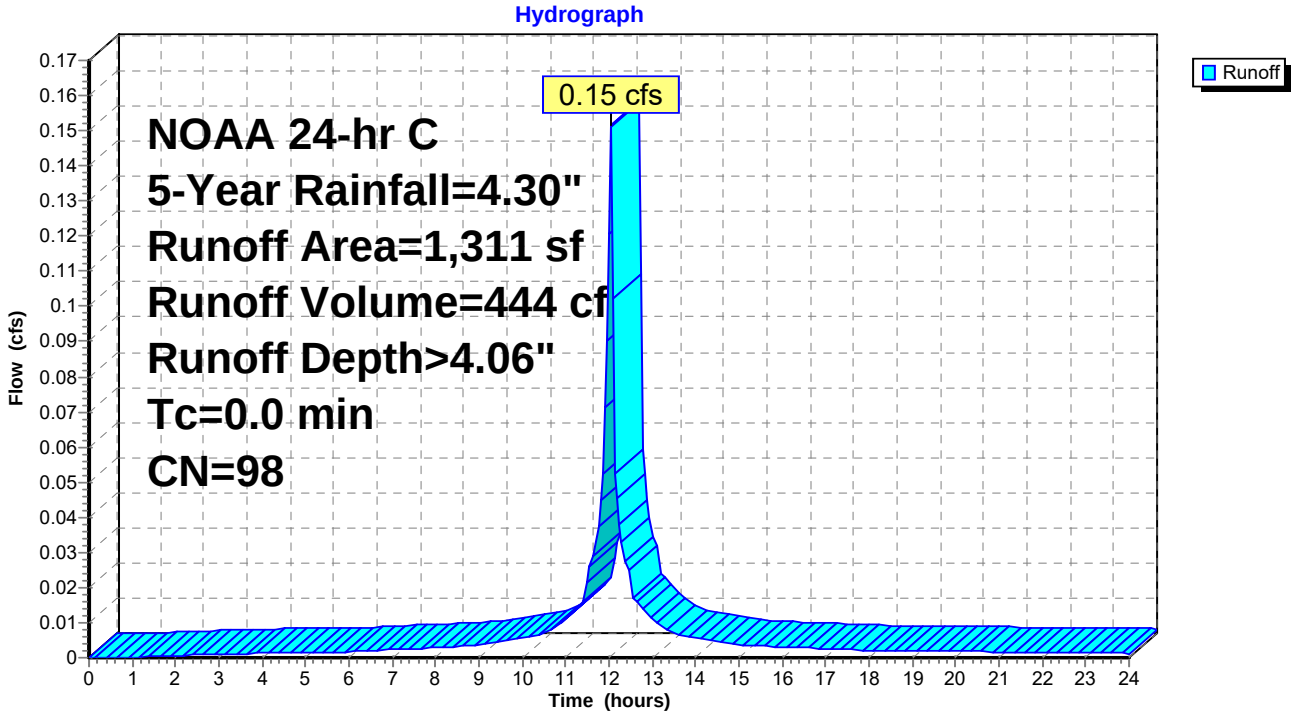
Summary for Subcatchment 3S: Undetained

Runoff = 0.15 cfs @ 12.04 hrs, Volume= 444 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

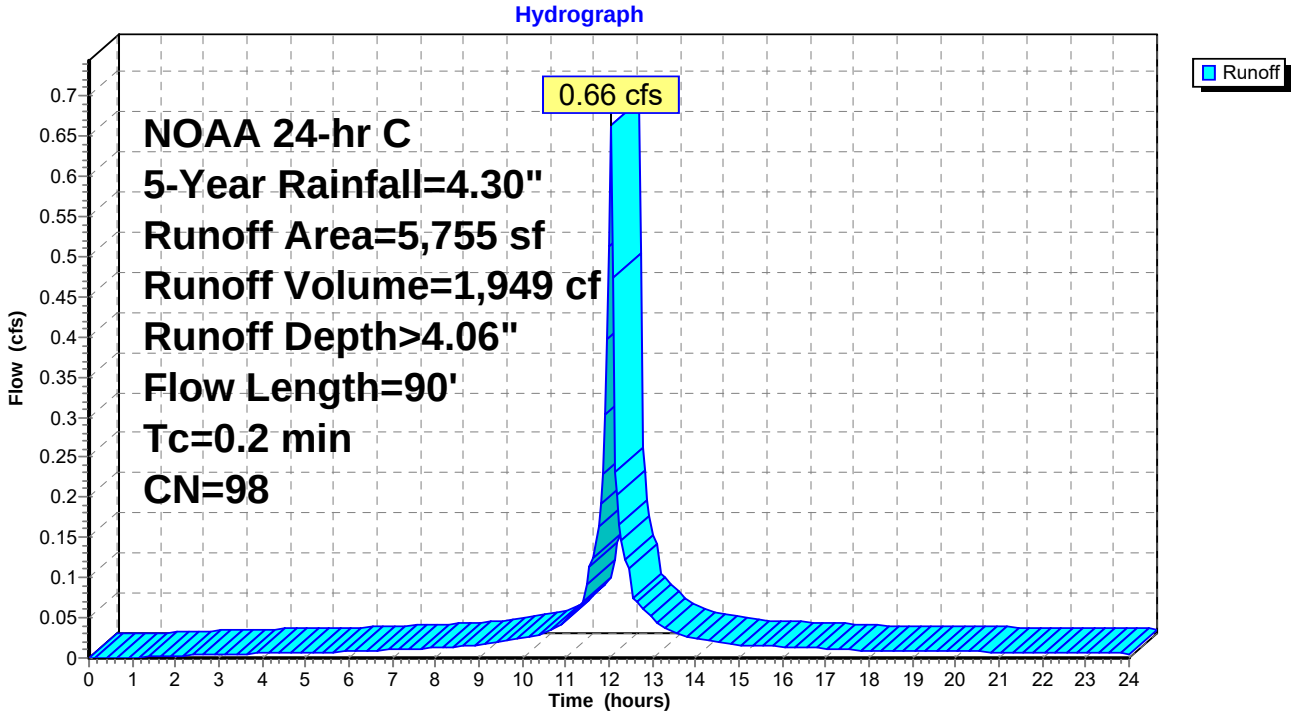
Runoff = 0.66 cfs @ 12.05 hrs, Volume= 1,949 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

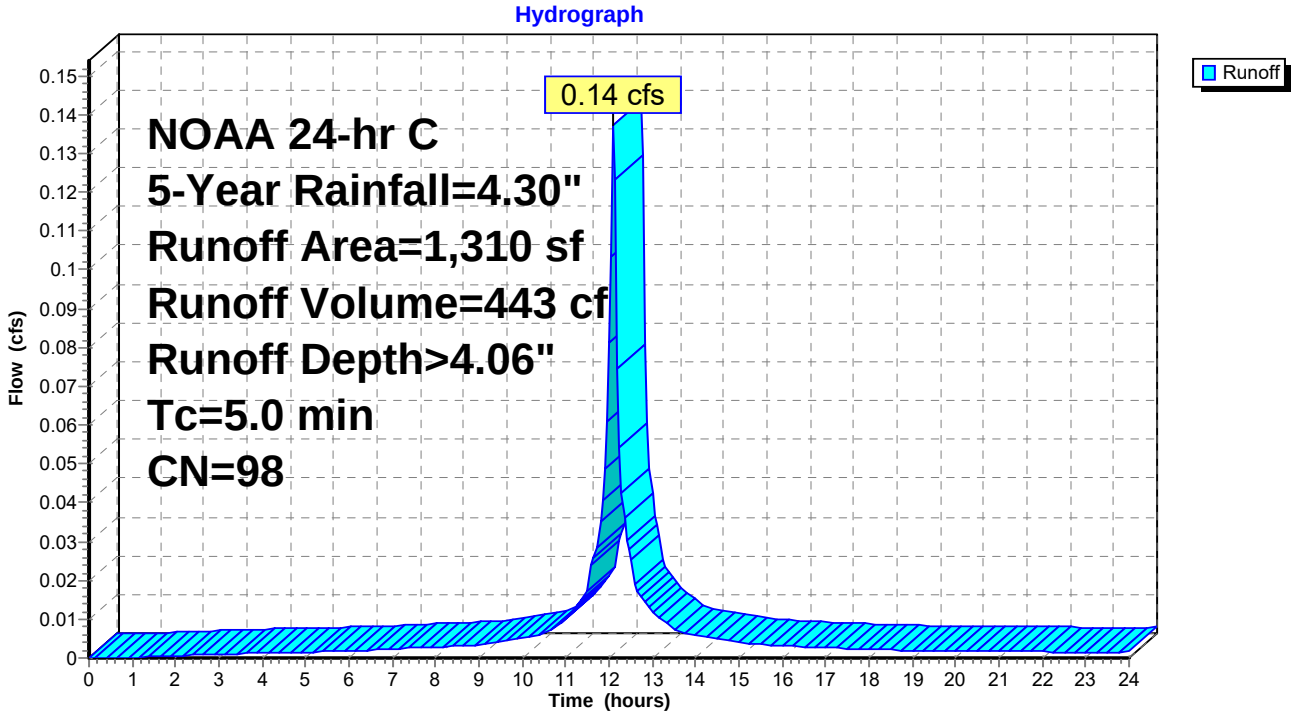
Runoff = 0.14 cfs @ 12.11 hrs, Volume= 443 cf, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

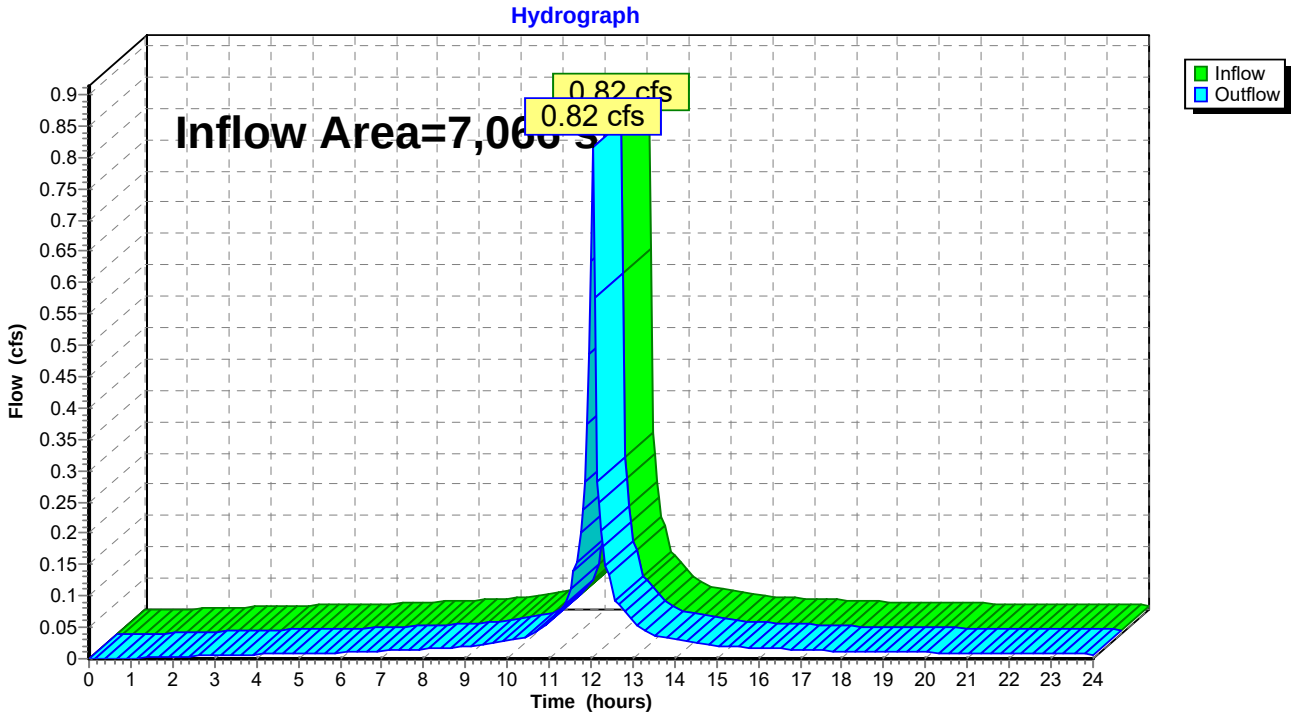


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 4.06" for 5-Year event
Inflow = 0.82 cfs @ 12.05 hrs, Volume= 2,393 cf
Outflow = 0.82 cfs @ 12.05 hrs, Volume= 2,393 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

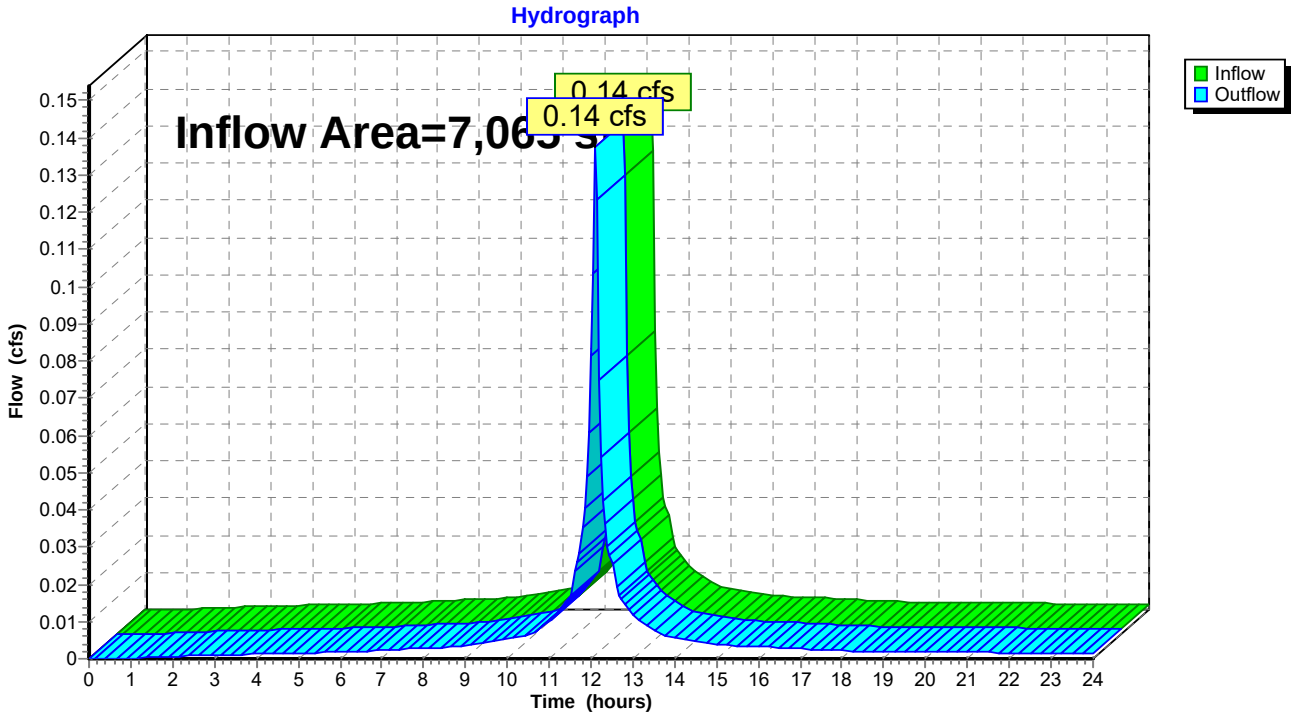


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 0.75" for 5-Year event
Inflow = 0.14 cfs @ 12.11 hrs, Volume= 443 cf
Outflow = 0.14 cfs @ 12.11 hrs, Volume= 443 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 4.06" for 5-Year event
Inflow = 0.66 cfs @ 12.05 hrs, Volume= 1,949 cf
Outflow = 0.04 cfs @ 13.09 hrs, Volume= 1,726 cf, Atten= 93%, Lag= 62.4 min
Discarded = 0.04 cfs @ 13.09 hrs, Volume= 1,726 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.17' @ 13.09 hrs Surf.Area= 3,873 sf Storage= 1,024 cf

Plug-Flow detention time= 259.0 min calculated for 1,726 cf (89% of inflow)
Center-of-Mass det. time= 201.7 min (947.8 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

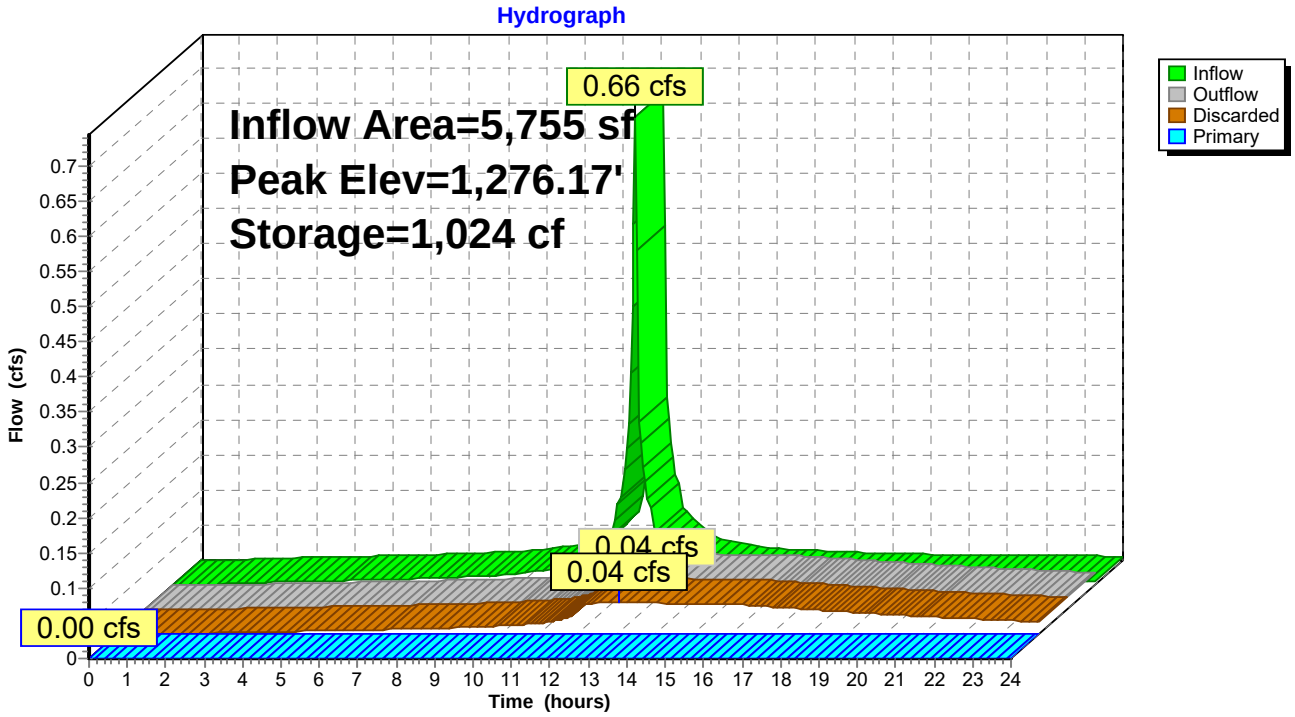
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.04 cfs @ 13.09 hrs HW=1,276.17' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
Inflow Area=5,755 sf
Peak Elev=1,276.17'
Storage=1,024 cf
0.66 cfs
0.04 cfs
0.04 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>2.61"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.40 cfs 1,539 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>4.76"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.77 cfs 2,284 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>4.76"
Tc=0.0 min CN=98 Runoff=0.18 cfs 520 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>4.76"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.77 cfs 2,284 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>4.76"
Tc=5.0 min CN=98 Runoff=0.16 cfs 520 cf

Reach 4R: Post Inflow=0.95 cfs 2,805 cf
Outflow=0.95 cfs 2,805 cf

Reach 8R: Post w BMP Inflow=0.16 cfs 520 cf
Outflow=0.16 cfs 520 cf

Pond 6P: Pad Peak Elev=1,276.29' Storage=1,225 cf Inflow=0.77 cfs 2,284 cf
Discarded=0.05 cfs 1,969 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 1,969 cf

Total Runoff Area = 21,197 sf Runoff Volume = 7,147 cf Average Runoff Depth = 4.05"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

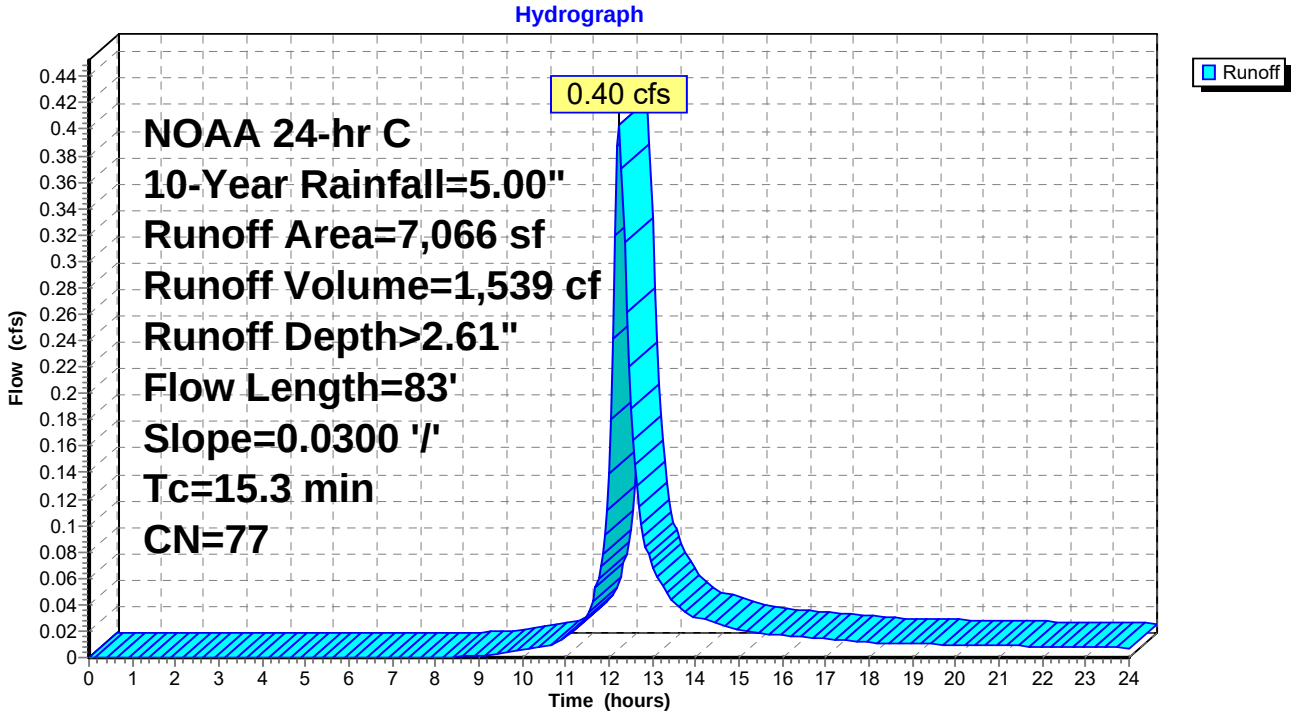
Runoff = 0.40 cfs @ 12.24 hrs, Volume= 1,539 cf, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

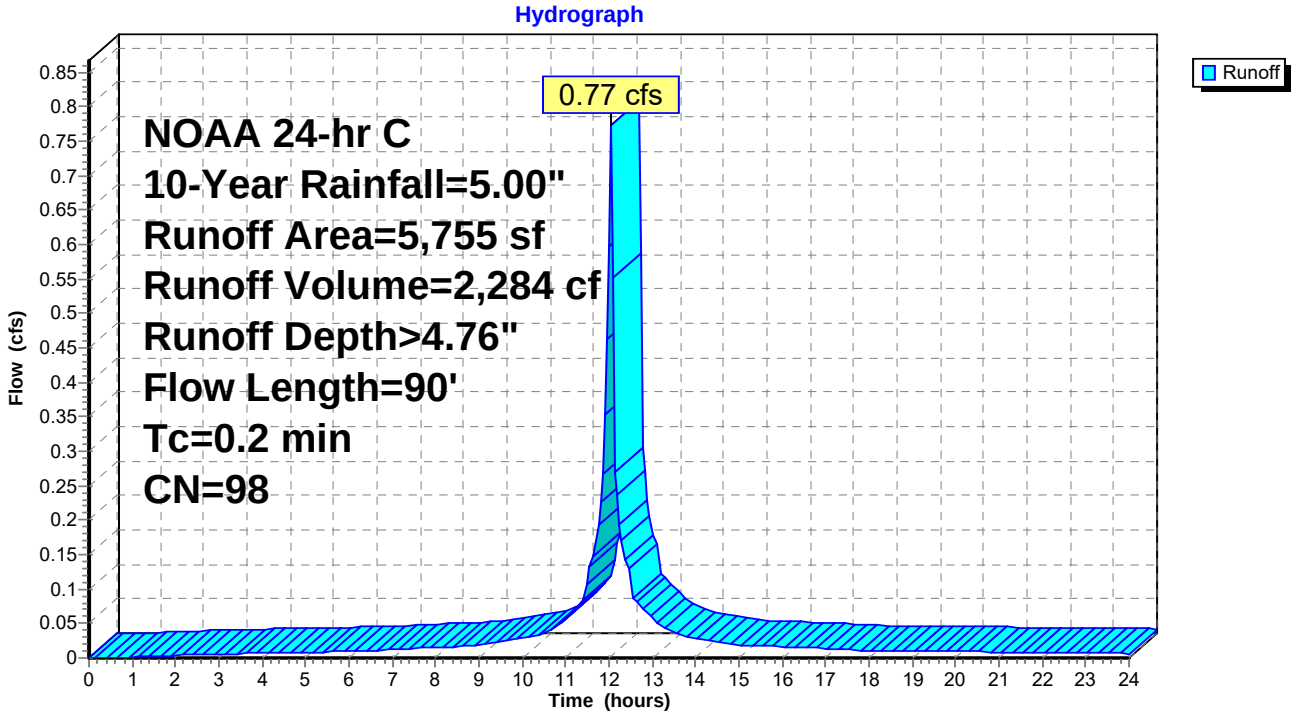
Runoff = 0.77 cfs @ 12.05 hrs, Volume= 2,284 cf, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



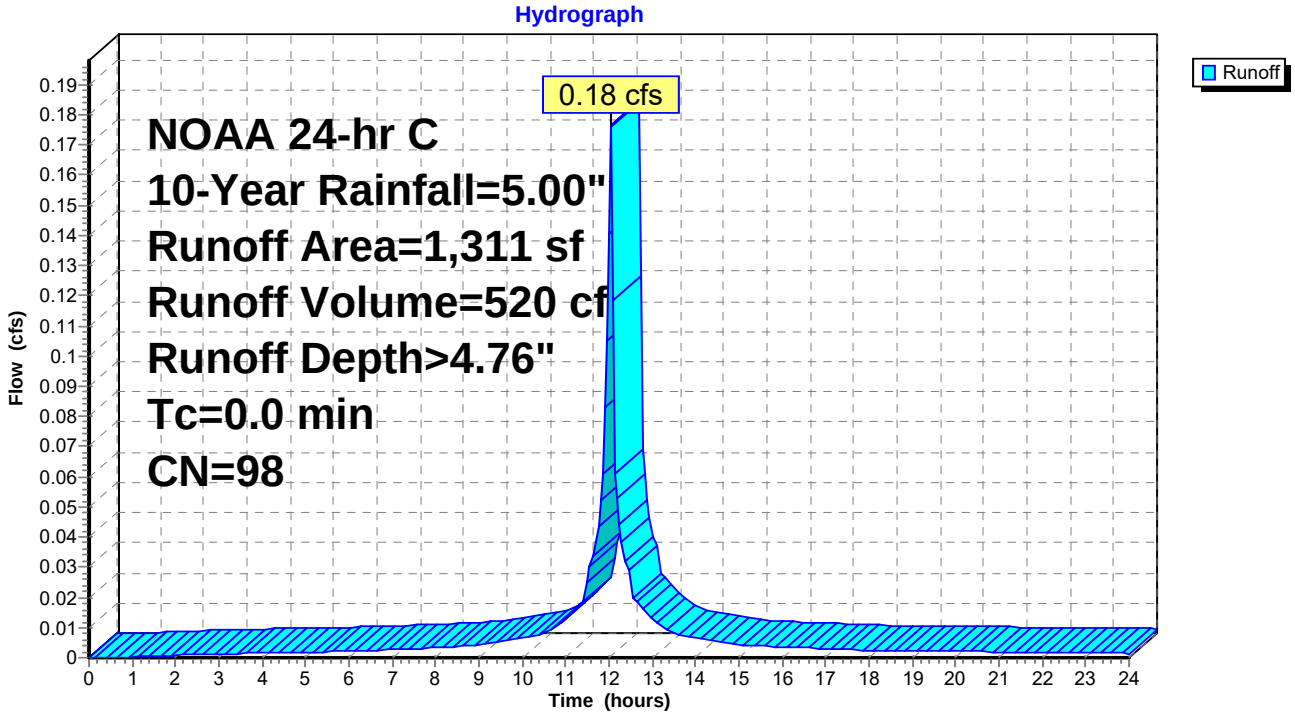
Summary for Subcatchment 3S: Undetained

Runoff = 0.18 cfs @ 12.04 hrs, Volume= 520 cf, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

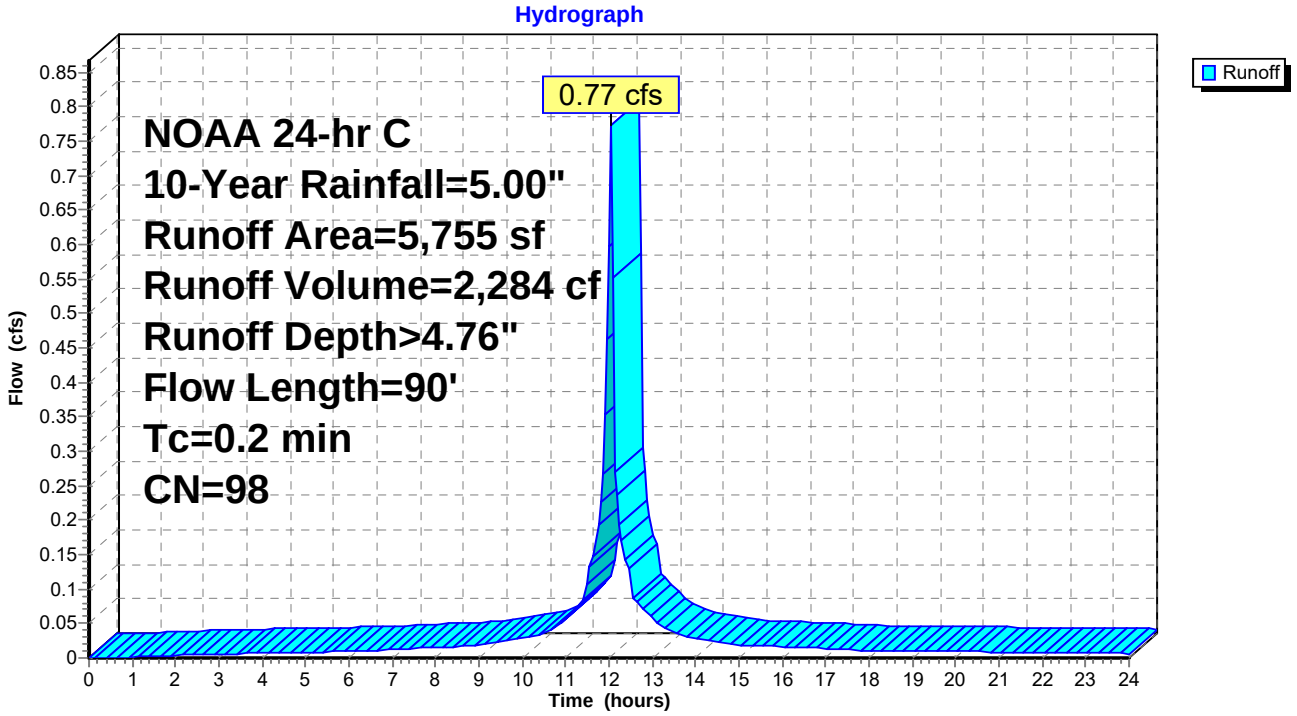
Runoff = 0.77 cfs @ 12.05 hrs, Volume= 2,284 cf, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

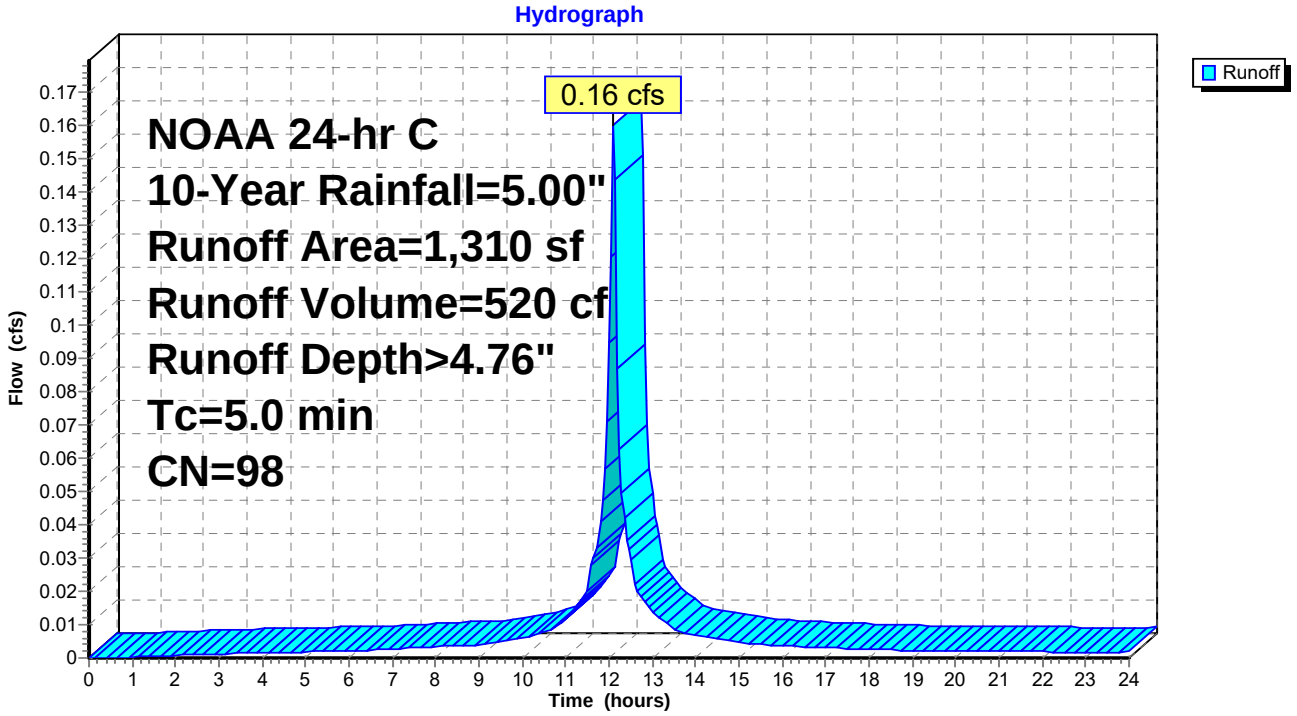
Runoff = 0.16 cfs @ 12.11 hrs, Volume= 520 cf, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

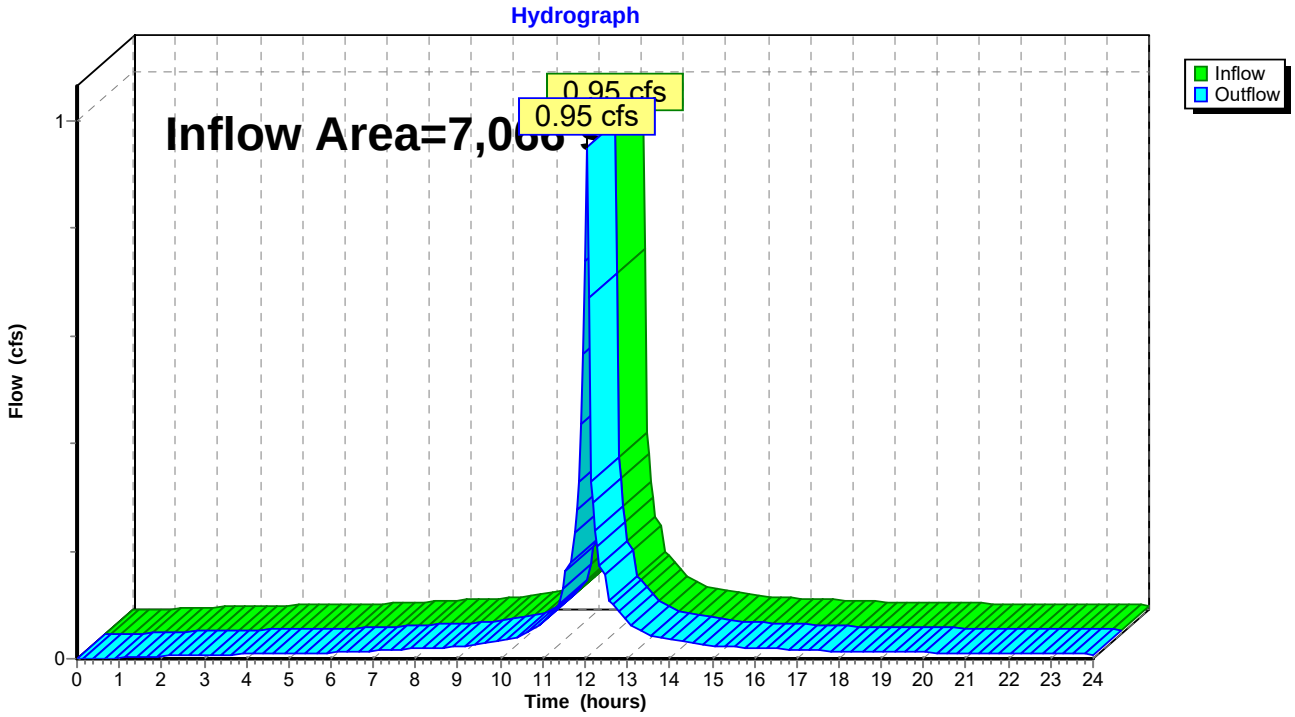


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 4.76" for 10-Year event
Inflow = 0.95 cfs @ 12.05 hrs, Volume= 2,805 cf
Outflow = 0.95 cfs @ 12.05 hrs, Volume= 2,805 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

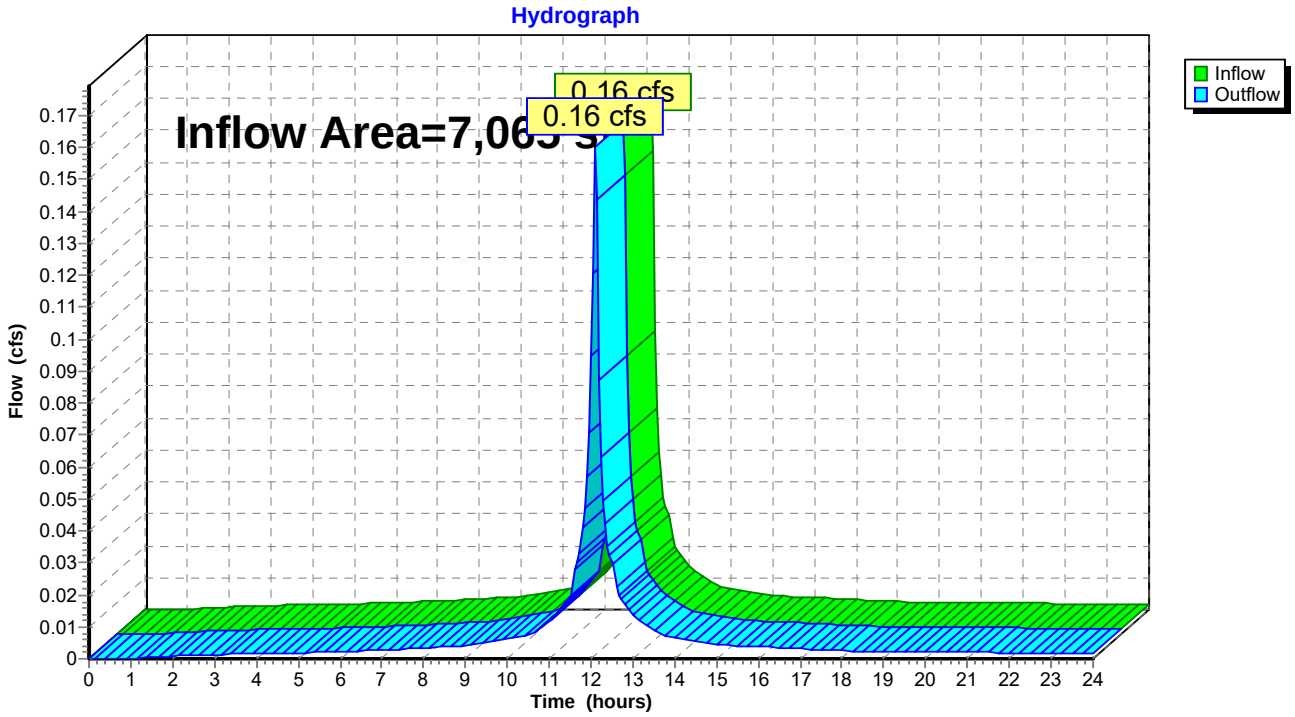


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 0.88" for 10-Year event
Inflow = 0.16 cfs @ 12.11 hrs, Volume= 520 cf
Outflow = 0.16 cfs @ 12.11 hrs, Volume= 520 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 4.76" for 10-Year event
Inflow = 0.77 cfs @ 12.05 hrs, Volume= 2,284 cf
Outflow = 0.05 cfs @ 13.22 hrs, Volume= 1,969 cf, Atten= 94%, Lag= 70.6 min
Discarded = 0.05 cfs @ 13.22 hrs, Volume= 1,969 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.29' @ 13.22 hrs Surf.Area= 4,256 sf Storage= 1,225 cf

Plug-Flow detention time= 278.0 min calculated for 1,969 cf (86% of inflow)
Center-of-Mass det. time= 213.2 min (956.6 - 743.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

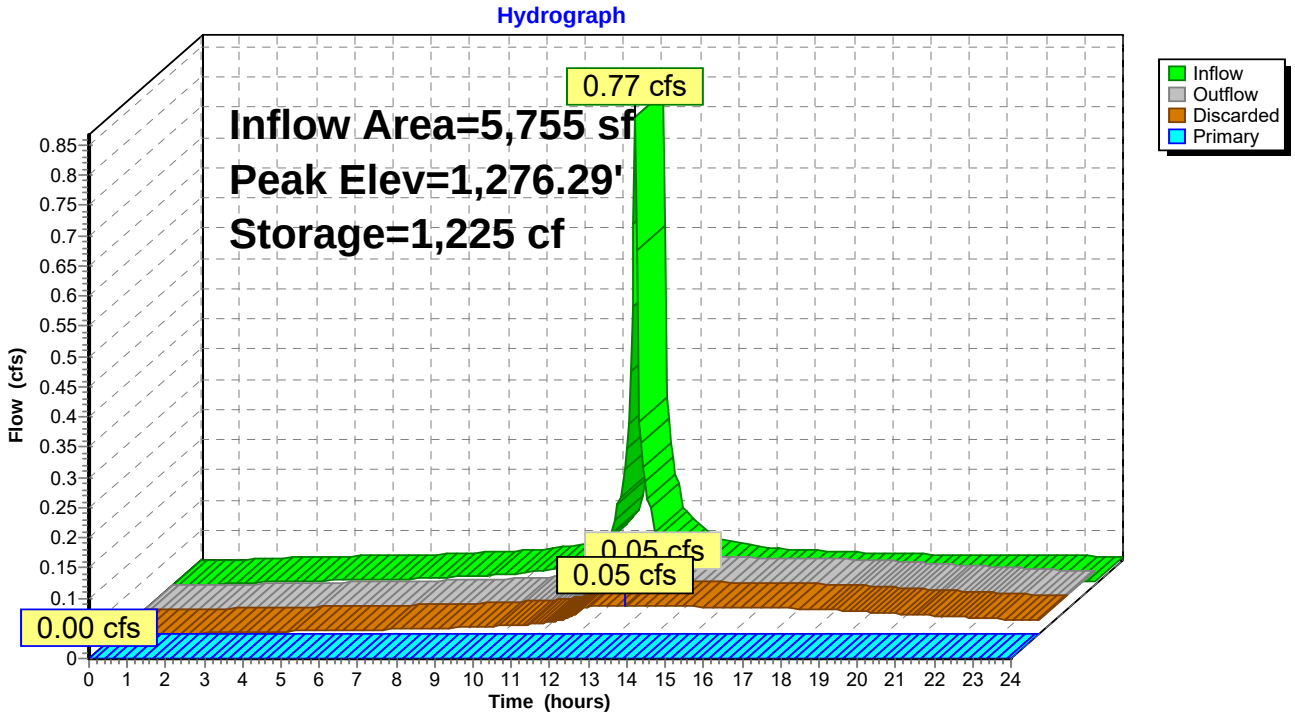
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.05 cfs @ 13.22 hrs HW=1,276.29' (Free Discharge)
2=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
Inflow Area=5,755 sf
Peak Elev=1,276.29'
Storage=1,225 cf
0.77 cfs
0.05 cfs
0.05 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>3.64"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.56 cfs 2,144 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>5.96"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.96 cfs 2,859 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>5.96"
Tc=0.0 min CN=98 Runoff=0.22 cfs 651 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>5.96"
Flow Length=90' Tc=0.2 min CN=98 Runoff=0.96 cfs 2,859 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>5.96"
Tc=5.0 min CN=98 Runoff=0.20 cfs 650 cf

Reach 4R: Post Inflow=1.18 cfs 3,510 cf
Outflow=1.18 cfs 3,510 cf

Reach 8R: Post w BMP Inflow=0.20 cfs 650 cf
Outflow=0.20 cfs 650 cf

Pond 6P: Pad Peak Elev=1,276.49' Storage=1,580 cf Inflow=0.96 cfs 2,859 cf
Discarded=0.05 cfs 2,324 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 2,324 cf

Total Runoff Area = 21,197 sf Runoff Volume = 9,164 cf Average Runoff Depth = 5.19"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

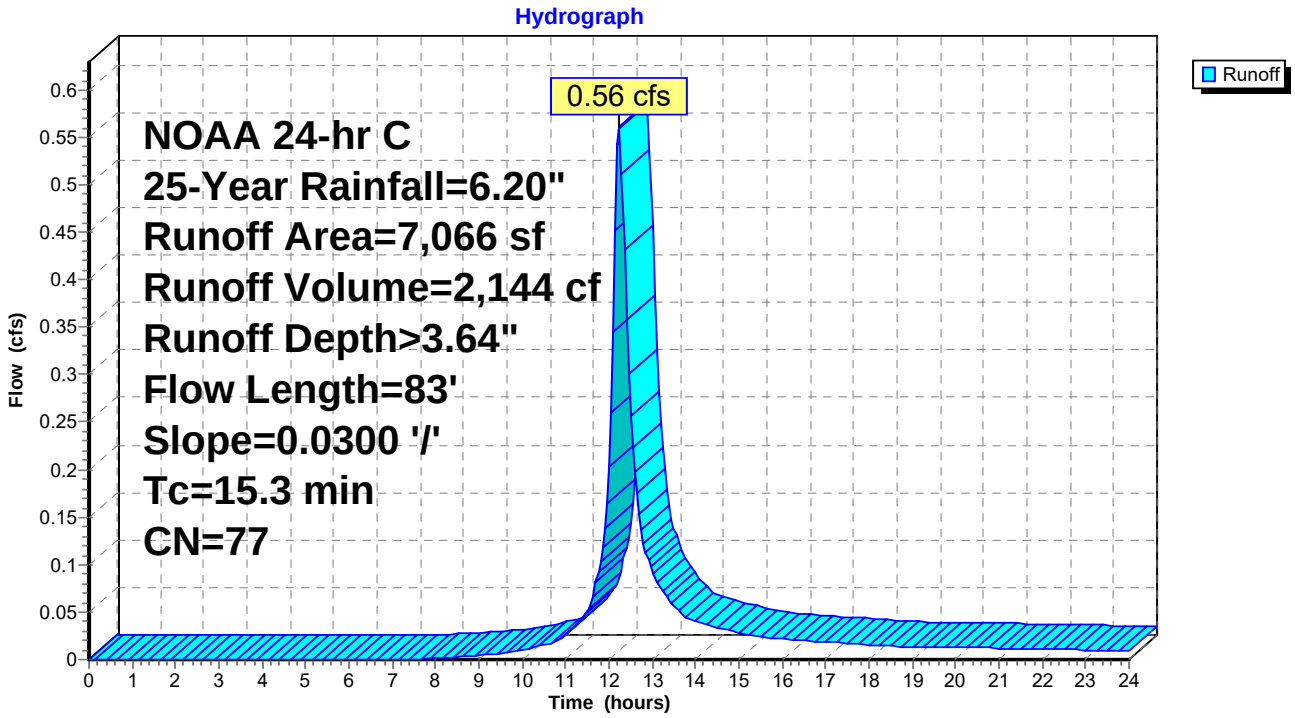
Runoff = 0.56 cfs @ 12.24 hrs, Volume= 2,144 cf, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

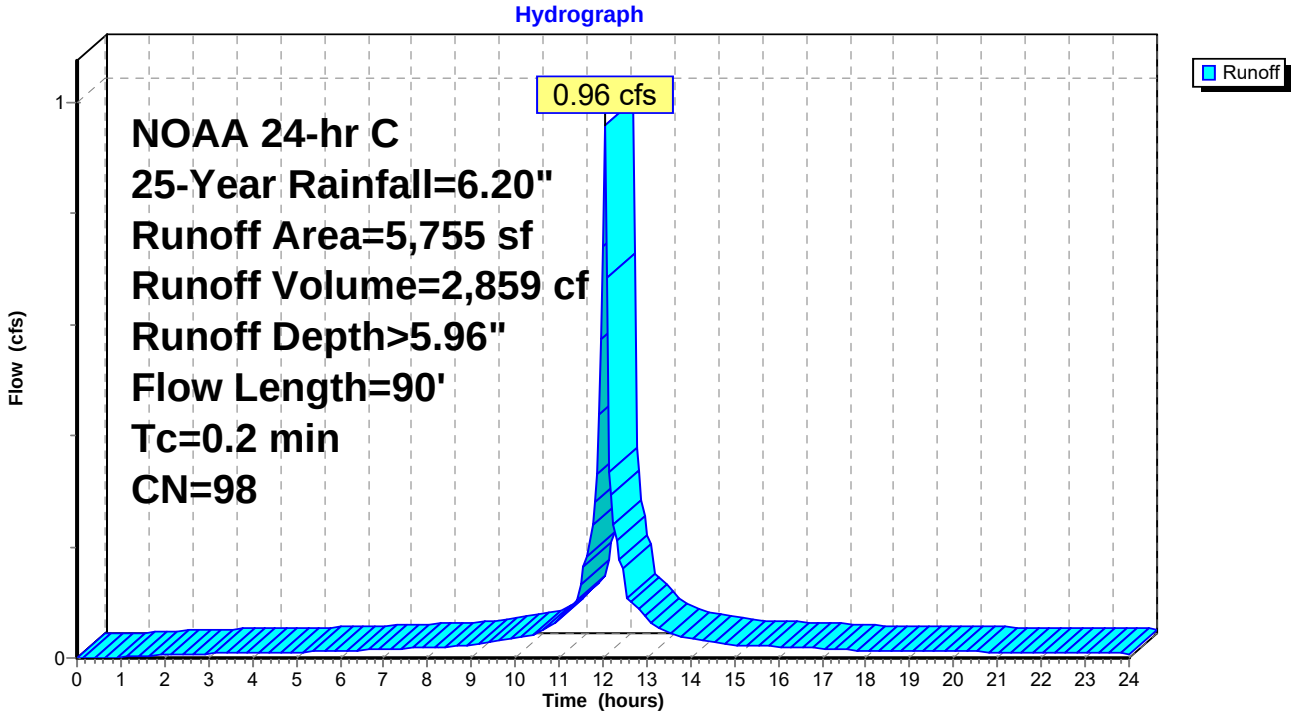
Runoff = 0.96 cfs @ 12.05 hrs, Volume= 2,859 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



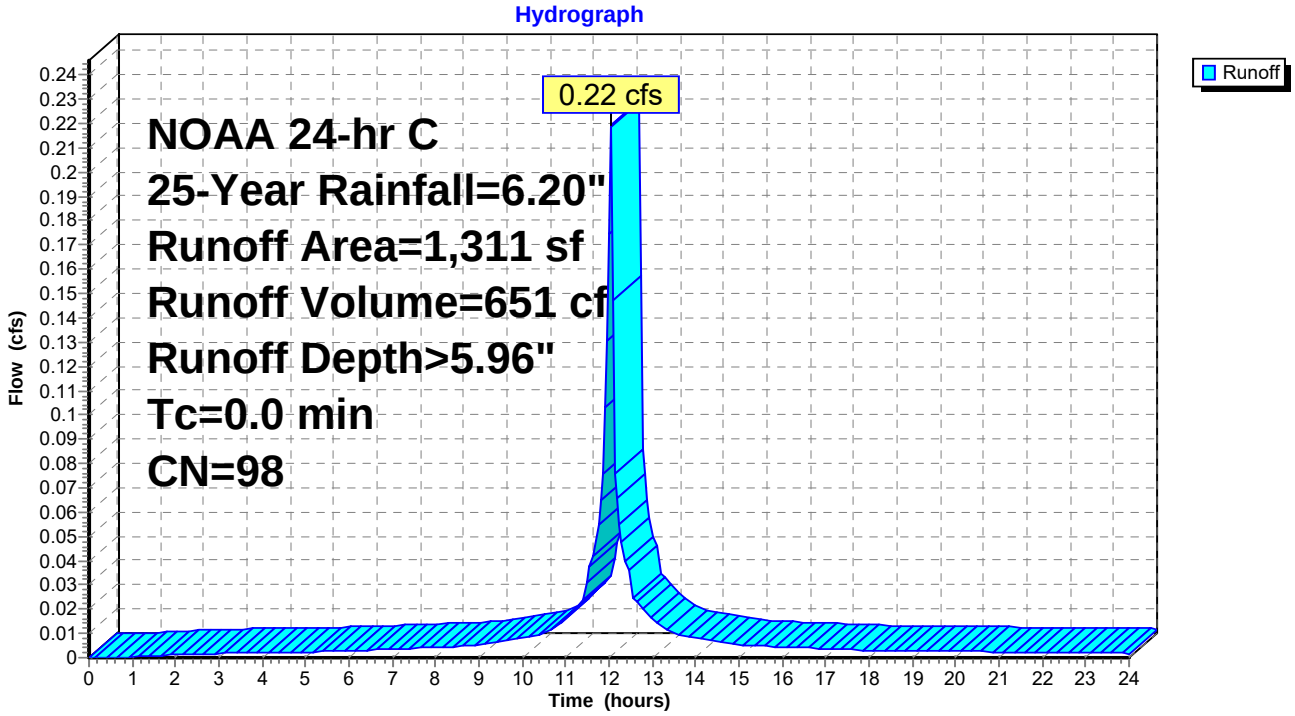
Summary for Subcatchment 3S: Undetained

Runoff = 0.22 cfs @ 12.04 hrs, Volume= 651 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

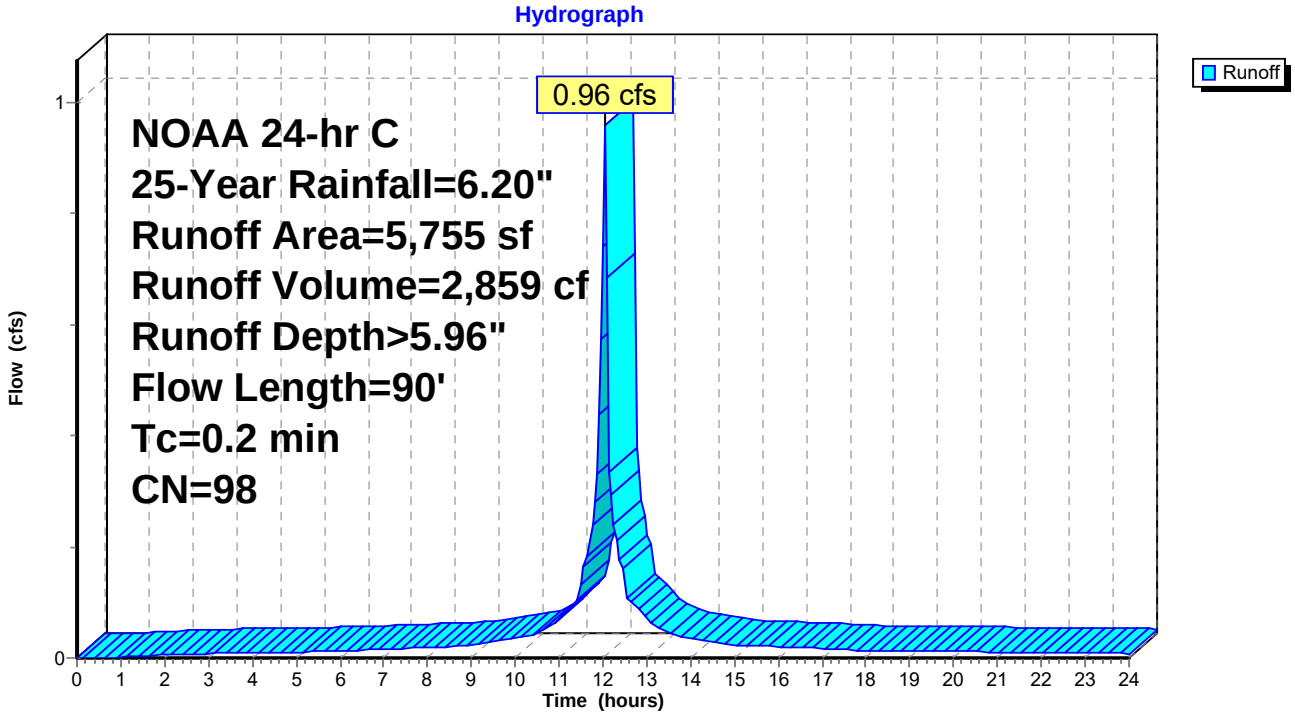
Runoff = 0.96 cfs @ 12.05 hrs, Volume= 2,859 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

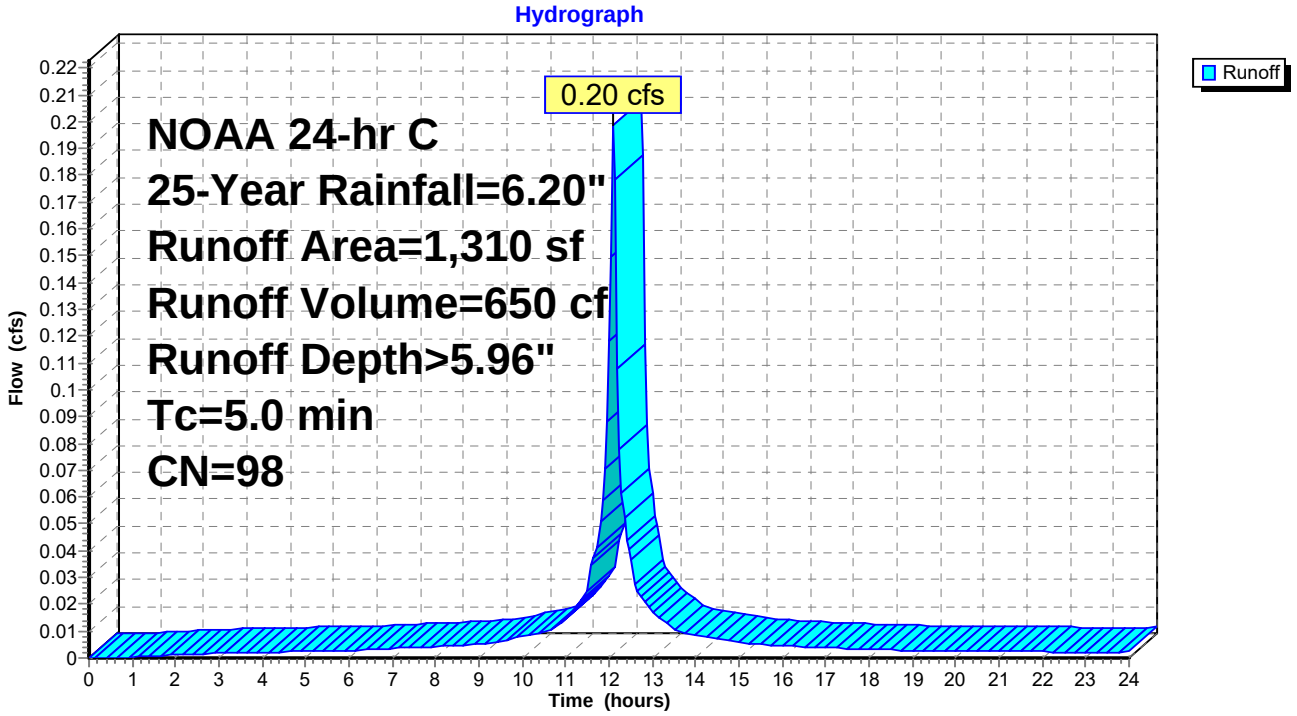
Runoff = 0.20 cfs @ 12.11 hrs, Volume= 650 cf, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

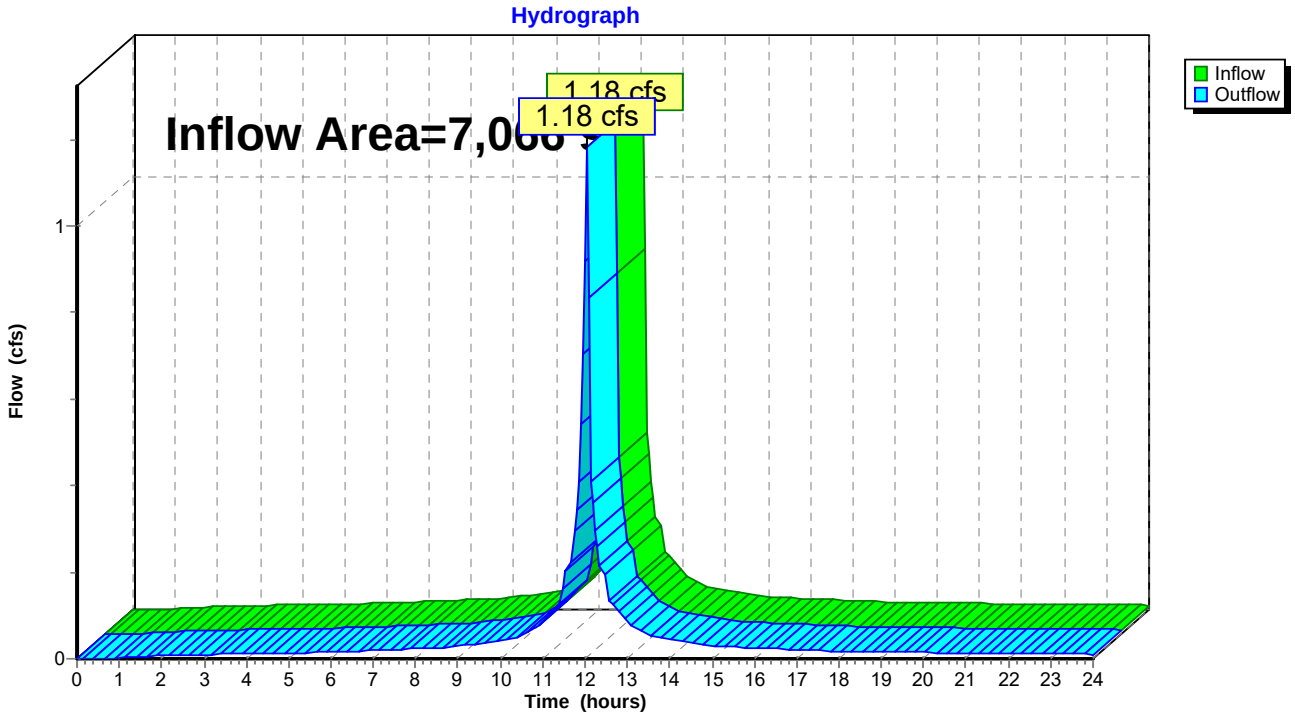


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 5.96" for 25-Year event
Inflow = 1.18 cfs @ 12.05 hrs, Volume= 3,510 cf
Outflow = 1.18 cfs @ 12.05 hrs, Volume= 3,510 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

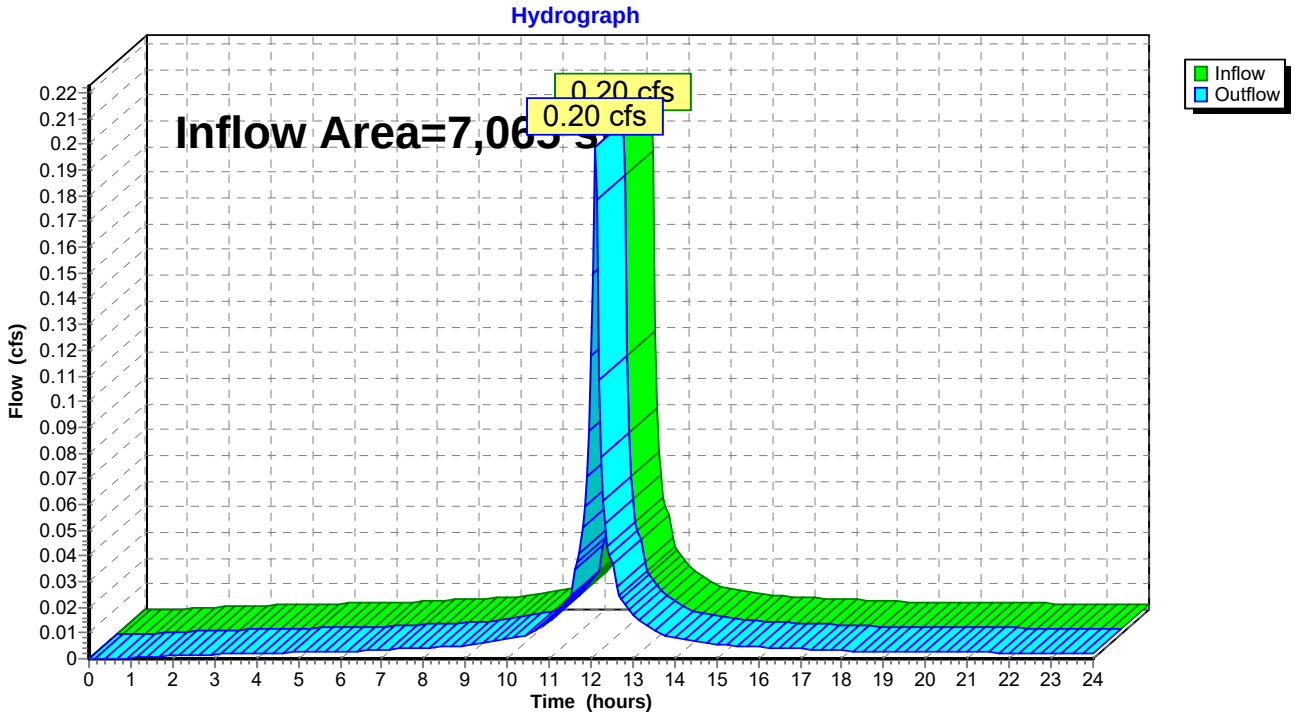


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 1.10" for 25-Year event
Inflow = 0.20 cfs @ 12.11 hrs, Volume= 650 cf
Outflow = 0.20 cfs @ 12.11 hrs, Volume= 650 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 5.96" for 25-Year event
Inflow = 0.96 cfs @ 12.05 hrs, Volume= 2,859 cf
Outflow = 0.05 cfs @ 13.39 hrs, Volume= 2,324 cf, Atten= 95%, Lag= 80.6 min
Discarded = 0.05 cfs @ 13.39 hrs, Volume= 2,324 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.49' @ 13.39 hrs Surf.Area= 4,858 sf Storage= 1,580 cf

Plug-Flow detention time= 304.6 min calculated for 2,324 cf (81% of inflow)
Center-of-Mass det. time= 227.0 min (967.0 - 740.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

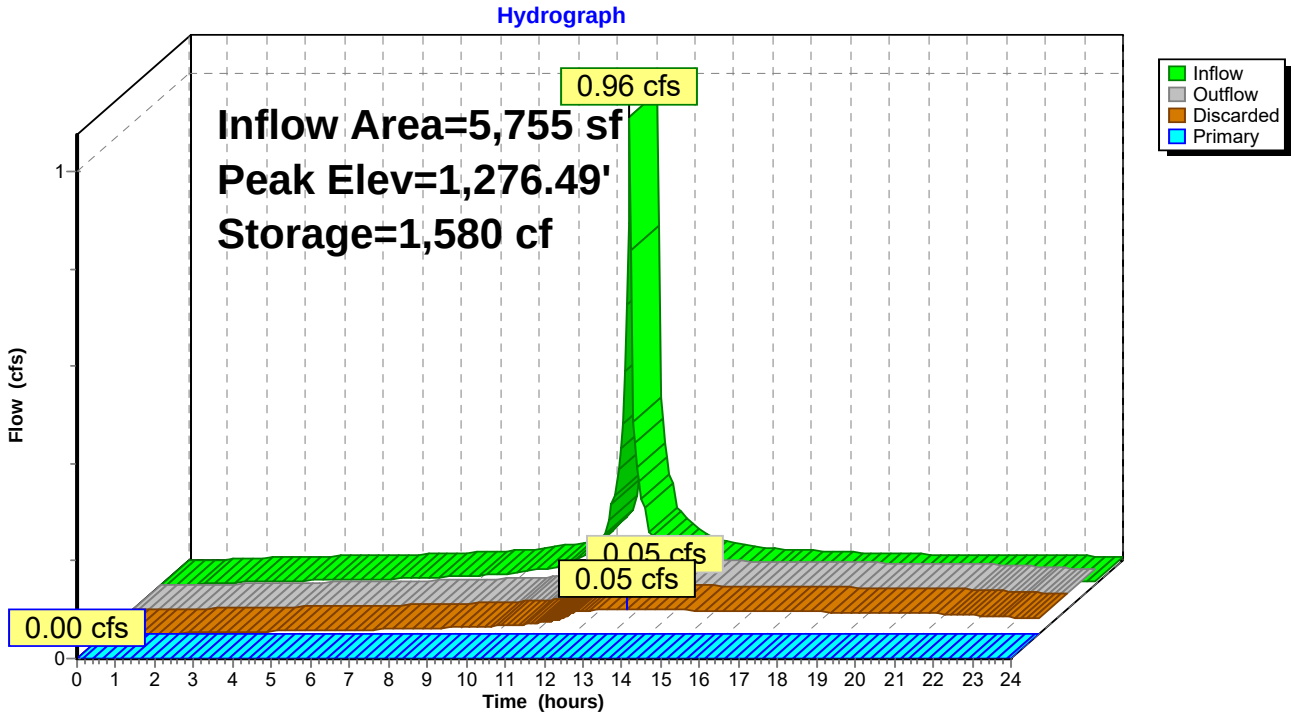
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.05 cfs @ 13.39 hrs HW=1,276.49' (Free Discharge)
↑**2=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
Inflow
Outflow
Discarded
Primary
0.96 cfs
Inflow Area=5,755 sf
Peak Elev=1,276.49'
Storage=1,580 cf
0.05 cfs
0.05 cfs
0.00 cfs
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>4.65"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.71 cfs 2,737 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>7.09"
Flow Length=90' Tc=0.2 min CN=98 Runoff=1.14 cfs 3,401 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>7.09"
Tc=0.0 min CN=98 Runoff=0.26 cfs 775 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>7.09"
Flow Length=90' Tc=0.2 min CN=98 Runoff=1.14 cfs 3,401 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>7.09"
Tc=5.0 min CN=98 Runoff=0.24 cfs 774 cf

Reach 4R: Post Inflow=1.40 cfs 4,175 cf
Outflow=1.40 cfs 4,175 cf

Reach 8R: Post w BMP Inflow=0.24 cfs 774 cf
Outflow=0.24 cfs 774 cf

Pond 6P: Pad Peak Elev=1,276.66' Storage=1,922 cf Inflow=1.14 cfs 3,401 cf
Discarded=0.05 cfs 2,570 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 2,570 cf

Total Runoff Area = 21,197 sf Runoff Volume = 11,086 cf Average Runoff Depth = 6.28"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

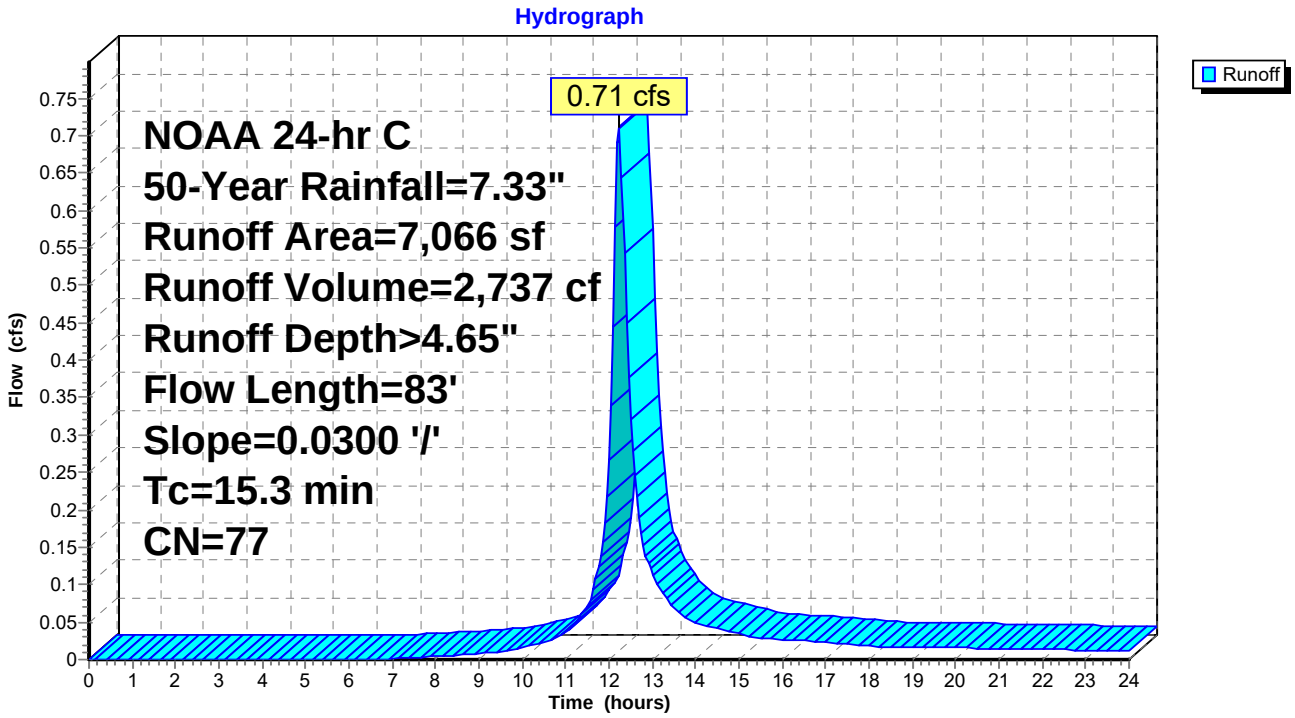
Runoff = 0.71 cfs @ 12.24 hrs, Volume= 2,737 cf, Depth> 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

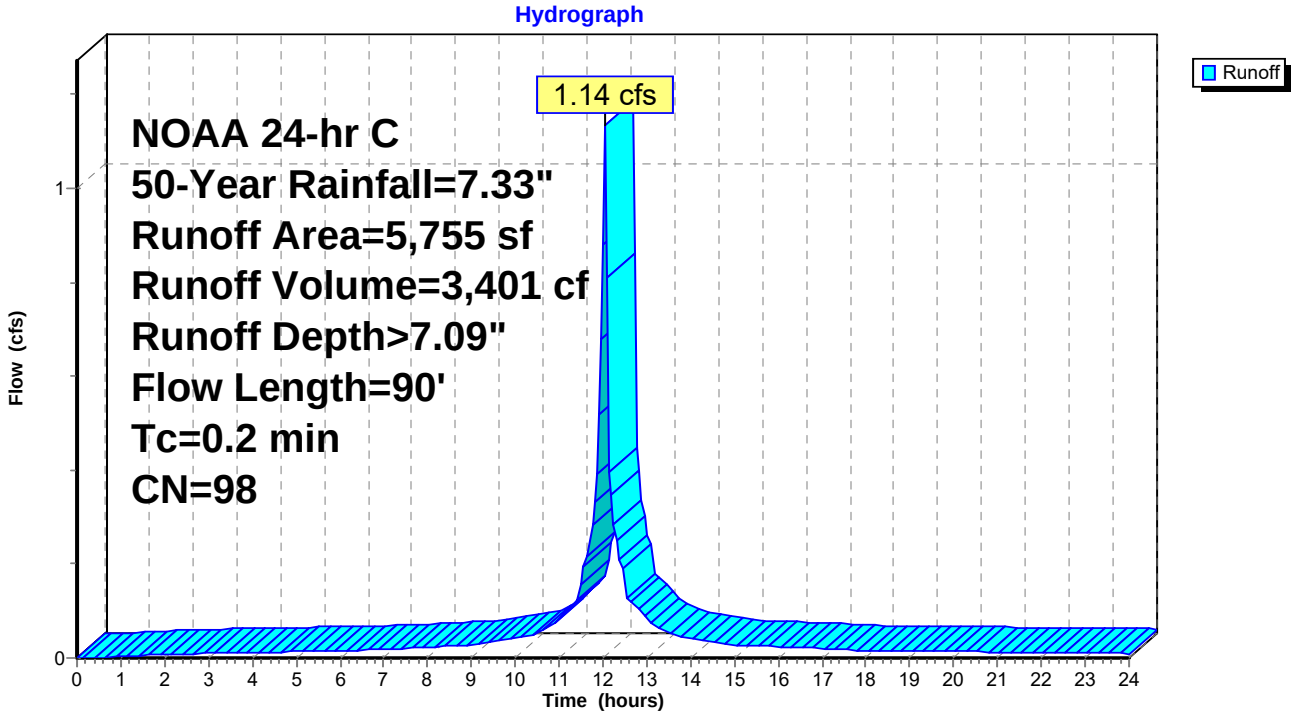
Runoff = 1.14 cfs @ 12.05 hrs, Volume= 3,401 cf, Depth> 7.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



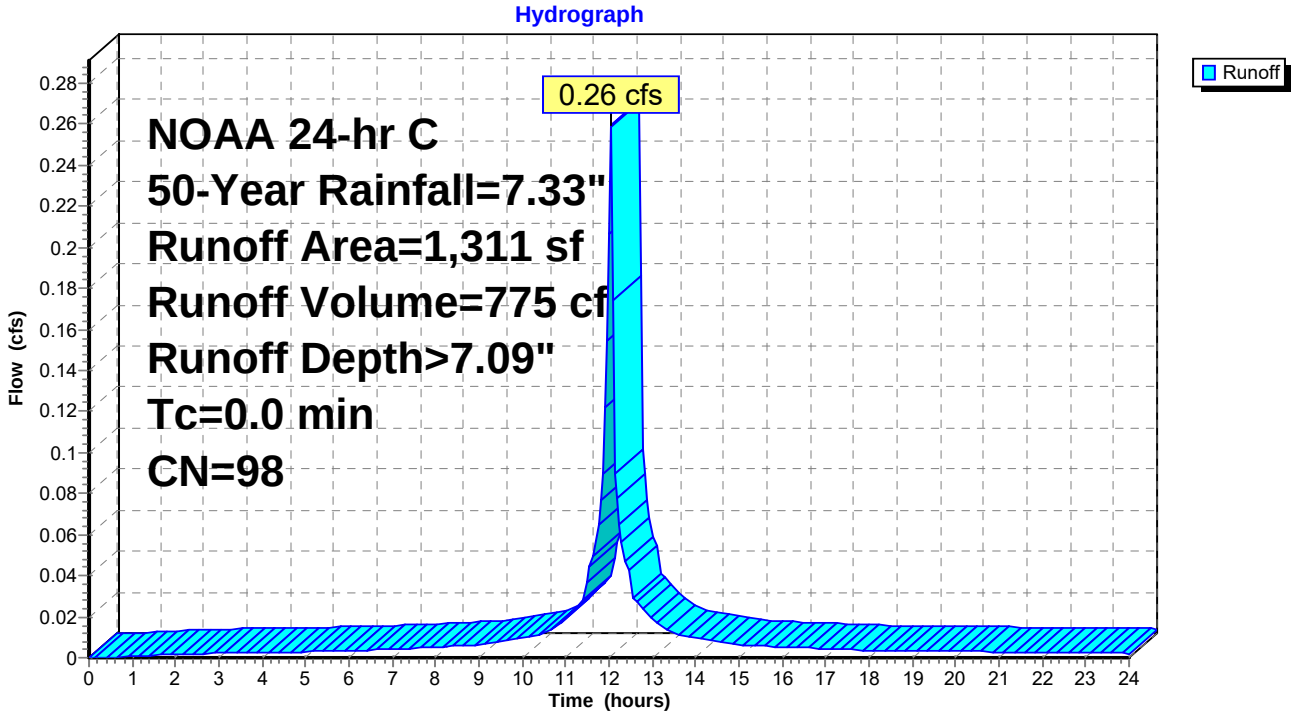
Summary for Subcatchment 3S: Undetained

Runoff = 0.26 cfs @ 12.04 hrs, Volume= 775 cf, Depth> 7.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

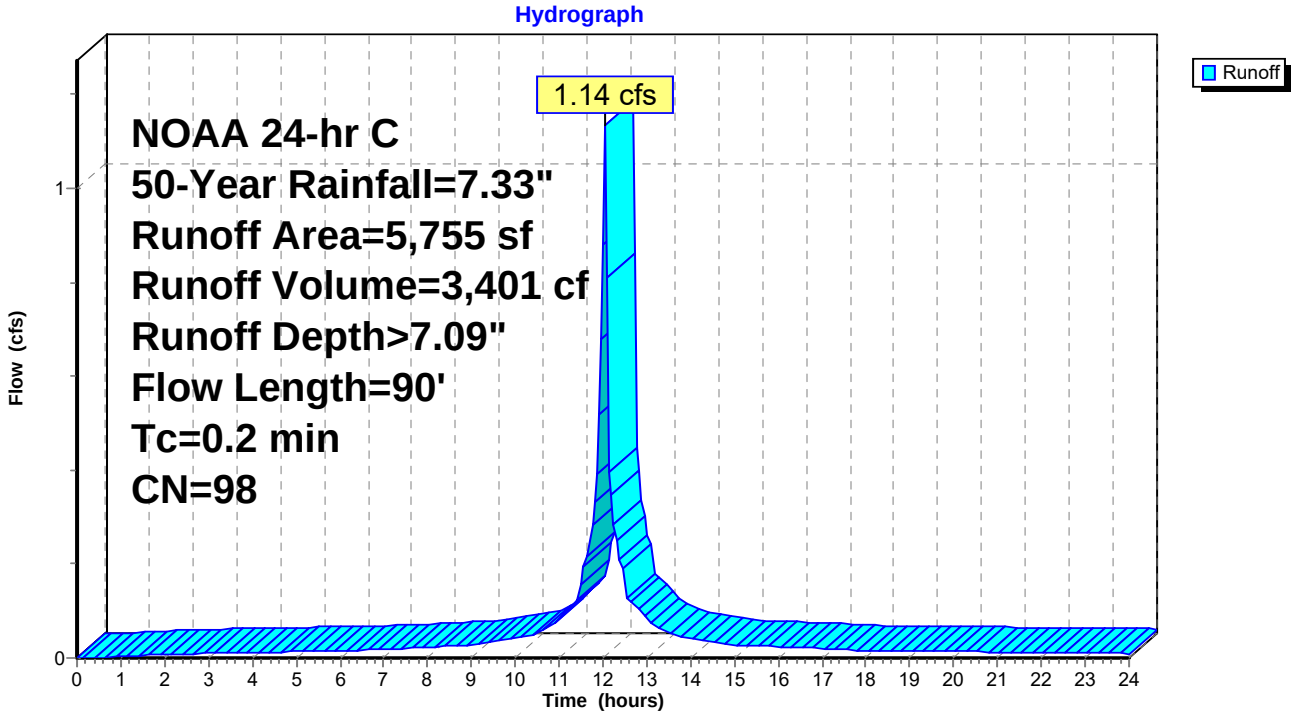
Runoff = 1.14 cfs @ 12.05 hrs, Volume= 3,401 cf, Depth> 7.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

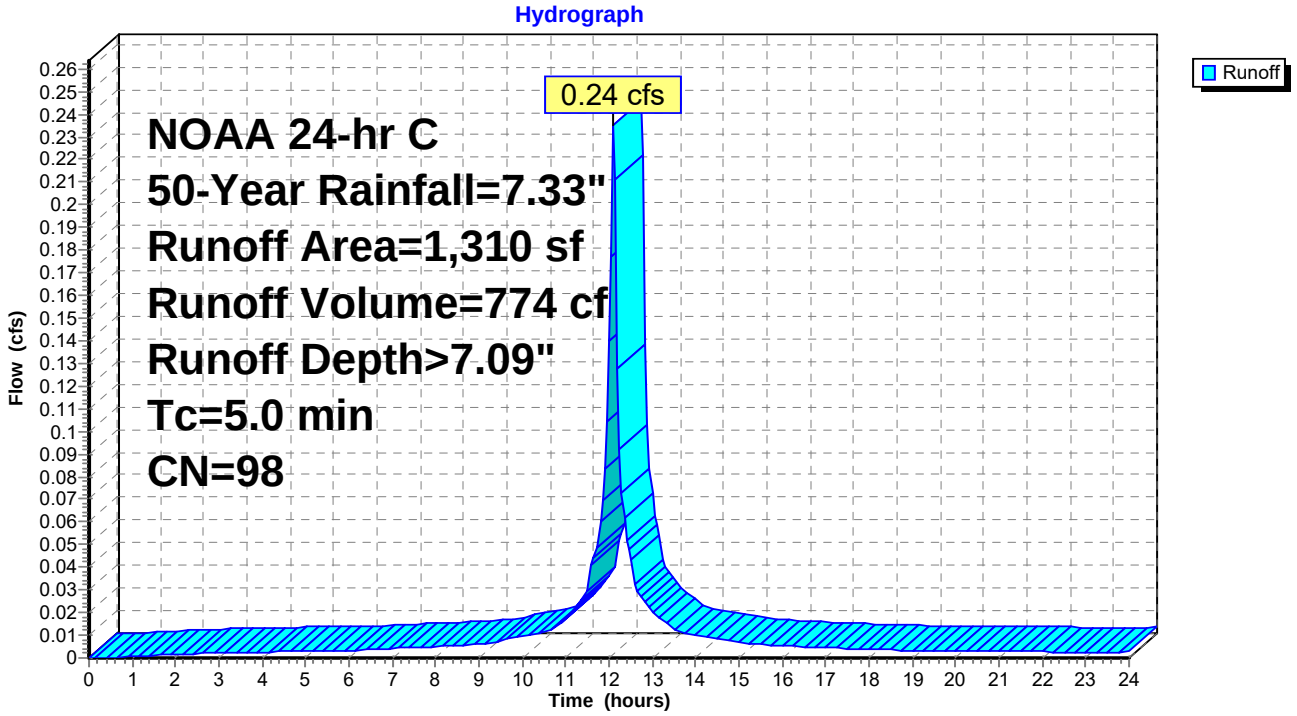
Runoff = 0.24 cfs @ 12.11 hrs, Volume= 774 cf, Depth> 7.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

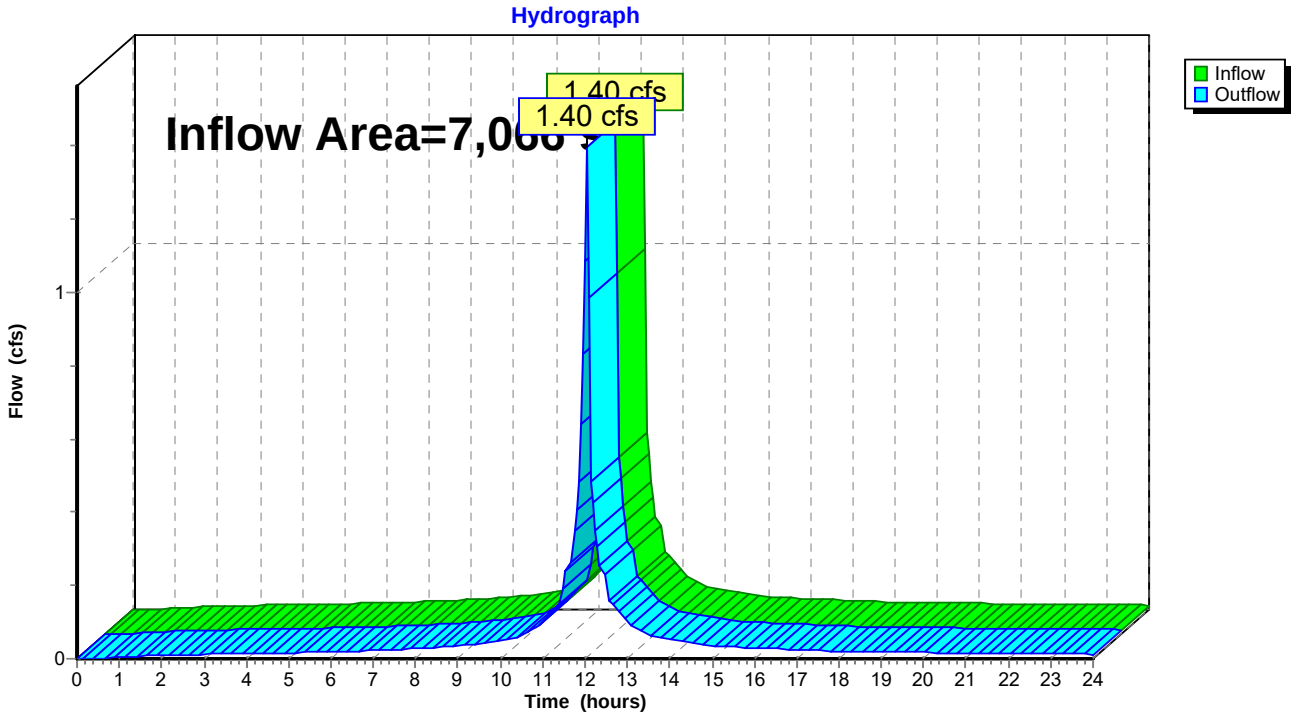


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 7.09" for 50-Year event
Inflow = 1.40 cfs @ 12.05 hrs, Volume= 4,175 cf
Outflow = 1.40 cfs @ 12.05 hrs, Volume= 4,175 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

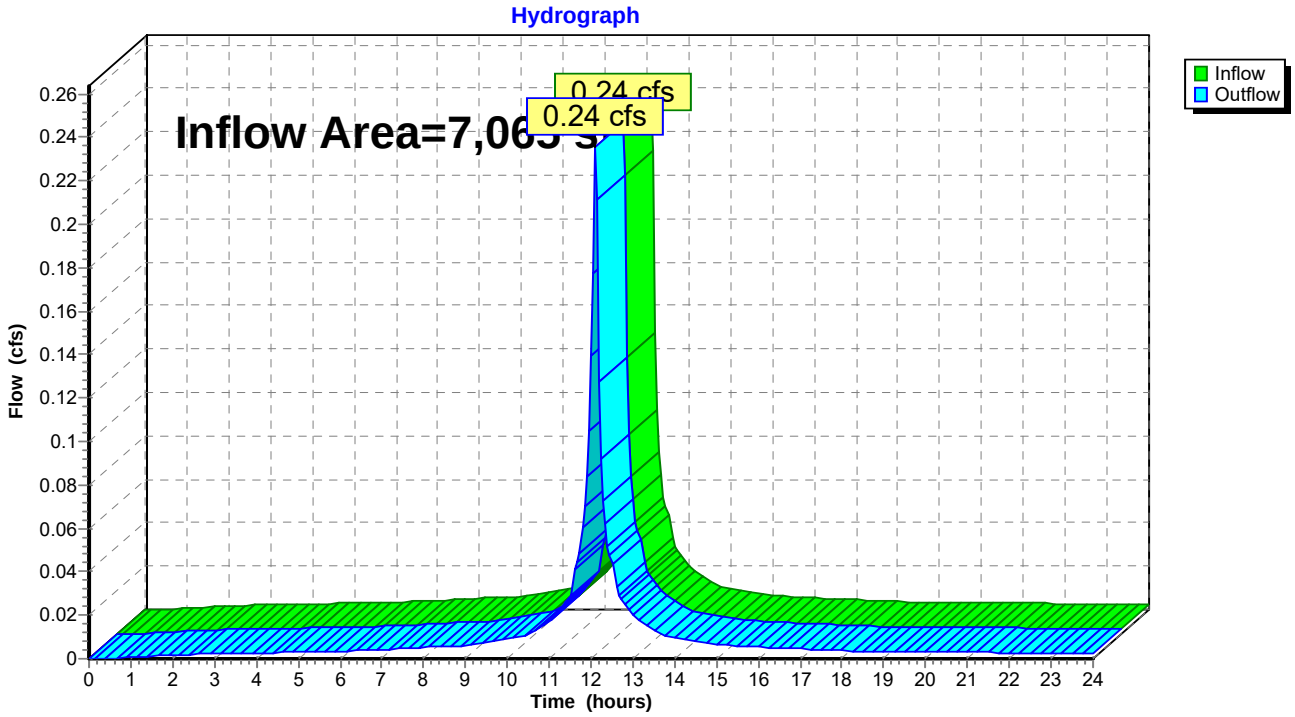


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 1.31" for 50-Year event
Inflow = 0.24 cfs @ 12.11 hrs, Volume= 774 cf
Outflow = 0.24 cfs @ 12.11 hrs, Volume= 774 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 7.09" for 50-Year event
Inflow = 1.14 cfs @ 12.05 hrs, Volume= 3,401 cf
Outflow = 0.05 cfs @ 13.50 hrs, Volume= 2,570 cf, Atten= 95%, Lag= 87.2 min
Discarded = 0.05 cfs @ 13.50 hrs, Volume= 2,570 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.66' @ 13.50 hrs Surf.Area= 4,998 sf Storage= 1,922 cf

Plug-Flow detention time= 316.9 min calculated for 2,565 cf (75% of inflow)
Center-of-Mass det. time= 228.4 min (966.0 - 737.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

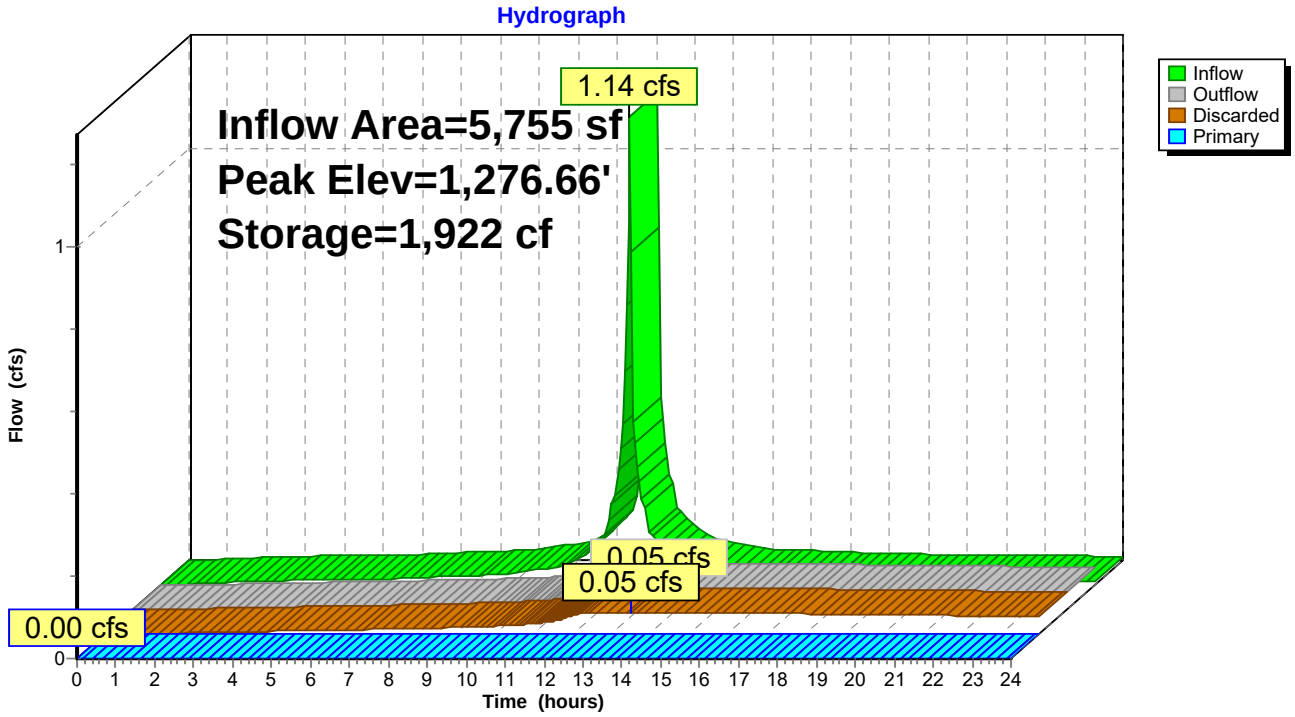
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.05 cfs @ 13.50 hrs HW=1,276.66' (Free Discharge)
2=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,275.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Pad


Hydrograph
1.14 cfs
Inflow Area=5,755 sf
Peak Elev=1,276.66'
Storage=1,922 cf
0.05 cfs
0.05 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (hours)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Construction Runoff Area=7,066 sf 0.00% Impervious Runoff Depth>5.87"
Flow Length=83' Slope=0.0300 '/' Tc=15.3 min CN=77 Runoff=0.89 cfs 3,458 cf

Subcatchment 2S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>8.43"
Flow Length=90' Tc=0.2 min CN=98 Runoff=1.35 cfs 4,043 cf

Subcatchment 3S: Undetained Runoff Area=1,311 sf 100.00% Impervious Runoff Depth>8.43"
Tc=0.0 min CN=98 Runoff=0.31 cfs 921 cf

Subcatchment 5S: Post Construction Runoff Area=5,755 sf 100.00% Impervious Runoff Depth>8.43"
Flow Length=90' Tc=0.2 min CN=98 Runoff=1.35 cfs 4,043 cf

Subcatchment 7S: Undetained Runoff Area=1,310 sf 100.00% Impervious Runoff Depth>8.42"
Tc=5.0 min CN=98 Runoff=0.28 cfs 920 cf

Reach 4R: Post Inflow=1.65 cfs 4,964 cf
Outflow=1.65 cfs 4,964 cf

Reach 8R: Post w BMP Inflow=0.28 cfs 1,161 cf
Outflow=0.28 cfs 1,161 cf

Pond 6P: Pad Peak Elev=1,276.77' Storage=2,135 cf Inflow=1.35 cfs 4,043 cf
Discarded=0.05 cfs 2,740 cf Primary=0.12 cfs 241 cf Outflow=0.18 cfs 2,982 cf

Total Runoff Area = 21,197 sf Runoff Volume = 13,384 cf Average Runoff Depth = 7.58"
33.33% Pervious = 7,066 sf 66.67% Impervious = 14,131 sf

Summary for Subcatchment 1S: Pre-Construction

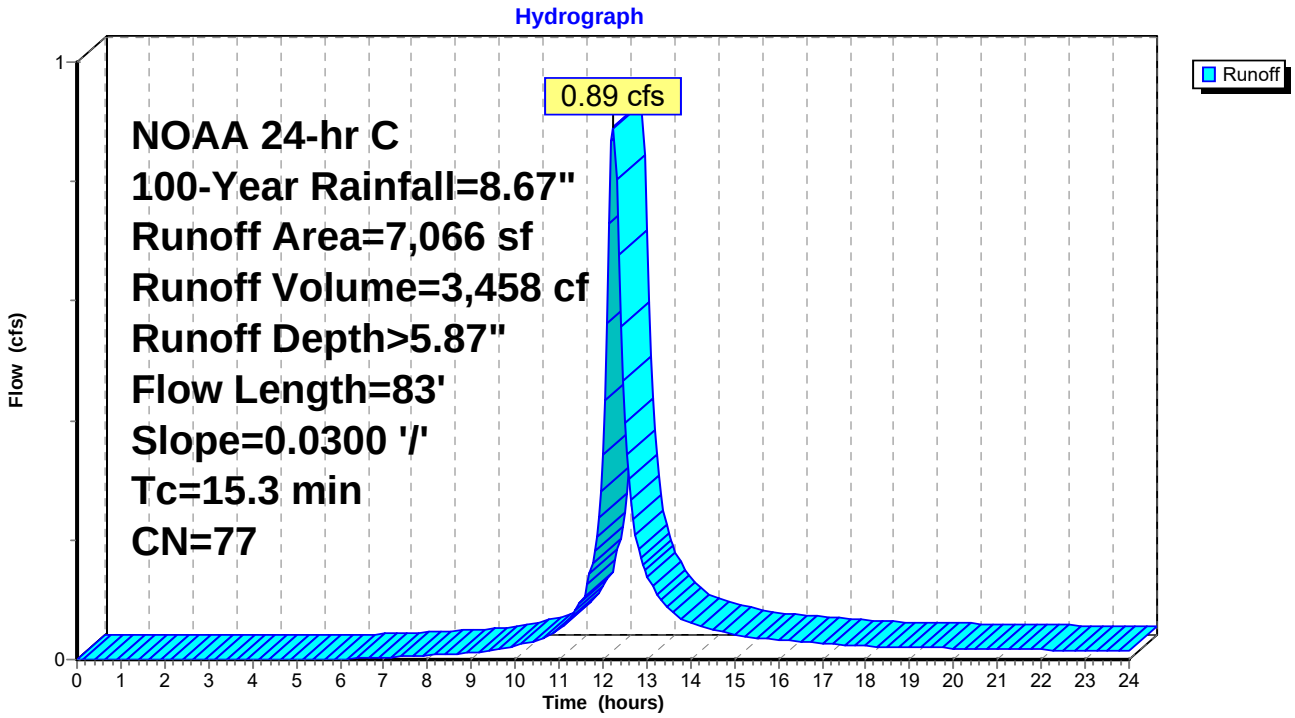
Runoff = 0.89 cfs @ 12.24 hrs, Volume= 3,458 cf, Depth> 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (sf)	CN	Description
4,050	77	Woods, Good, HSG D
3,016	78	Meadow, non-grazed, HSG D
7,066	77	Weighted Average
7,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	83	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction

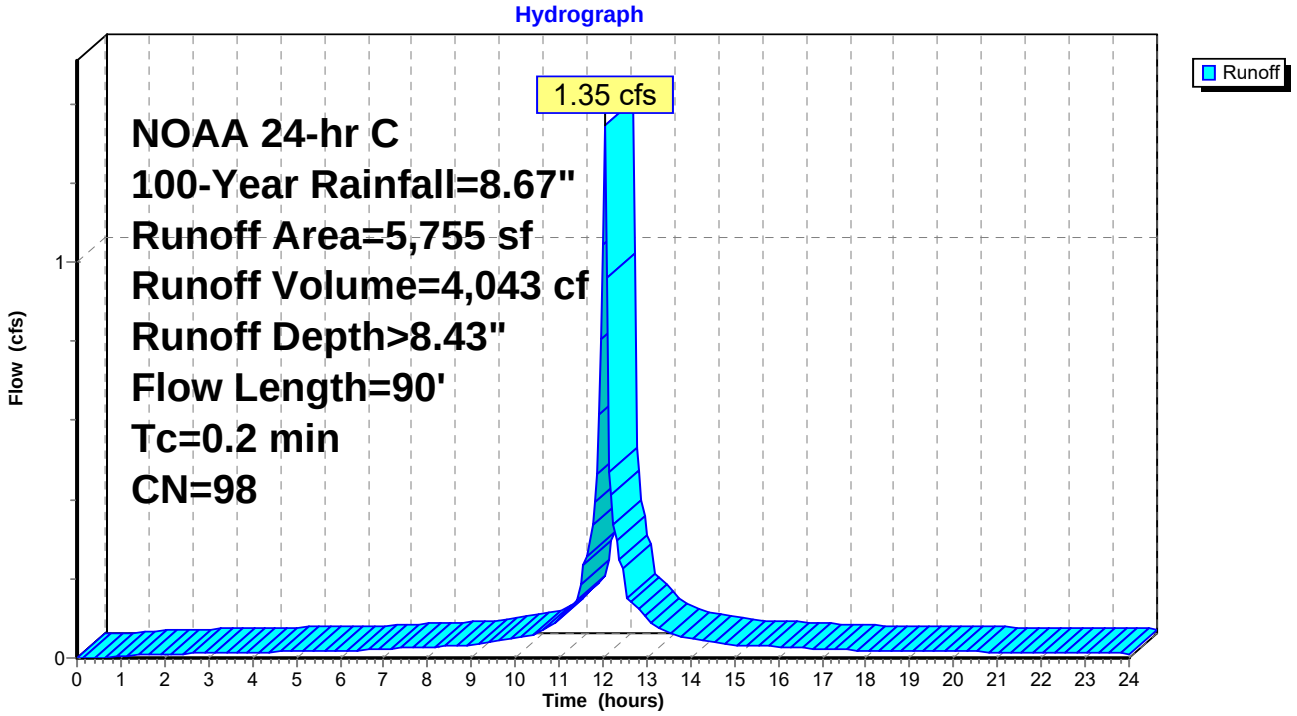
Runoff = 1.35 cfs @ 12.05 hrs, Volume= 4,043 cf, Depth> 8.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction



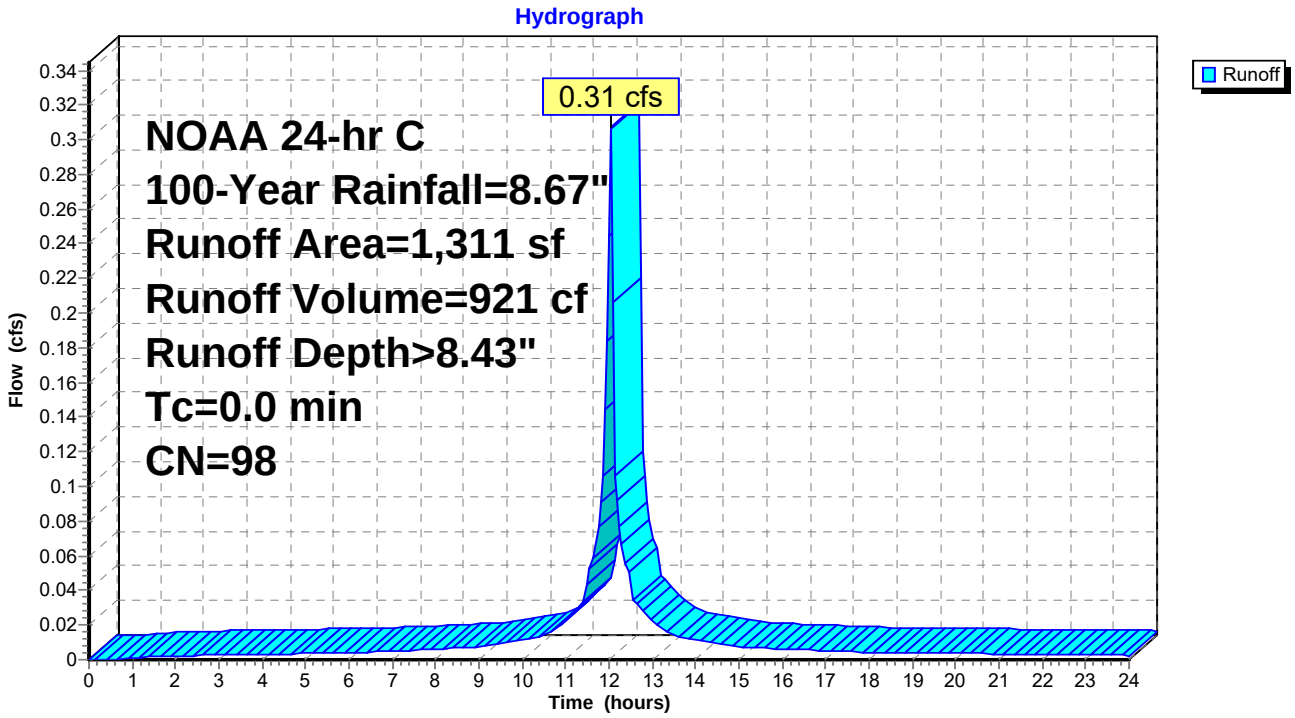
Summary for Subcatchment 3S: Undetained

Runoff = 0.31 cfs @ 12.04 hrs, Volume= 921 cf, Depth> 8.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

	Area (sf)	CN	Description
*	1,311	98	Gravel
	1,311		100.00% Impervious Area

Subcatchment 3S: Undetained



Summary for Subcatchment 5S: Post Construction

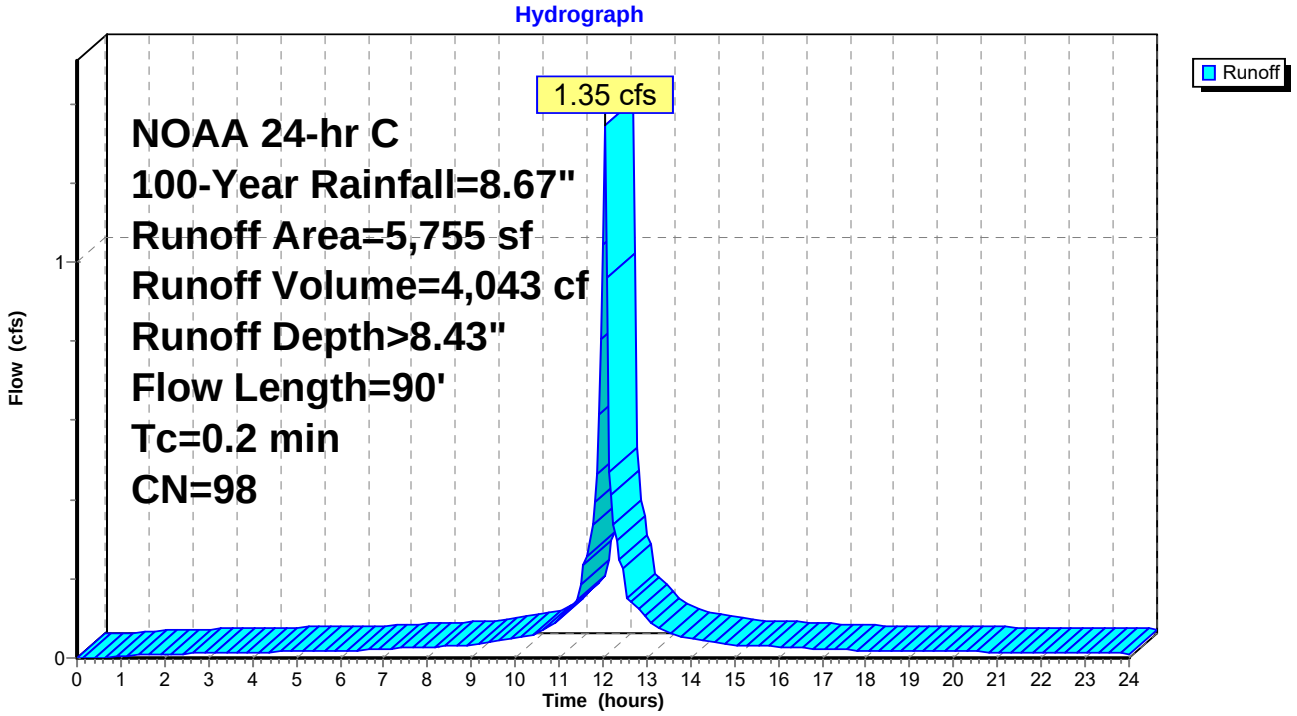
Runoff = 1.35 cfs @ 12.05 hrs, Volume= 4,043 cf, Depth> 8.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

	Area (sf)	CN	Description
*	5,755	98	Gravel roads, HSG D
	5,755		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	90		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction



Summary for Subcatchment 7S: Undetained

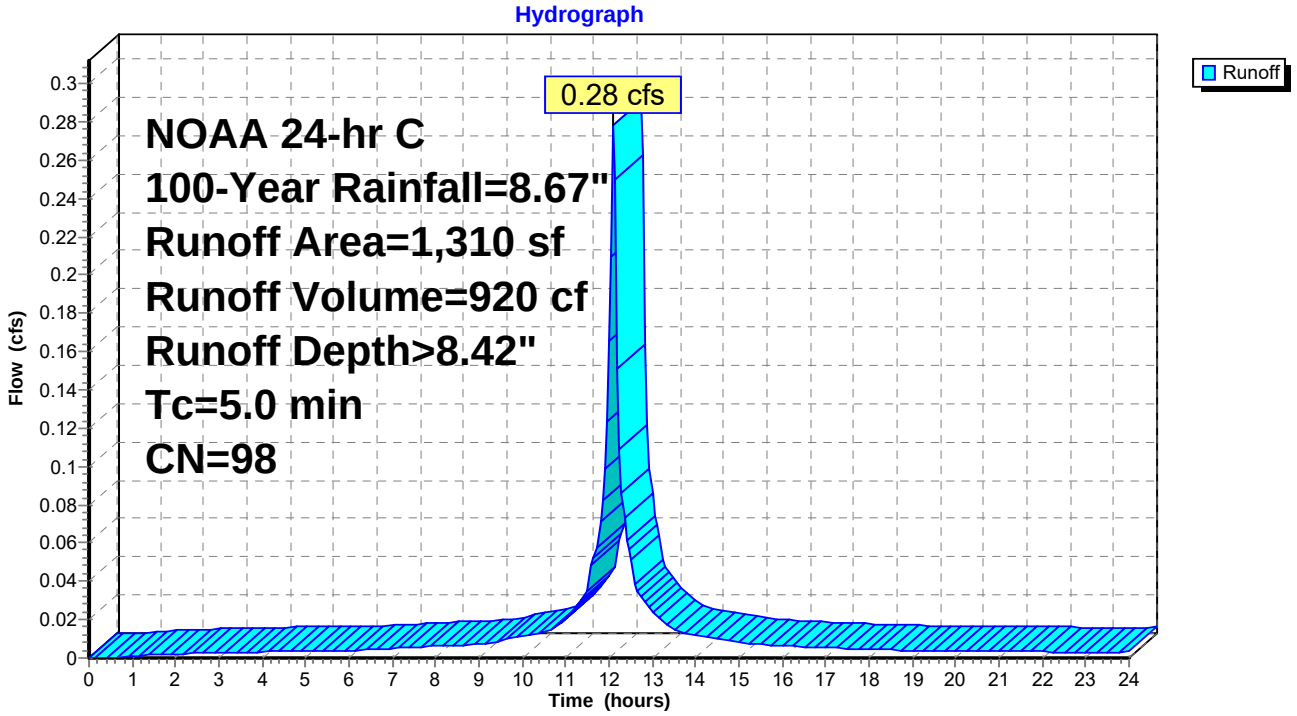
Runoff = 0.28 cfs @ 12.11 hrs, Volume= 920 cf, Depth> 8.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

	Area (sf)	CN	Description
*	1,310	98	Gravel
	1,310		100.00% Impervious Area

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

Subcatchment 7S: Undetained

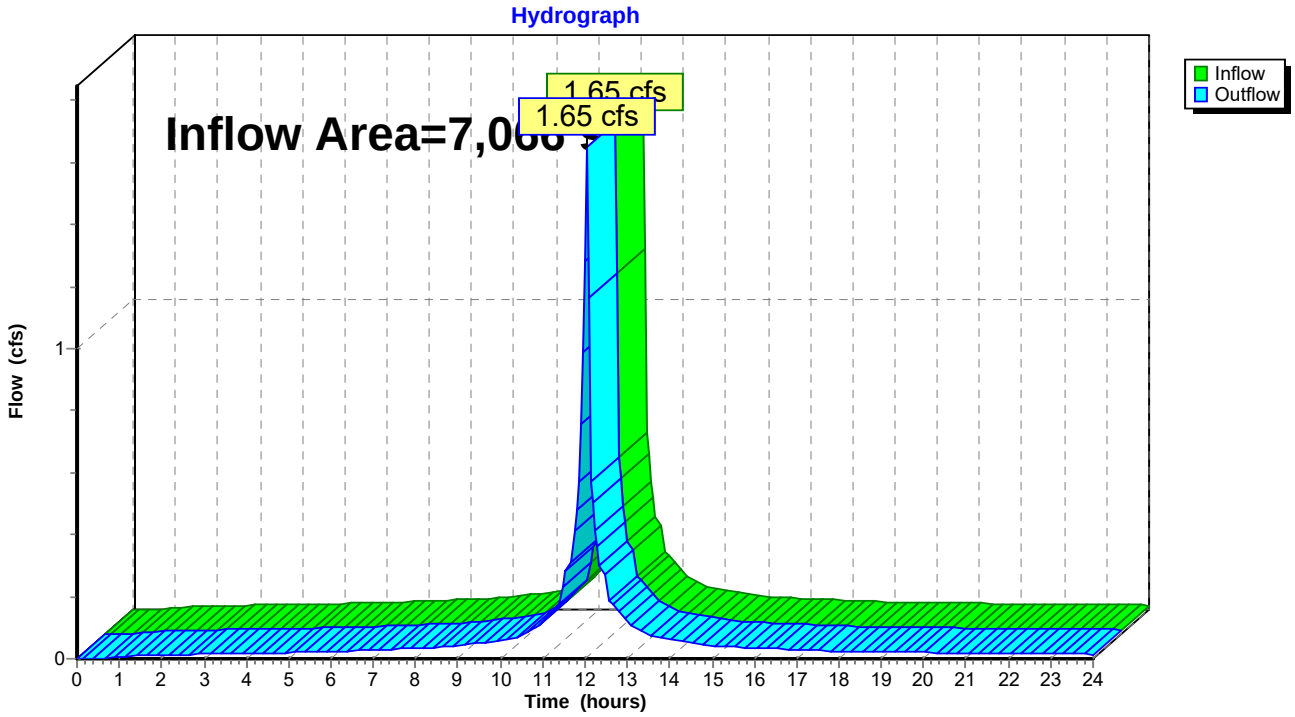


Summary for Reach 4R: Post

Inflow Area = 7,066 sf,100.00% Impervious, Inflow Depth > 8.43" for 100-Year event
Inflow = 1.65 cfs @ 12.05 hrs, Volume= 4,964 cf
Outflow = 1.65 cfs @ 12.05 hrs, Volume= 4,964 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 4R: Post

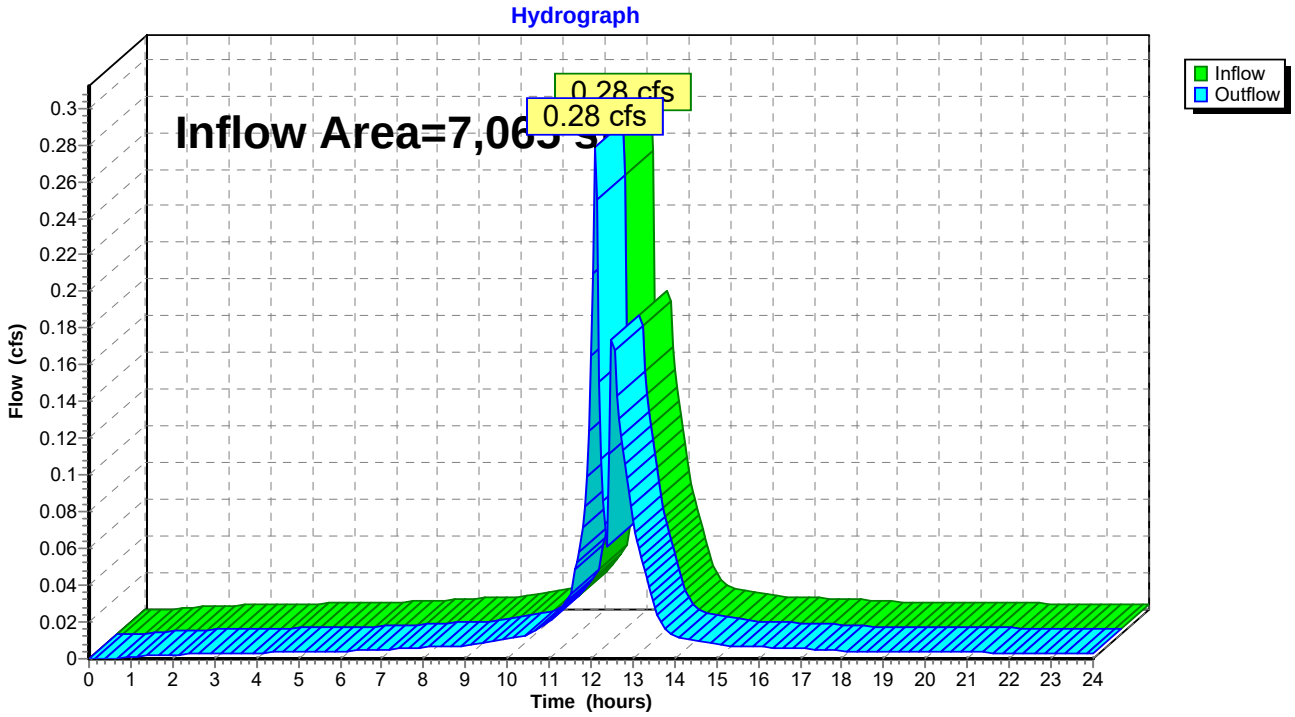


Summary for Reach 8R: Post w BMP

Inflow Area = 7,065 sf,100.00% Impervious, Inflow Depth > 1.97" for 100-Year event
Inflow = 0.28 cfs @ 12.11 hrs, Volume= 1,161 cf
Outflow = 0.28 cfs @ 12.11 hrs, Volume= 1,161 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 8R: Post w BMP



Summary for Pond 6P: Pad

Inflow Area = 5,755 sf,100.00% Impervious, Inflow Depth > 8.43" for 100-Year event
Inflow = 1.35 cfs @ 12.05 hrs, Volume= 4,043 cf
Outflow = 0.18 cfs @ 12.53 hrs, Volume= 2,982 cf, Atten= 87%, Lag= 28.7 min
Discarded = 0.05 cfs @ 12.53 hrs, Volume= 2,740 cf
Primary = 0.12 cfs @ 12.53 hrs, Volume= 241 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,276.77' @ 12.53 hrs Surf.Area= 5,067 sf Storage= 2,135 cf

Plug-Flow detention time= 297.3 min calculated for 2,975 cf (74% of inflow)
Center-of-Mass det. time= 205.4 min (940.8 - 735.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,275.00'	2,613 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 6,533 cf Overall x 40.0% Voids

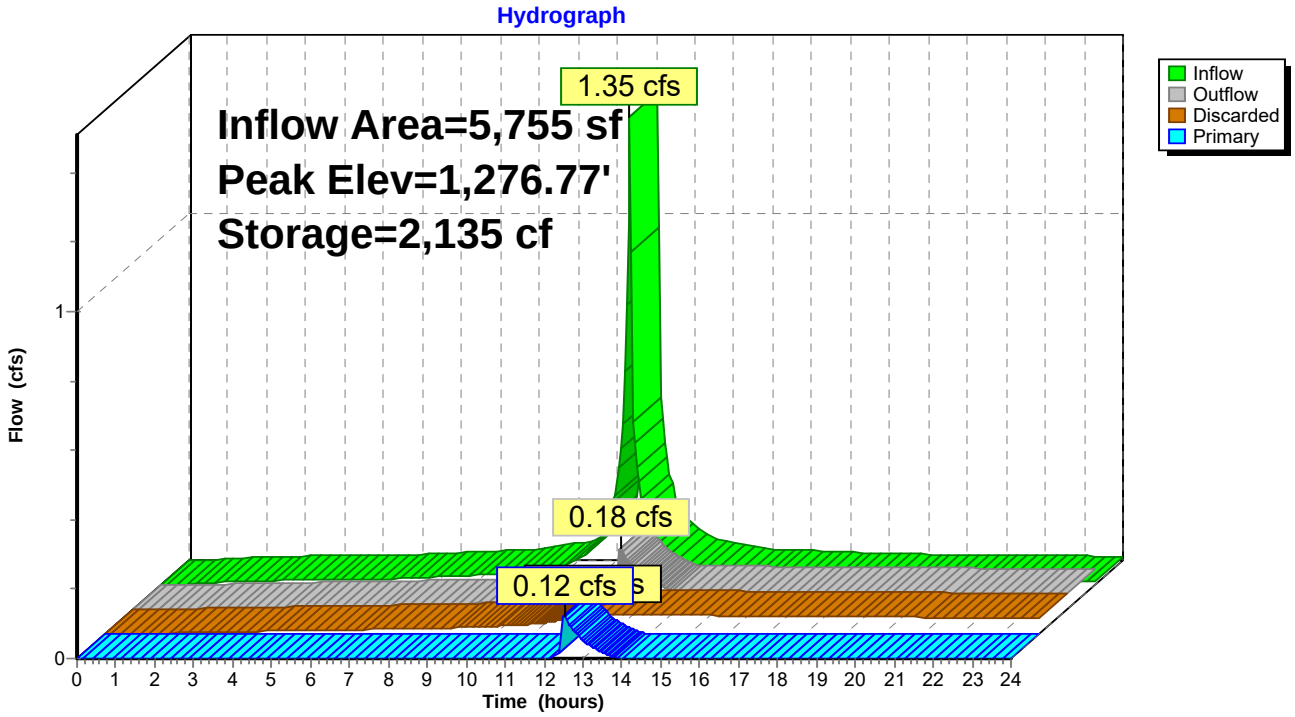
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,275.00	544	0	0
1,275.50	1,945	622	622
1,276.00	3,346	1,323	1,945
1,276.50	4,893	2,060	4,005
1,277.00	5,218	2,528	6,533

Device	Routing	Invert	Outlet Devices
#1	Primary	1,276.75'	**20.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,275.00'	**0.500 in/hr Exfiltration over Surface area from 1,275.00' - 1,276.00'** Conductivity to Groundwater Elevation = 1,273.50' Excluded Surface area = 544 sf

Discarded OutFlow Max=0.05 cfs @ 12.53 hrs HW=1,276.77' (Free Discharge)
↑**2=Exfiltration** (Controls 0.05 cfs)

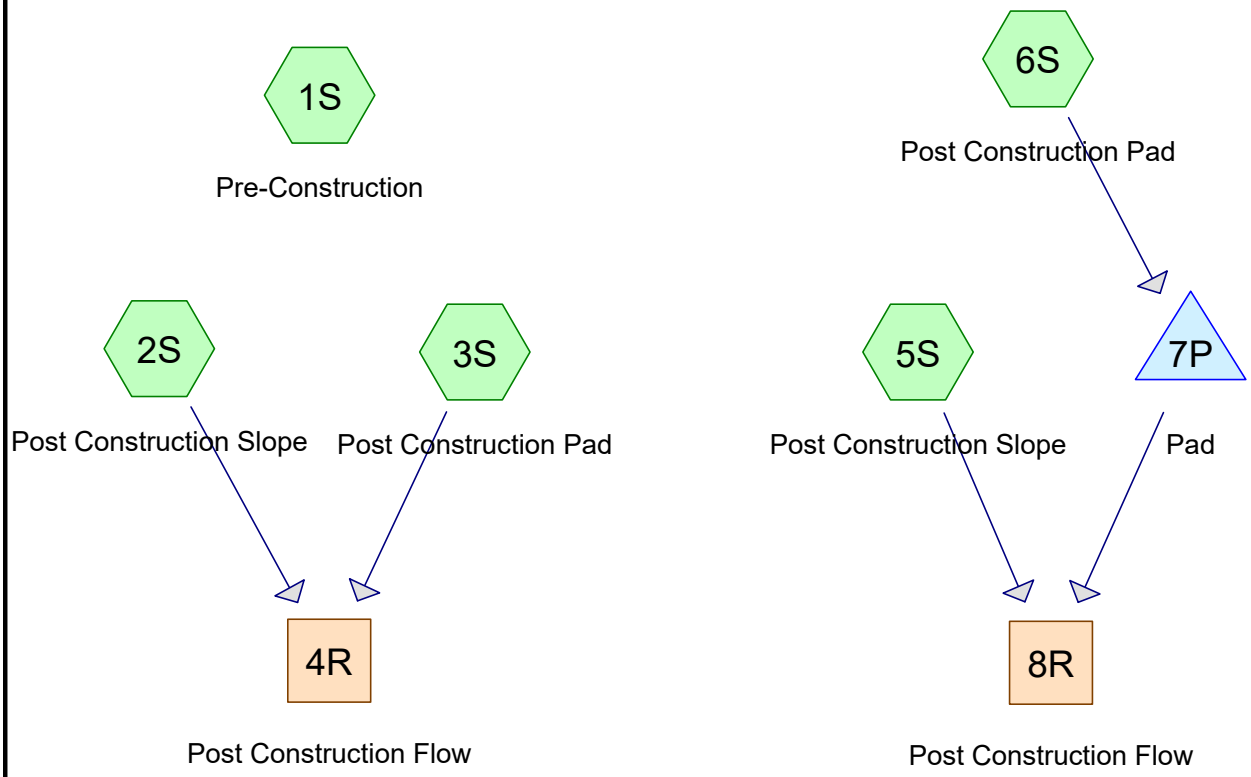
Primary OutFlow Max=0.11 cfs @ 12.53 hrs HW=1,276.77' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.11 cfs @ 0.31 fps)

Pond 6P: Pad


Hydrograph
Inflow Area=5,755 sf
Peak Elev=1,276.77'
Storage=2,135 cf
1.35 cfs
0.18 cfs
0.12 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

ATTACHMENT 4.16

BMP HYDROCAD REPORT – HILDEBRANDT TIE-IN/MLV-515RA40



Subcat Reach Pond Link

Routing Diagram for Post w-bmp_Hildebrant_Rev 2
Prepared by Microsoft, Printed 2/25/2022
HydroCAD® 10.00-26 s/n 09711 © 2020 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C
Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.046	71	Meadow, non-grazed, HSG C (1S, 2S, 5S)
0.282	78	Meadow, non-grazed, HSG D (1S, 2S, 5S)
0.492	98	Paved parking, HSG D (3S, 6S)
0.022	98	Paved roads w/curbs & sewers, HSG C (2S, 5S)
0.030	70	Woods, Good, HSG C (1S)
0.100	77	Woods, Good, HSG D (1S)
0.972	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.098	HSG C	1S, 2S, 5S
0.874	HSG D	1S, 2S, 3S, 5S, 6S
0.000	Other	
0.972		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.046	0.282	0.000	0.328	Meadow, non-grazed	1S, 2S, 5S
0.000	0.000	0.000	0.492	0.000	0.492	Paved parking	3S, 6S
0.000	0.000	0.022	0.000	0.000	0.022	Paved roads w/curbs & sewers	2S, 5S
0.000	0.000	0.030	0.100	0.000	0.130	Woods, Good	1S
0.000	**0.000**	**0.098**	**0.874**	**0.000**	**0.972**	**TOTAL AREA**	

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>0.90"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=0.27 cfs 0.024 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>1.07"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.13 cfs 0.007 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>2.47"
Flow Length=50' Tc=0.1 min CN=98 Runoff=0.83 cfs 0.051 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>1.07"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.13 cfs 0.007 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>2.47"
Flow Length=50' Tc=0.1 min CN=98 Runoff=0.83 cfs 0.051 af

Reach 4R: Post Construction Flow Inflow=0.96 cfs 0.058 af
Outflow=0.96 cfs 0.058 af

Reach 8R: Post Construction Flow Inflow=0.13 cfs 0.007 af
Outflow=0.13 cfs 0.007 af

Pond 7P: Pad Peak Elev=1,279.82' Storage=1,141 cf Inflow=0.83 cfs 0.051 af
Discarded=0.04 cfs 0.035 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.035 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.139 af Average Runoff Depth = 1.72"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

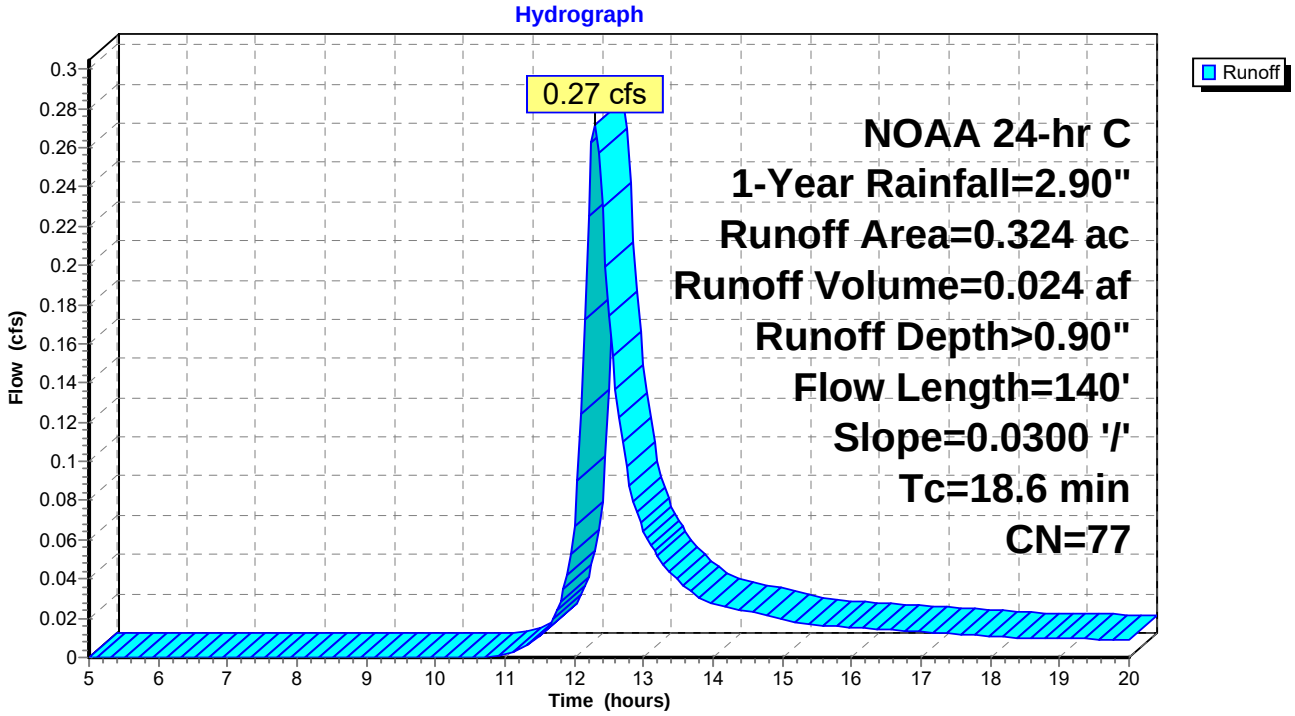
Runoff = 0.27 cfs @ 12.29 hrs, Volume= 0.024 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

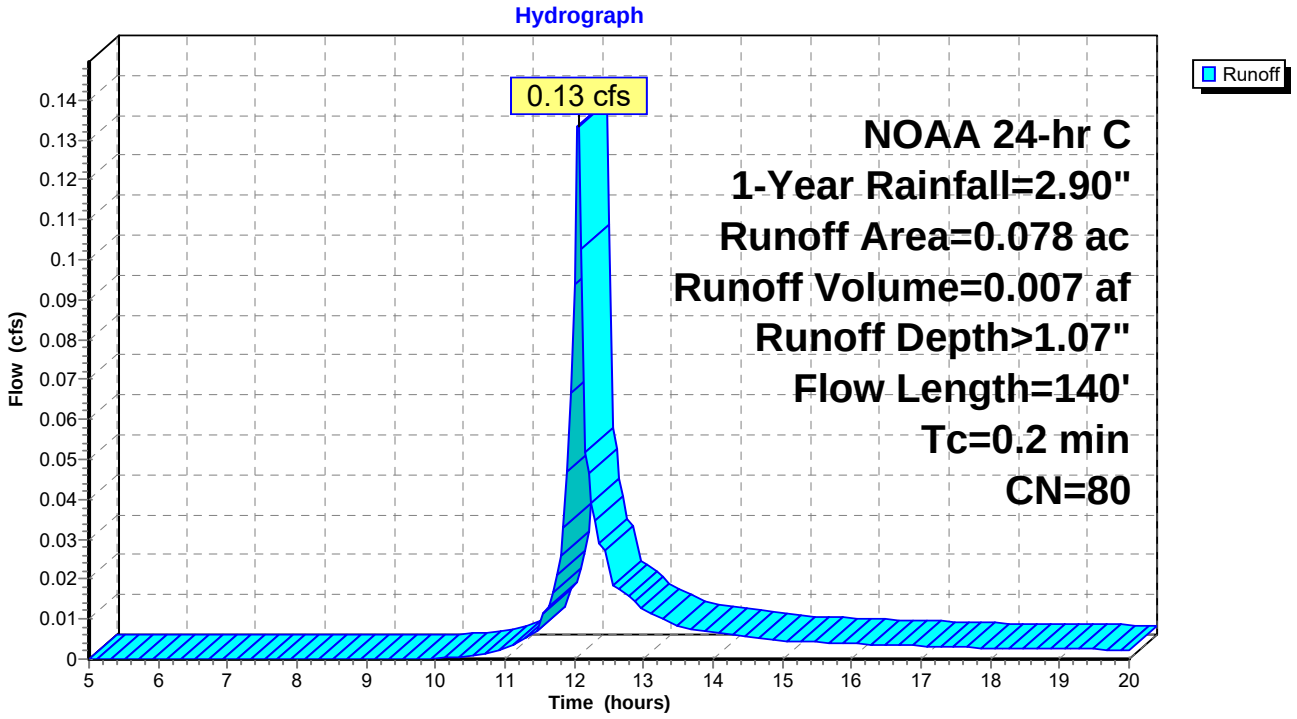
Runoff = 0.13 cfs @ 12.05 hrs, Volume= 0.007 af, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

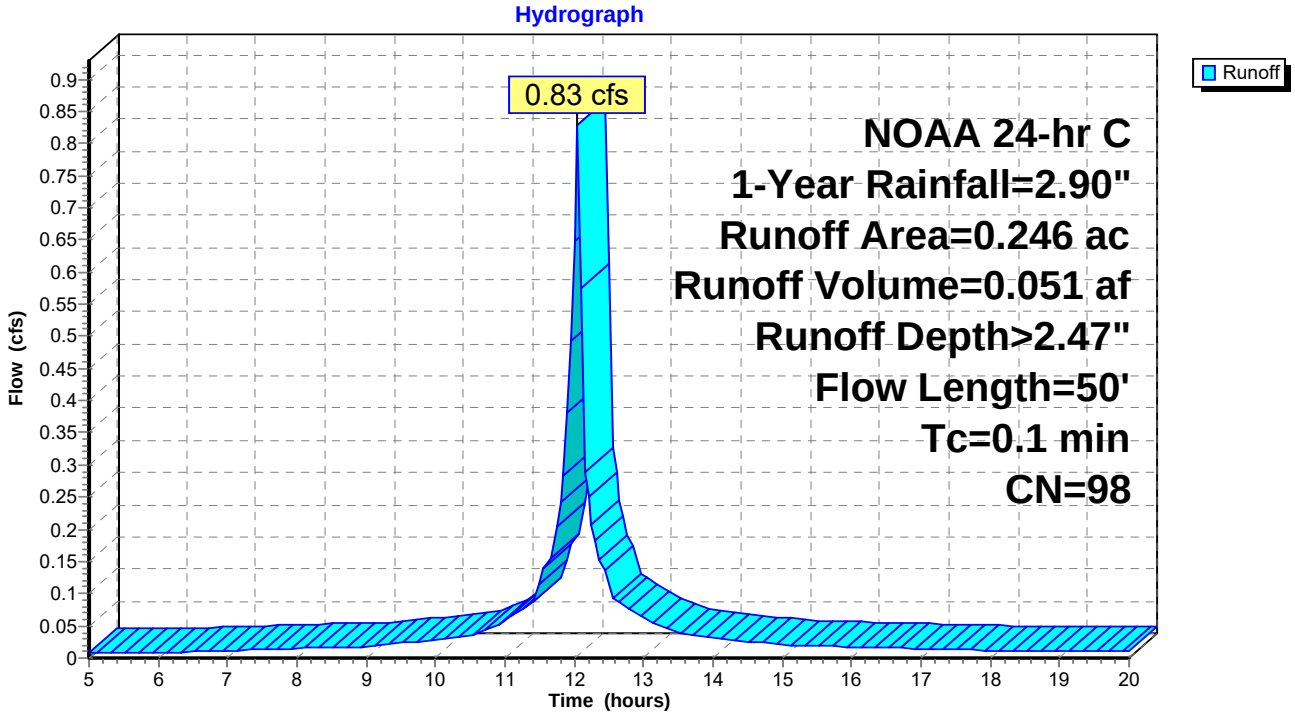
Runoff = 0.83 cfs @ 12.05 hrs, Volume= 0.051 af, Depth> 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

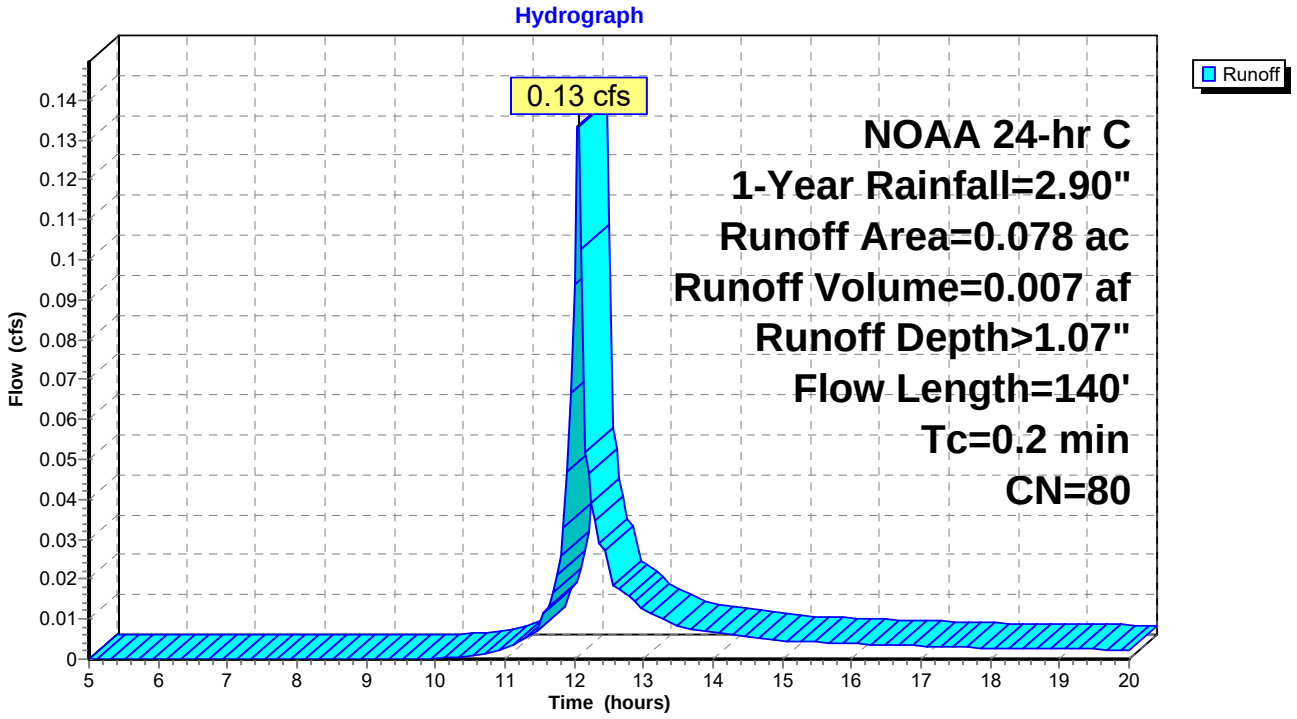
Runoff = 0.13 cfs @ 12.05 hrs, Volume= 0.007 af, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

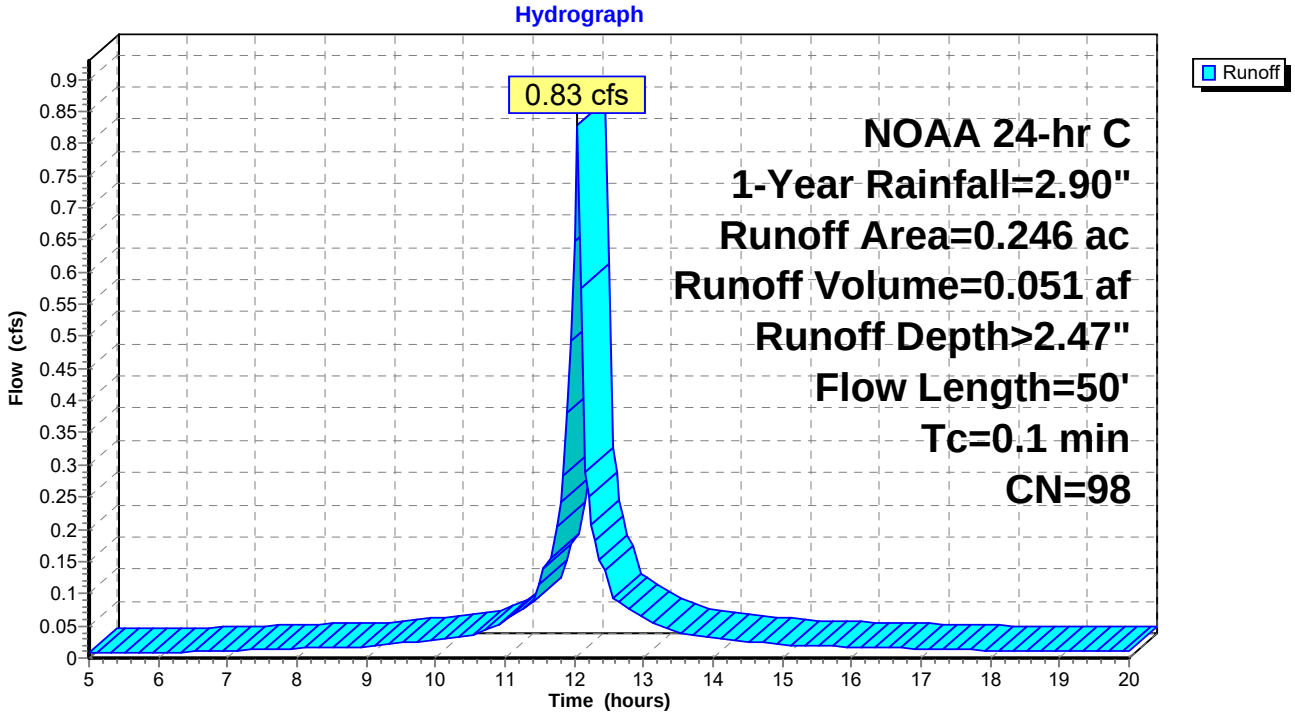
Runoff = 0.83 cfs @ 12.05 hrs, Volume= 0.051 af, Depth> 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



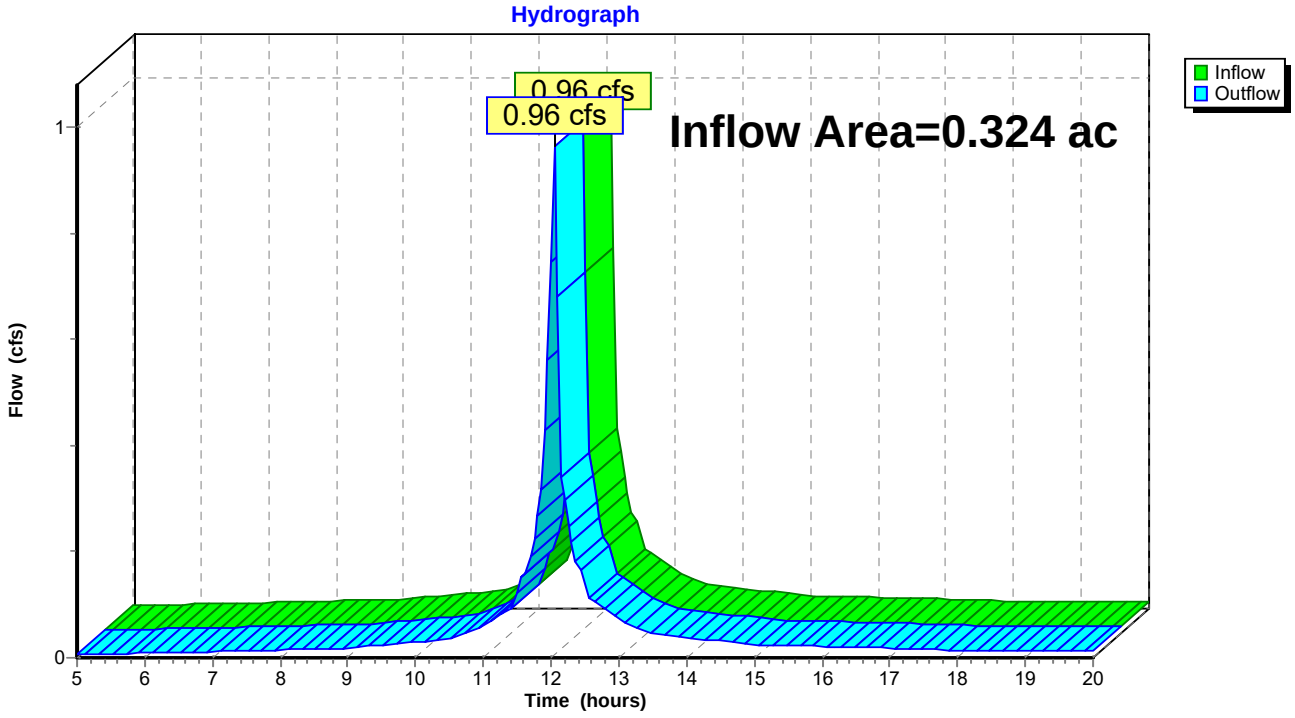
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 2.13" for 1-Year event
Inflow = 0.96 cfs @ 12.05 hrs, Volume= 0.058 af
Outflow = 0.96 cfs @ 12.05 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



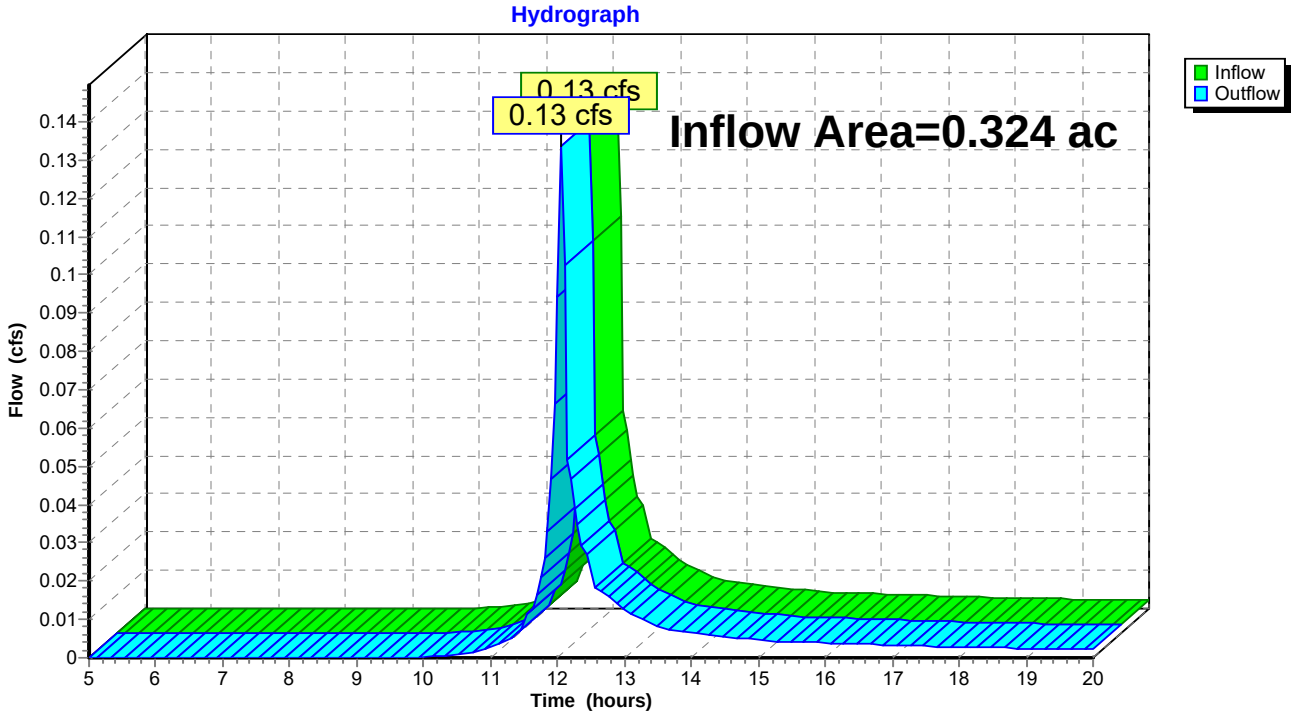
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 0.26" for 1-Year event
Inflow = 0.13 cfs @ 12.05 hrs, Volume= 0.007 af
Outflow = 0.13 cfs @ 12.05 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 2.47" for 1-Year event
Inflow = 0.83 cfs @ 12.05 hrs, Volume= 0.051 af
Outflow = 0.04 cfs @ 13.51 hrs, Volume= 0.035 af, Atten= 95%, Lag= 87.9 min
Discarded = 0.04 cfs @ 13.51 hrs, Volume= 0.035 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,279.82' @ 13.51 hrs Surf.Area= 9,063 sf Storage= 1,141 cf

Plug-Flow detention time= 175.9 min calculated for 0.035 af (69% of inflow)
Center-of-Mass det. time= 108.7 min (843.8 - 735.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

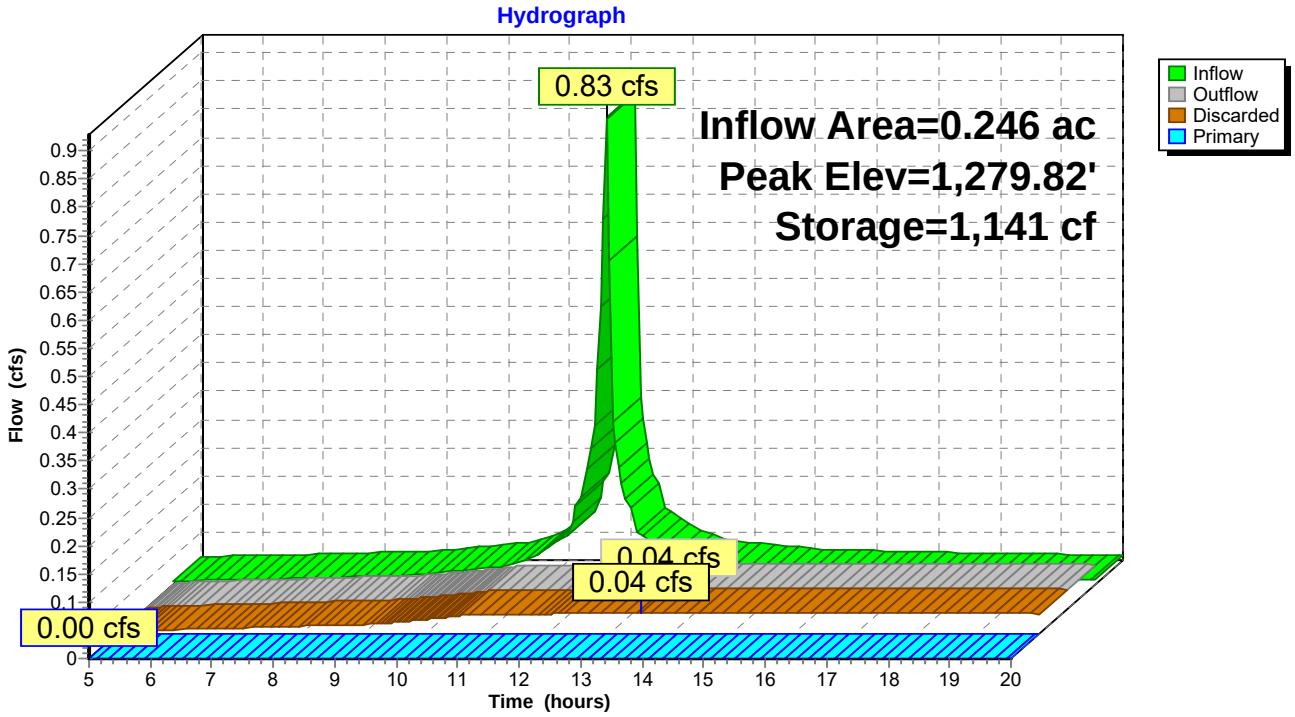
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.04 cfs @ 13.51 hrs HW=1,279.82' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,279.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Pad


Hydrograph
0.83 cfs
Inflow Area=0.246 ac
Peak Elev=1,279.82'
Storage=1,141 cf
0.04 cfs
0.04 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
5
6
7
8
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10
11
12
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14
15
16
17
18
19
20

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>1.23"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=0.38 cfs 0.033 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>1.43"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.18 cfs 0.009 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>2.92"
Flow Length=50' Tc=0.1 min CN=98 Runoff=0.98 cfs 0.060 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>1.43"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.18 cfs 0.009 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>2.92"
Flow Length=50' Tc=0.1 min CN=98 Runoff=0.98 cfs 0.060 af

Reach 4R: Post Construction Flow Inflow=1.15 cfs 0.069 af
Outflow=1.15 cfs 0.069 af

Reach 8R: Post Construction Flow Inflow=0.18 cfs 0.009 af
Outflow=0.18 cfs 0.009 af

Pond 7P: Pad Peak Elev=1,279.89' Storage=1,412 cf Inflow=0.98 cfs 0.060 af
Discarded=0.04 cfs 0.037 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.037 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.171 af Average Runoff Depth = 2.12"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

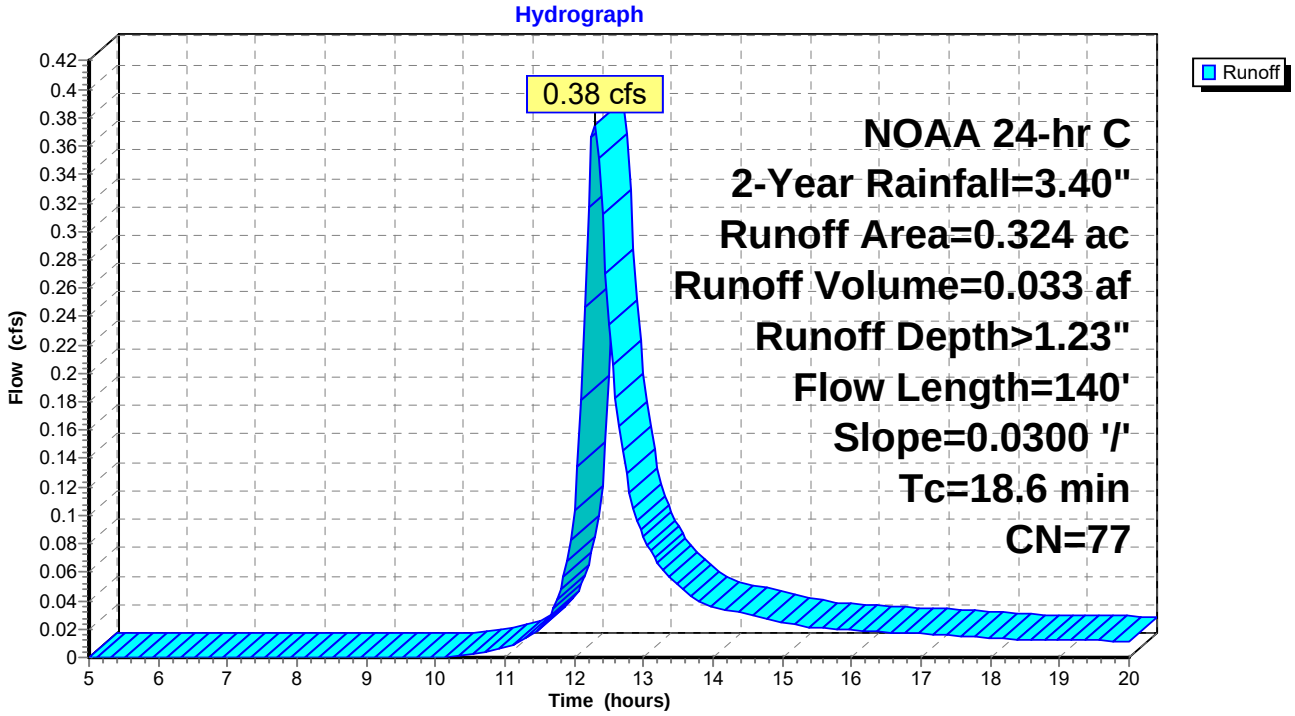
Runoff = 0.38 cfs @ 12.29 hrs, Volume= 0.033 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

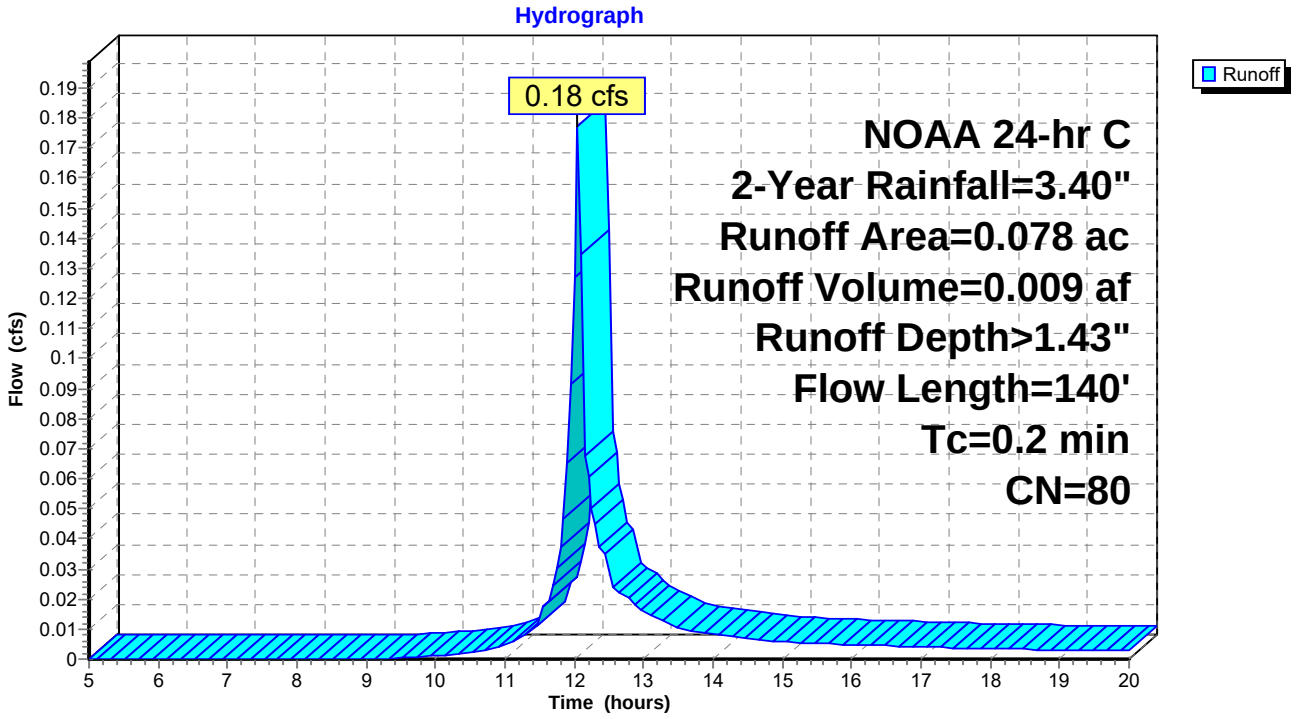
Runoff = 0.18 cfs @ 12.05 hrs, Volume= 0.009 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

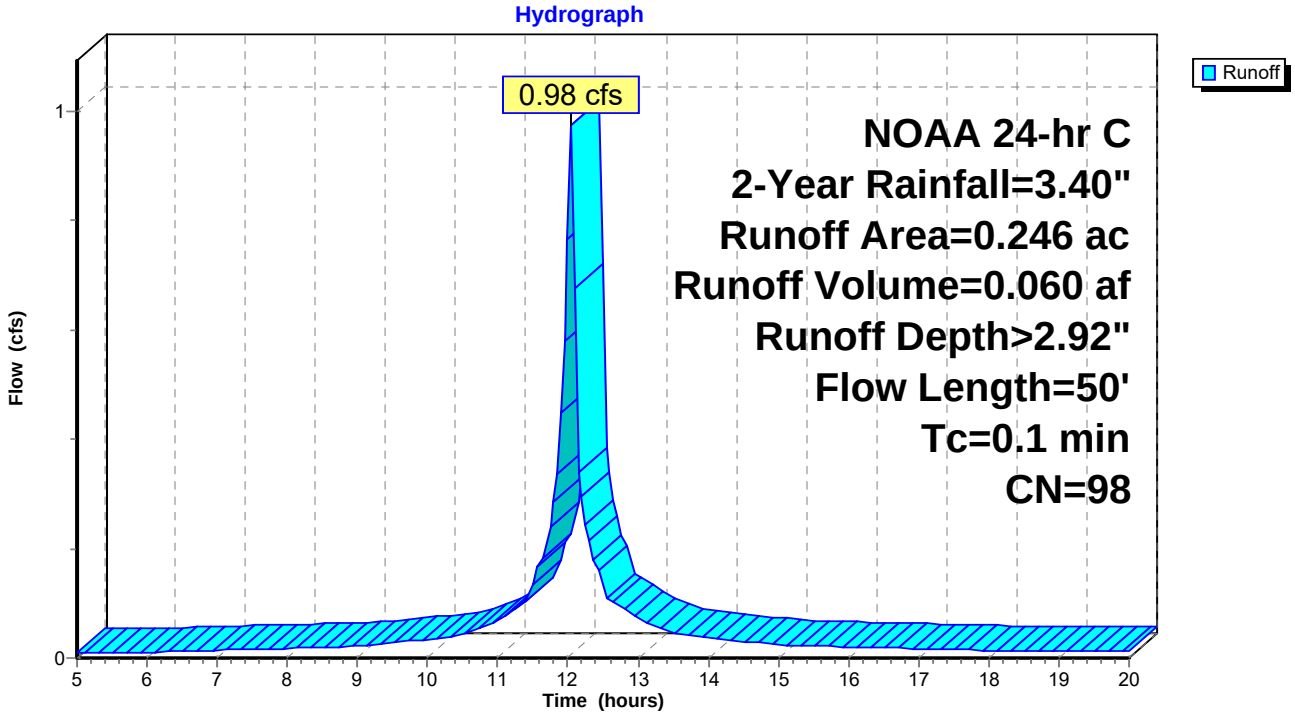
Runoff = 0.98 cfs @ 12.05 hrs, Volume= 0.060 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

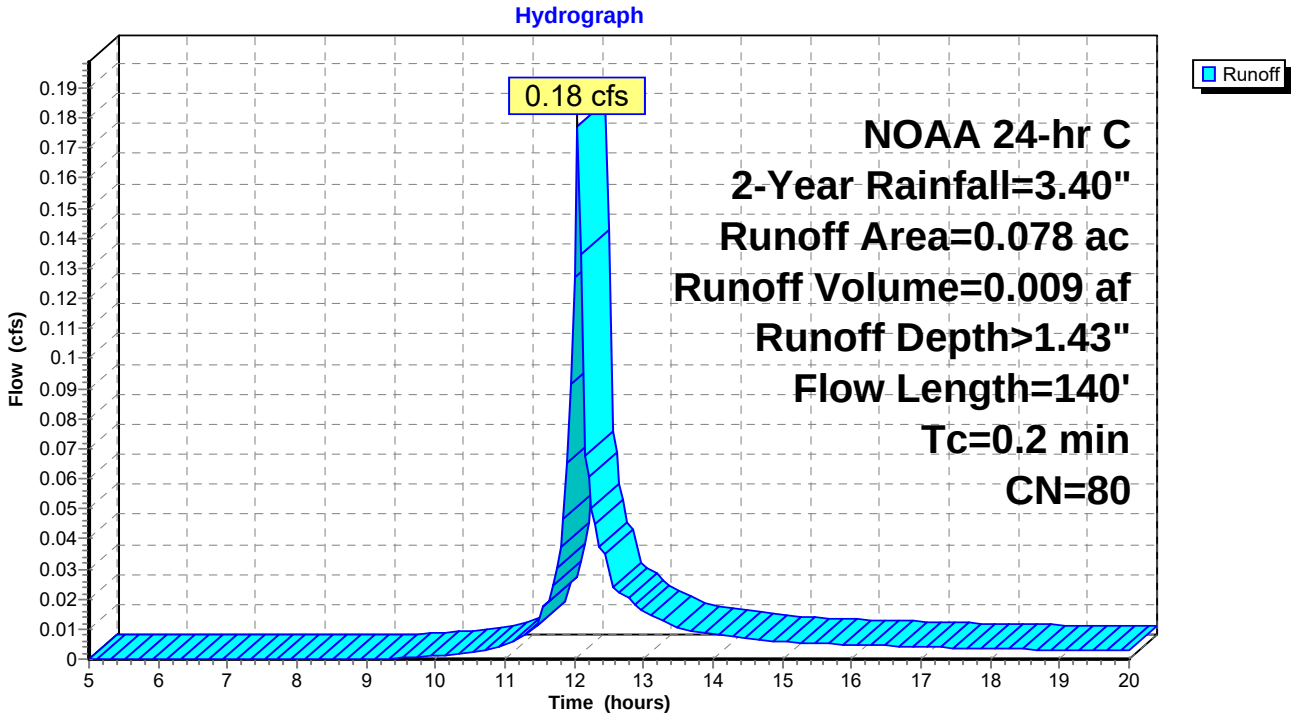
Runoff = 0.18 cfs @ 12.05 hrs, Volume= 0.009 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

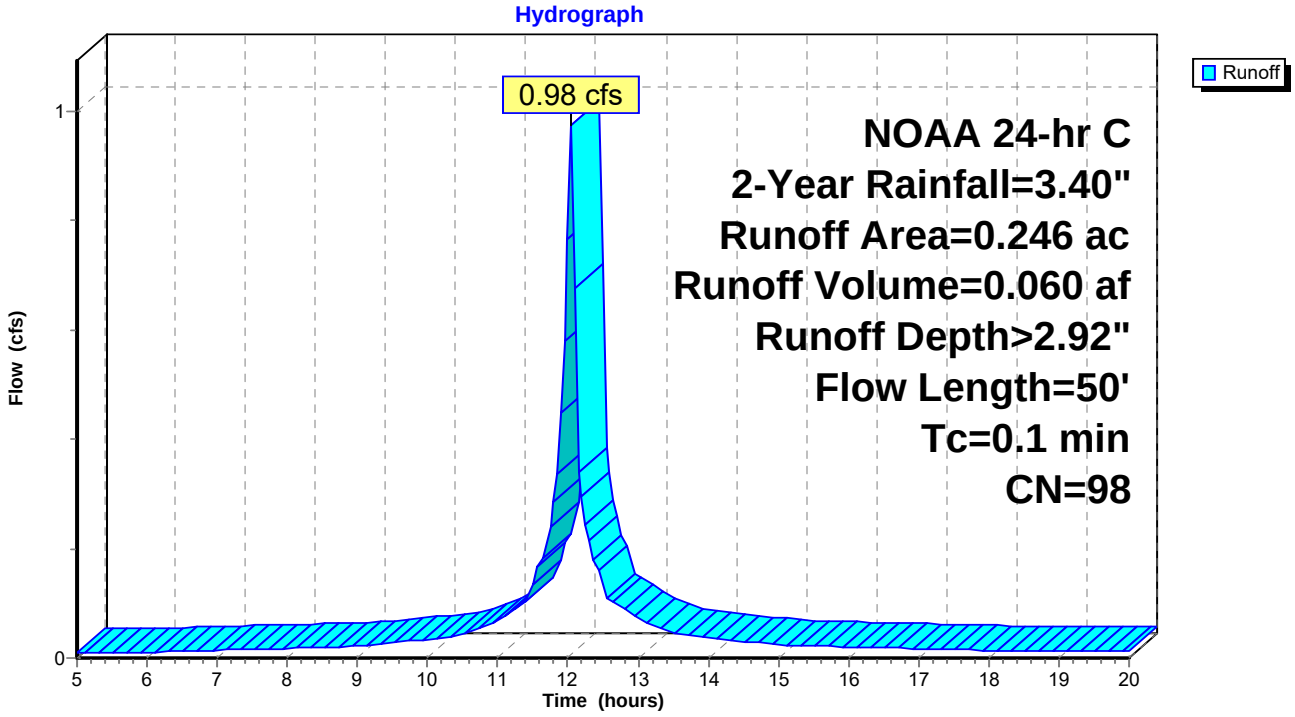
Runoff = 0.98 cfs @ 12.05 hrs, Volume= 0.060 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



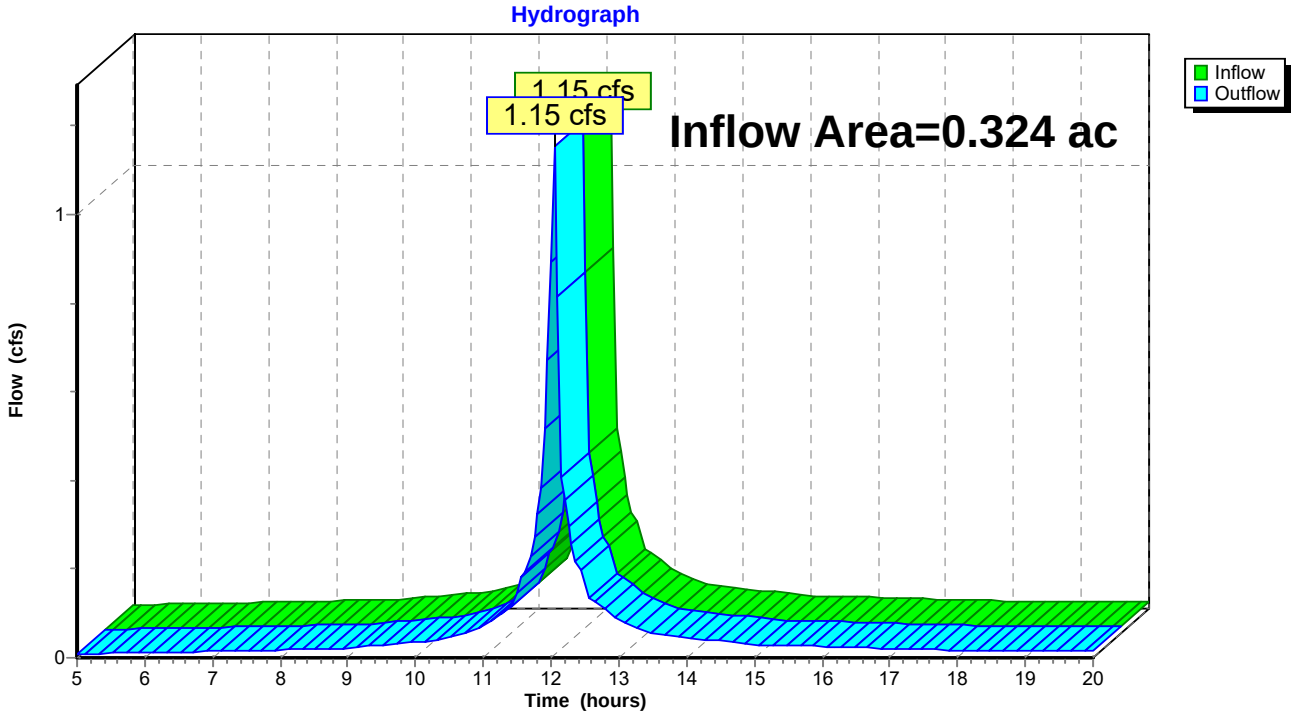
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 2.56" for 2-Year event
Inflow = 1.15 cfs @ 12.05 hrs, Volume= 0.069 af
Outflow = 1.15 cfs @ 12.05 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



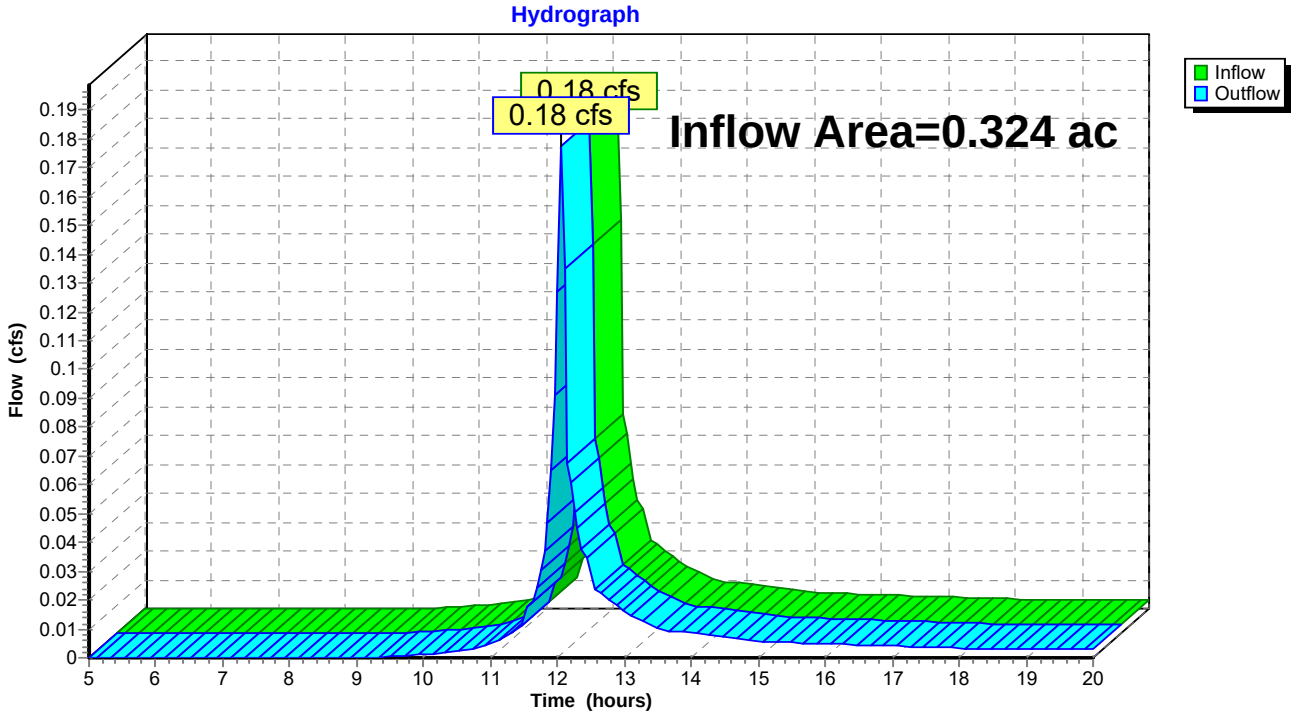
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 0.34" for 2-Year event
Inflow = 0.18 cfs @ 12.05 hrs, Volume= 0.009 af
Outflow = 0.18 cfs @ 12.05 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 2.92" for 2-Year event
Inflow = 0.98 cfs @ 12.05 hrs, Volume= 0.060 af
Outflow = 0.04 cfs @ 13.82 hrs, Volume= 0.037 af, Atten= 96%, Lag= 106.6 min
Discarded = 0.04 cfs @ 13.82 hrs, Volume= 0.037 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,279.89' @ 13.82 hrs Surf.Area= 9,130 sf Storage= 1,412 cf

Plug-Flow detention time= 175.0 min calculated for 0.037 af (62% of inflow)
Center-of-Mass det. time= 100.6 min (834.3 - 733.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

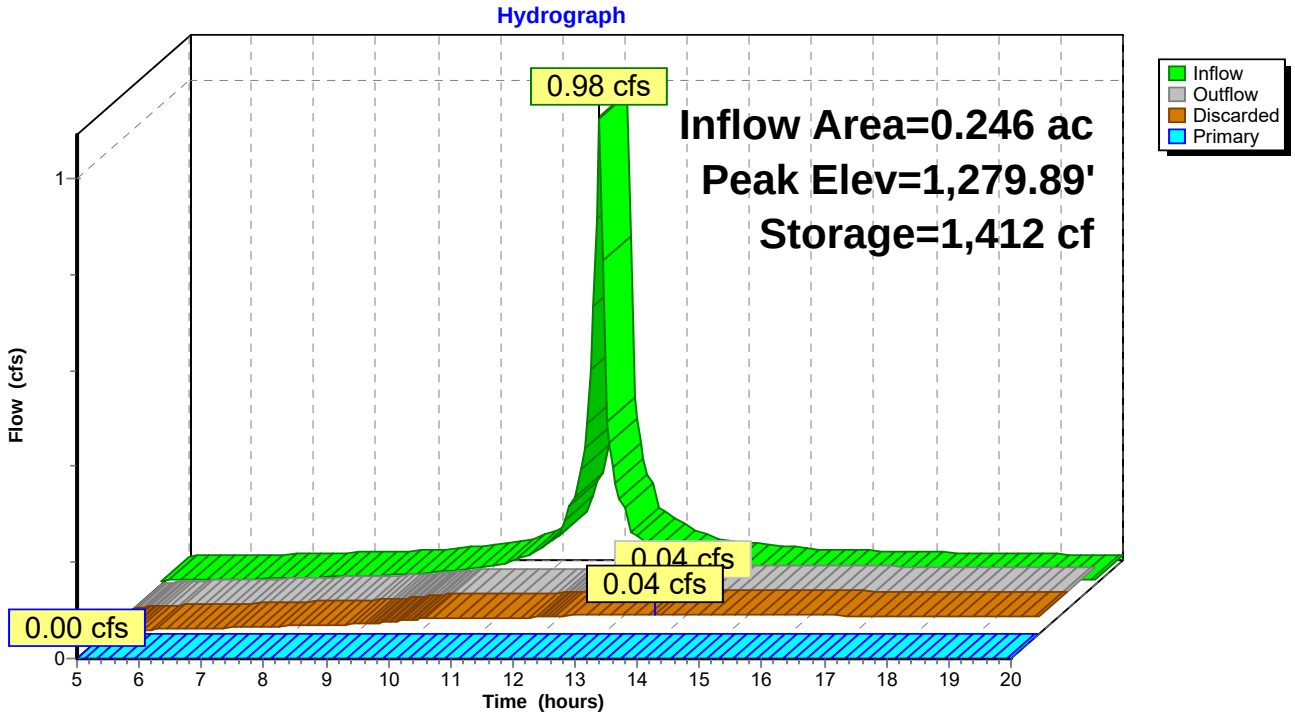
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.04 cfs @ 13.82 hrs HW=1,279.89' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,279.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Pad


Hydrograph
0.98 cfs
Inflow Area=0.246 ac
Peak Elev=1,279.89'
Storage=1,412 cf
0.04 cfs
0.04 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>2.40"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=0.74 cfs 0.065 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>2.68"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.33 cfs 0.017 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>4.36"
Flow Length=50' Tc=0.1 min CN=98 Runoff=1.44 cfs 0.089 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>2.68"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.33 cfs 0.017 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>4.36"
Flow Length=50' Tc=0.1 min CN=98 Runoff=1.44 cfs 0.089 af

Reach 4R: Post Construction Flow Inflow=1.77 cfs 0.107 af
Outflow=1.77 cfs 0.107 af

Reach 8R: Post Construction Flow Inflow=0.33 cfs 0.017 af
Outflow=0.33 cfs 0.017 af

Pond 7P: Pad Peak Elev=1,280.15' Storage=2,346 cf Inflow=1.44 cfs 0.089 af
Discarded=0.04 cfs 0.043 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.043 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.279 af Average Runoff Depth = 3.44"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

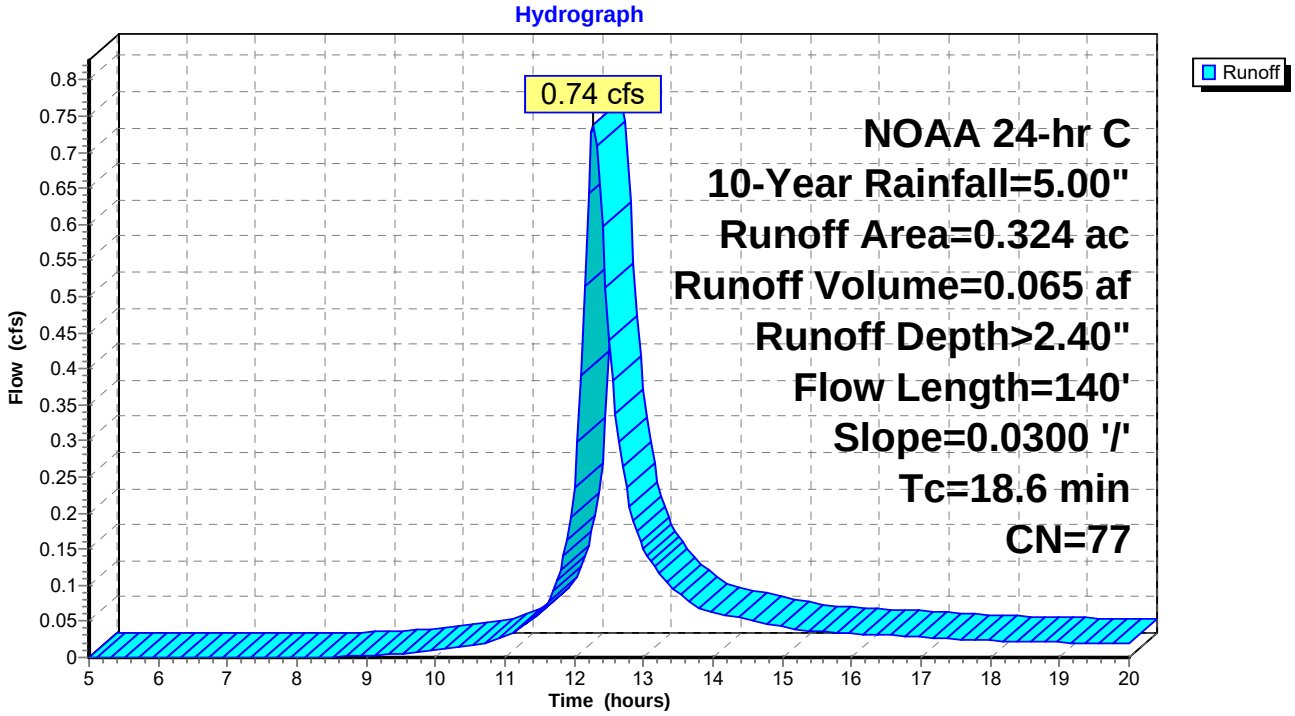
Runoff = 0.74 cfs @ 12.28 hrs, Volume= 0.065 af, Depth> 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

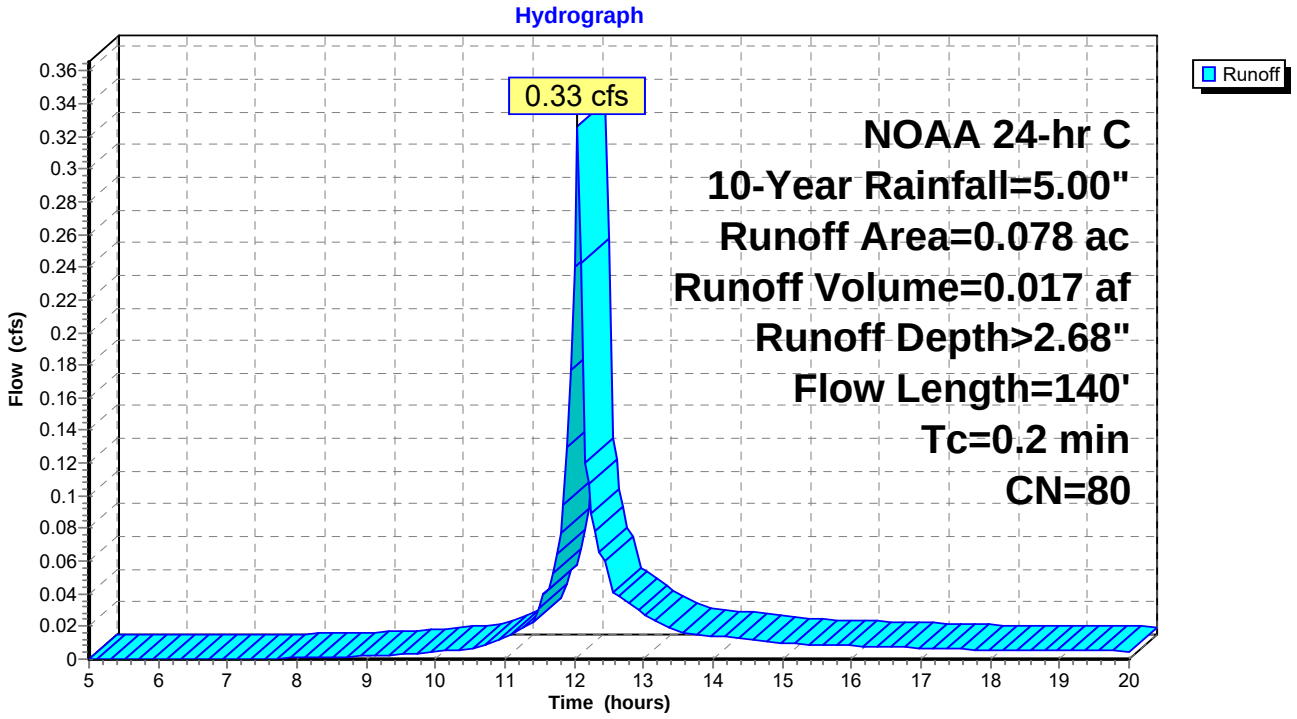
Runoff = 0.33 cfs @ 12.05 hrs, Volume= 0.017 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

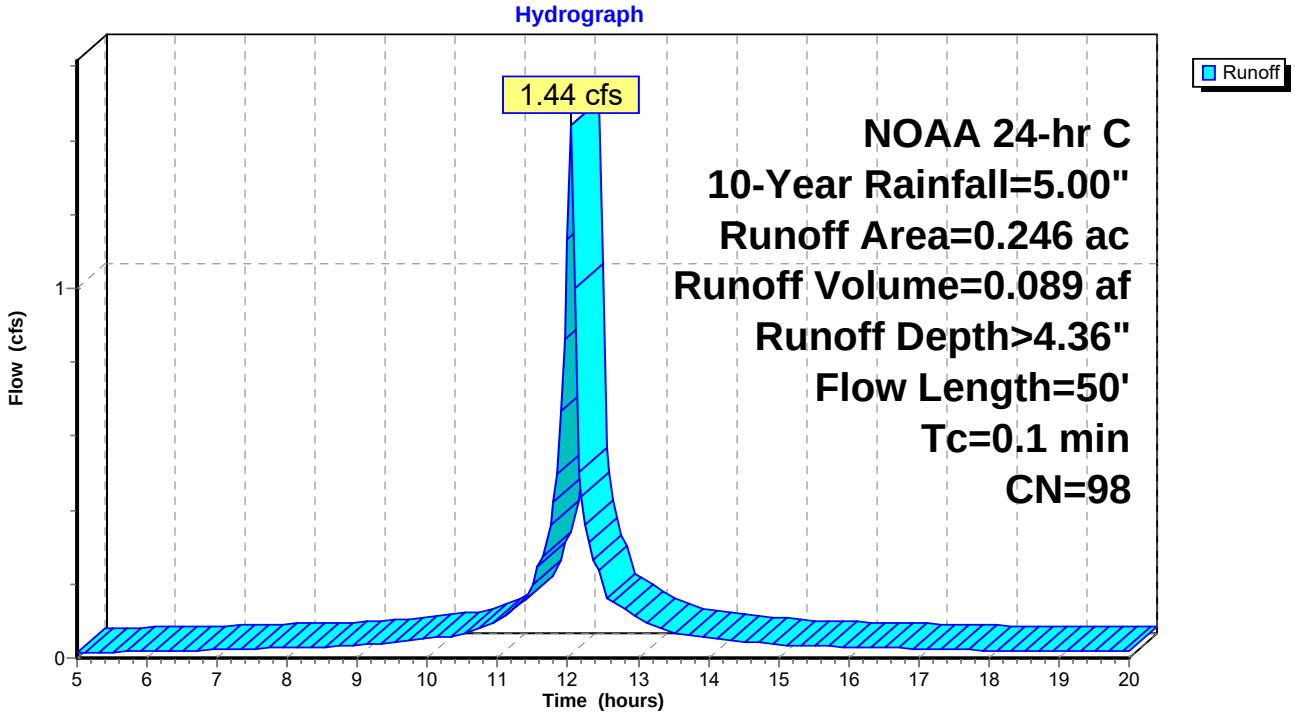
Runoff = 1.44 cfs @ 12.05 hrs, Volume= 0.089 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

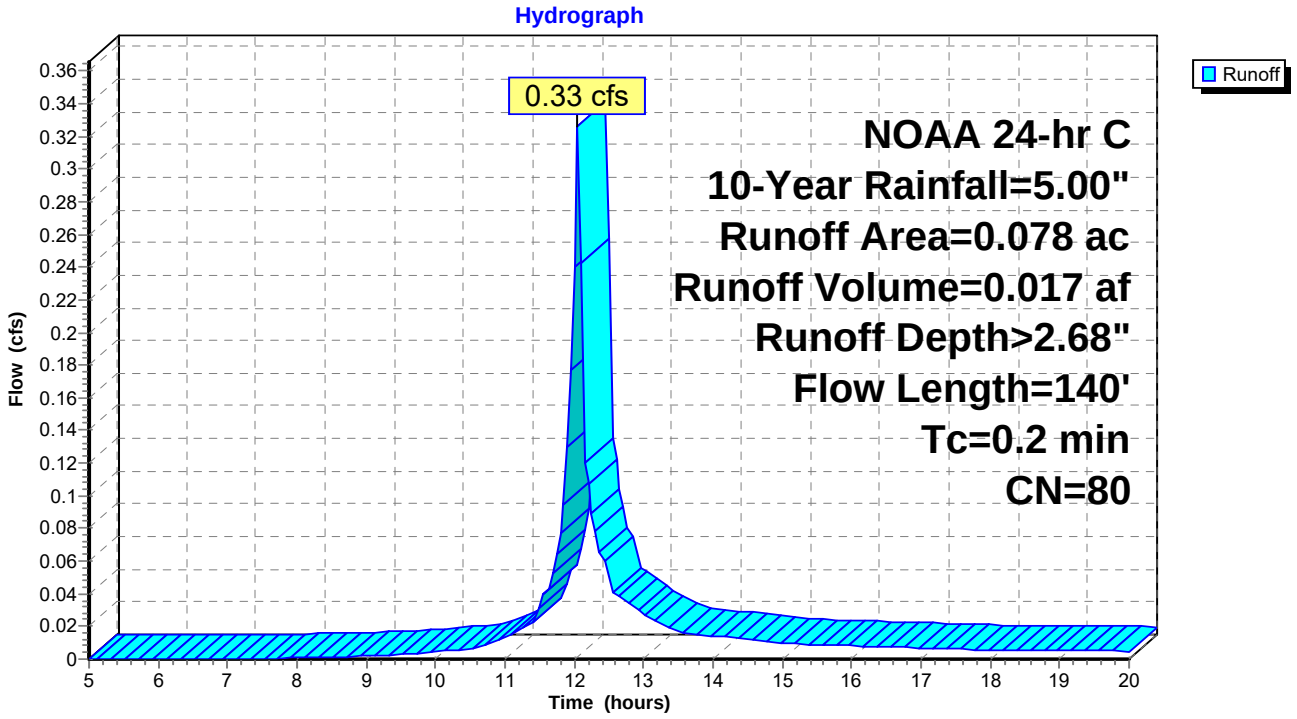
Runoff = 0.33 cfs @ 12.05 hrs, Volume= 0.017 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

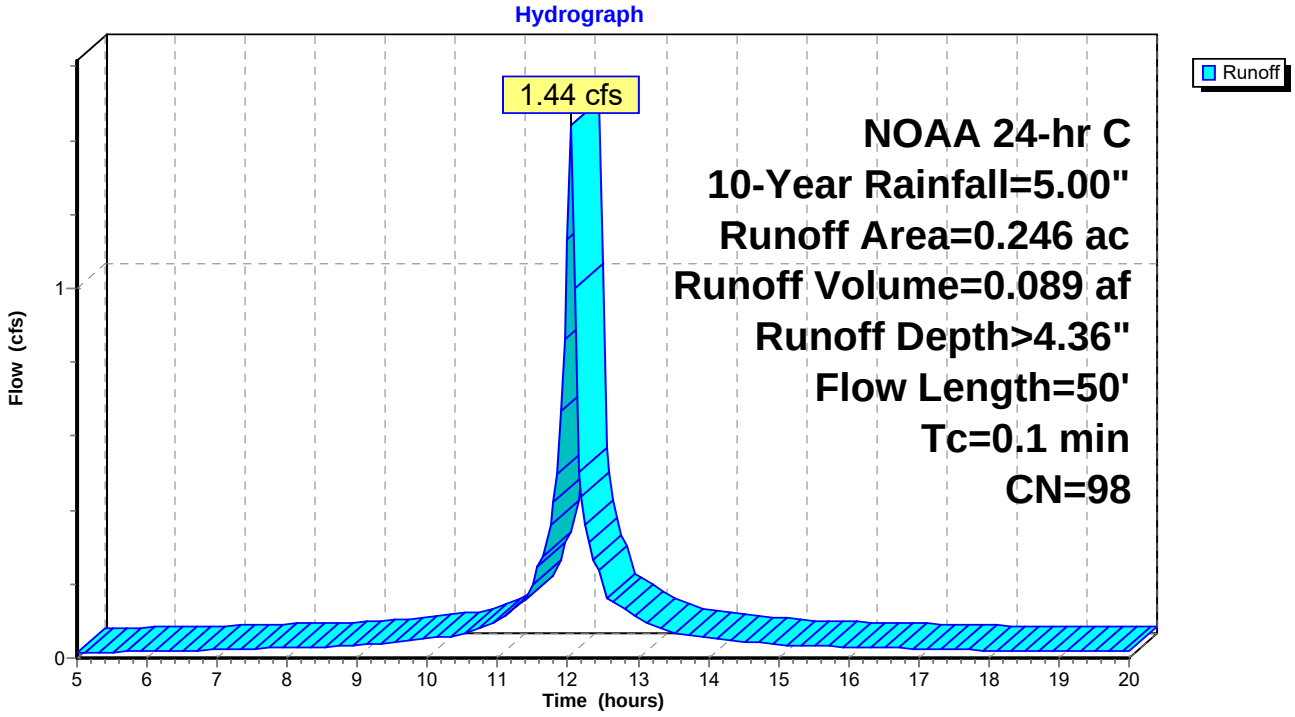
Runoff = 1.44 cfs @ 12.05 hrs, Volume= 0.089 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



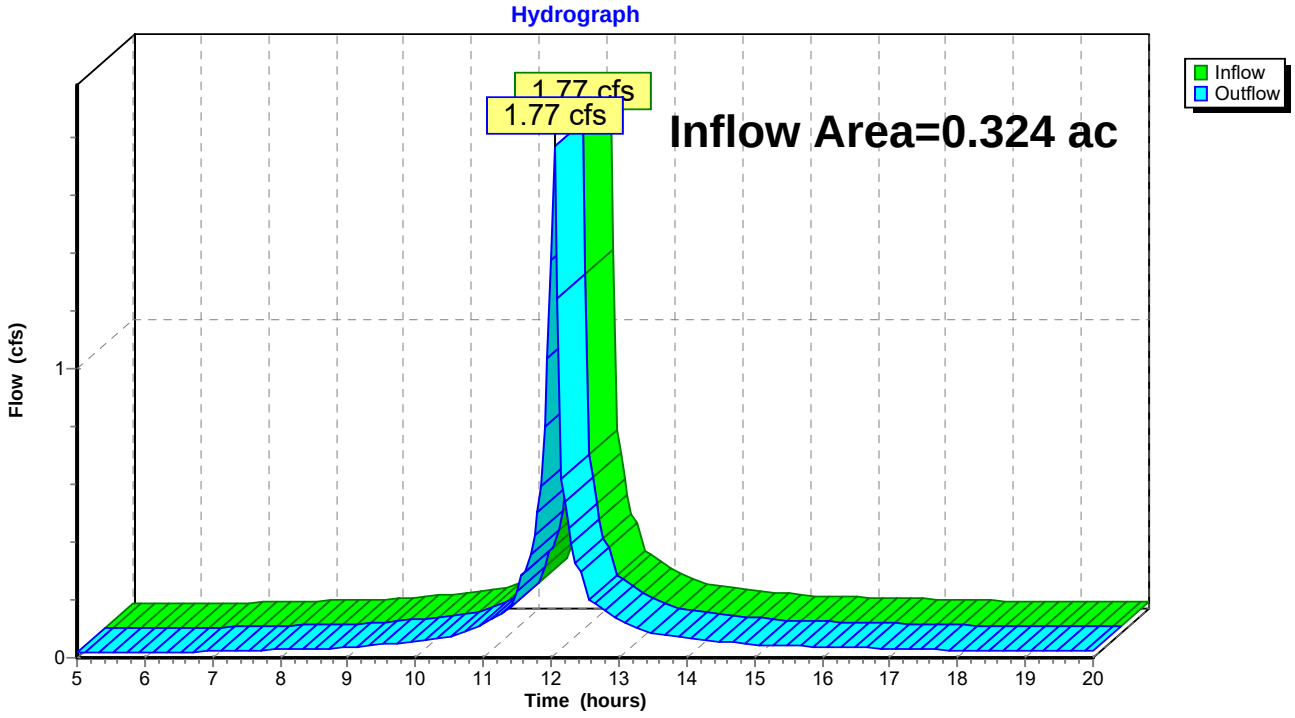
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 3.96" for 10-Year event
Inflow = 1.77 cfs @ 12.05 hrs, Volume= 0.107 af
Outflow = 1.77 cfs @ 12.05 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



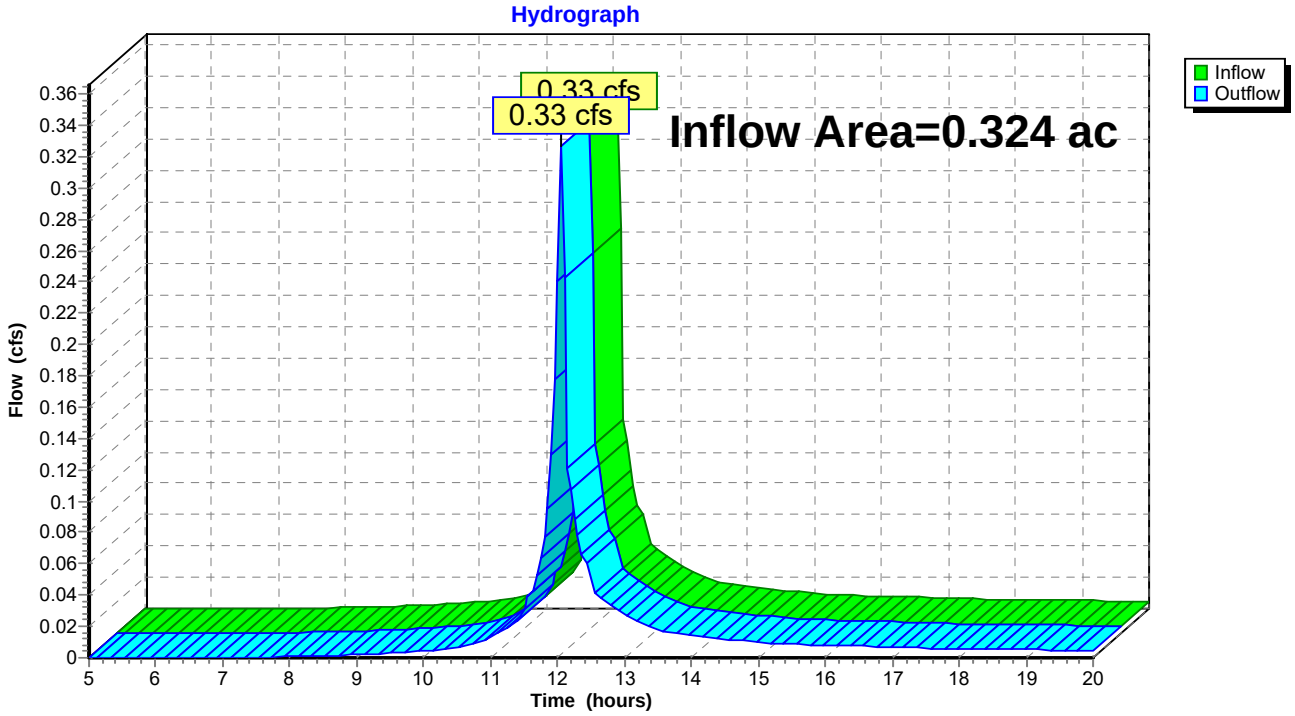
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 0.65" for 10-Year event
Inflow = 0.33 cfs @ 12.05 hrs, Volume= 0.017 af
Outflow = 0.33 cfs @ 12.05 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 4.36" for 10-Year event
Inflow = 1.44 cfs @ 12.05 hrs, Volume= 0.089 af
Outflow = 0.04 cfs @ 14.59 hrs, Volume= 0.043 af, Atten= 97%, Lag= 152.6 min
Discarded = 0.04 cfs @ 14.59 hrs, Volume= 0.043 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,280.15' @ 14.59 hrs Surf.Area= 9,333 sf Storage= 2,346 cf

Plug-Flow detention time= 179.8 min calculated for 0.043 af (49% of inflow)
Center-of-Mass det. time= 84.4 min (815.4 - 731.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

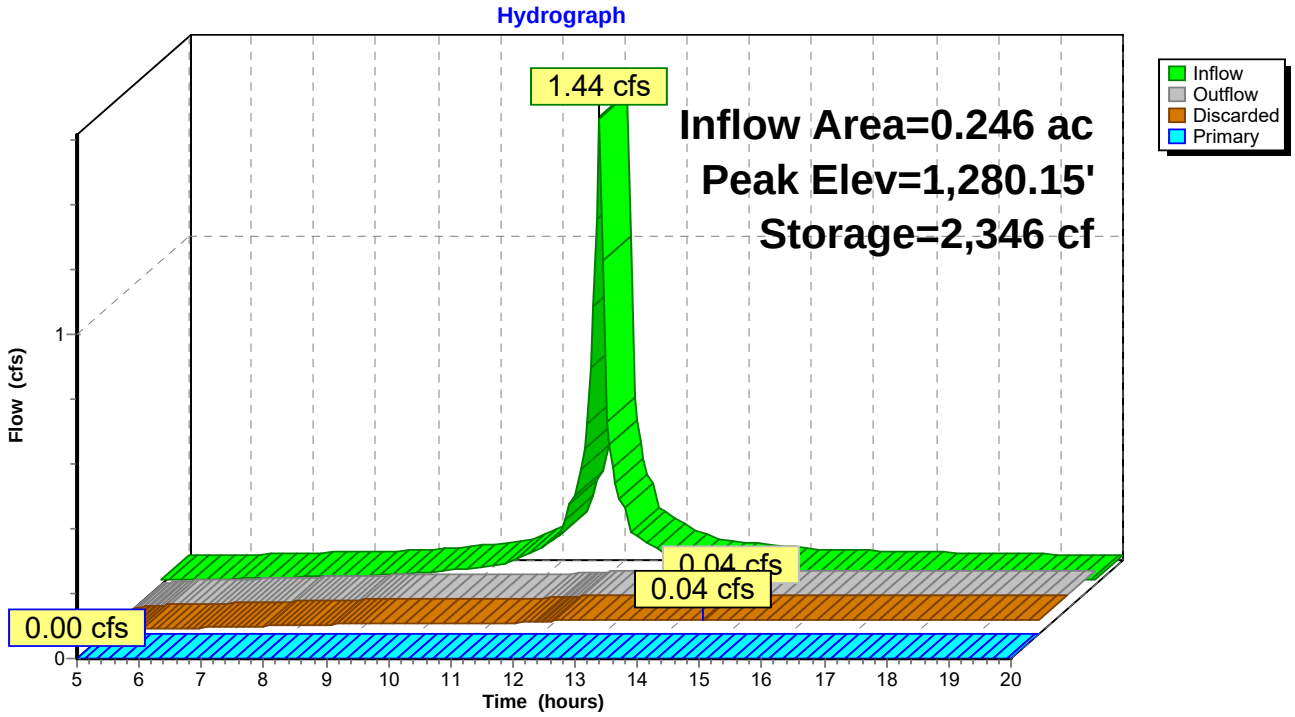
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.04 cfs @ 14.59 hrs HW=1,280.15' (Free Discharge)
2=Exfiltration (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,279.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 7P: Pad


Hydrograph
1.44 cfs
Inflow Area=0.246 ac
Peak Elev=1,280.15'
Storage=2,346 cf
Inflow
Outflow
Discarded
Primary
0.04 cfs
0.04 cfs
0.00 cfs
Flow (cfs)
0
1
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>3.37"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=1.03 cfs 0.091 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>3.69"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.44 cfs 0.024 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>5.44"
Flow Length=50' Tc=0.1 min CN=98 Runoff=1.79 cfs 0.111 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>3.69"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.44 cfs 0.024 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>5.44"
Flow Length=50' Tc=0.1 min CN=98 Runoff=1.79 cfs 0.111 af

Reach 4R: Post Construction Flow Inflow=2.23 cfs 0.135 af
Outflow=2.23 cfs 0.135 af

Reach 8R: Post Construction Flow Inflow=0.44 cfs 0.032 af
Outflow=0.44 cfs 0.032 af

Pond 7P: Pad Peak Elev=1,280.29' Storage=2,882 cf Inflow=1.79 cfs 0.111 af
Discarded=0.05 cfs 0.047 af Primary=0.06 cfs 0.008 af Outflow=0.10 cfs 0.054 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.362 af Average Runoff Depth = 4.47"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

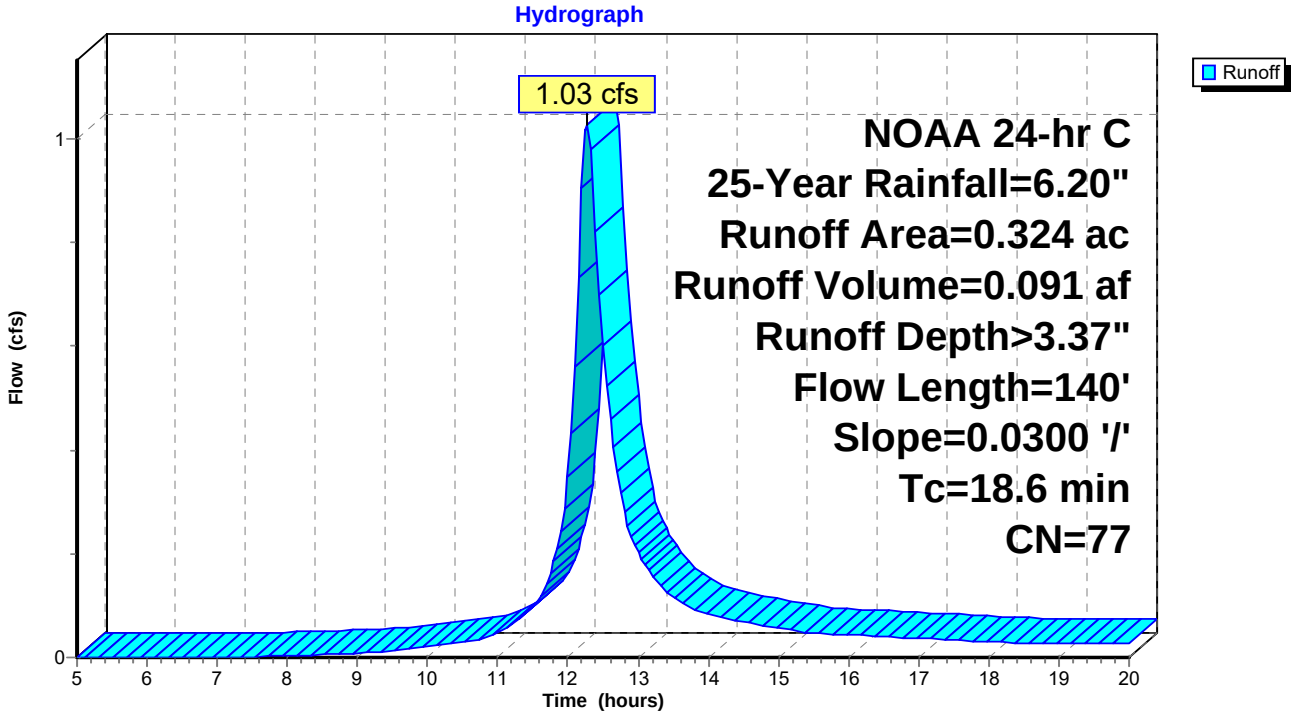
Runoff = 1.03 cfs @ 12.28 hrs, Volume= 0.091 af, Depth> 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

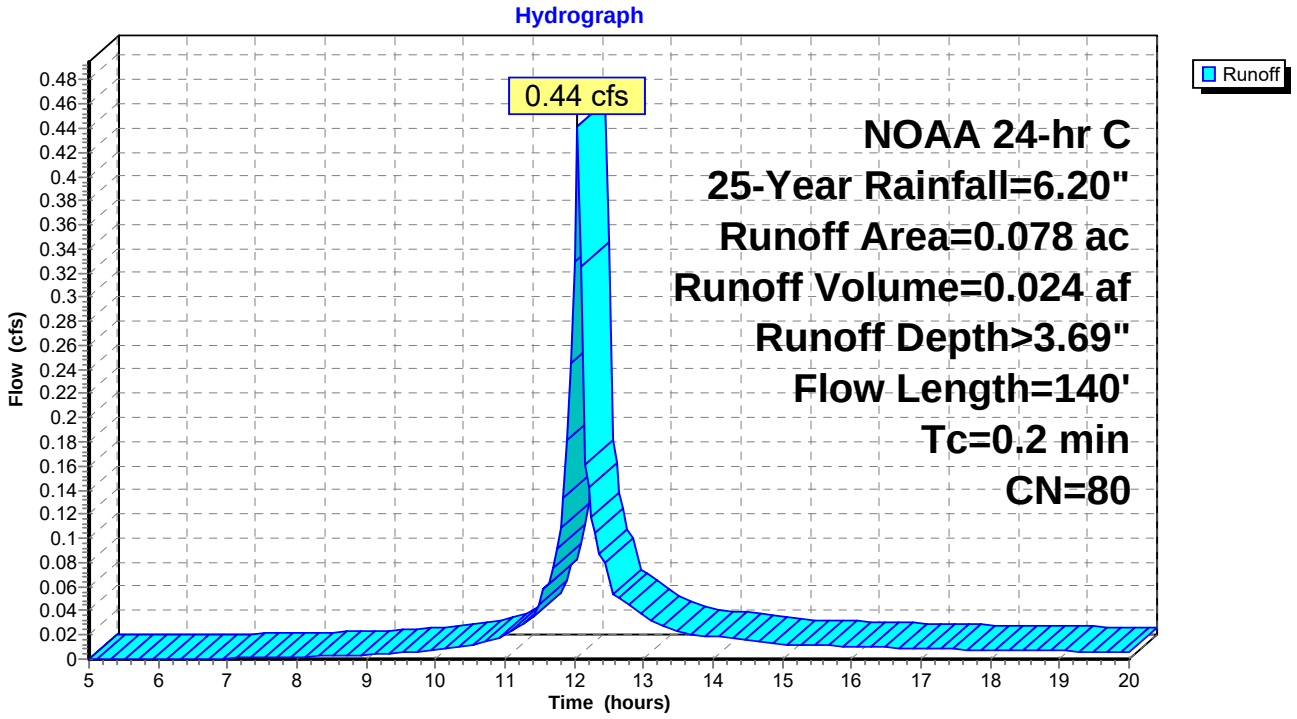
Runoff = 0.44 cfs @ 12.05 hrs, Volume= 0.024 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

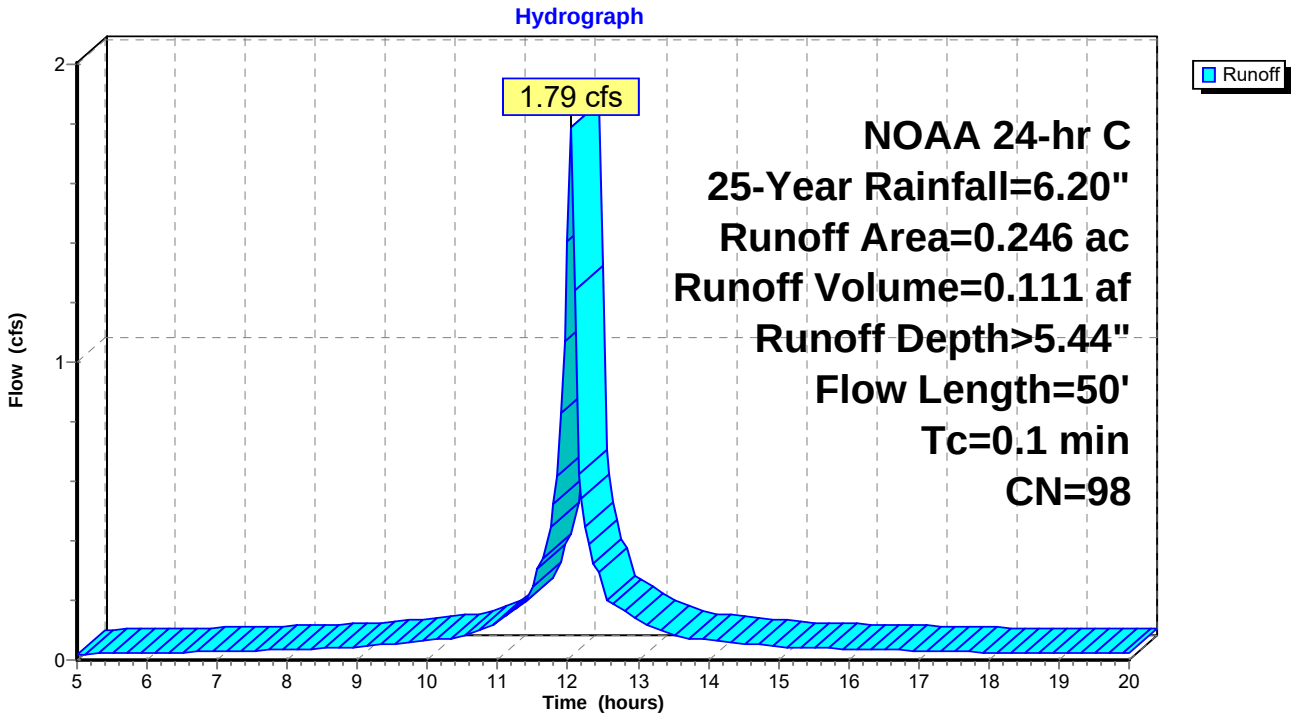
Runoff = 1.79 cfs @ 12.05 hrs, Volume= 0.111 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

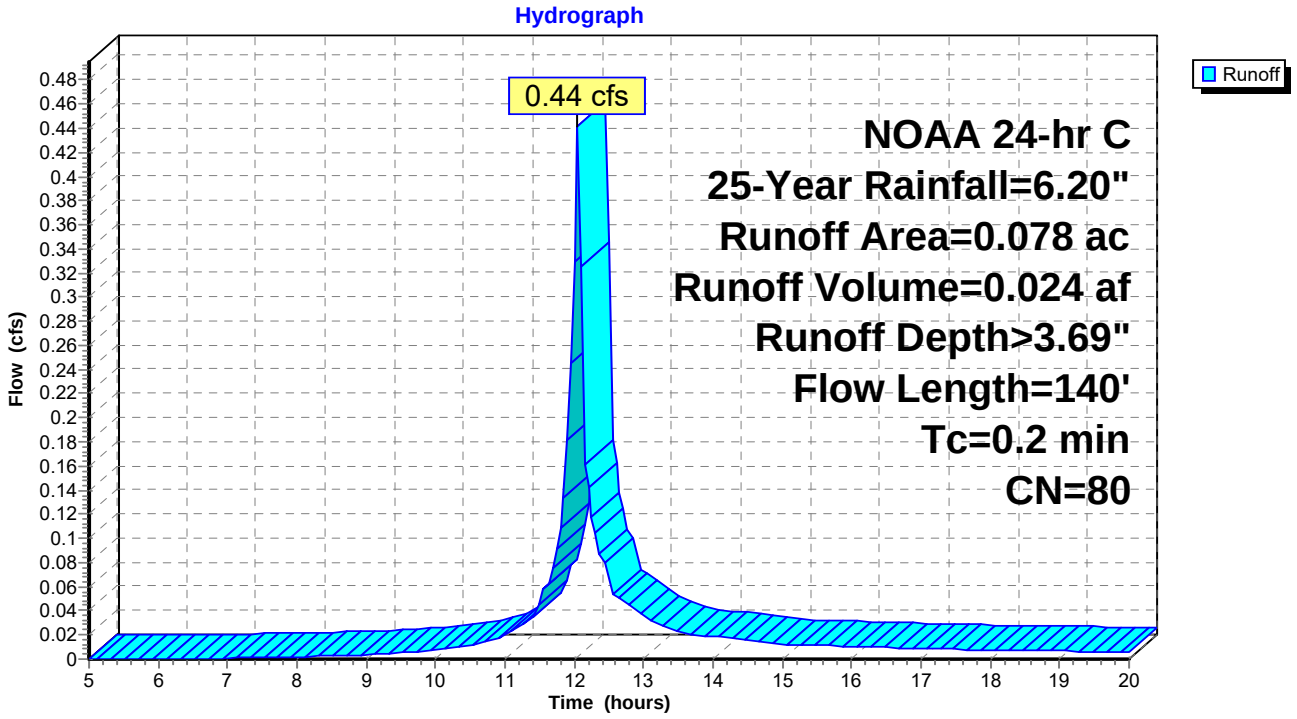
Runoff = 0.44 cfs @ 12.05 hrs, Volume= 0.024 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

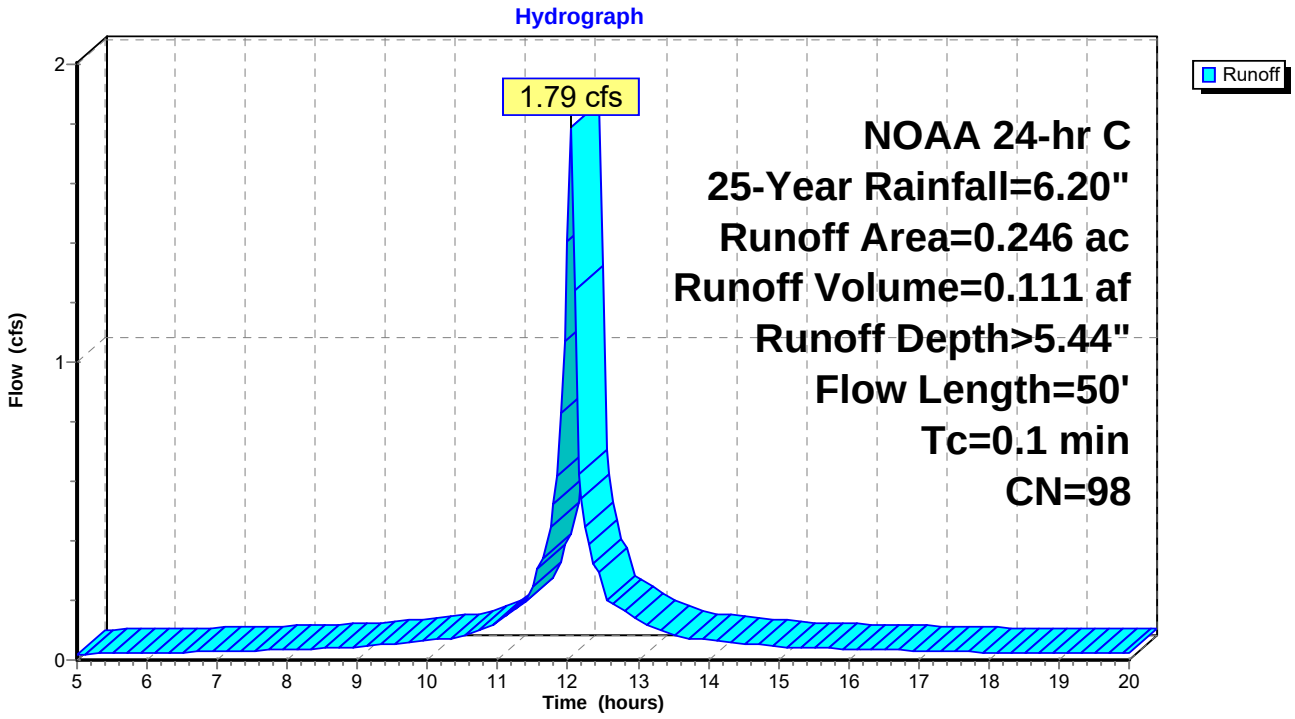
Runoff = 1.79 cfs @ 12.05 hrs, Volume= 0.111 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



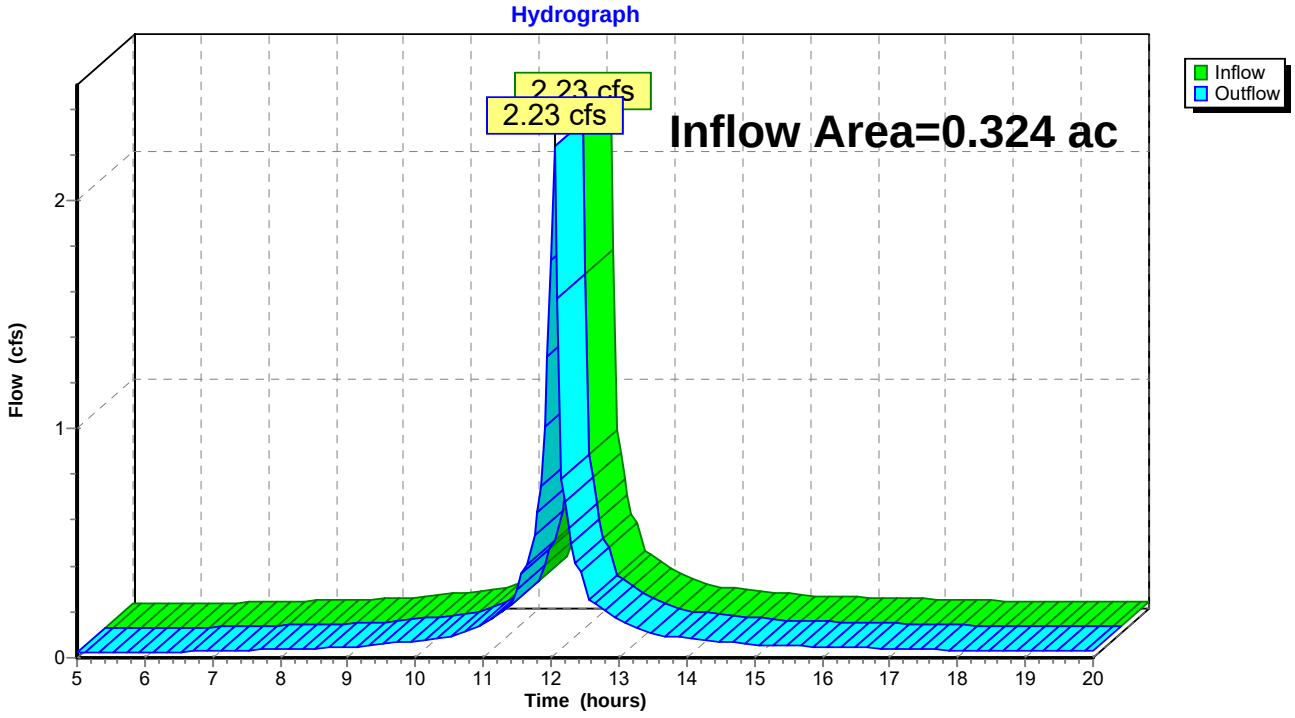
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 5.02" for 25-Year event
Inflow = 2.23 cfs @ 12.05 hrs, Volume= 0.135 af
Outflow = 2.23 cfs @ 12.05 hrs, Volume= 0.135 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



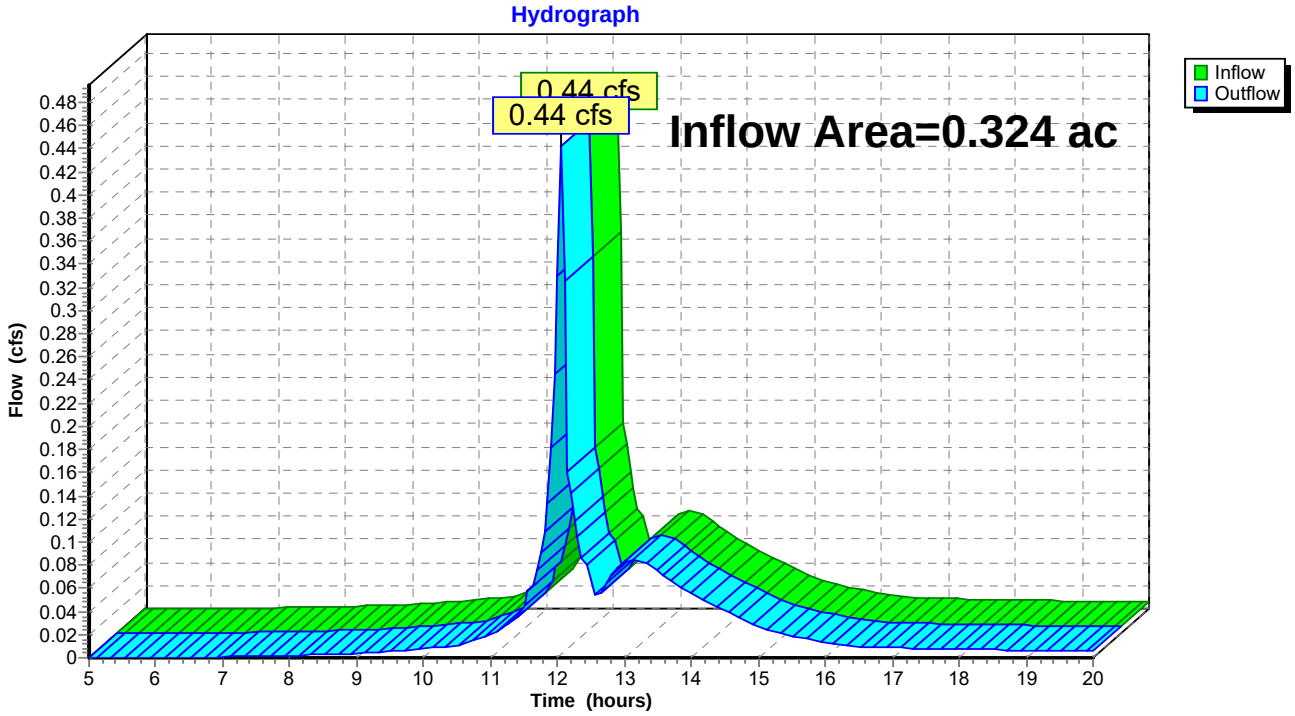
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 1.17" for 25-Year event
Inflow = 0.44 cfs @ 12.05 hrs, Volume= 0.032 af
Outflow = 0.44 cfs @ 12.05 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 5.44" for 25-Year event
Inflow = 1.79 cfs @ 12.05 hrs, Volume= 0.111 af
Outflow = 0.10 cfs @ 13.28 hrs, Volume= 0.054 af, Atten= 94%, Lag= 74.2 min
Discarded = 0.05 cfs @ 13.28 hrs, Volume= 0.047 af
Primary = 0.06 cfs @ 13.28 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,280.29' @ 13.28 hrs Surf.Area= 9,439 sf Storage= 2,882 cf

Plug-Flow detention time= 174.1 min calculated for 0.054 af (48% of inflow)
Center-of-Mass det. time= 79.2 min (809.3 - 730.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

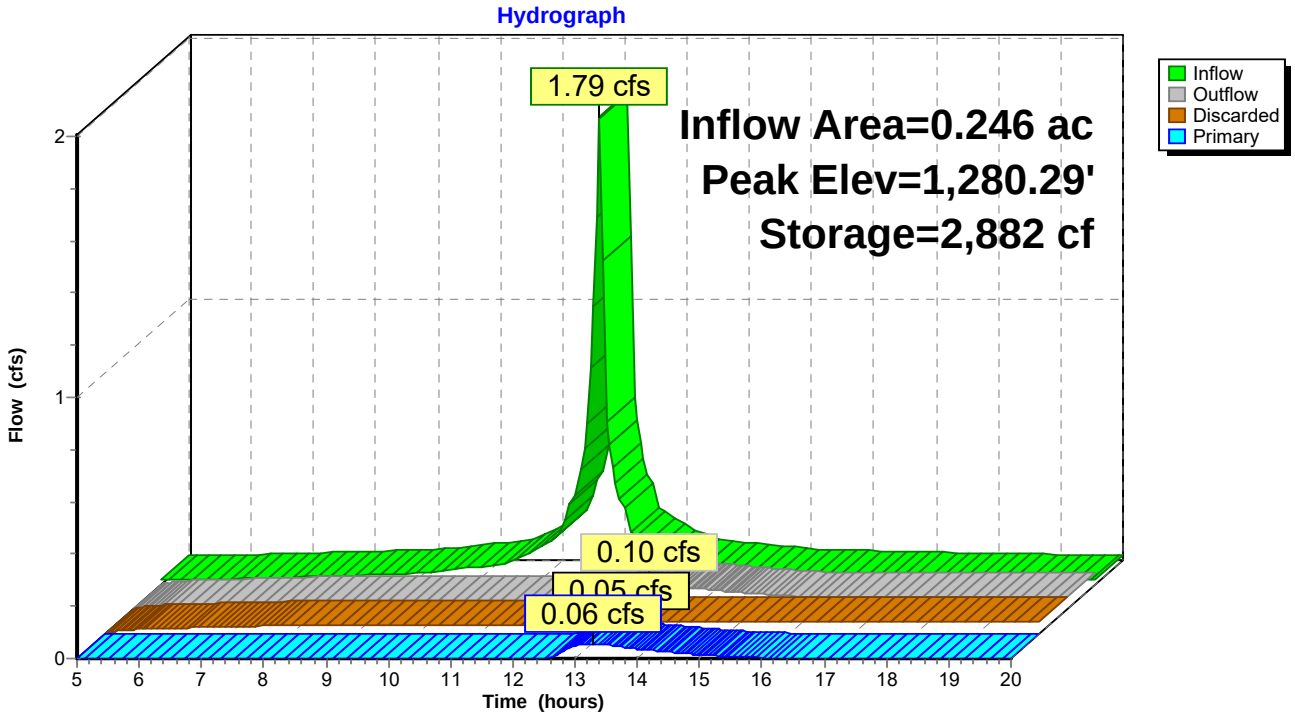
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.05 cfs @ 13.28 hrs HW=1,280.29' (Free Discharge)
2=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.06 cfs @ 13.28 hrs HW=1,280.29' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.47 fps)

Pond 7P: Pad


Hydrograph
1.79 cfs
Inflow Area=0.246 ac
Peak Elev=1,280.29'
Storage=2,882 cf
0.10 cfs
0.06 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
1
2
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>4.32"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=1.31 cfs 0.117 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>4.67"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.55 cfs 0.030 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>6.45"
Flow Length=50' Tc=0.1 min CN=98 Runoff=2.12 cfs 0.132 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>4.67"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.55 cfs 0.030 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>6.45"
Flow Length=50' Tc=0.1 min CN=98 Runoff=2.12 cfs 0.132 af

Reach 4R: Post Construction Flow Inflow=2.67 cfs 0.163 af
Outflow=2.67 cfs 0.163 af

Reach 8R: Post Construction Flow Inflow=0.55 cfs 0.056 af
Outflow=0.55 cfs 0.056 af

Pond 7P: Pad Peak Elev=1,280.35' Storage=3,107 cf Inflow=2.12 cfs 0.132 af
Discarded=0.05 cfs 0.048 af Primary=0.22 cfs 0.025 af Outflow=0.27 cfs 0.073 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.442 af Average Runoff Depth = 5.45"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

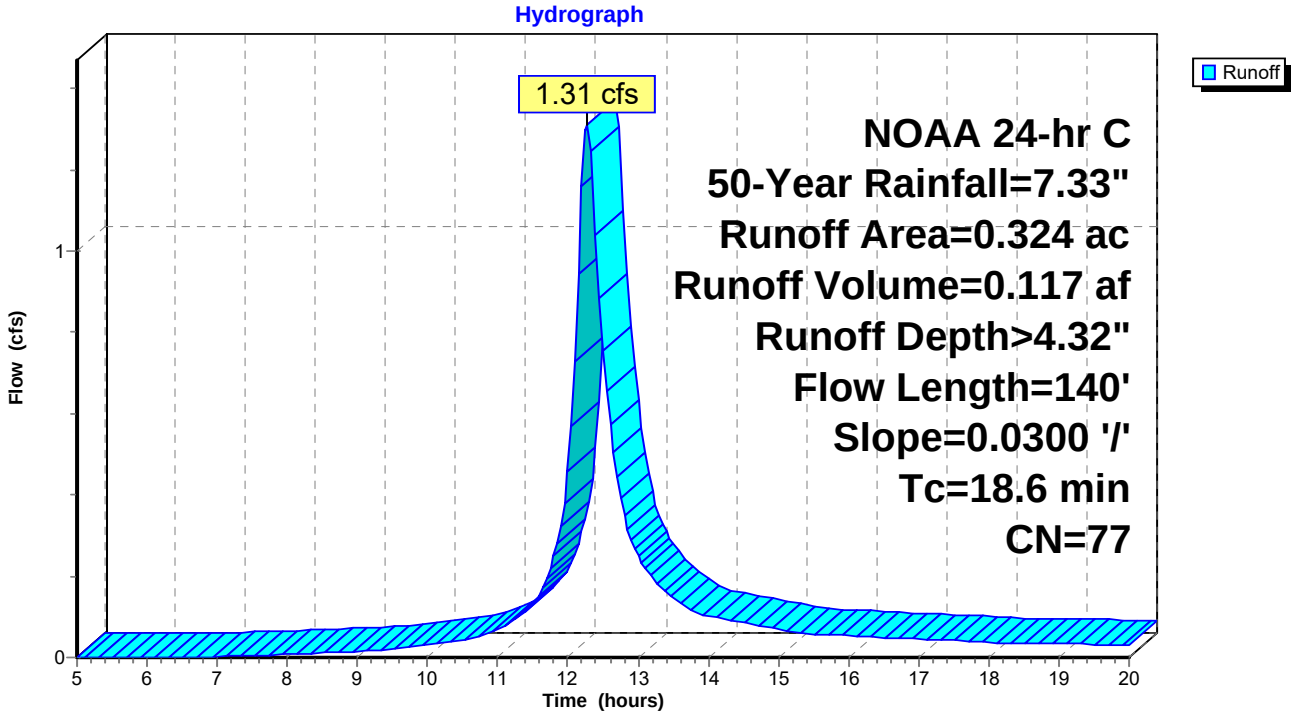
Runoff = 1.31 cfs @ 12.27 hrs, Volume= 0.117 af, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

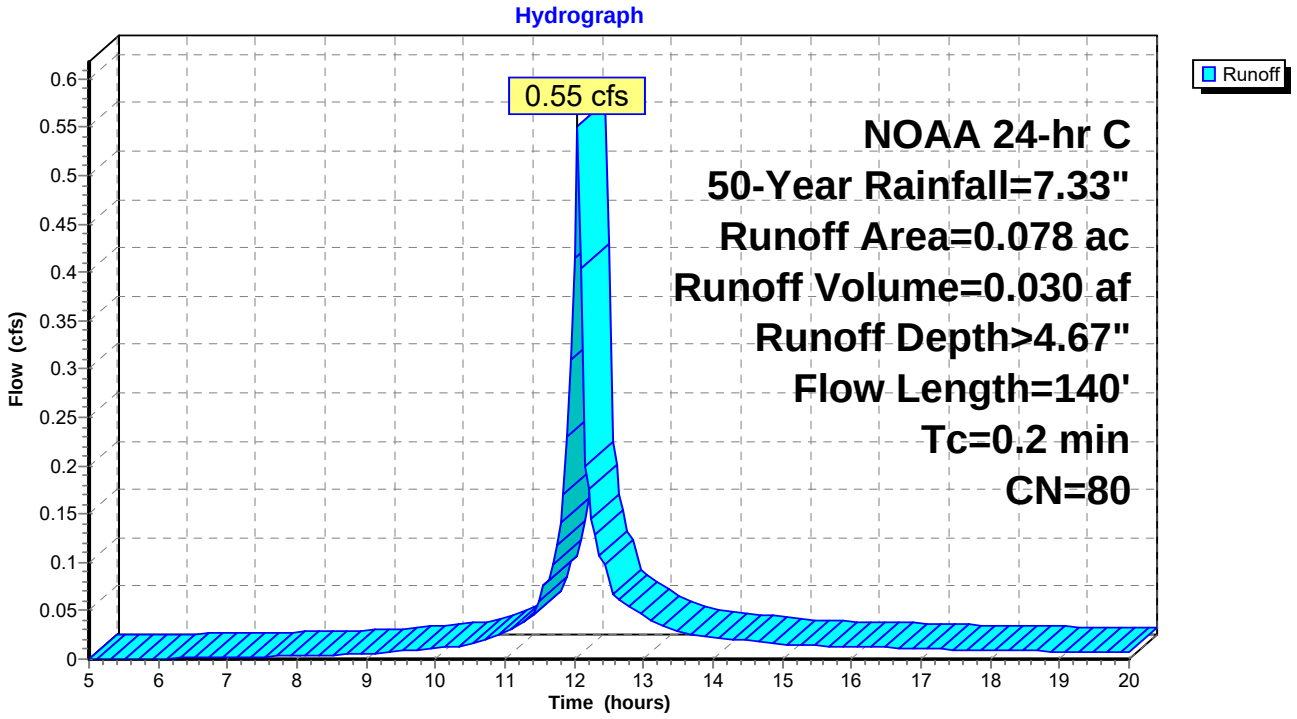
Runoff = 0.55 cfs @ 12.05 hrs, Volume= 0.030 af, Depth> 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

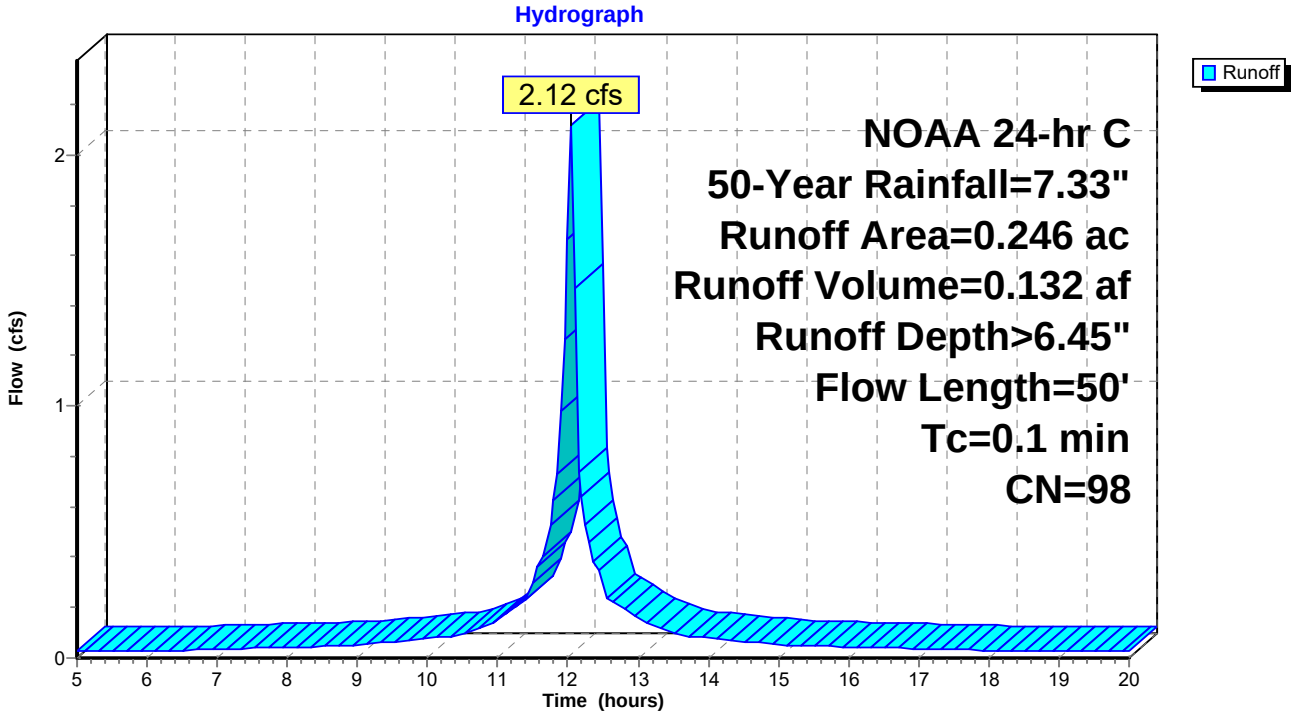
Runoff = 2.12 cfs @ 12.05 hrs, Volume= 0.132 af, Depth> 6.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

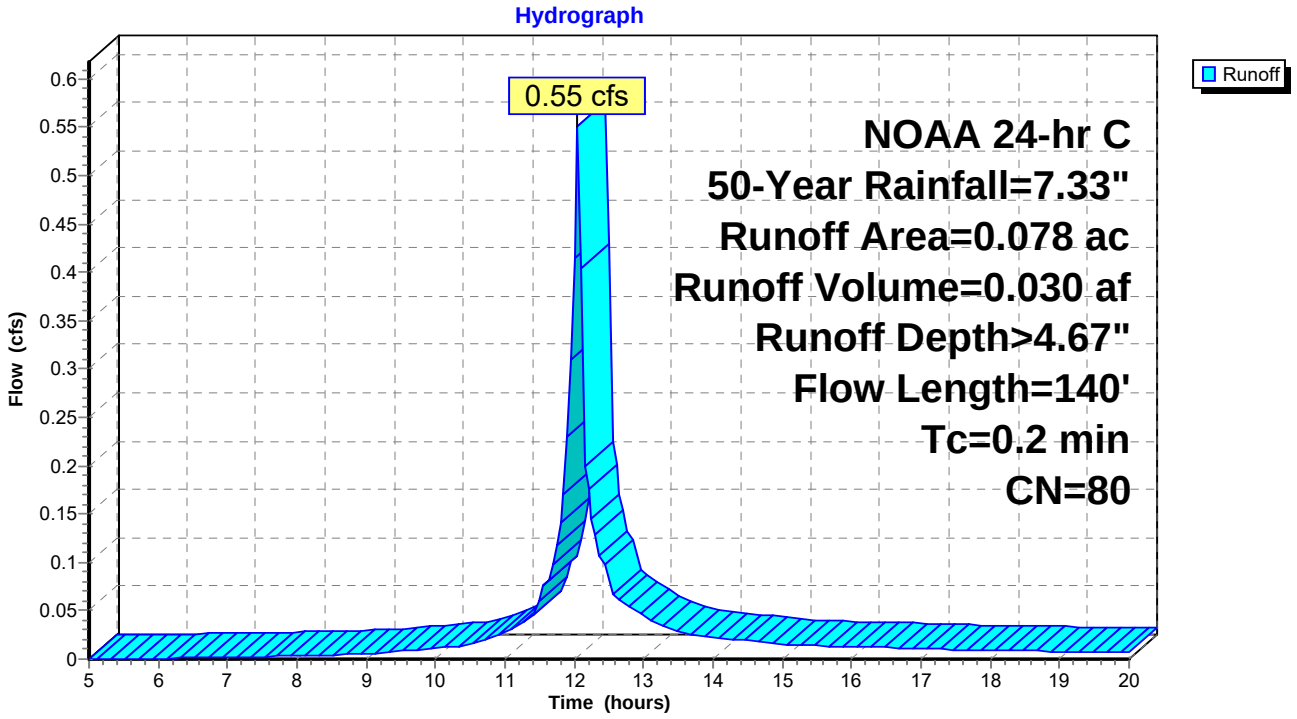
Runoff = 0.55 cfs @ 12.05 hrs, Volume= 0.030 af, Depth> 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

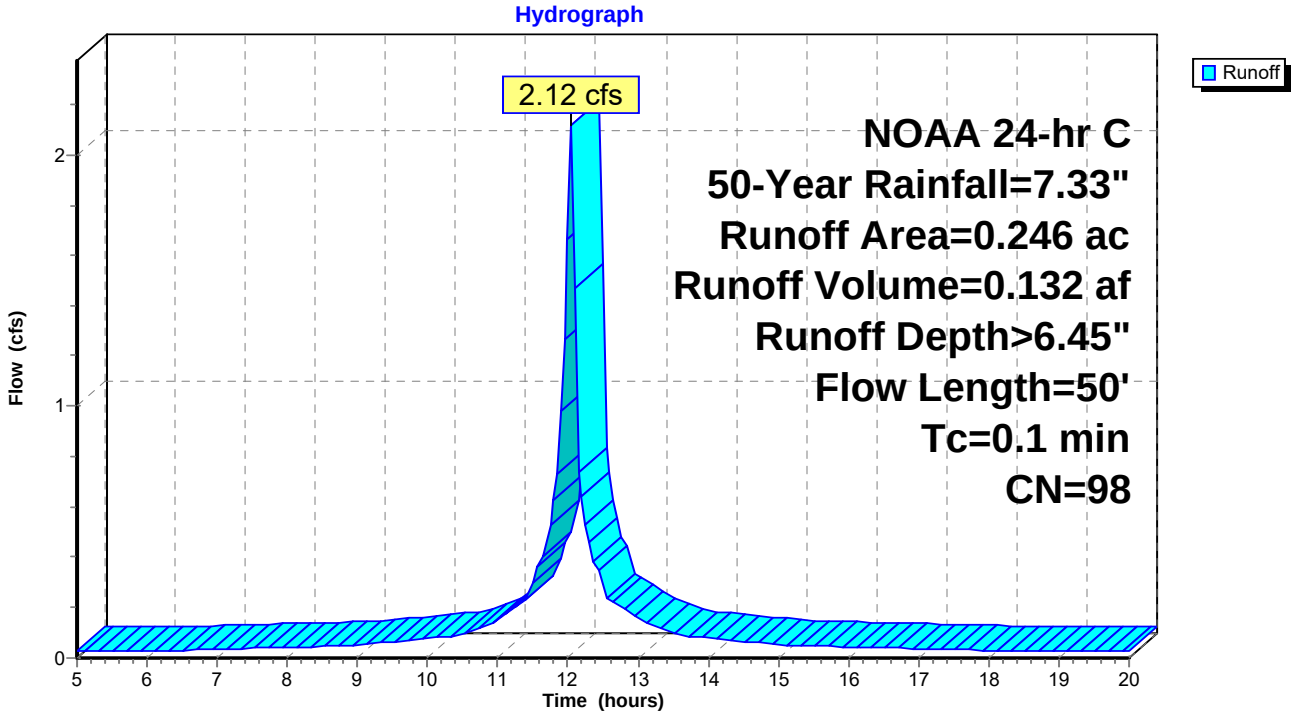
Runoff = 2.12 cfs @ 12.05 hrs, Volume= 0.132 af, Depth> 6.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



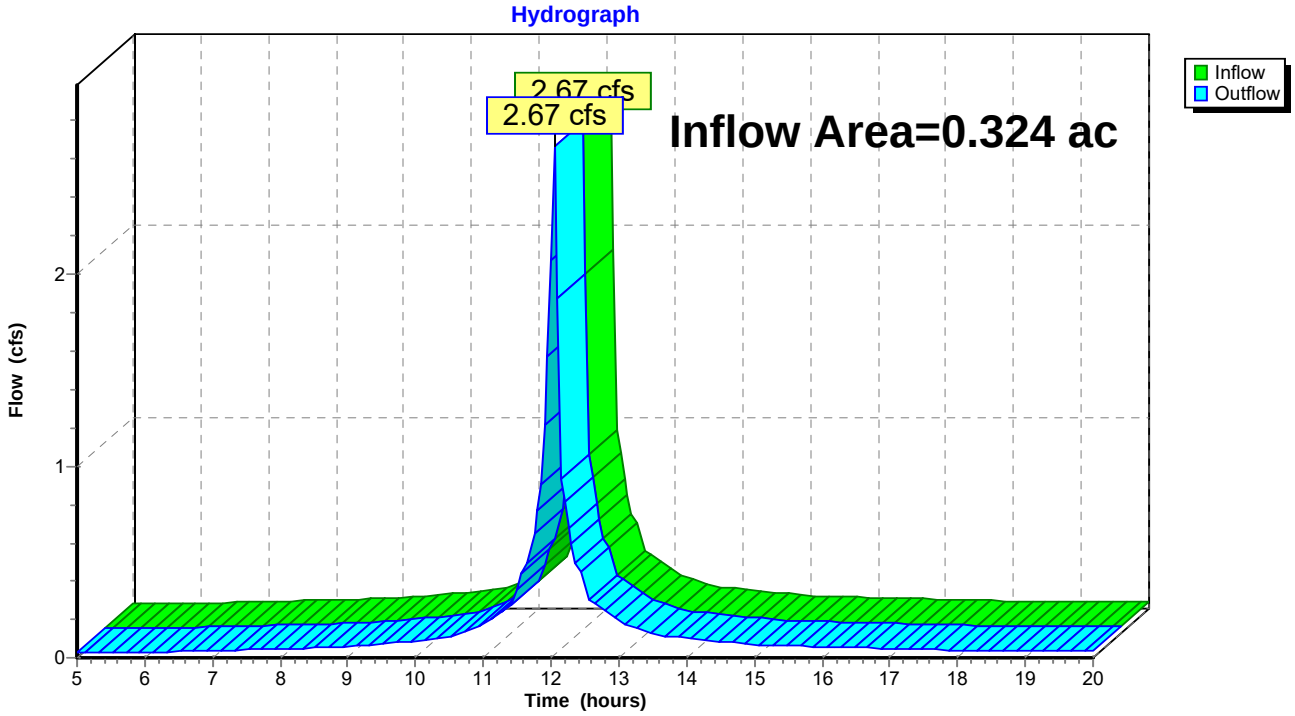
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 6.02" for 50-Year event
Inflow = 2.67 cfs @ 12.05 hrs, Volume= 0.163 af
Outflow = 2.67 cfs @ 12.05 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



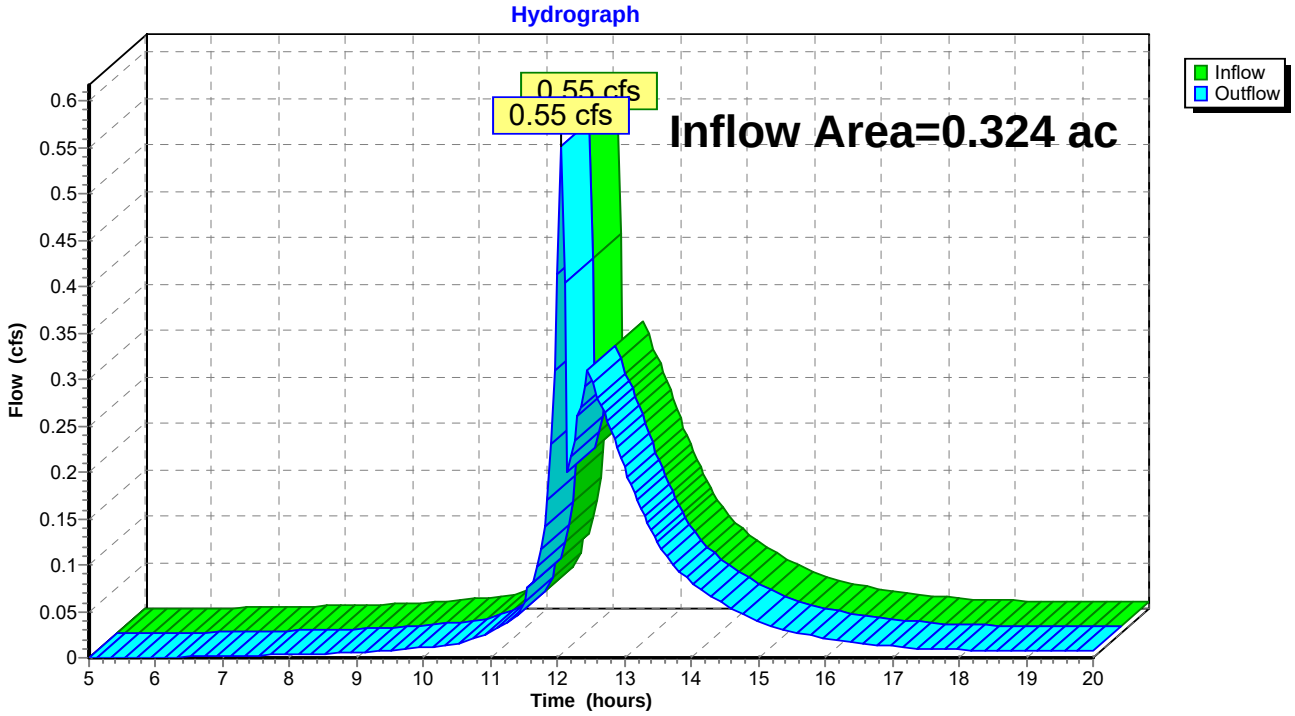
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 2.06" for 50-Year event
Inflow = 0.55 cfs @ 12.05 hrs, Volume= 0.056 af
Outflow = 0.55 cfs @ 12.05 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 6.45" for 50-Year event
Inflow = 2.12 cfs @ 12.05 hrs, Volume= 0.132 af
Outflow = 0.27 cfs @ 12.53 hrs, Volume= 0.073 af, Atten= 87%, Lag= 29.2 min
Discarded = 0.05 cfs @ 12.53 hrs, Volume= 0.048 af
Primary = 0.22 cfs @ 12.53 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,280.35' @ 12.53 hrs Surf.Area= 9,483 sf Storage= 3,107 cf

Plug-Flow detention time= 154.0 min calculated for 0.073 af (55% of inflow)
Center-of-Mass det. time= 68.6 min (798.1 - 729.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

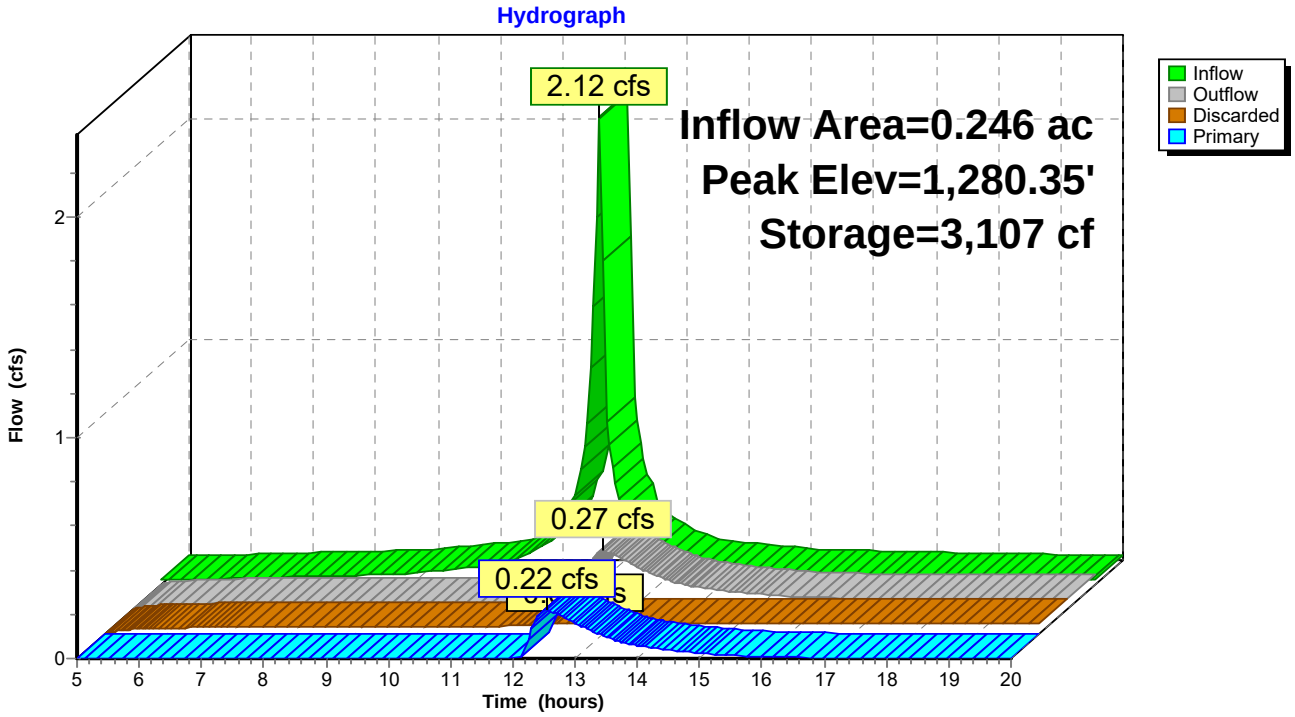
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.05 cfs @ 12.53 hrs HW=1,280.35' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.22 cfs @ 12.53 hrs HW=1,280.35' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.22 cfs @ 0.74 fps)

Pond 7P: Pad


Hydrograph
2.12 cfs
Inflow Area=0.246 ac
Peak Elev=1,280.35'
Storage=3,107 cf
0.27 cfs
0.22 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

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

Subcatchment 1S: Pre-Construction Runoff Area=0.324 ac 0.00% Impervious Runoff Depth>5.47"
Flow Length=140' Slope=0.0300 '/' Tc=18.6 min CN=77 Runoff=1.64 cfs 0.148 af

Subcatchment 2S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>5.86"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.68 cfs 0.038 af

Subcatchment 3S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>7.65"
Flow Length=50' Tc=0.1 min CN=98 Runoff=2.51 cfs 0.157 af

Subcatchment 5S: Post Construction Slope Runoff Area=0.078 ac 14.10% Impervious Runoff Depth>5.86"
Flow Length=140' Tc=0.2 min CN=80 Runoff=0.68 cfs 0.038 af

Subcatchment 6S: Post Construction Pad Runoff Area=0.246 ac 100.00% Impervious Runoff Depth>7.65"
Flow Length=50' Tc=0.1 min CN=98 Runoff=2.51 cfs 0.157 af

Reach 4R: Post Construction Flow Inflow=3.19 cfs 0.195 af
Outflow=3.19 cfs 0.195 af

Reach 8R: Post Construction Flow Inflow=0.73 cfs 0.085 af
Outflow=0.73 cfs 0.085 af

Pond 7P: Pad Peak Elev=1,280.42' Storage=3,386 cf Inflow=2.51 cfs 0.157 af
Discarded=0.05 cfs 0.049 af Primary=0.50 cfs 0.047 af Outflow=0.55 cfs 0.096 af

Total Runoff Area = 0.972 ac Runoff Volume = 0.537 af Average Runoff Depth = 6.63"
47.12% Pervious = 0.458 ac 52.88% Impervious = 0.514 ac

Summary for Subcatchment 1S: Pre-Construction

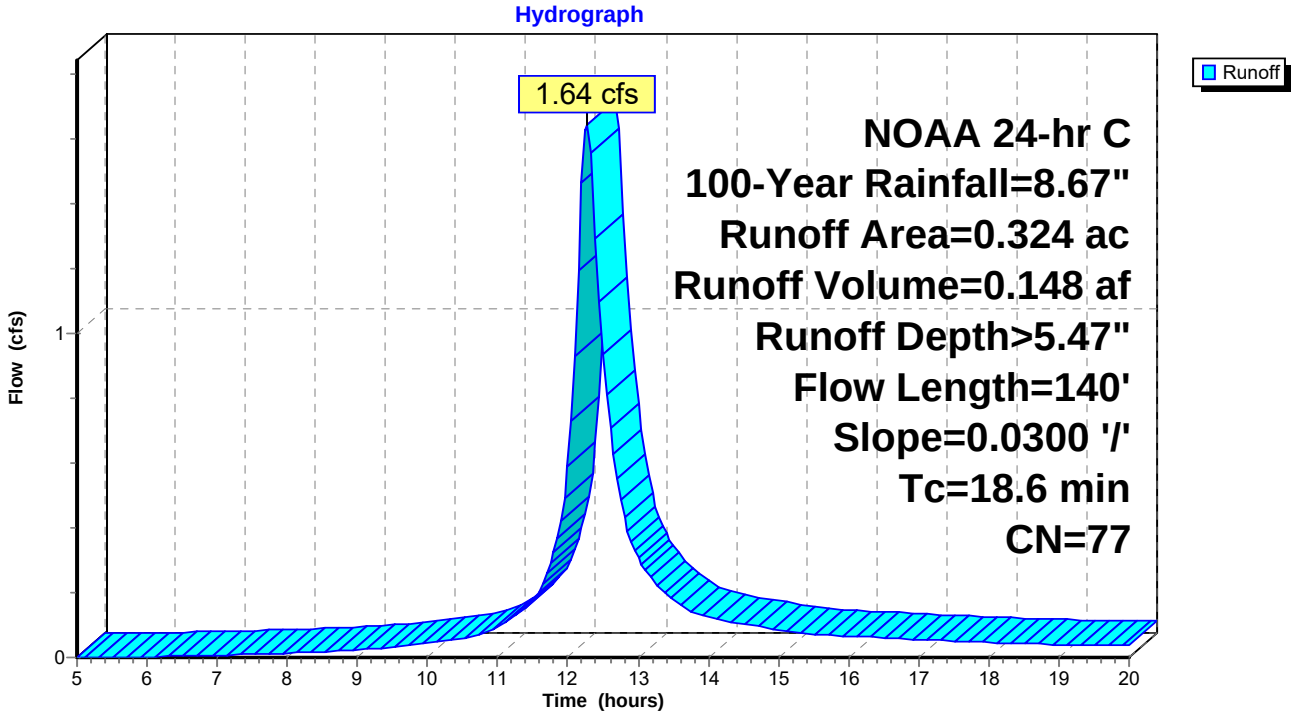
Runoff = 1.64 cfs @ 12.27 hrs, Volume= 0.148 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.030	70	Woods, Good, HSG C
0.100	77	Woods, Good, HSG D
0.020	71	Meadow, non-grazed, HSG C
0.174	78	Meadow, non-grazed, HSG D
0.324	77	Weighted Average
0.324		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	70	0.0300	0.09		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 3.40"
4.5	30	0.0300	0.11		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 3.40"
0.8	40	0.0300	0.87		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
18.6	140	Total			

Subcatchment 1S: Pre-Construction



Summary for Subcatchment 2S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

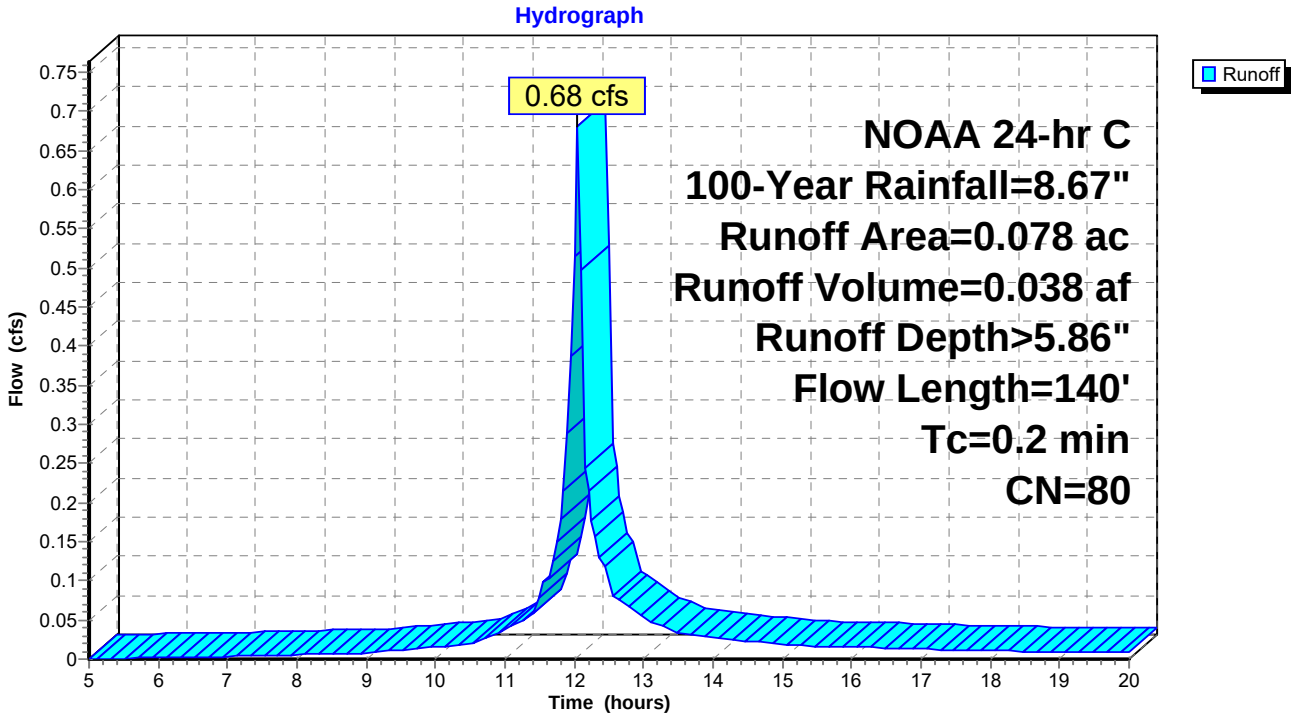
Runoff = 0.68 cfs @ 12.05 hrs, Volume= 0.038 af, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 2S: Post Construction Slope



Summary for Subcatchment 3S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

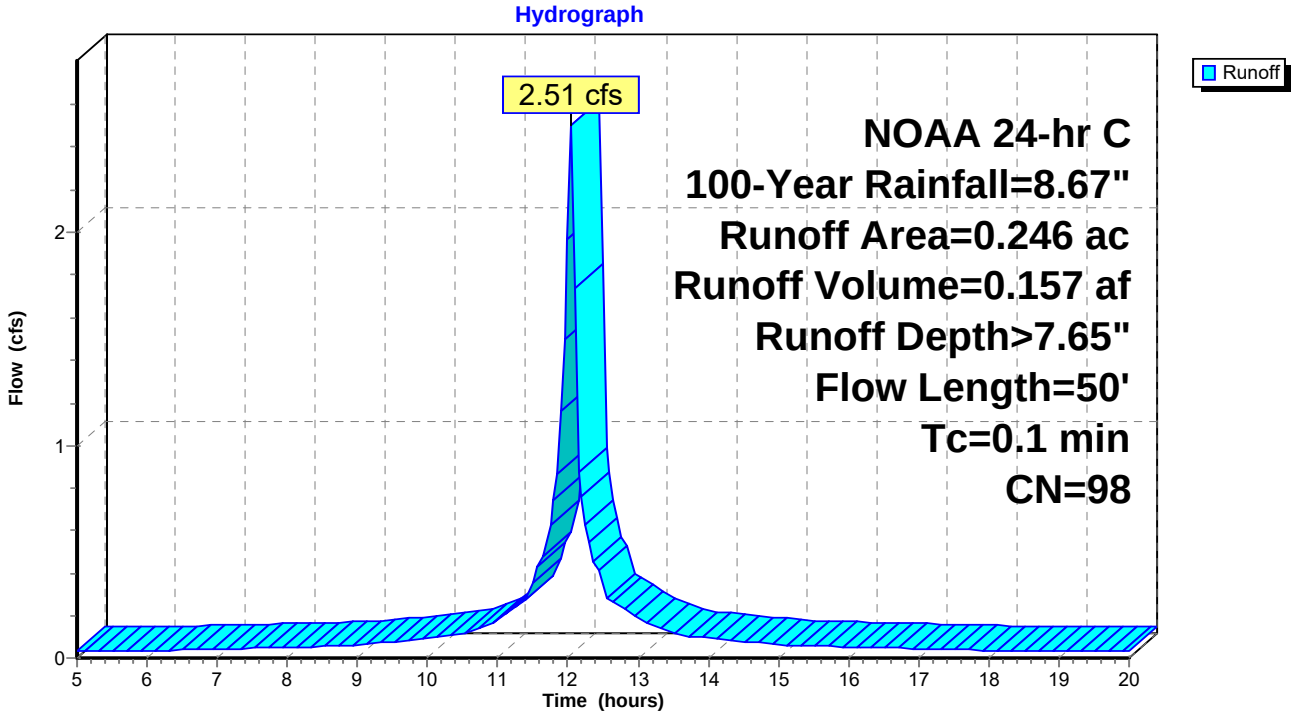
Runoff = 2.51 cfs @ 12.05 hrs, Volume= 0.157 af, Depth> 7.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 3S: Post Construction Pad



Summary for Subcatchment 5S: Post Construction Slope

[49] Hint: Tc<2dt may require smaller dt

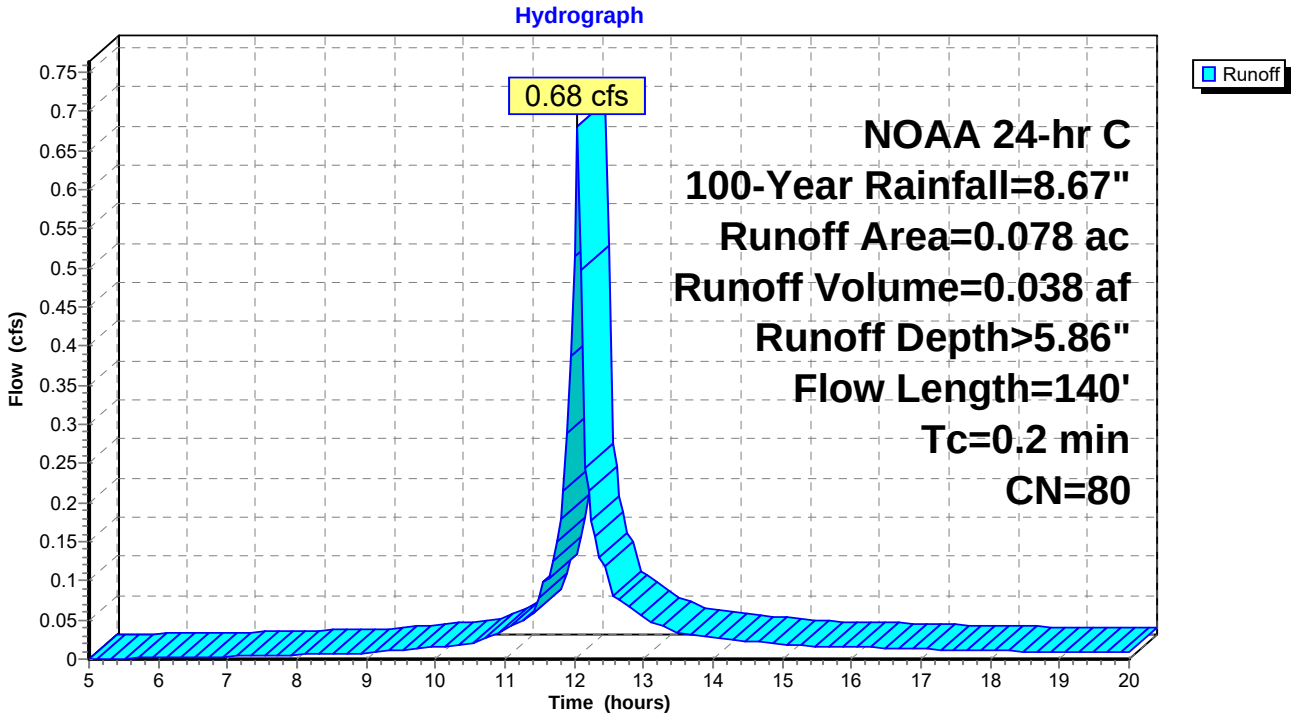
Runoff = 0.68 cfs @ 12.05 hrs, Volume= 0.038 af, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.013	71	Meadow, non-grazed, HSG C
0.054	78	Meadow, non-grazed, HSG D
0.011	98	Paved roads w/curbs & sewers, HSG C
0.078	80	Weighted Average
0.067		85.90% Pervious Area
0.011		14.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	140		10.00		**Direct Entry, Tc**

Subcatchment 5S: Post Construction Slope



Summary for Subcatchment 6S: Post Construction Pad

[49] Hint: Tc<2dt may require smaller dt

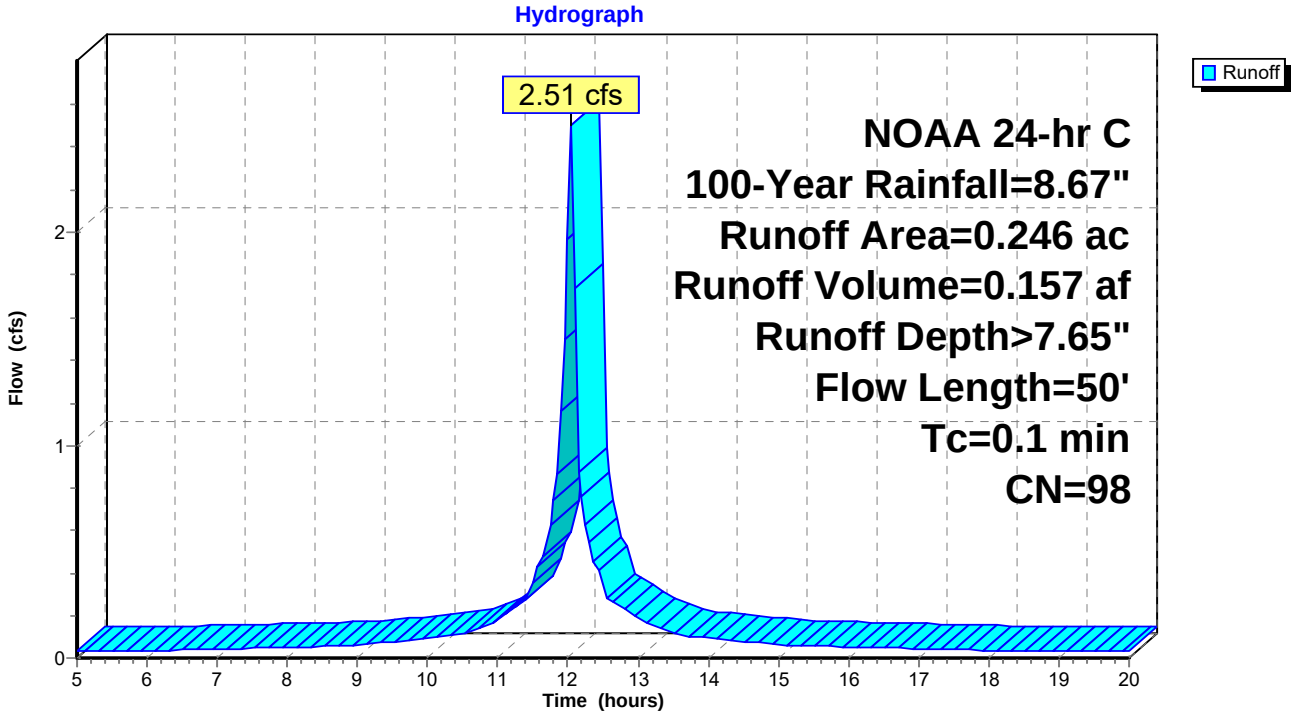
Runoff = 2.51 cfs @ 12.05 hrs, Volume= 0.157 af, Depth> 7.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.246	98	Paved parking, HSG D
0.246		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	50		10.00		**Direct Entry, tc**

Subcatchment 6S: Post Construction Pad



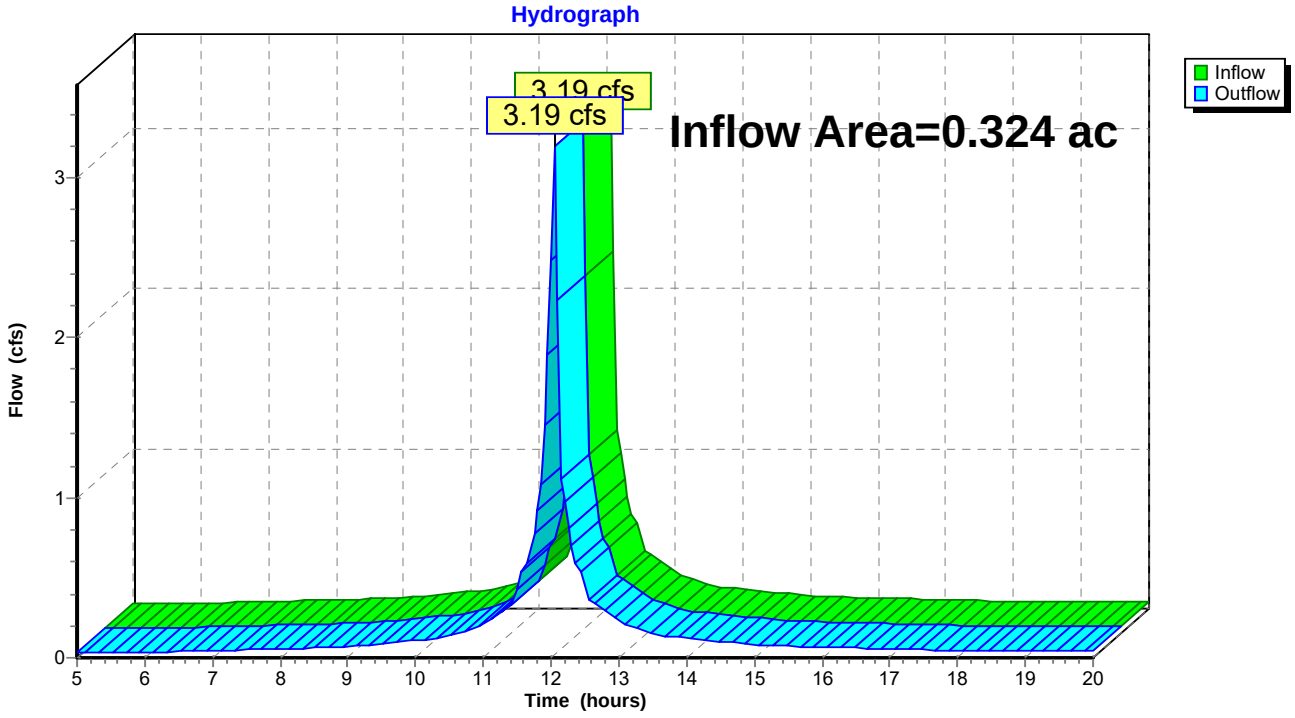
Summary for Reach 4R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 7.22" for 100-Year event
Inflow = 3.19 cfs @ 12.05 hrs, Volume= 0.195 af
Outflow = 3.19 cfs @ 12.05 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

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

Reach 4R: Post Construction Flow



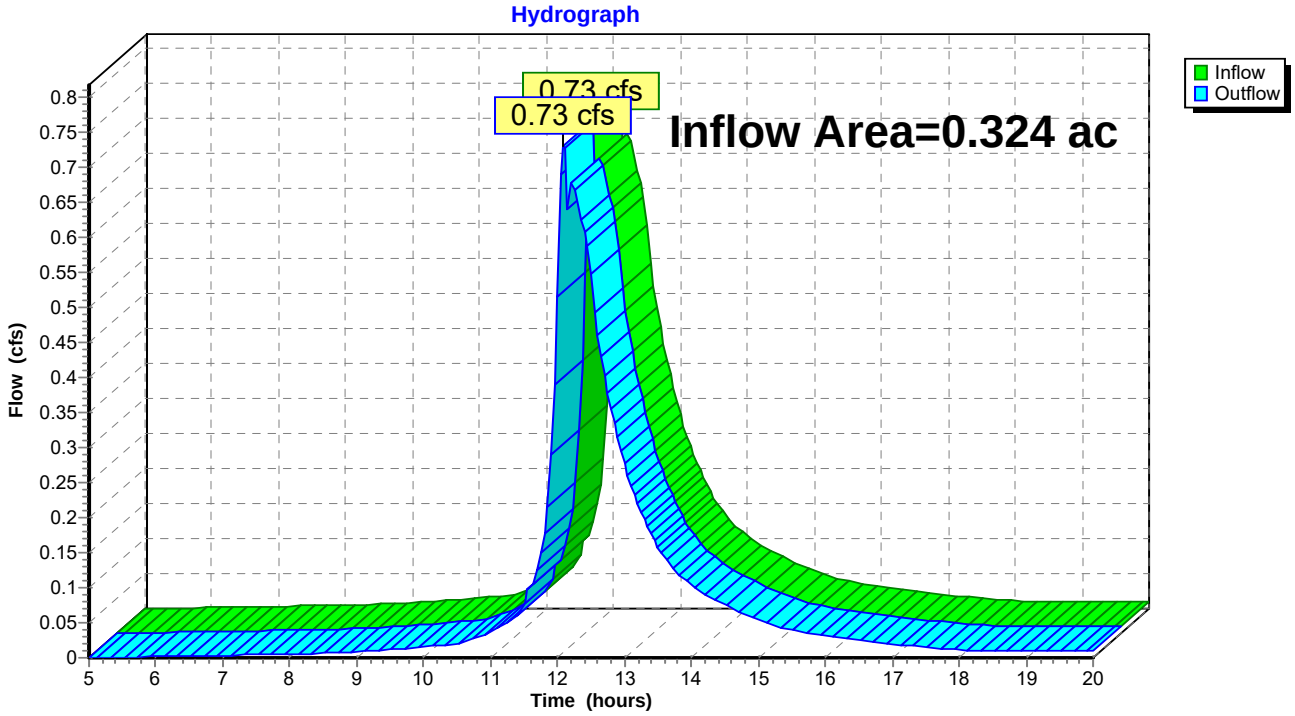
Summary for Reach 8R: Post Construction Flow

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

Inflow Area = 0.324 ac, 79.32% Impervious, Inflow Depth > 3.15" for 100-Year event
Inflow = 0.73 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 0.73 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

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

Reach 8R: Post Construction Flow



Summary for Pond 7P: Pad

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.246 ac,100.00% Impervious, Inflow Depth > 7.65" for 100-Year event
Inflow = 2.51 cfs @ 12.05 hrs, Volume= 0.157 af
Outflow = 0.55 cfs @ 12.30 hrs, Volume= 0.096 af, Atten= 78%, Lag= 15.2 min
Discarded = 0.05 cfs @ 12.30 hrs, Volume= 0.049 af
Primary = 0.50 cfs @ 12.30 hrs, Volume= 0.047 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,280.42' @ 12.30 hrs Surf.Area= 9,537 sf Storage= 3,386 cf

Plug-Flow detention time= 137.9 min calculated for 0.096 af (61% of inflow)
Center-of-Mass det. time= 60.3 min (789.4 - 729.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,279.50'	3,682 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 9,205 cf Overall x 40.0% Voids

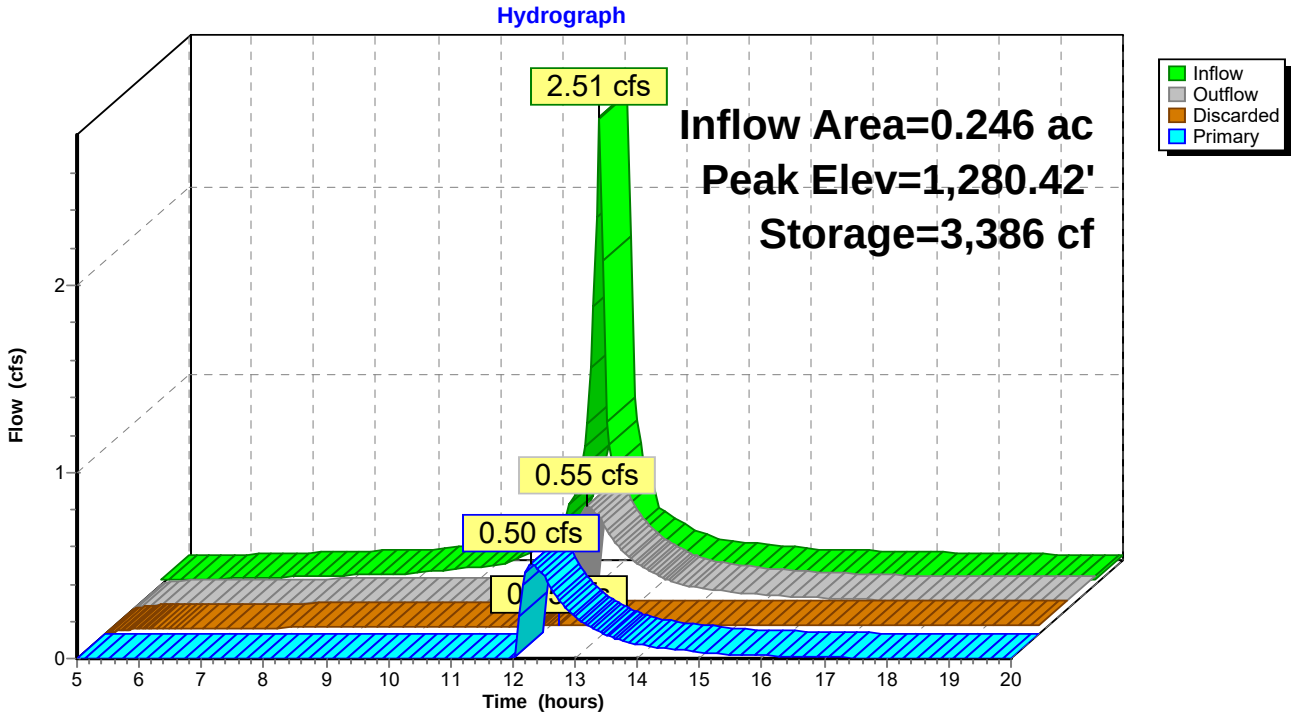
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,279.50	8,775	0	0
1,280.00	9,225	4,500	4,500
1,280.50	9,594	4,705	9,205

Device	Routing	Invert	Outlet Devices
#1	Primary	1,280.25'	**3.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	1,279.50'	**0.160 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,277.00'

Discarded OutFlow Max=0.05 cfs @ 12.30 hrs HW=1,280.42' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.50 cfs @ 12.30 hrs HW=1,280.42' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.50 cfs @ 0.97 fps)

Pond 7P: Pad


Hydrograph
2.51 cfs
0.55 cfs
0.50 cfs
Inflow Area=0.246 ac
Peak Elev=1,280.42'
Storage=3,386 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

ATTACHMENT 4.17

CHANNEL DESIGN WORKSHEETS – MLV-515RA20

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE –MLV-515RA20
LOCATION: Luzerne County, PA
PREPARED BY: JB DATE: 07/08/2022
CHECKED BY: PW DATE: 07/08/2022

OVERLAND FLOW:

Path Number	Length (ft)	"n" Value	Average Slope (ft/ft)	Time (min)
ZEN-DC-D1 REACH A	37	0.15	0.27	5.0
ZEN-DC-D1 REACH B	-	-	-	5.0
ZEN-CC-C1	72	0.011	0.056	5.0
ZEN-CC-C2	43	0.15	0.16	5.0

$$T_{c\,(sheet\,flow)} = \left[\frac{2(\quad)(n)}{3(\quad)^{0.5}}\right]^{0.4673}$$

n Type of Cover
0.02 smooth pavement
0.1 bare parched soil
0.3 poor grass cover
0.4 average grass cover
0.8 dense grass cover
(L = 150' maximum)

SHALLOW CONCENTRATED FLOW:

Path Number	Length (ft)	"n" Value	Average Slope (ft/ft)	Time (min)	Tc Total (min)
ZEN-DC-D1 REACH A	-	-	-	-	5.0
ZEN-DC-D1 REACH B	-	-	-	-	5.0
ZEN-CC-C1	-	-	-	-	5.0
ZEN-CC-C2	-	-	-	-	5.0

Channel Dimensions:

Path Number	Bottom Width (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Total Depth (ft)	Top Width (ft)
ZEN-DC-D1 REACH A	1	1	1	1	3.00
ZEN-DC-D1 REACH B	1	1	1	1.75	4
ZEN-CC-C1	1	1	1	1.25	3.50
ZEN-CC-C2	2	2	2	1	6.0

STANDARD E&S WORKSHEET # 11
Channel Design Data

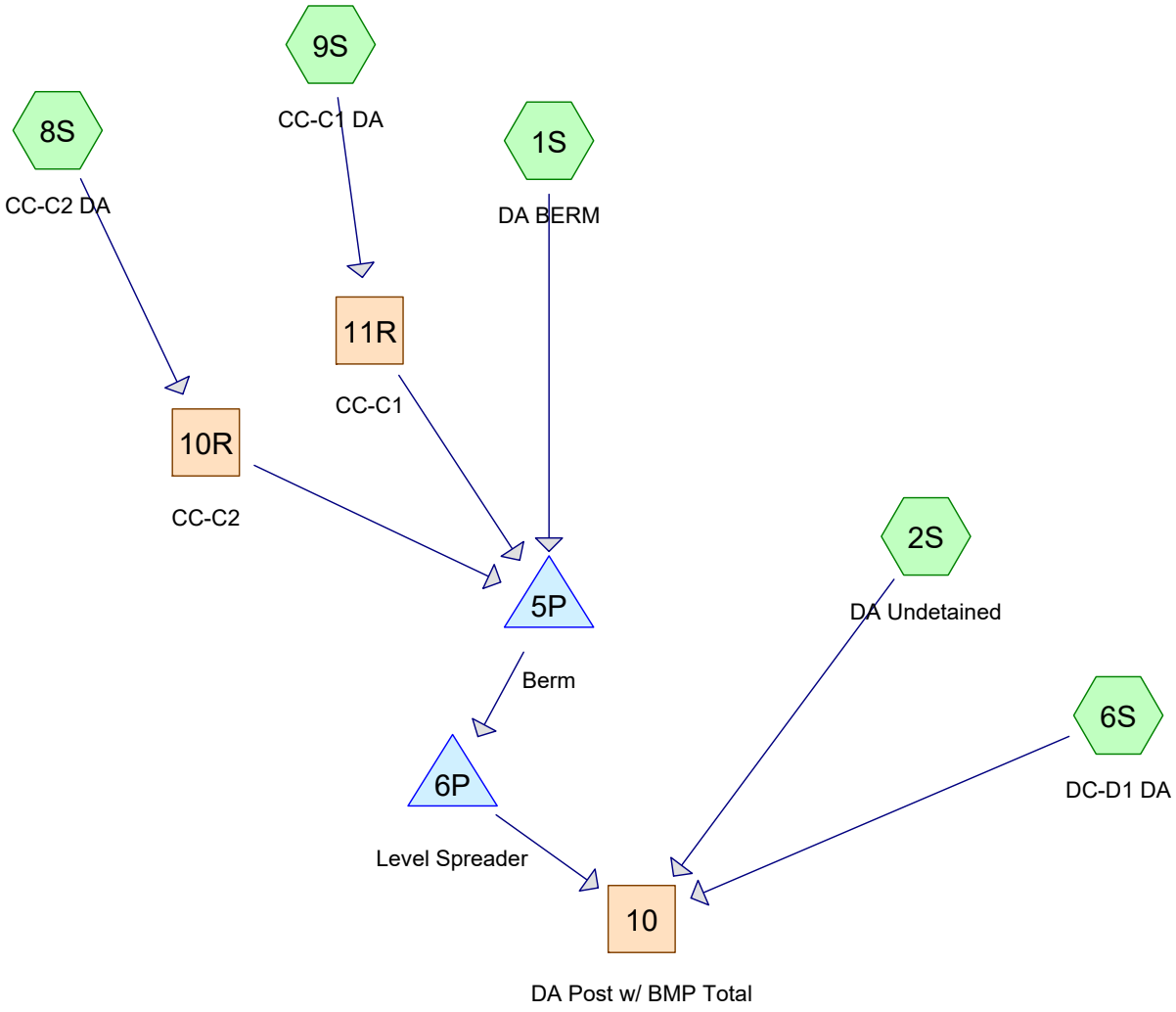
PROJECT NAME: Williams REAE – MLV-515RA20
LOCATION: Luzerne County, PA
PREPARED BY: BM DATE: 07/20/22
CHECKED BY: PW DATE: 07/20/22

CHANNEL OR CHANNEL SECTION		ZEN-DC-D1 REACH A	ZEN-DC-D1 REACH A	ZEN-DC-D1 REACH B	ZEN-DC-D1 REACH B
TEMPORARY OR PERMANENT?	(T OR P)	T	P	T	P
DESIGN STORM		100 YR	100 YR	100 YR	100 YR
ACRES	(AC)	0.05	0.05	0.36	0.36
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A
Q_r (REQUIRED CAPACITY)	(CFS)	0.44	0.44	3.40	3.40
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.44	0.45	3.44	3.46
PROTECTIVE LINING[2]		ECM (SC150BN)	ECM with Vegetation	ECM (SC150BN)	ECM with Vegetation
n (MANNING'S COEFFICIENT)[2]		0.05	0.085	0.043	0.068
V_a (ALLOWABLE VELOCITY)	(FPS)	8.0	15.0	8.0	15.0
V_τ (CALCULATED AT FLOW DEPTH d)	(FPS)	1.0	0.7	2.0	1.4
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.1	8.0	2.1	8.0
$_d$ (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.2	0.2	0.5	0.6
CHANNEL BOTTOM WIDTH	(FT)	1	1	1	1
CHANNEL SIDE SLOPES	(H:V)	1	1	1	1
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.75	1.75
CHANNEL TOP WIDTH @ D	(FT)	3.0	3.0	4.5	4.5
d (CALCULATED FLOW DEPTH)	(FT)	0.32	0.43	0.90	1.13
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	1.64	1.86	2.80	3.26
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	3.13	2.33	1.11	0.88
d_{50} STONE SIZE	(IN)	-	-	-	-
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.422	0.615	1.710	2.407
R (HYDRAULIC RADIUS)	(FT)	0.222	0.277	0.482	0.574
S (BED SLOPE)[3]	(FT/FT)	0.009	0.009	0.009	0.009
S_c (CRITICAL SLOPE)	(FT/FT)	0.070	0.179	0.043	0.104
$.7S_c$	(FT/FT)	0.049	0.125	0.030	0.073
$1.3S_c$	(FT/FT)	0.091	0.232	0.056	0.136
STABLE FLOW?	(Y/N)	Y	Y	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	-	-	-
FREEBOARD BASED ON STABLE FLOW	(FT)	0.68	0.57	0.85	0.62
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING[5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		S	S	S	S

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

CHANNEL OR CHANNEL SECTION		ZEN-CC-C2	ZEN-CC-C2	ZEN-CC-C1	ZEN-CC-C1
TEMPORARY OR PERMANENT?	(T OR P)	T	P	T	P
DESIGN STORM		100 YR	100 YR	100 YR	100 YR
ACRES	(AC)	0.16	0.16	0.14	0.14
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A
Q_r (REQUIRED CAPACITY)	(CFS)	1.41	1.41	1.43	1.43
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	1.41	1.48	1.47	1.45
PROTECTIVE LINING[2]		ECM (SC150BN)	ECM with Vegetation	ECM (SC150BN)	ECM with Vegetation
n (MANNING'S COEFFICIENT)[2]		0.05	0.051	0.05	0.065
V_a (ALLOWABLE VELOCITY)	(FPS)	8.0	15.0	8.0	15.0
V (CALCULATED AT FLOW DEPTH d)	(FPS)	2.3	2.2	2.1	1.7
$_a$ (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.1	8.0	2.1	8.0
$_d$ (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.8	0.8	0.7	0.8
CHANNEL BOTTOM WIDTH	(FT)	2	2	1	1
CHANNEL SIDE SLOPES	(H:V)	2	2	1	1
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.25	1.25
CHANNEL TOP WIDTH @ D	(FT)	6.0	6.0	3.5	3.5
d (CALCULATED FLOW DEPTH)	(FT)	0.25	0.25	0.48	0.55
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.0	3.0	1.96	2.10
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	8.0	8.0	2.08	1.82
d_{50} STONE SIZE	(IN)	-	-	-	-
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.625	0.655	0.710	0.853
R (HYDRAULIC RADIUS)	(FT)	0.20	0.21	0.301	0.334
S (BED SLOPE)[3]	(FT/FT)	0.049	0.049	0024	0.024
S_c (CRITICAL SLOPE)	(FT/FT)	0.065	0.067	0.065	0.108
$.7S_c$	(FT/FT)	0.045	0.047	0.046	0.076
$1.3S_c$	(FT/FT)	0.084	0.087	0.085	0.140
STABLE FLOW?	(Y/N)	N	N	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.75	0.75	-	-
FREEBOARD BASED ON STABLE FLOW	(FT)	-	-	0.77	0.70
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		S	S	S	S

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.



Subcat Reach Pond Link

Routing Diagram for Zenker Post w BMP- REV3

Prepared by {enter your company name here}, Printed 7/19/2022

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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,957	91	Gravel roads, HSG D (8S, 9S)
32,034	78	Meadow, non-grazed, HSG D (1S, 2S, 6S, 8S, 9S)
38,991	**80**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
38,991	HSG D	1S, 2S, 6S, 8S, 9S
0	Other	
38,991		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	6,957	0	6,957	Gravel roads	
0	0	0	32,034	0	32,034	Meadow, non-grazed	
0	**0**	**0**	**38,991**	**0**	**38,991**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	5P	1,425.45	1,422.00	13.0	0.2654	0.010	3.0	0.0	0.0

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.13 cfs 266 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.12 cfs 257 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=0.76"
Tc=5.0 min CN=78 Runoff=0.55 cfs 1,126 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=0.97"
Tc=5.0 min CN=82 Runoff=0.27 cfs 549 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=1.42"
Tc=5.0 min CN=89 Runoff=0.36 cfs 738 cf

Reach 10: DA Post w/ BMP Total Inflow=0.67 cfs 1,413 cf
Outflow=0.67 cfs 1,413 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.09' Max Vel=1.26 fps Inflow=0.27 cfs 549 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.25 cfs 549 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.21' Max Vel=1.35 fps Inflow=0.36 cfs 738 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.34 cfs 738 cf

Pond 5P: Berm Peak Elev=1,425.46' Storage=1,012 cf Inflow=0.69 cfs 1,552 cf
Discarded=0.01 cfs 912 cf Primary=0.00 cfs 30 cf Outflow=0.02 cfs 942 cf

Pond 6P: Level Spreader Peak Elev=1,422.00' Storage=0 cf Inflow=0.00 cfs 30 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 30 cf Outflow=0.00 cfs 30 cf

Total Runoff Area = 38,991 sf Runoff Volume = 2,935 cf Average Runoff Depth = 0.90"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

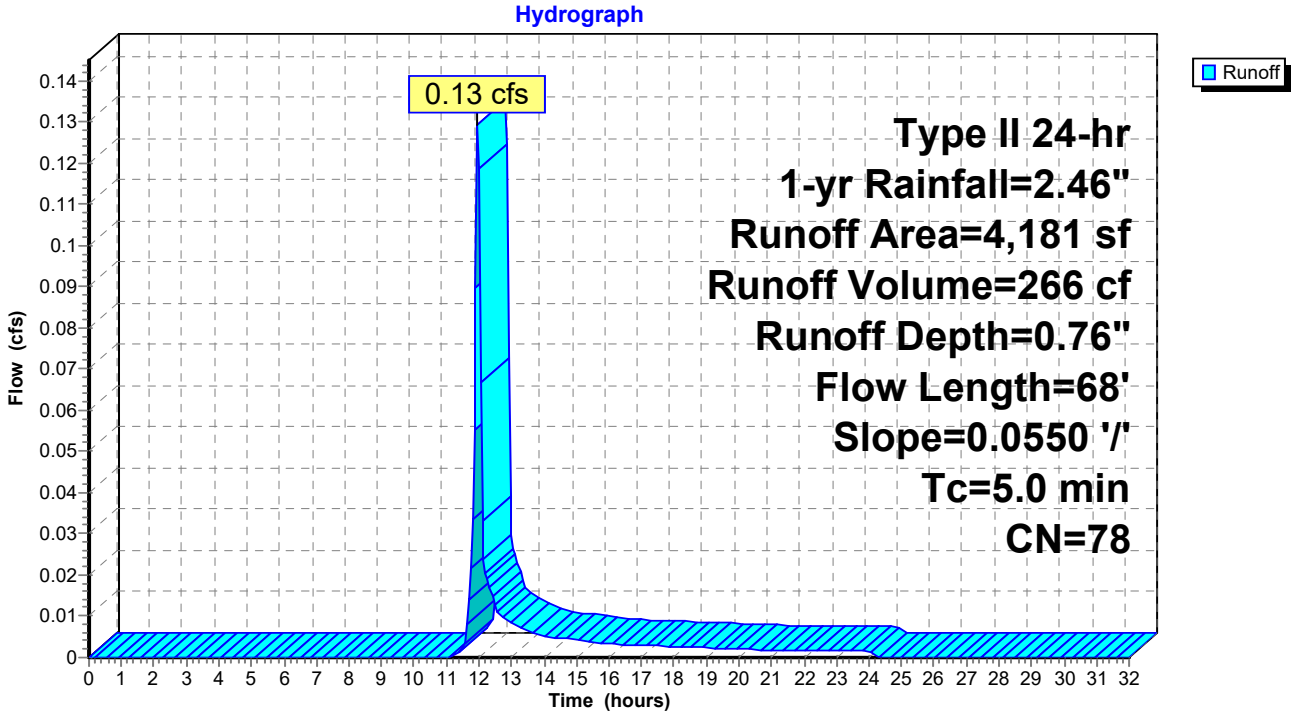
Runoff = 0.13 cfs @ 11.97 hrs, Volume= 266 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

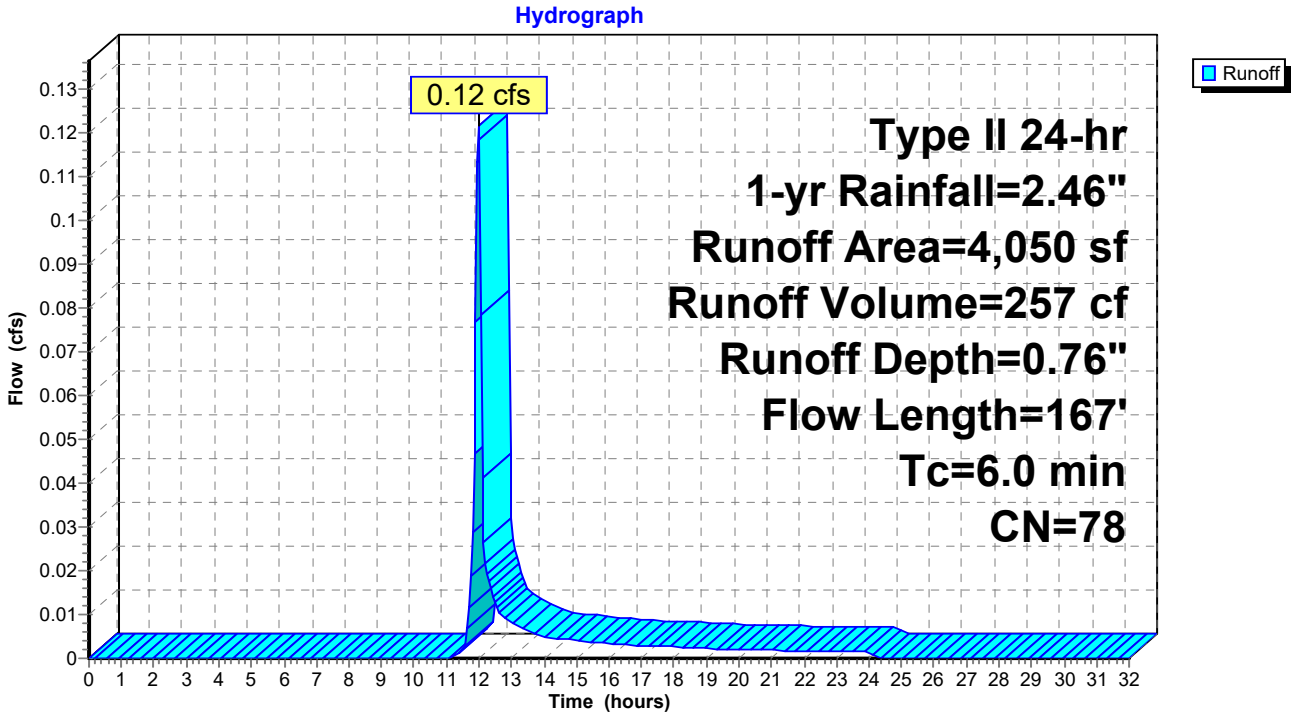
Runoff = 0.12 cfs @ 11.98 hrs, Volume= 257 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

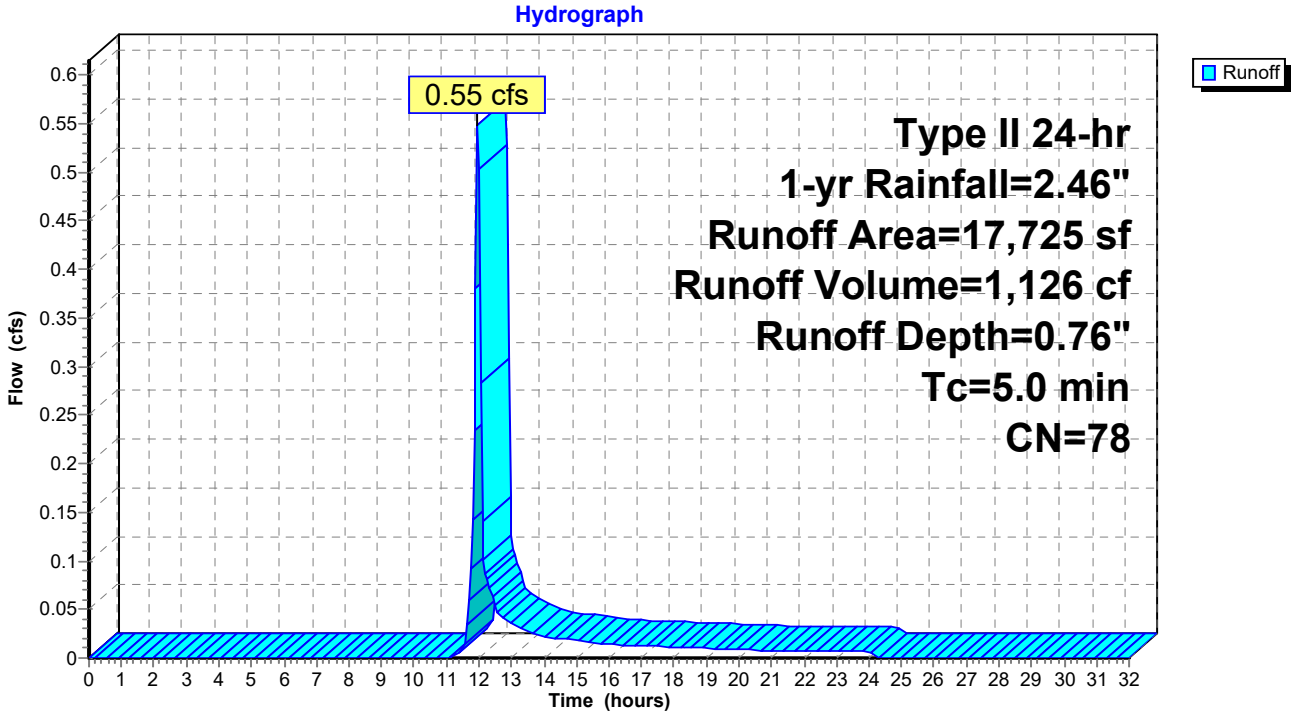
Runoff = 0.55 cfs @ 11.97 hrs, Volume= 1,126 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

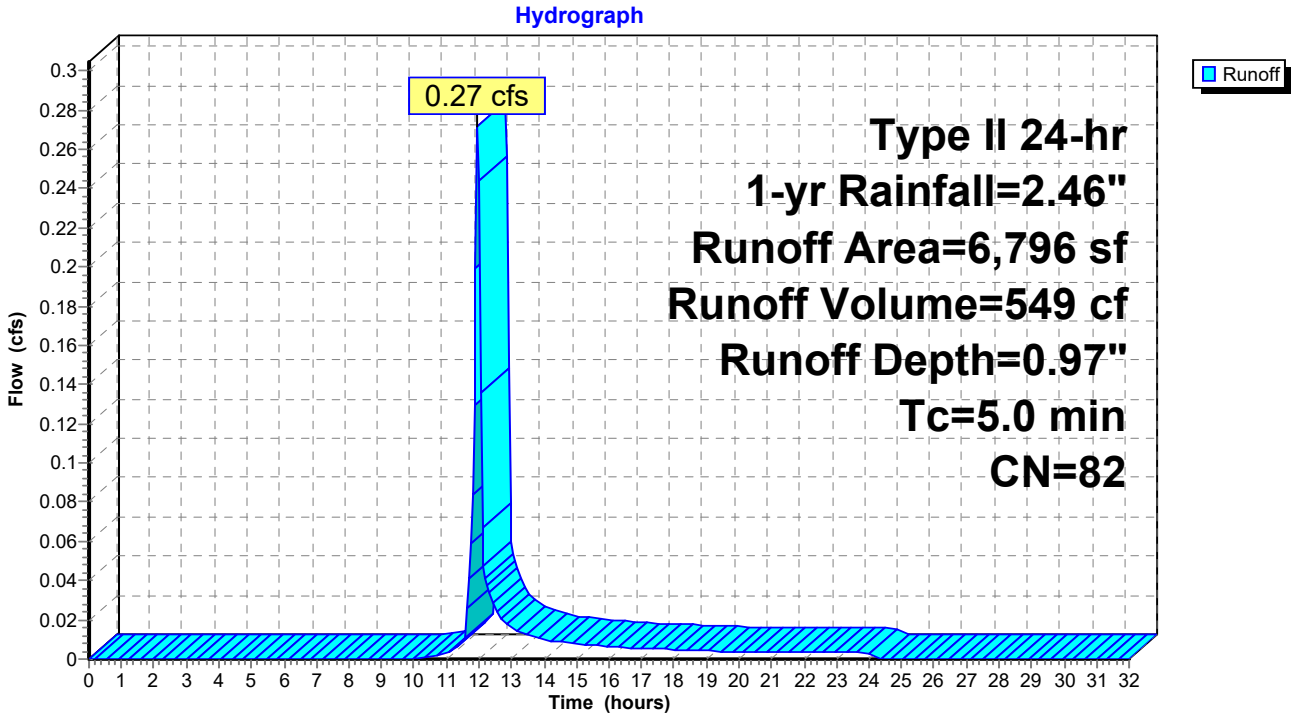
Runoff = 0.27 cfs @ 11.96 hrs, Volume= 549 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

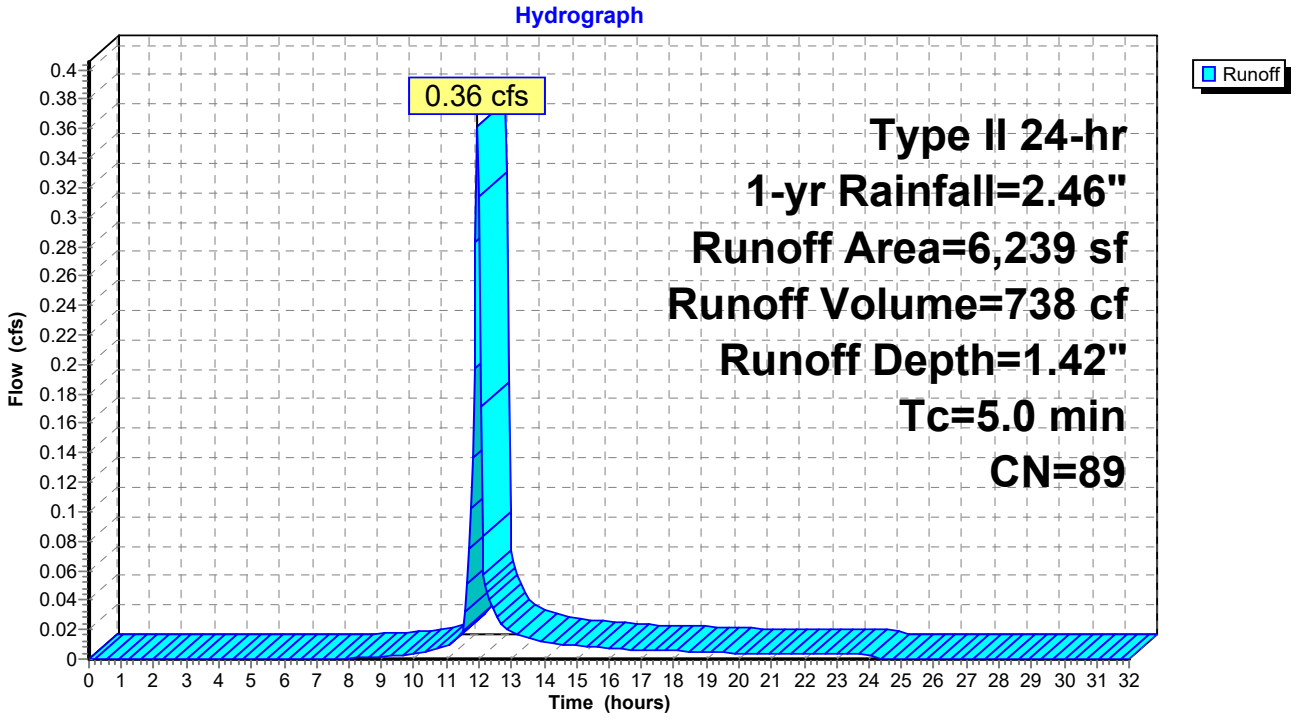
Runoff = 0.36 cfs @ 11.96 hrs, Volume= 738 cf, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.46"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



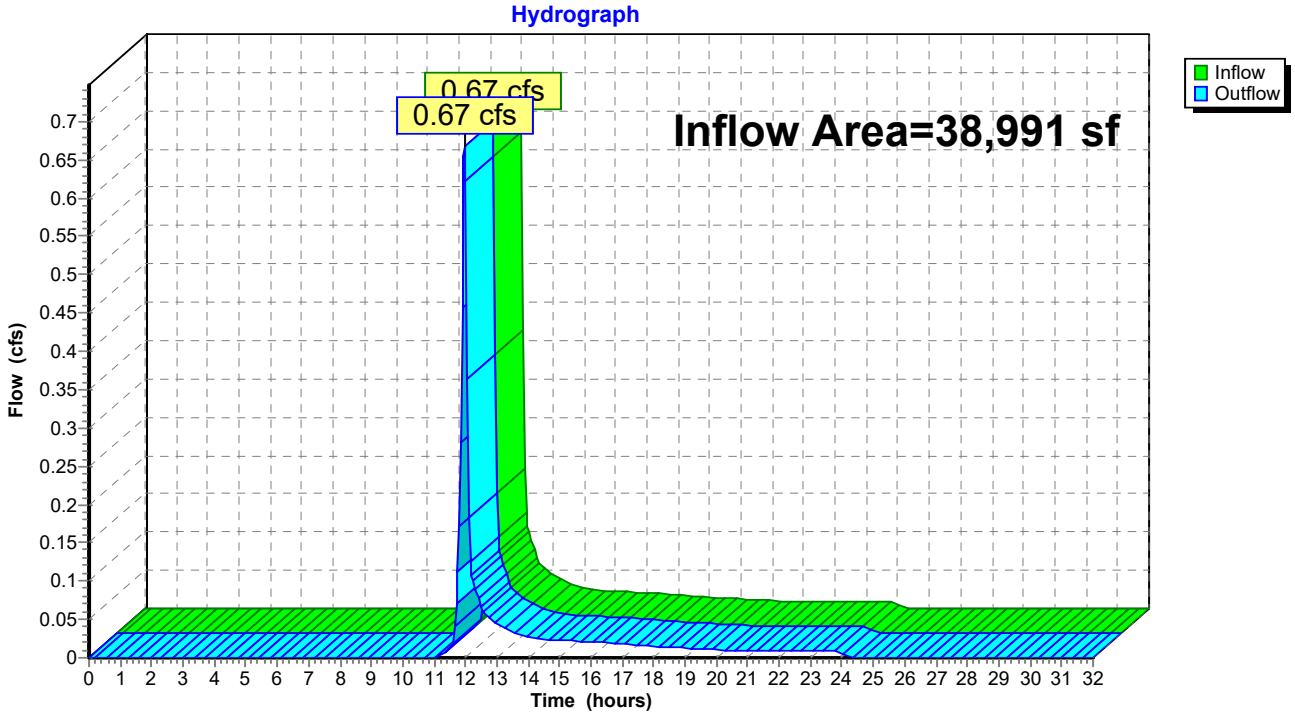
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 0.43" for 1-yr event
Inflow = 0.67 cfs @ 11.97 hrs, Volume= 1,413 cf
Outflow = 0.67 cfs @ 11.97 hrs, Volume= 1,413 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 0.97" for 1-yr event
Inflow = 0.27 cfs @ 11.96 hrs, Volume= 549 cf
Outflow = 0.25 cfs @ 12.03 hrs, Volume= 549 cf, Atten= 8%, Lag= 4.2 min

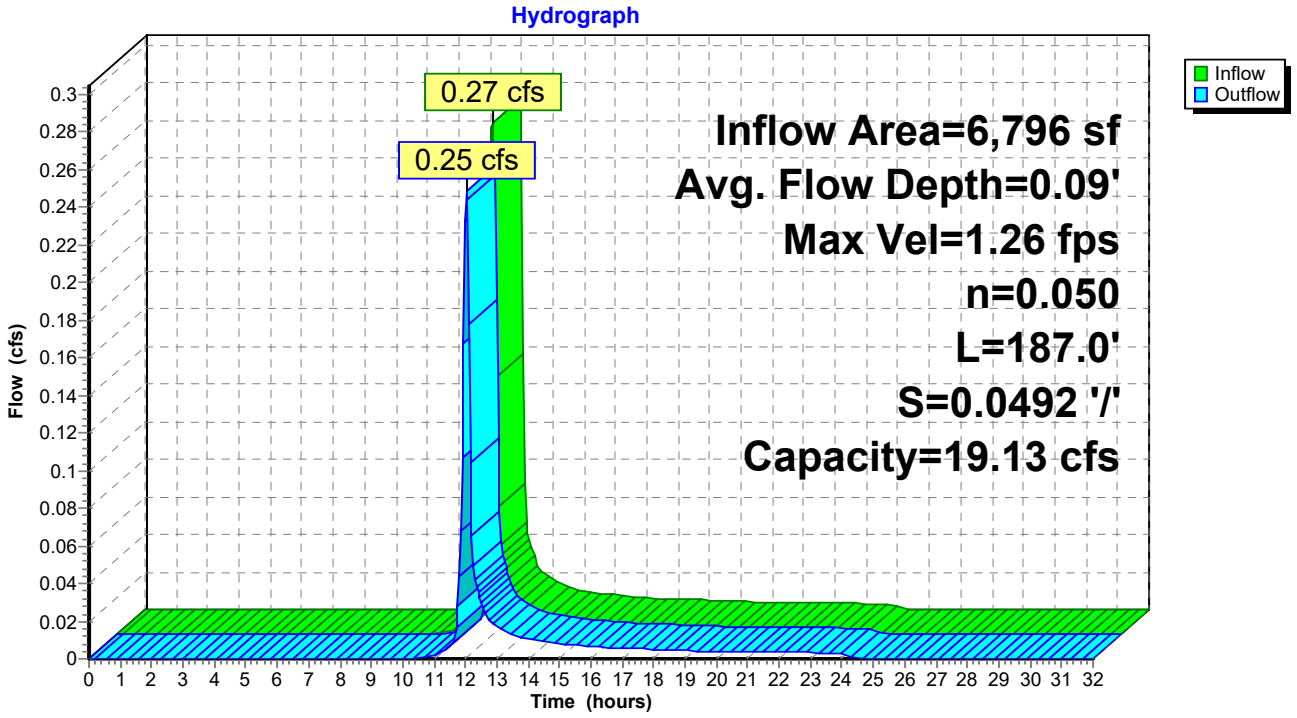
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.26 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 8.8 min

Peak Storage= 38 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



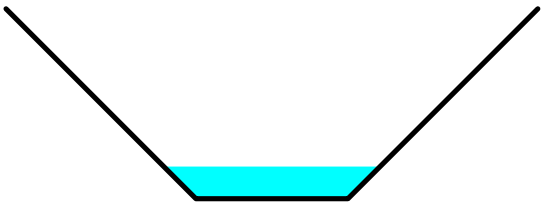
Summary for Reach 11R: CC-C1

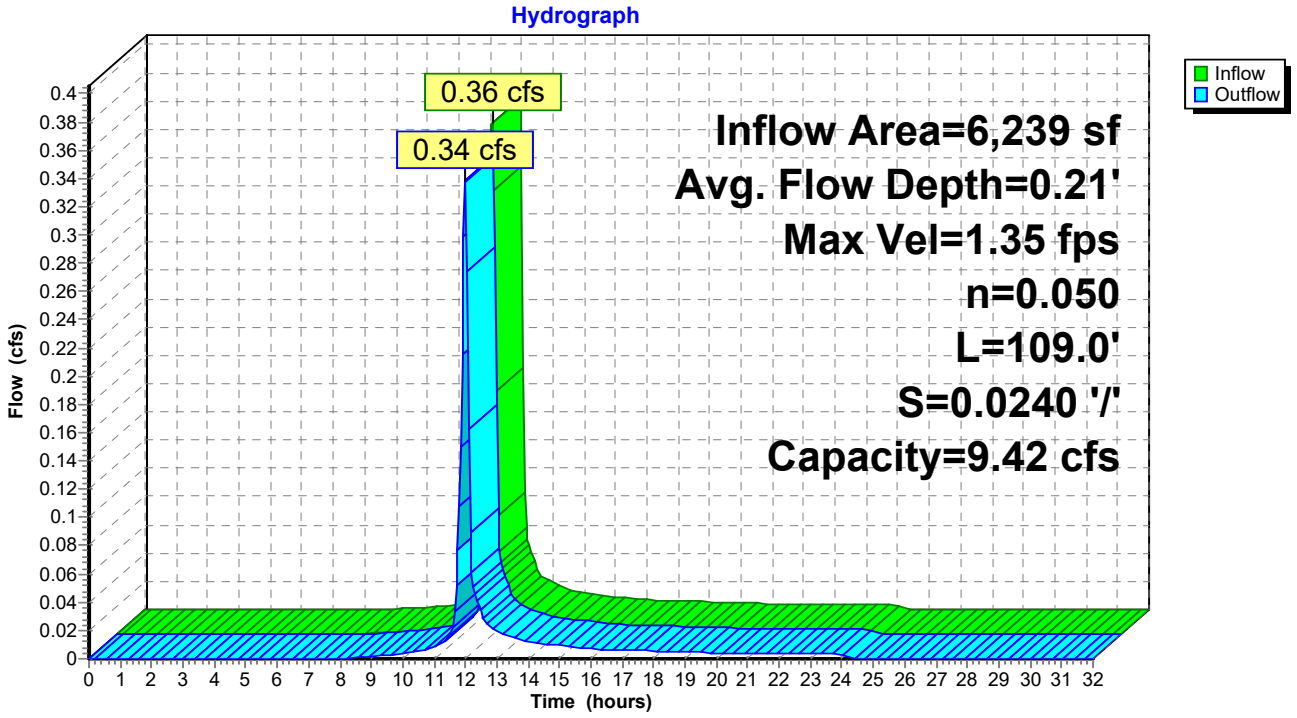
Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 1.42" for 1-yr event
Inflow = 0.36 cfs @ 11.96 hrs, Volume= 738 cf
Outflow = 0.34 cfs @ 11.99 hrs, Volume= 738 cf, Atten= 7%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.35 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 5.3 min

Peak Storage= 28 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'





Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.08" for 1-yr event
Inflow = 0.69 cfs @ 12.00 hrs, Volume= 1,552 cf
Outflow = 0.02 cfs @ 16.03 hrs, Volume= 942 cf, Atten= 98%, Lag= 241.9 min
Discarded = 0.01 cfs @ 16.03 hrs, Volume= 912 cf
Primary = 0.00 cfs @ 16.03 hrs, Volume= 30 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.46' @ 16.03 hrs Surf.Area= 1,454 sf Storage= 1,012 cf

Plug-Flow detention time= 550.3 min calculated for 941 cf (61% of inflow)
Center-of-Mass det. time= 430.9 min (1,271.2 - 840.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

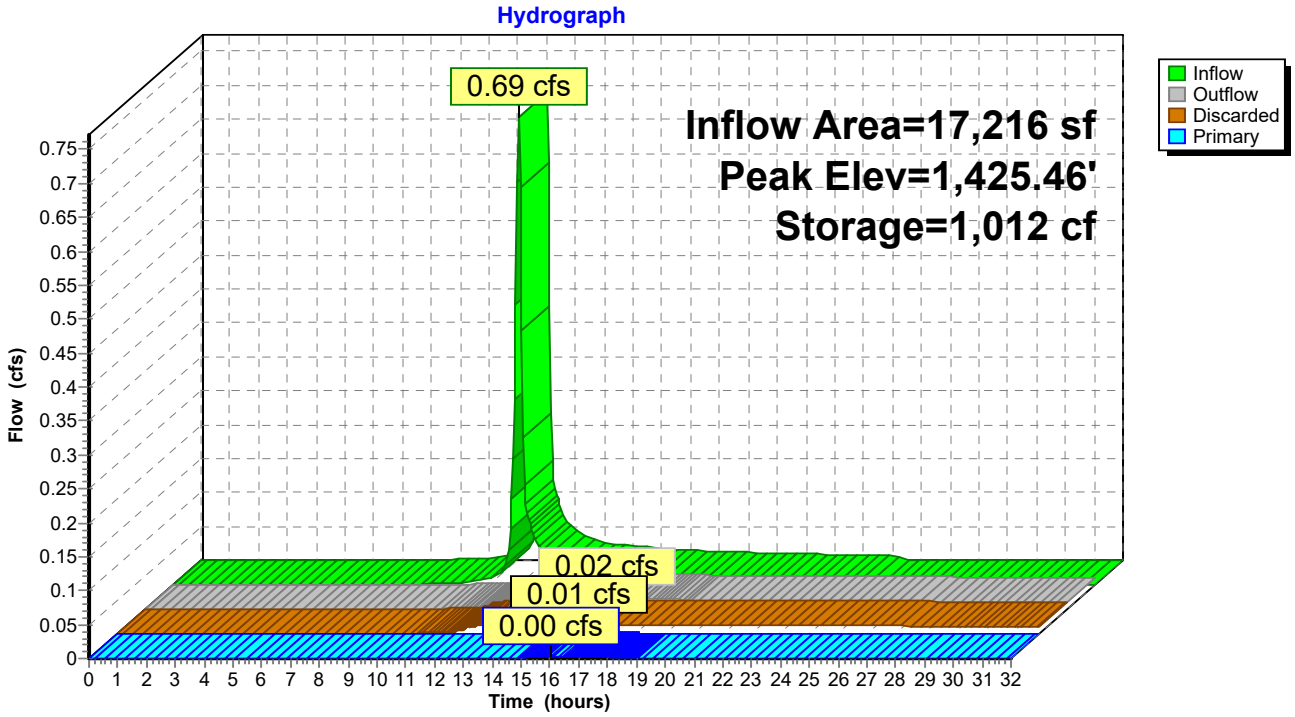
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.01 cfs @ 16.03 hrs HW=1,425.46' (Free Discharge)
└**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,425.46' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.00 cfs @ 0.28 fps)

Pond 5P: Berm


Hydrograph
0.69 cfs
0.02 cfs
0.01 cfs
0.00 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.46'
Storage=1,012 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Summary for Pond 6P: Level Spreader

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 0.02" for 1-yr event
Inflow = 0.00 cfs @ 16.03 hrs, Volume= 30 cf
Outflow = 0.00 cfs @ 16.03 hrs, Volume= 30 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 16.03 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 16.03 hrs, Volume= 30 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.00' @ 16.03 hrs Surf.Area= 35 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 30 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (997.8 - 997.8)

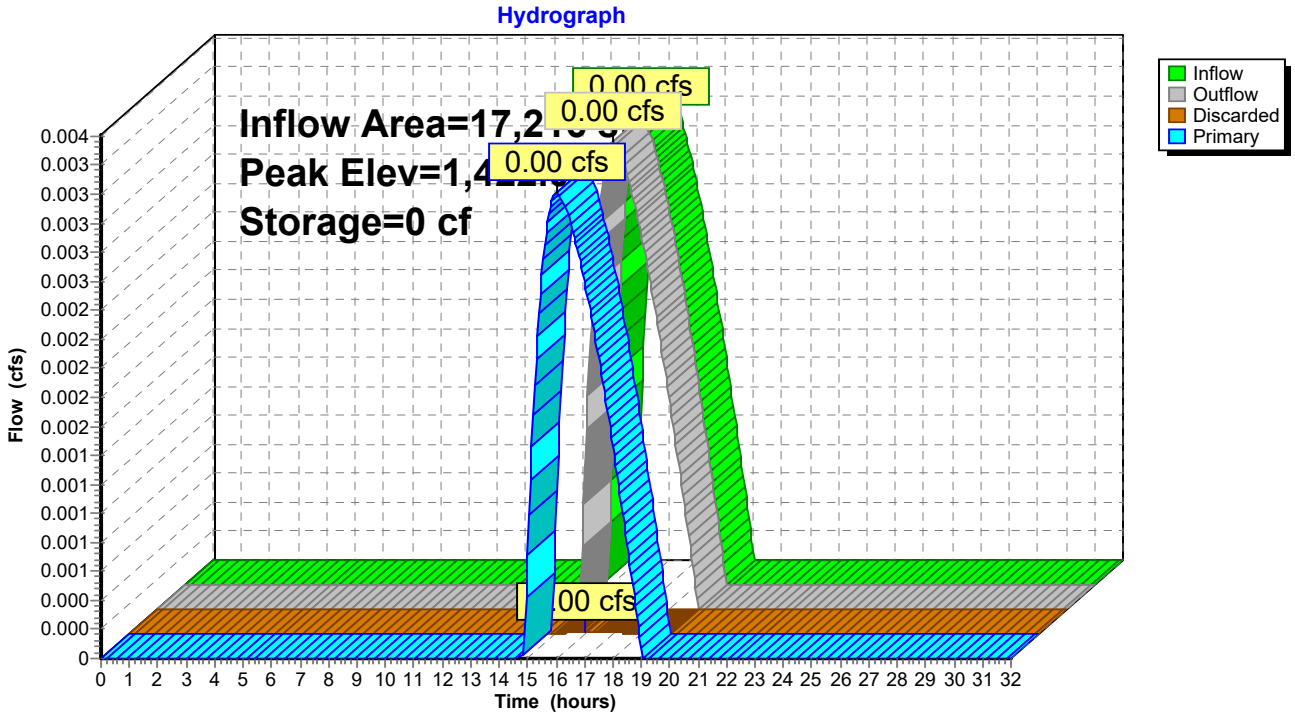
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,422.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 16.03 hrs HW=1,422.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.05 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=1.09"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.19 cfs 381 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=1.09"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.18 cfs 369 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=1.09"
Tc=5.0 min CN=78 Runoff=0.80 cfs 1,615 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=1.34"
Tc=5.0 min CN=82 Runoff=0.38 cfs 759 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=1.85"
Tc=5.0 min CN=89 Runoff=0.47 cfs 964 cf

Reach 10: DA Post w/ BMP Total Inflow=0.97 cfs 2,482 cf
Outflow=0.97 cfs 2,482 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.11' Max Vel=1.42 fps Inflow=0.38 cfs 759 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.34 cfs 759 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.25' Max Vel=1.46 fps Inflow=0.47 cfs 964 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.44 cfs 964 cf

Pond 5P: Berm Peak Elev=1,425.52' Storage=1,095 cf Inflow=0.94 cfs 2,104 cf
Discarded=0.01 cfs 961 cf Primary=0.07 cfs 499 cf Outflow=0.09 cfs 1,460 cf

Pond 6P: Level Spreader Peak Elev=1,422.01' Storage=0 cf Inflow=0.07 cfs 499 cf
Discarded=0.00 cfs 1 cf Primary=0.07 cfs 498 cf Outflow=0.07 cfs 499 cf

Total Runoff Area = 38,991 sf Runoff Volume = 4,088 cf Average Runoff Depth = 1.26"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

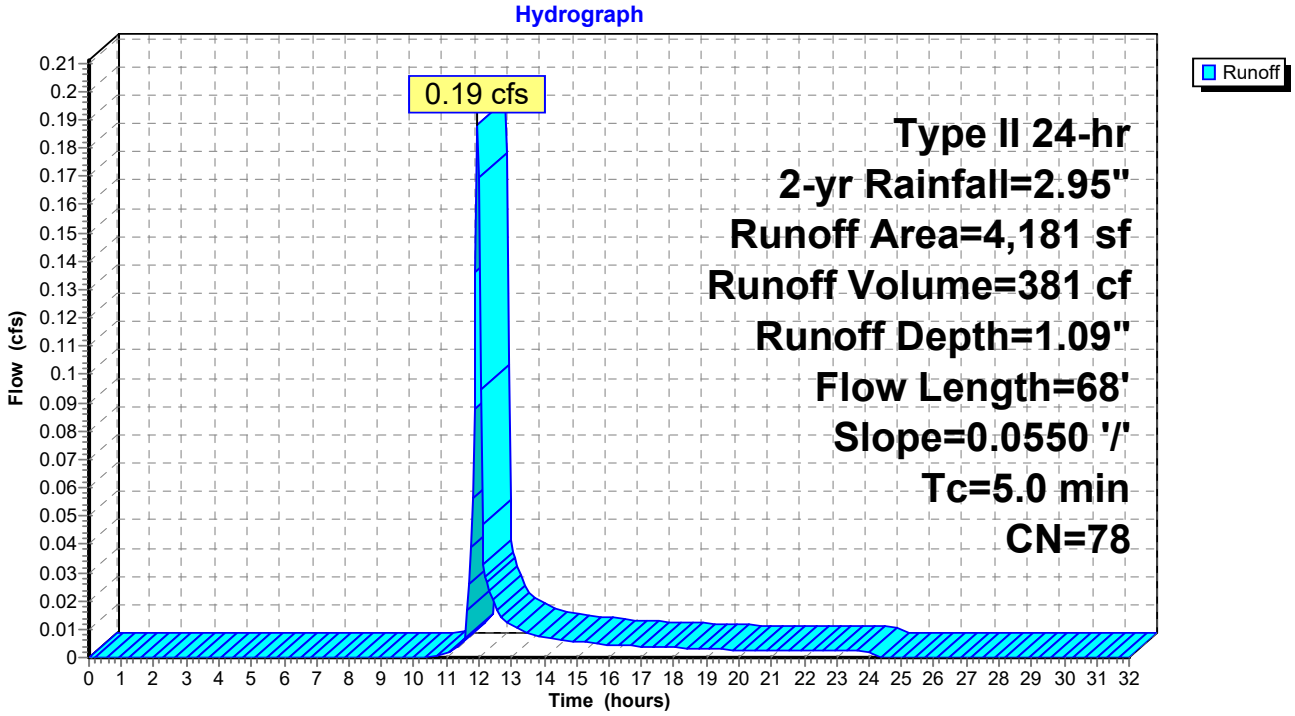
Runoff = 0.19 cfs @ 11.96 hrs, Volume= 381 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

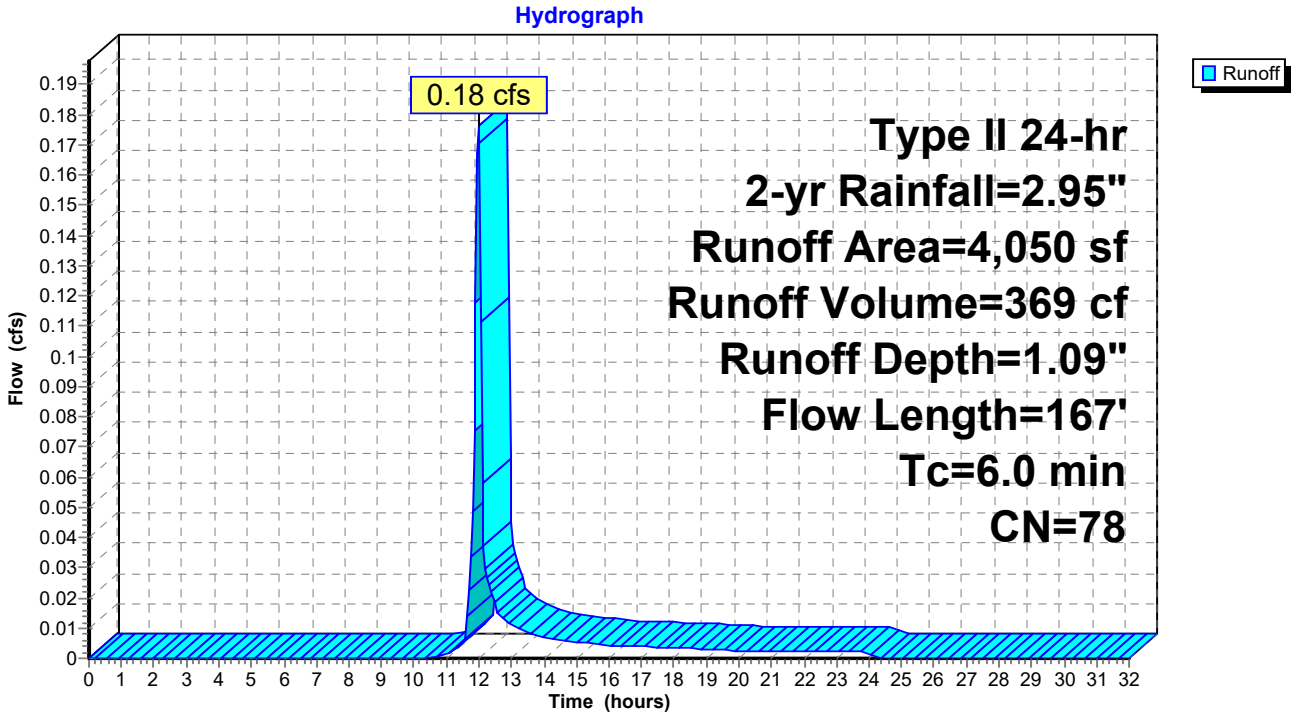
Runoff = 0.18 cfs @ 11.98 hrs, Volume= 369 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

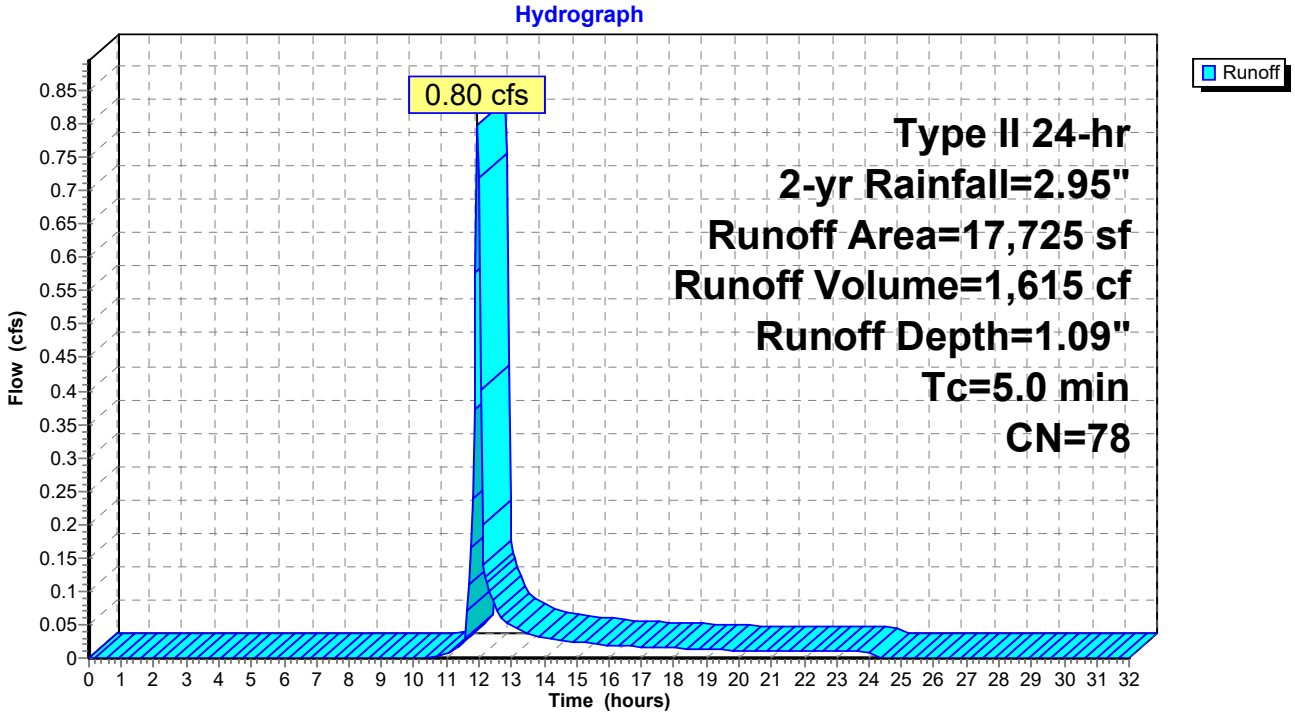
Runoff = 0.80 cfs @ 11.96 hrs, Volume= 1,615 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

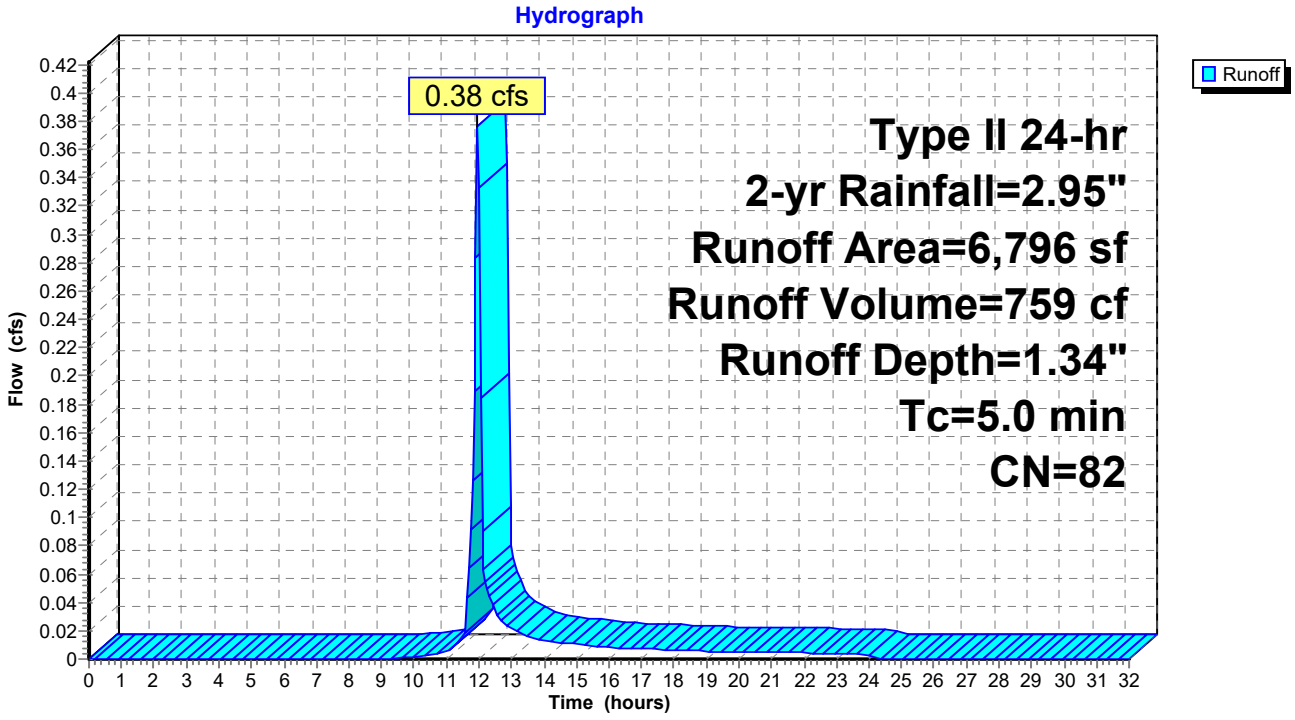
Runoff = 0.38 cfs @ 11.96 hrs, Volume= 759 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

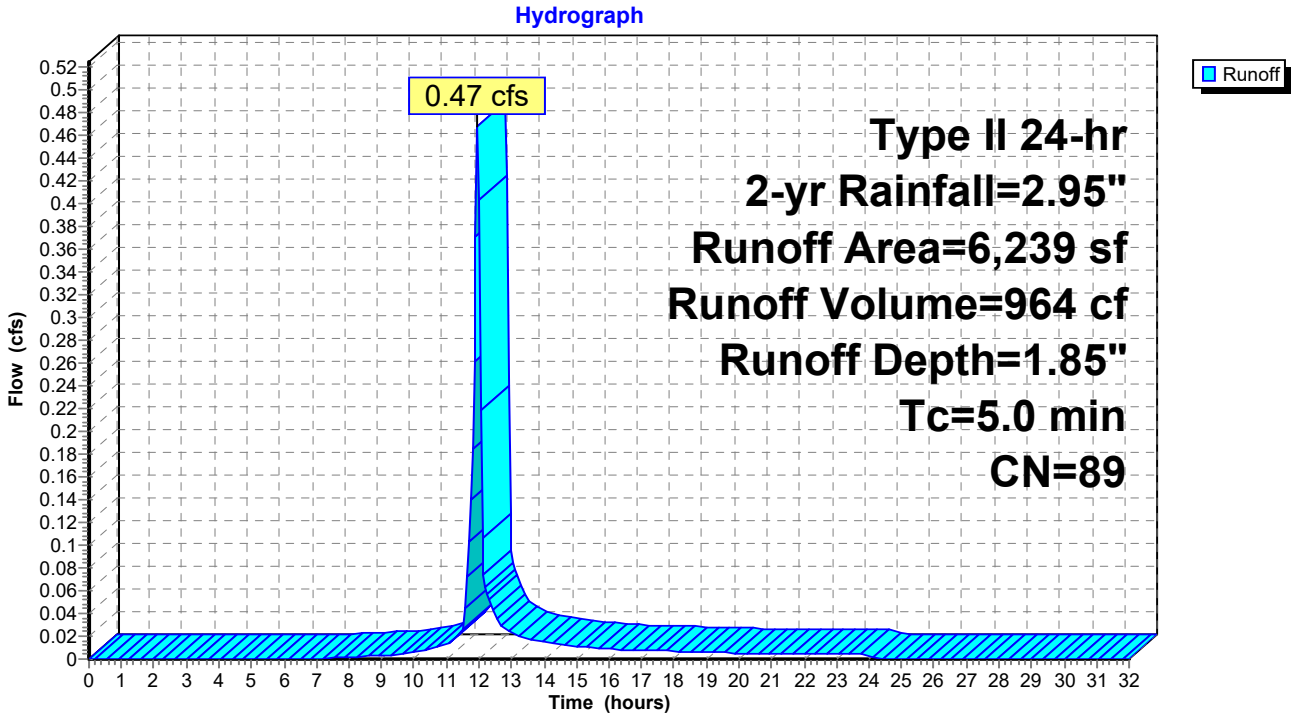
Runoff = 0.47 cfs @ 11.95 hrs, Volume= 964 cf, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.95"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



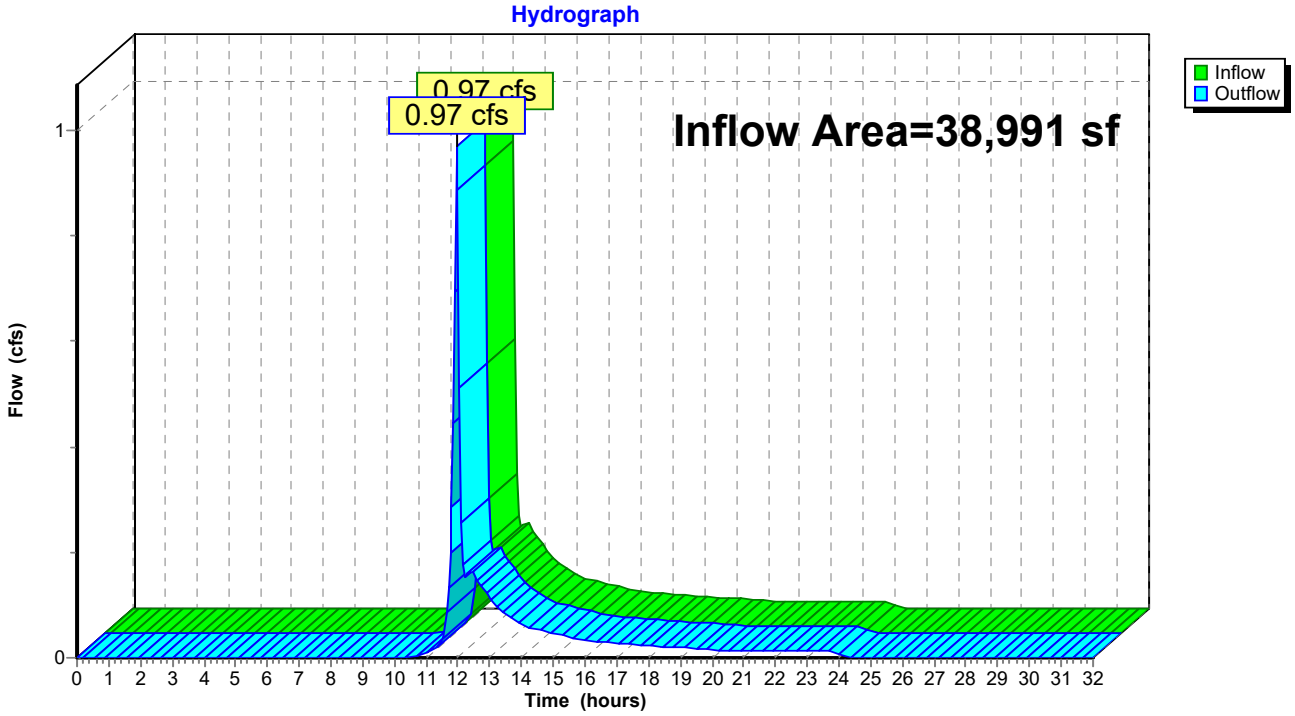
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 0.76" for 2-yr event
Inflow = 0.97 cfs @ 11.96 hrs, Volume= 2,482 cf
Outflow = 0.97 cfs @ 11.96 hrs, Volume= 2,482 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 1.34" for 2-yr event
Inflow = 0.38 cfs @ 11.96 hrs, Volume= 759 cf
Outflow = 0.34 cfs @ 12.02 hrs, Volume= 759 cf, Atten= 9%, Lag= 3.7 min

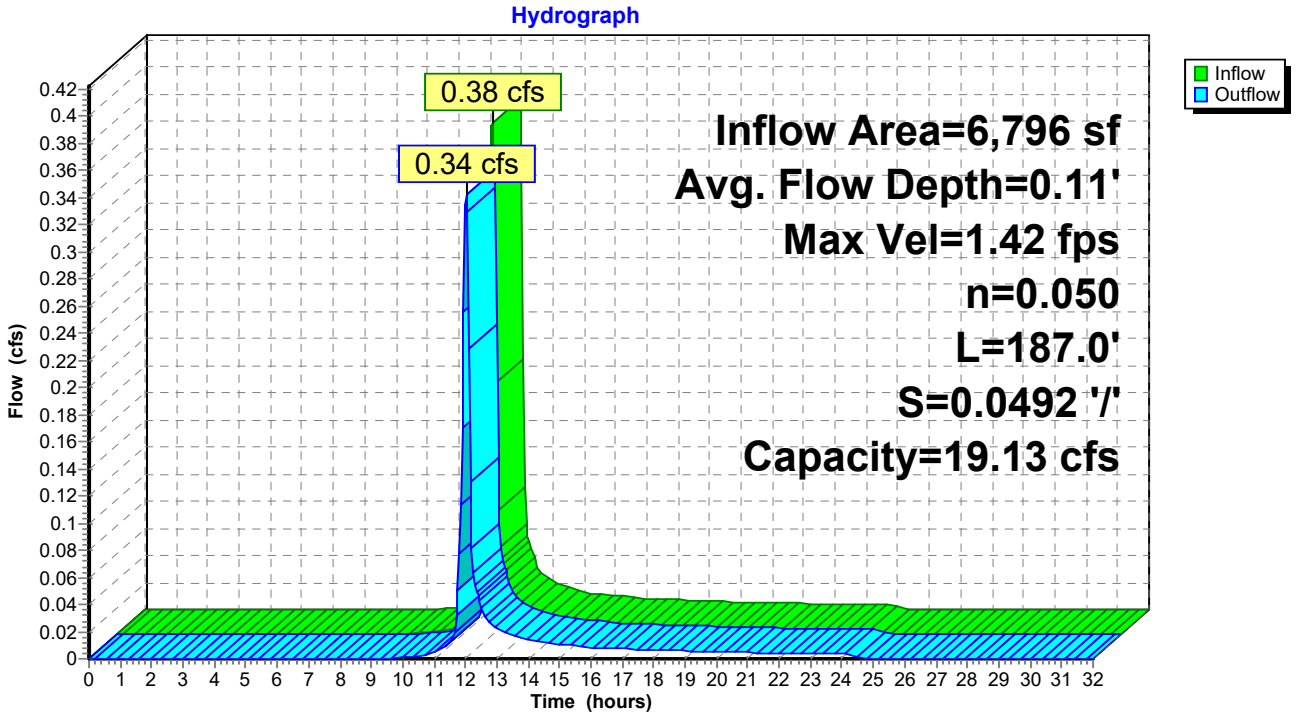
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.42 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 8.4 min

Peak Storage= 47 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



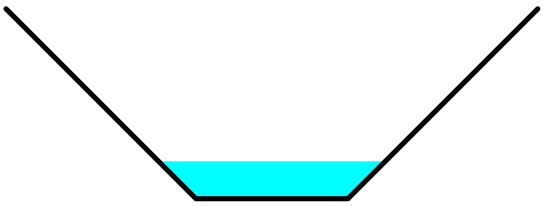
Summary for Reach 11R: CC-C1

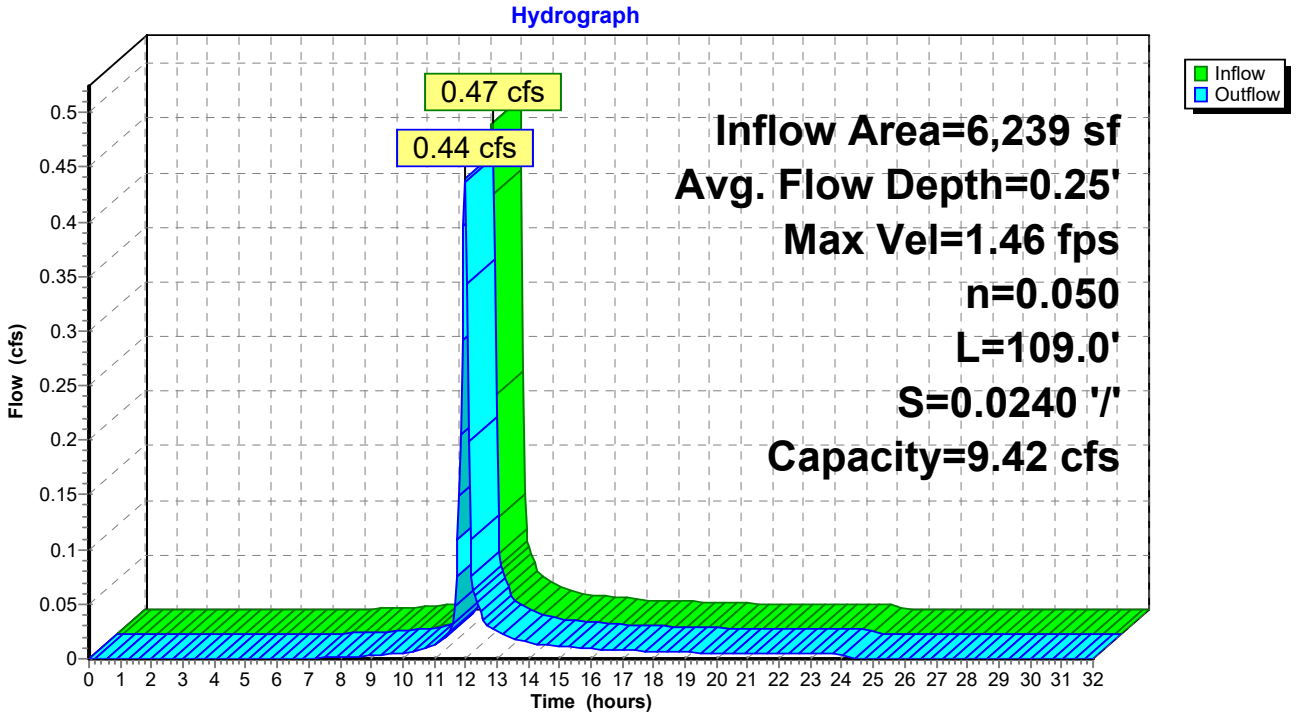
Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 1.85" for 2-yr event
Inflow = 0.47 cfs @ 11.95 hrs, Volume= 964 cf
Outflow = 0.44 cfs @ 11.99 hrs, Volume= 964 cf, Atten= 6%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.46 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 4.9 min

Peak Storage= 33 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'





Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.47" for 2-yr event
Inflow = 0.94 cfs @ 11.99 hrs, Volume= 2,104 cf
Outflow = 0.09 cfs @ 12.57 hrs, Volume= 1,460 cf, Atten= 91%, Lag= 34.8 min
Discarded = 0.01 cfs @ 12.57 hrs, Volume= 961 cf
Primary = 0.07 cfs @ 12.57 hrs, Volume= 499 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.52' @ 12.57 hrs Surf.Area= 1,544 sf Storage= 1,095 cf

Plug-Flow detention time= 401.1 min calculated for 1,460 cf (69% of inflow)
Center-of-Mass det. time= 294.5 min (1,126.1 - 831.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

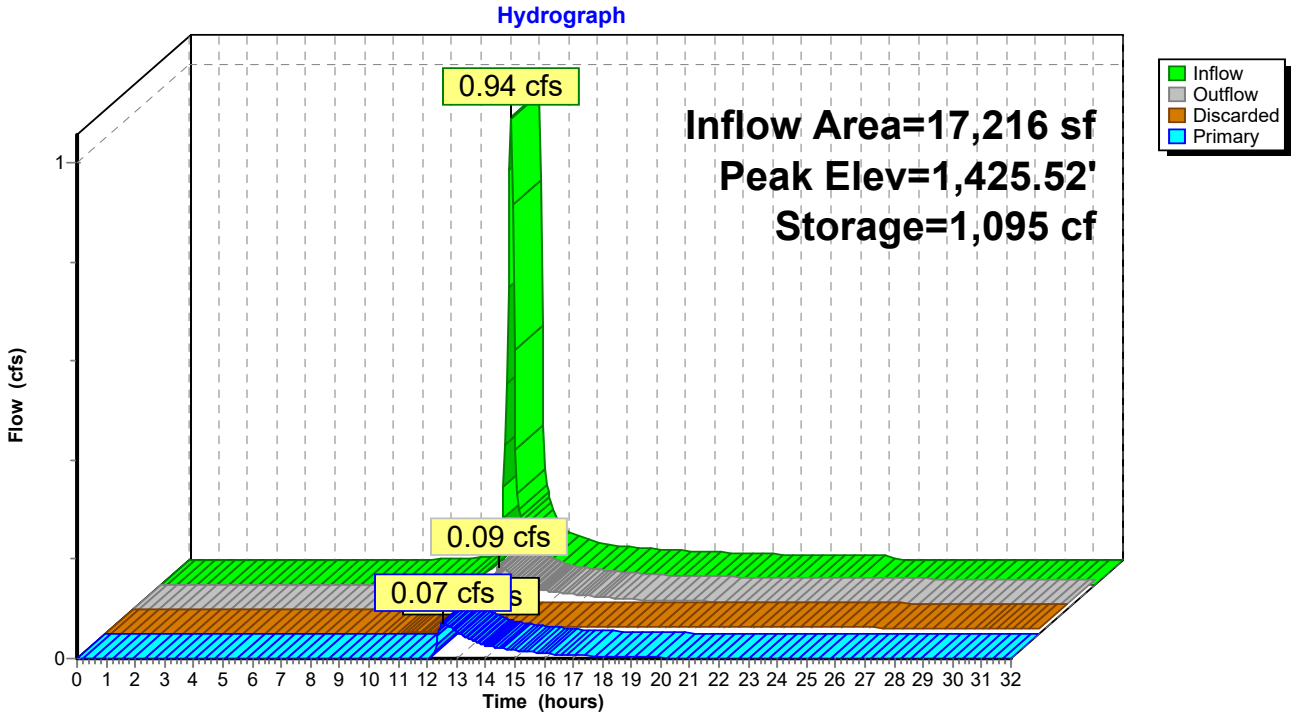
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.01 cfs @ 12.57 hrs HW=1,425.52' (Free Discharge)
└**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.07 cfs @ 12.57 hrs HW=1,425.52' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.07 cfs @ 0.69 fps)

Pond 5P: Berm


Hydrograph
0.94 cfs
0.09 cfs
0.07 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.52'
Storage=1,095 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.01'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 0.35" for 2-yr event
Inflow = 0.07 cfs @ 12.57 hrs, Volume= 499 cf
Outflow = 0.07 cfs @ 12.58 hrs, Volume= 499 cf, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.58 hrs, Volume= 1 cf
Primary = 0.07 cfs @ 12.58 hrs, Volume= 498 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.01' @ 12.58 hrs Surf.Area= 35 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 498 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (850.2 - 850.1)

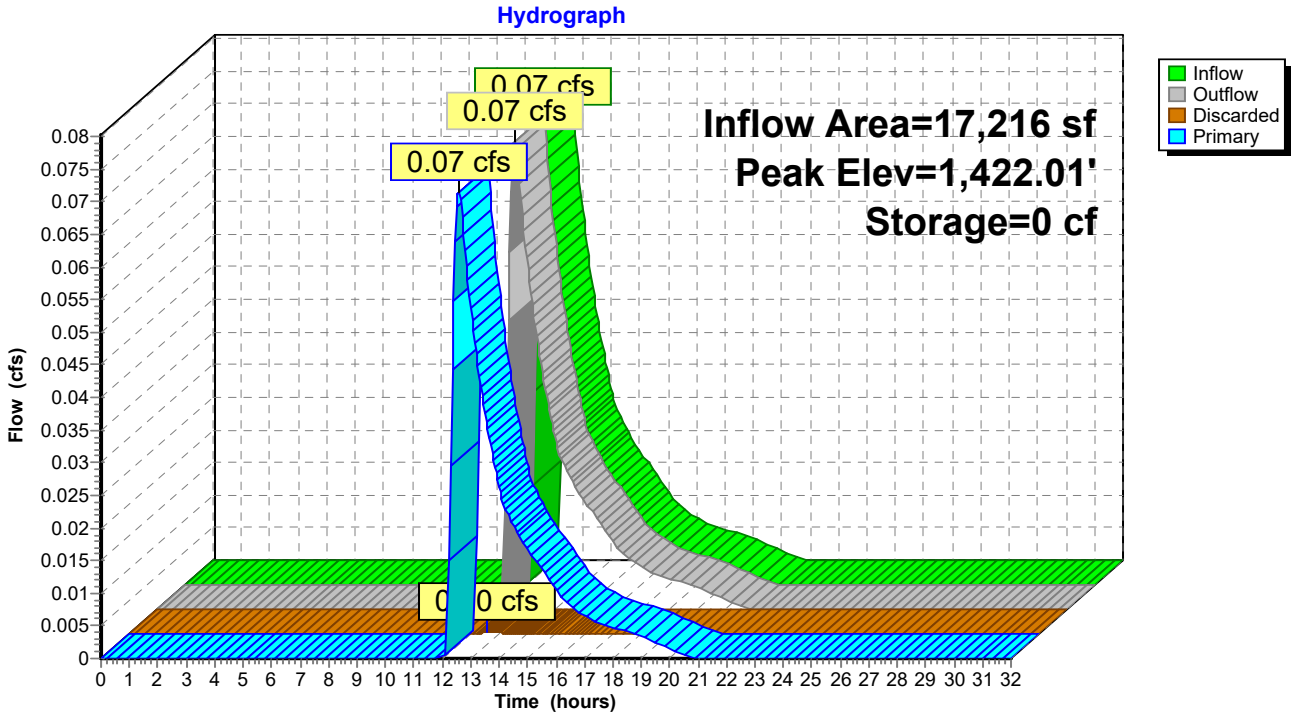
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.58 hrs HW=1,422.01' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.06 cfs @ 12.58 hrs HW=1,422.01' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.23 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.37 cfs 742 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.34 cfs 718 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=2.13"
Tc=5.0 min CN=78 Runoff=1.56 cfs 3,144 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=2.46"
Tc=5.0 min CN=82 Runoff=0.68 cfs 1,394 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=3.11"
Tc=5.0 min CN=89 Runoff=0.76 cfs 1,615 cf

Reach 10: DA Post w/ BMP Total Inflow=2.21 cfs 5,910 cf
Outflow=2.21 cfs 5,910 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.16' Max Vel=1.74 fps Inflow=0.68 cfs 1,394 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.63 cfs 1,394 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.33' Max Vel=1.70 fps Inflow=0.76 cfs 1,615 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.72 cfs 1,615 cf

Pond 5P: Berm Peak Elev=1,425.75' Storage=1,502 cf Inflow=1.68 cfs 3,750 cf
Discarded=0.02 cfs 1,024 cf Primary=0.78 cfs 2,051 cf Outflow=0.80 cfs 3,074 cf

Pond 6P: Level Spreader Peak Elev=1,422.04' Storage=1 cf Inflow=0.78 cfs 2,051 cf
Discarded=0.00 cfs 3 cf Primary=0.78 cfs 2,047 cf Outflow=0.78 cfs 2,051 cf

Total Runoff Area = 38,991 sf Runoff Volume = 7,613 cf Average Runoff Depth = 2.34"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

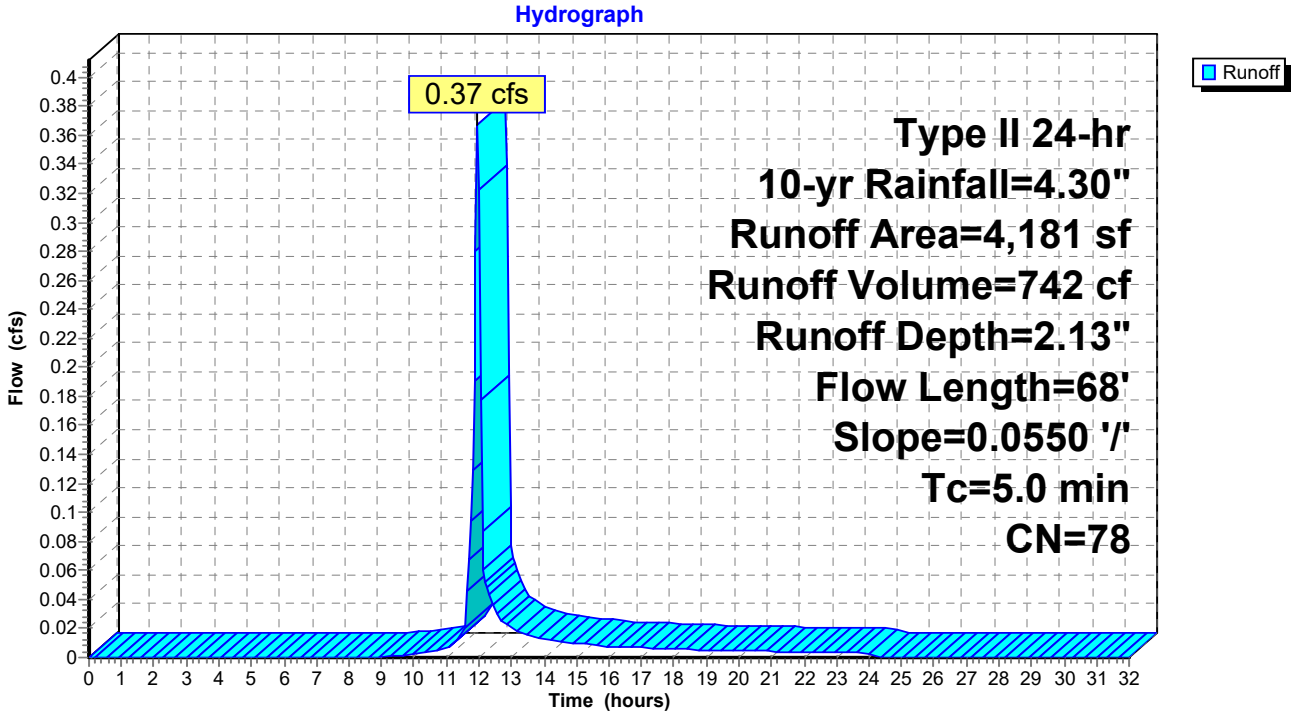
Runoff = 0.37 cfs @ 11.96 hrs, Volume= 742 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

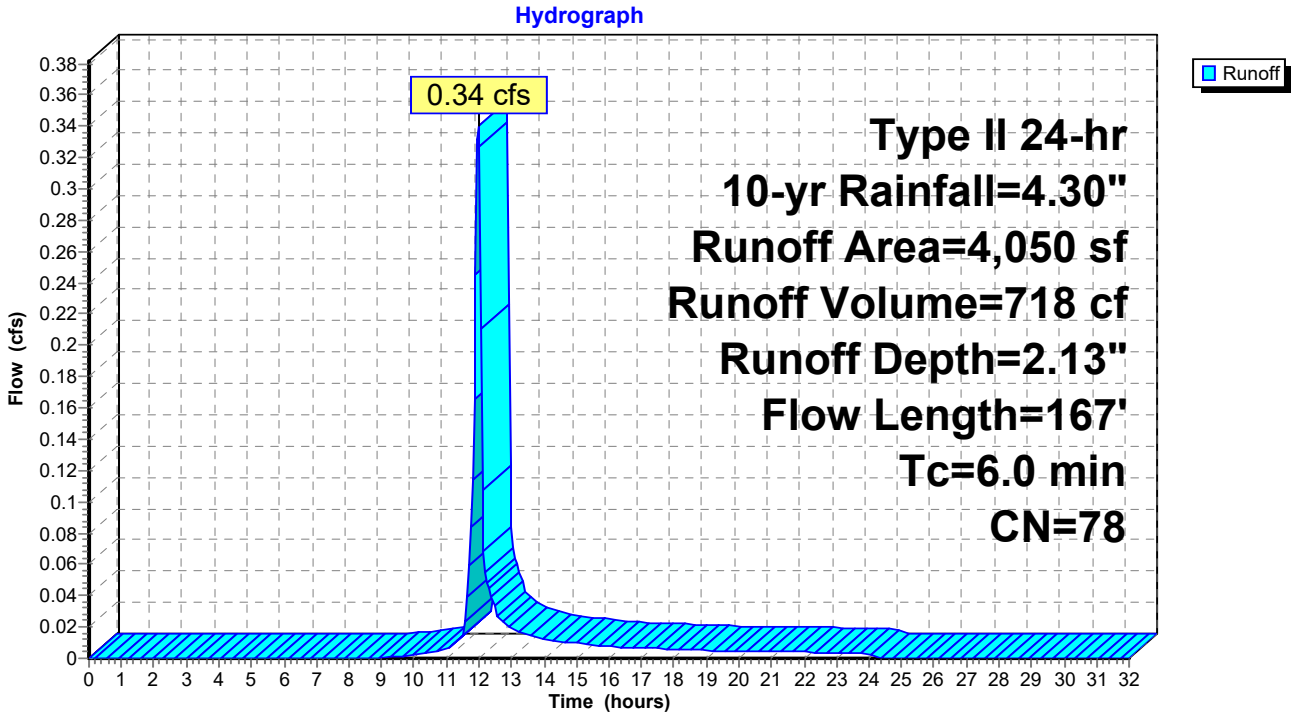
Runoff = 0.34 cfs @ 11.97 hrs, Volume= 718 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

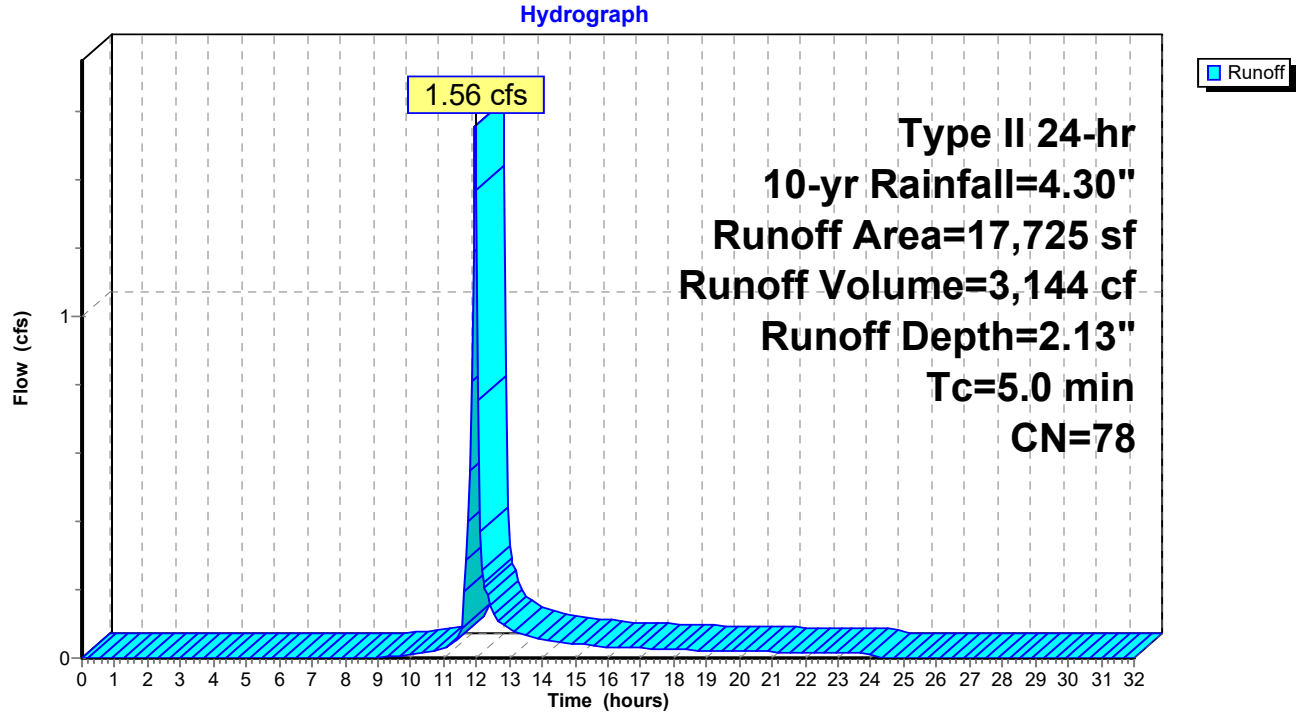
Runoff = 1.56 cfs @ 11.96 hrs, Volume= 3,144 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

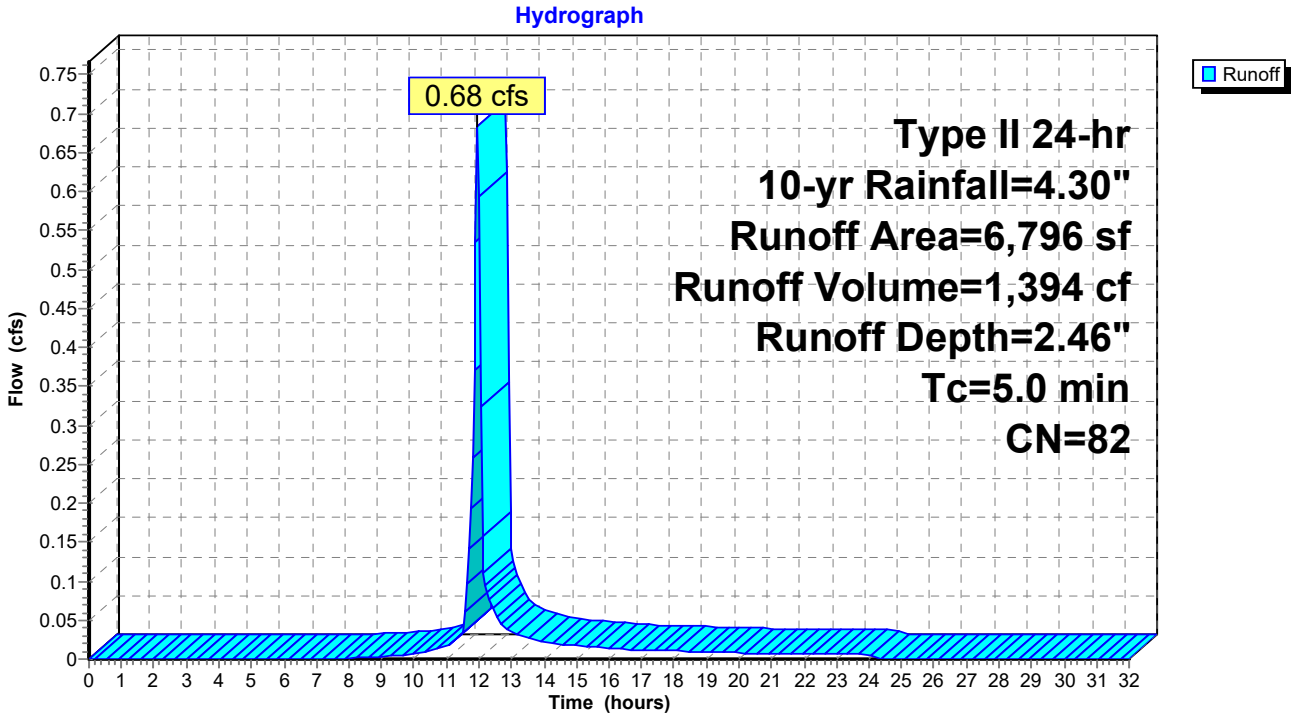
Runoff = 0.68 cfs @ 11.96 hrs, Volume= 1,394 cf, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

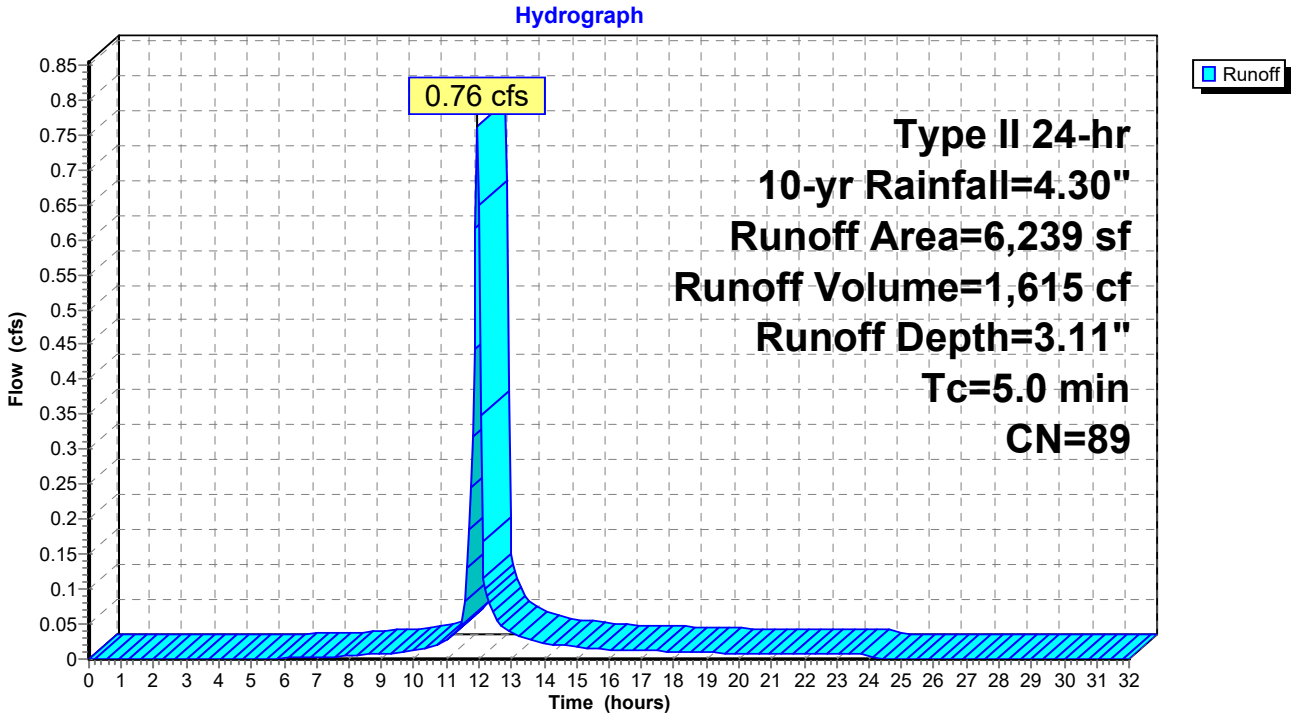
Runoff = 0.76 cfs @ 11.95 hrs, Volume= 1,615 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



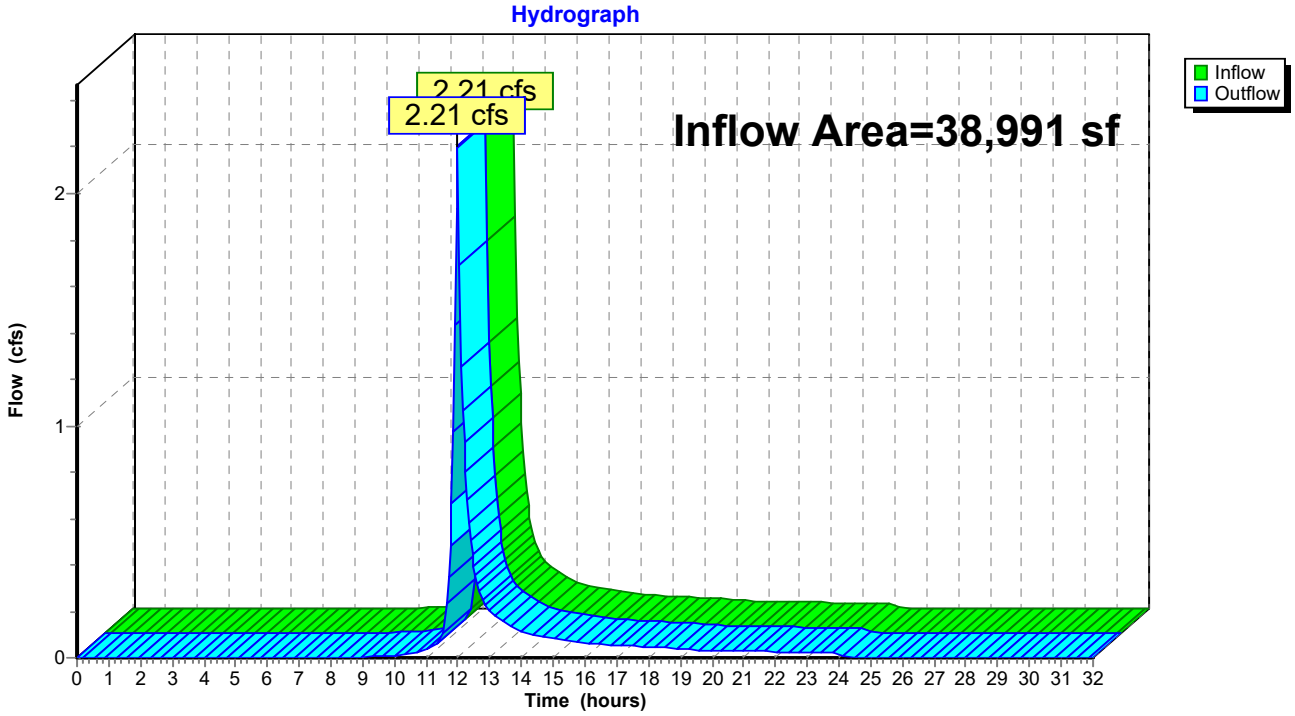
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 1.82" for 10-yr event
Inflow = 2.21 cfs @ 11.99 hrs, Volume= 5,910 cf
Outflow = 2.21 cfs @ 11.99 hrs, Volume= 5,910 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 2.46" for 10-yr event
Inflow = 0.68 cfs @ 11.96 hrs, Volume= 1,394 cf
Outflow = 0.63 cfs @ 12.01 hrs, Volume= 1,394 cf, Atten= 8%, Lag= 2.9 min

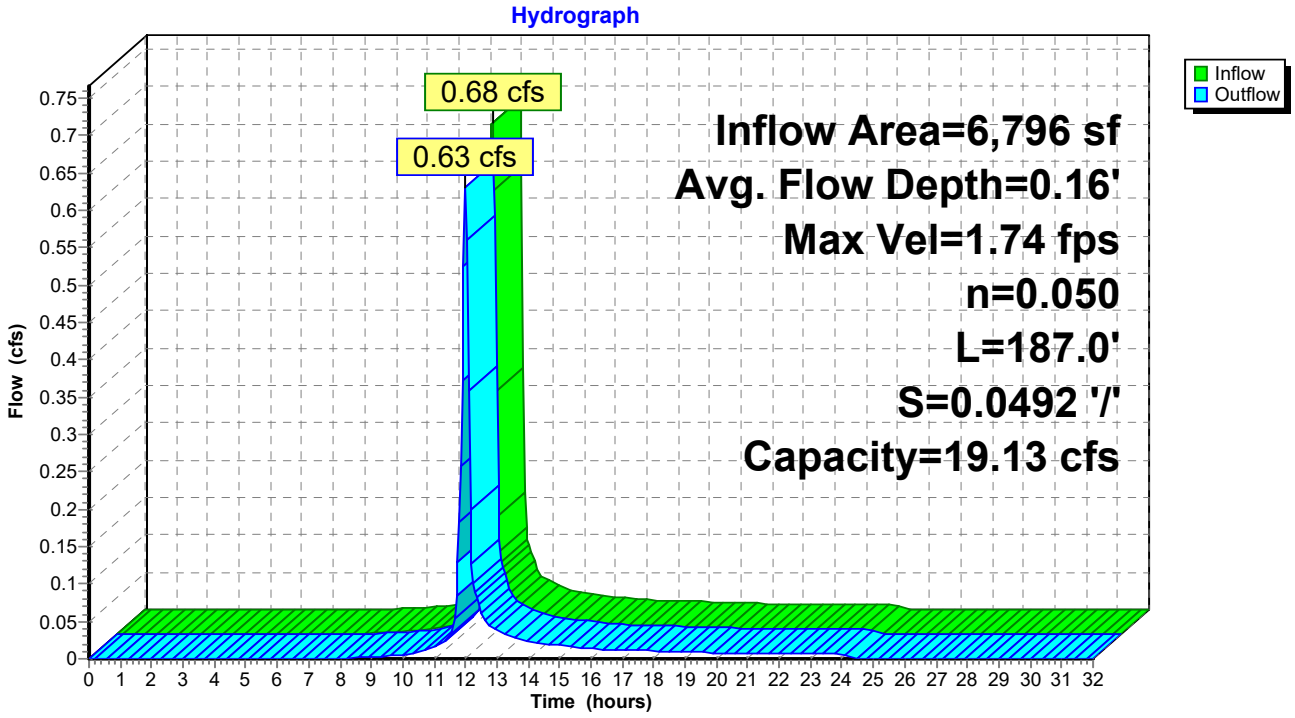
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.74 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 7.4 min

Peak Storage= 70 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



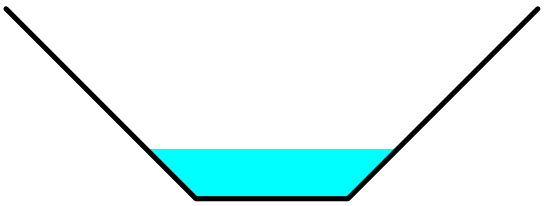
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 0.76 cfs @ 11.95 hrs, Volume= 1,615 cf
Outflow = 0.72 cfs @ 11.98 hrs, Volume= 1,615 cf, Atten= 6%, Lag= 1.8 min

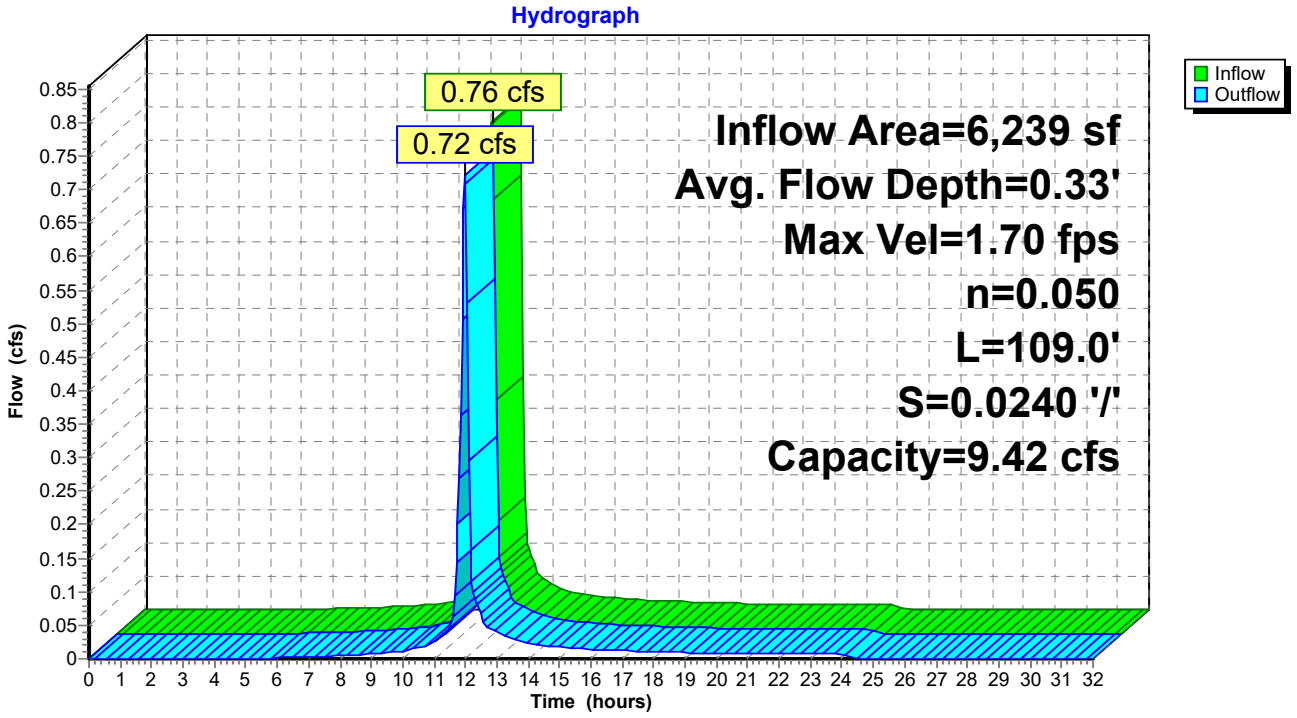
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 4.3 min

Peak Storage= 47 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 2.61" for 10-yr event
Inflow = 1.68 cfs @ 11.99 hrs, Volume= 3,750 cf
Outflow = 0.80 cfs @ 12.10 hrs, Volume= 3,074 cf, Atten= 52%, Lag= 7.0 min
Discarded = 0.02 cfs @ 12.10 hrs, Volume= 1,024 cf
Primary = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.75' @ 12.10 hrs Surf.Area= 1,930 sf Storage= 1,502 cf

Plug-Flow detention time= 225.2 min calculated for 3,069 cf (82% of inflow)
Center-of-Mass det. time= 148.2 min (963.3 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

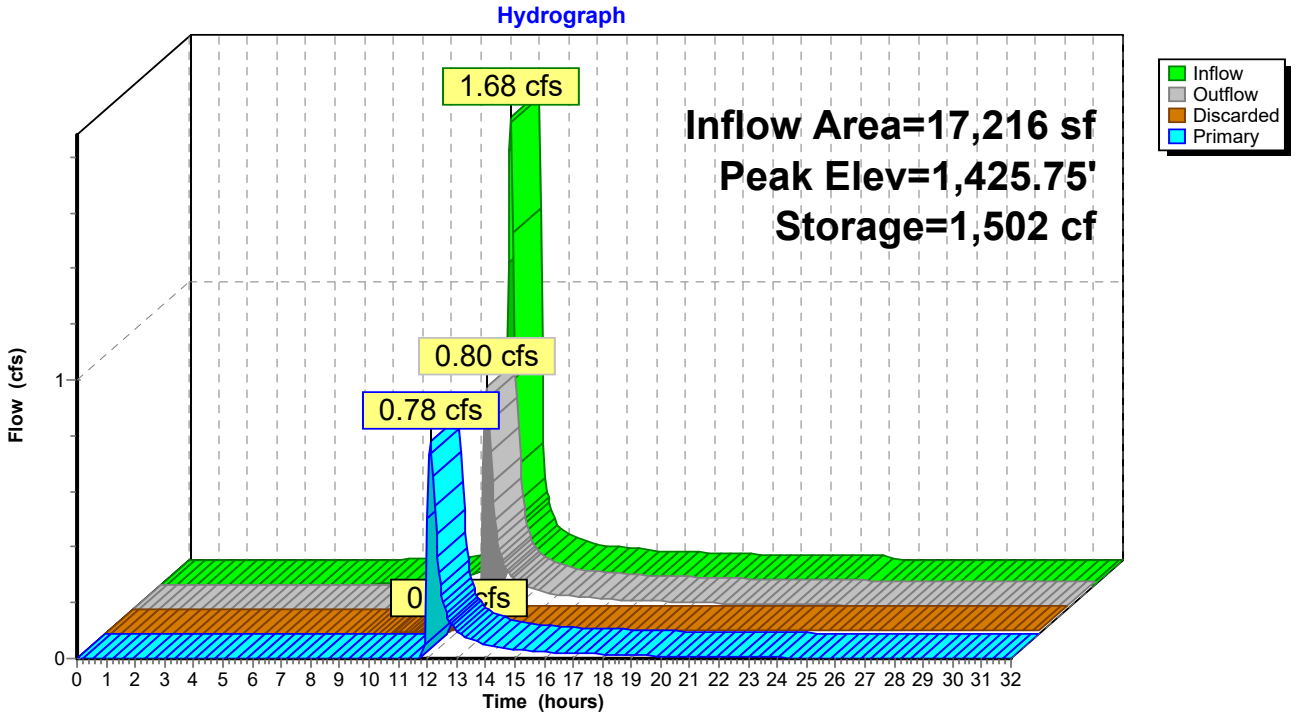
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.10 hrs HW=1,425.75' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.78 cfs @ 12.10 hrs HW=1,425.75' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.78 cfs @ 1.59 fps)

Pond 5P: Berm


Hydrograph
1.68 cfs
0.80 cfs
0.78 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.75'
Storage=1,502 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.04'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 1.43" for 10-yr event
Inflow = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf
Outflow = 0.78 cfs @ 12.10 hrs, Volume= 2,051 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.10 hrs, Volume= 3 cf
Primary = 0.78 cfs @ 12.10 hrs, Volume= 2,047 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.04' @ 12.10 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 2,047 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (822.0 - 822.0)

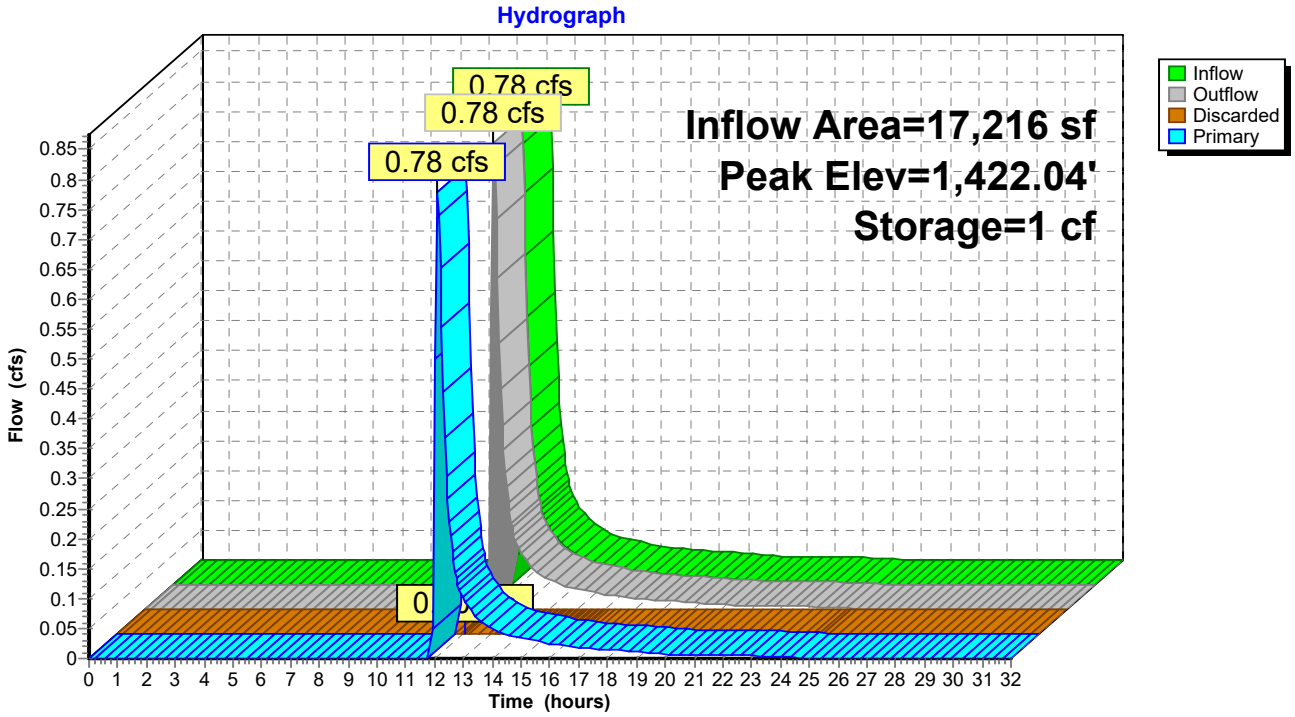
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.10 hrs HW=1,422.04' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.78 cfs @ 12.10 hrs HW=1,422.04' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.78 cfs @ 0.54 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=2.99"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.51 cfs 1,040 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=2.99"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.47 cfs 1,008 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=2.99"
Tc=5.0 min CN=78 Runoff=2.17 cfs 4,410 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=3.37"
Tc=5.0 min CN=82 Runoff=0.92 cfs 1,907 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=4.08"
Tc=5.0 min CN=89 Runoff=0.99 cfs 2,121 cf

Reach 10: DA Post w/ BMP Total Inflow=3.48 cfs 8,737 cf
Outflow=3.48 cfs 8,737 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.19' Max Vel=1.92 fps Inflow=0.92 cfs 1,907 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=0.86 cfs 1,907 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.38' Max Vel=1.83 fps Inflow=0.99 cfs 2,121 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=0.93 cfs 2,121 cf

Pond 5P: Berm Peak Elev=1,425.94' Storage=1,888 cf Inflow=2.26 cfs 5,068 cf
Discarded=0.02 cfs 1,061 cf Primary=1.12 cfs 3,324 cf Outflow=1.14 cfs 4,385 cf

Pond 6P: Level Spreader Peak Elev=1,422.05' Storage=1 cf Inflow=1.12 cfs 3,324 cf
Discarded=0.00 cfs 4 cf Primary=1.12 cfs 3,319 cf Outflow=1.12 cfs 3,324 cf

Total Runoff Area = 38,991 sf Runoff Volume = 10,485 cf Average Runoff Depth = 3.23"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

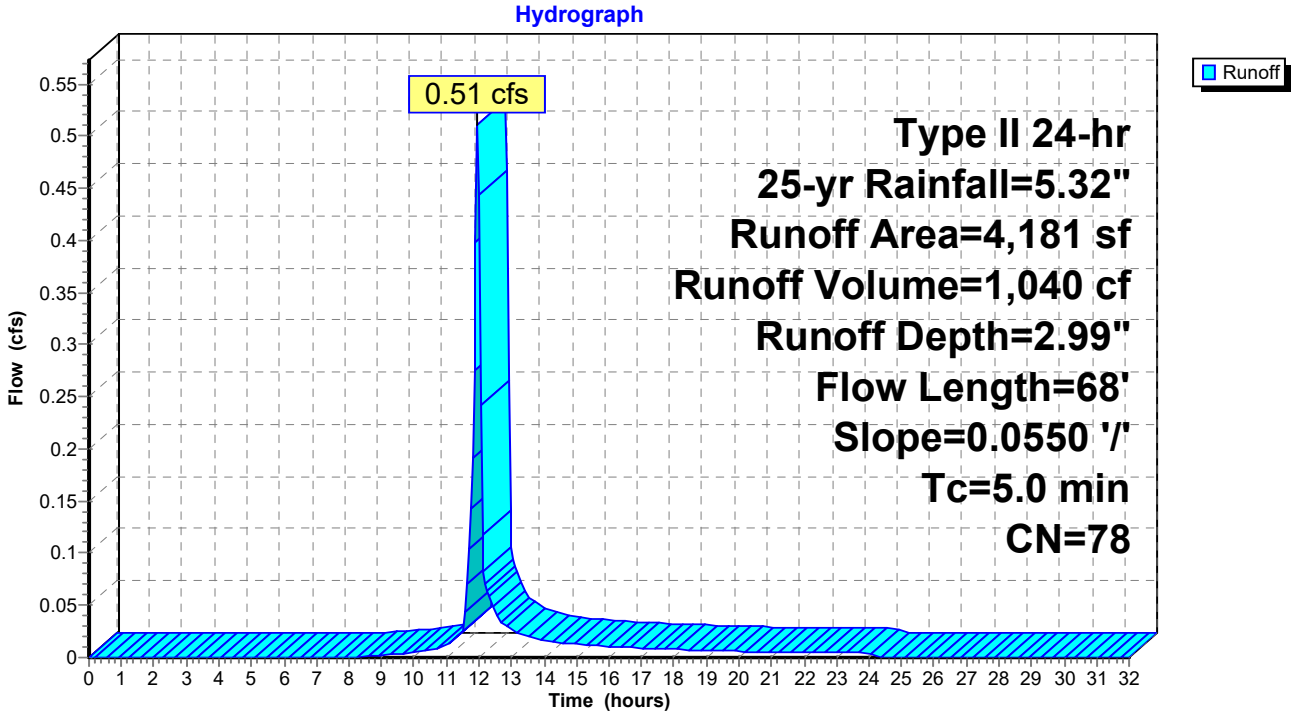
Runoff = 0.51 cfs @ 11.96 hrs, Volume= 1,040 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

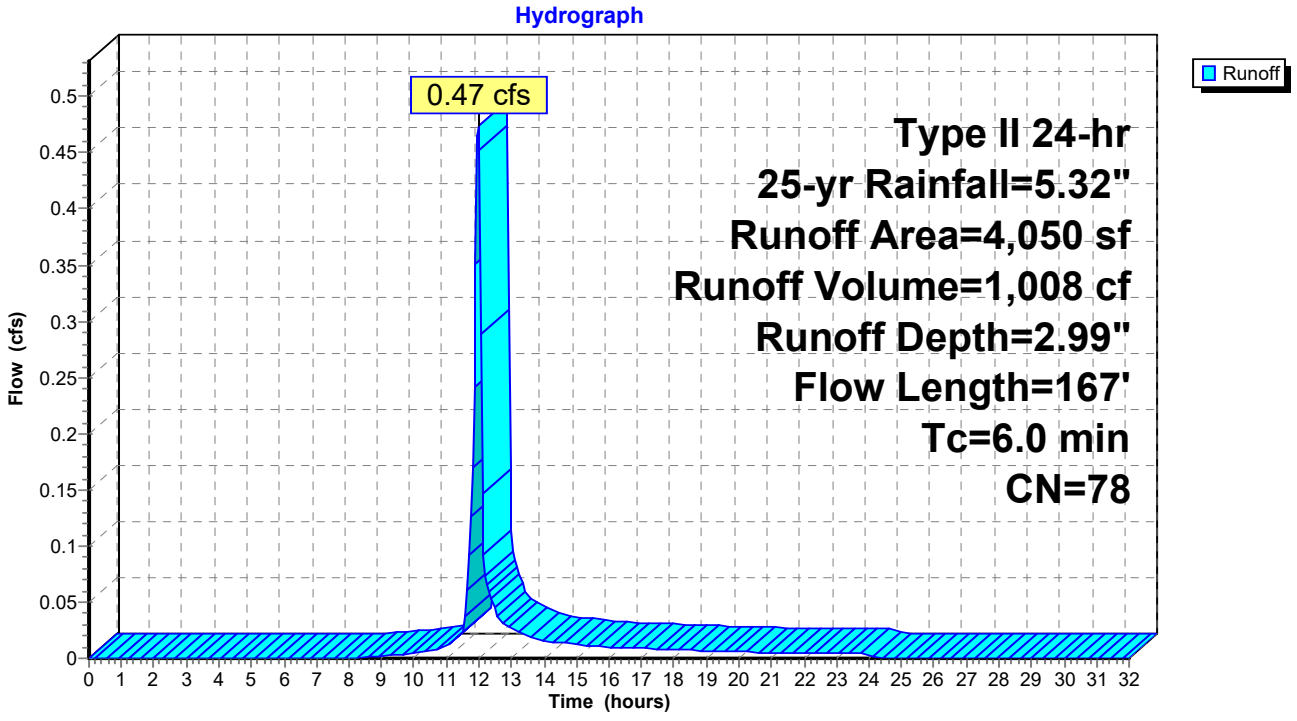
Runoff = 0.47 cfs @ 11.97 hrs, Volume= 1,008 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

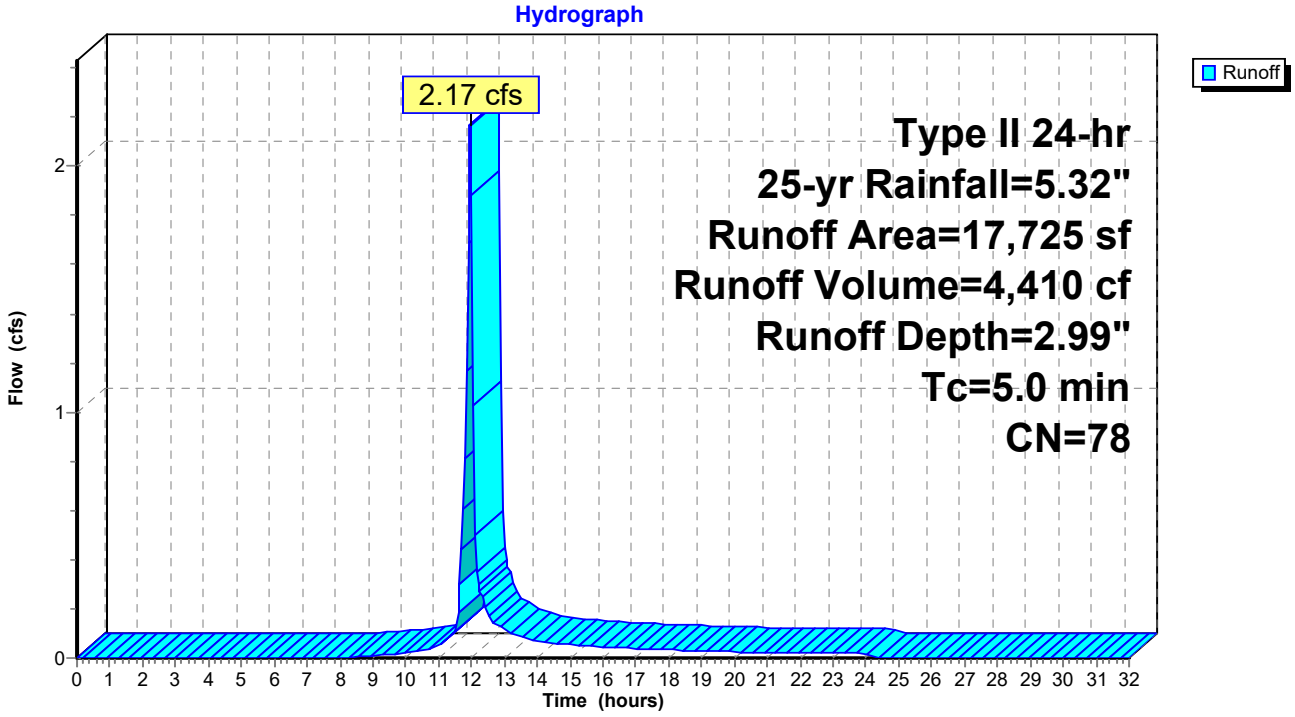
Runoff = 2.17 cfs @ 11.96 hrs, Volume= 4,410 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

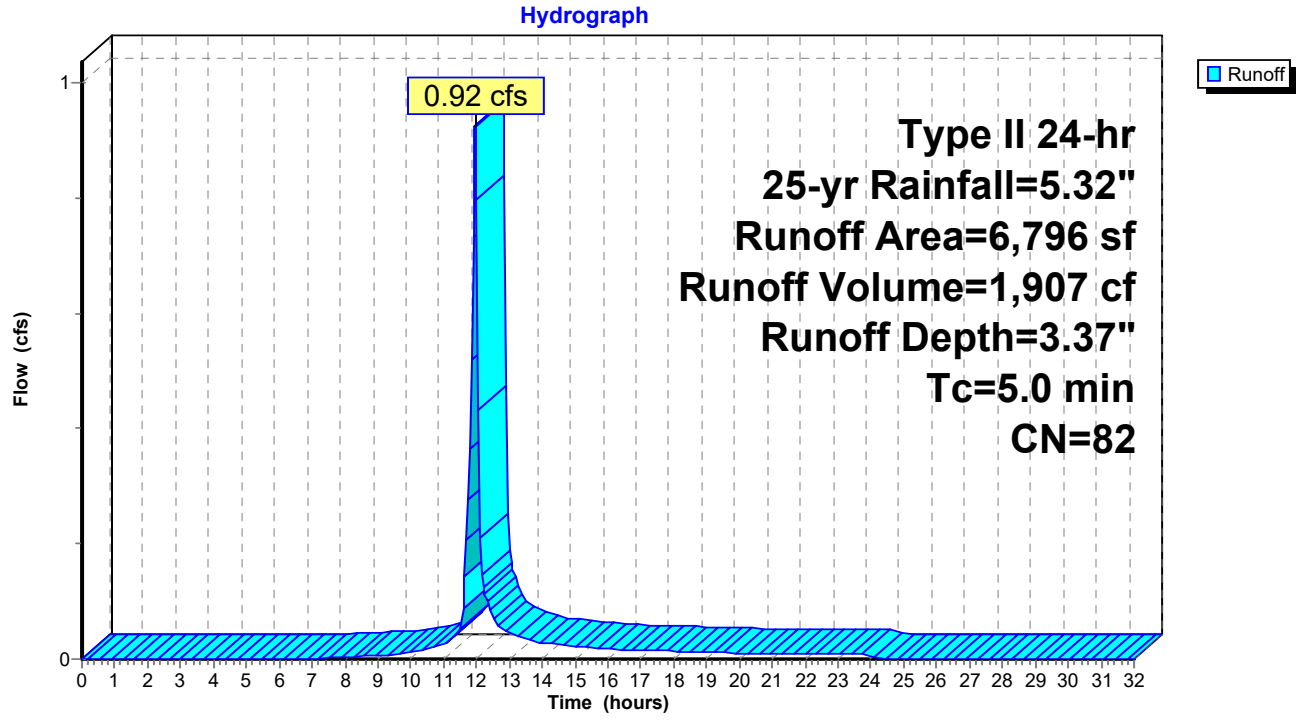
Runoff = 0.92 cfs @ 11.95 hrs, Volume= 1,907 cf, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

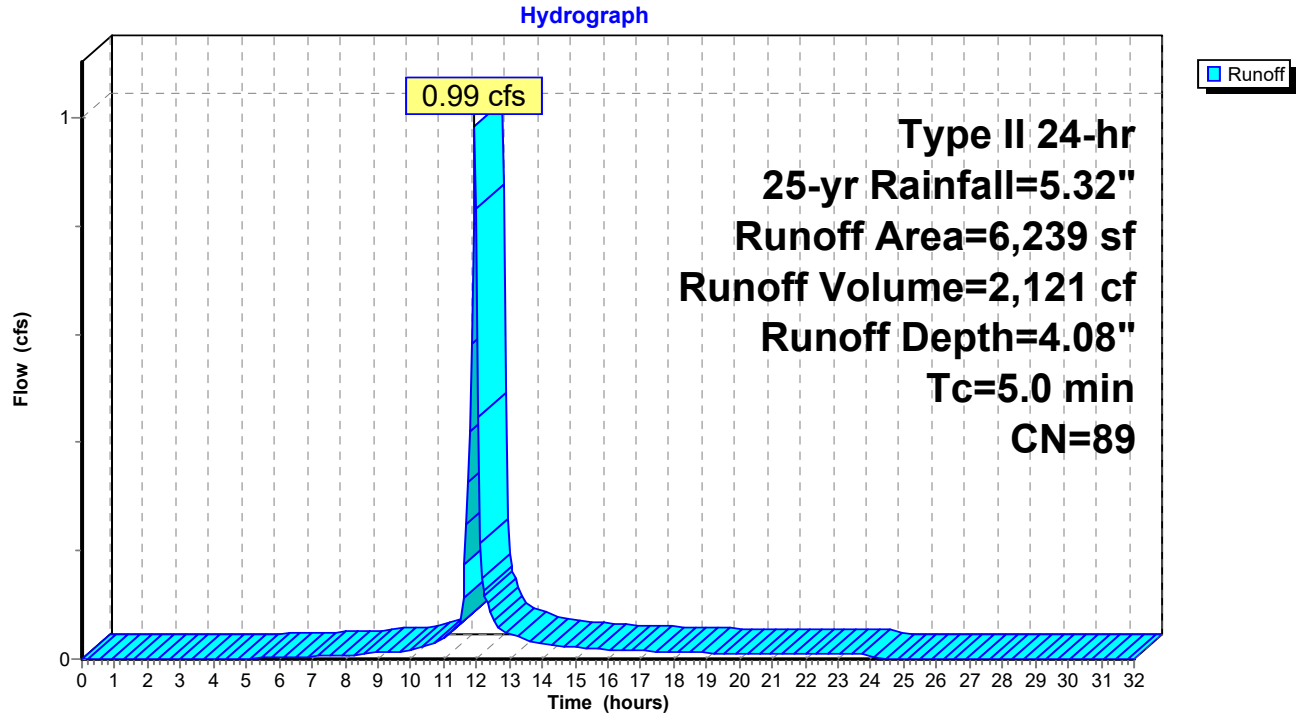
Runoff = 0.99 cfs @ 11.95 hrs, Volume= 2,121 cf, Depth= 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=5.32"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



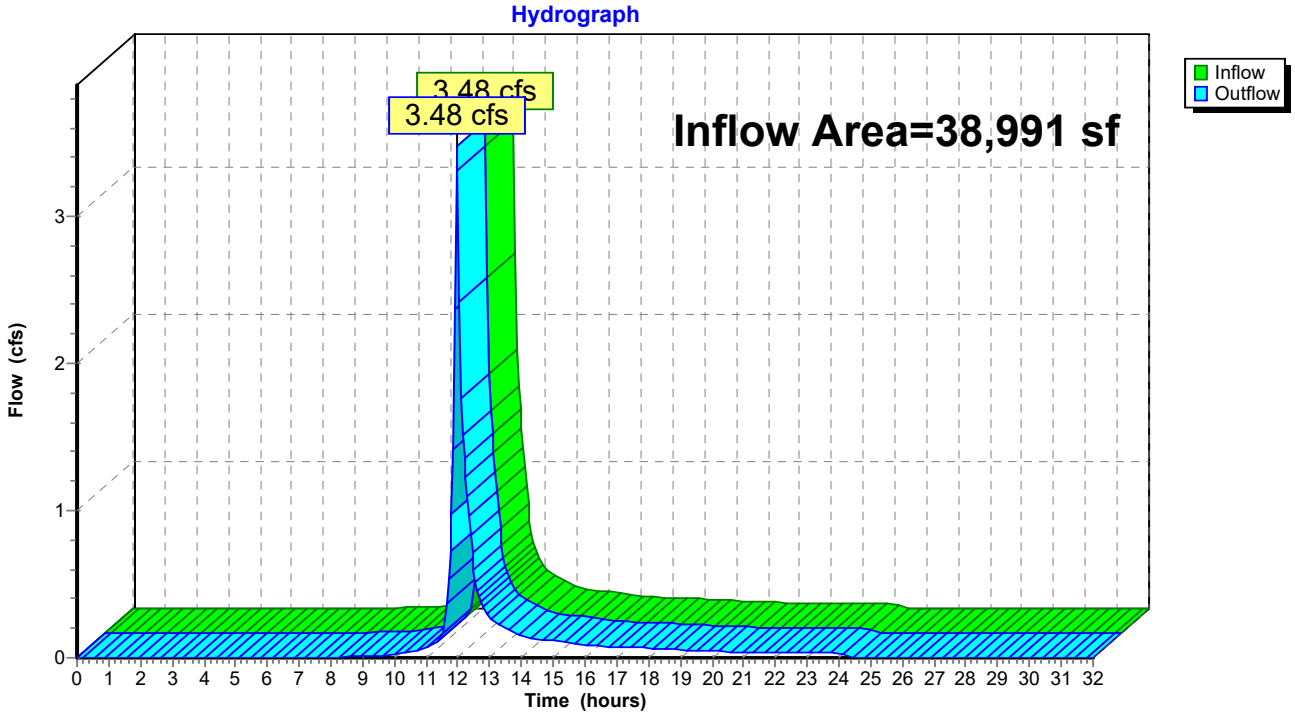
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 2.69" for 25-yr event
Inflow = 3.48 cfs @ 11.97 hrs, Volume= 8,737 cf
Outflow = 3.48 cfs @ 11.97 hrs, Volume= 8,737 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 3.37" for 25-yr event
Inflow = 0.92 cfs @ 11.95 hrs, Volume= 1,907 cf
Outflow = 0.86 cfs @ 12.00 hrs, Volume= 1,907 cf, Atten= 7%, Lag= 2.7 min

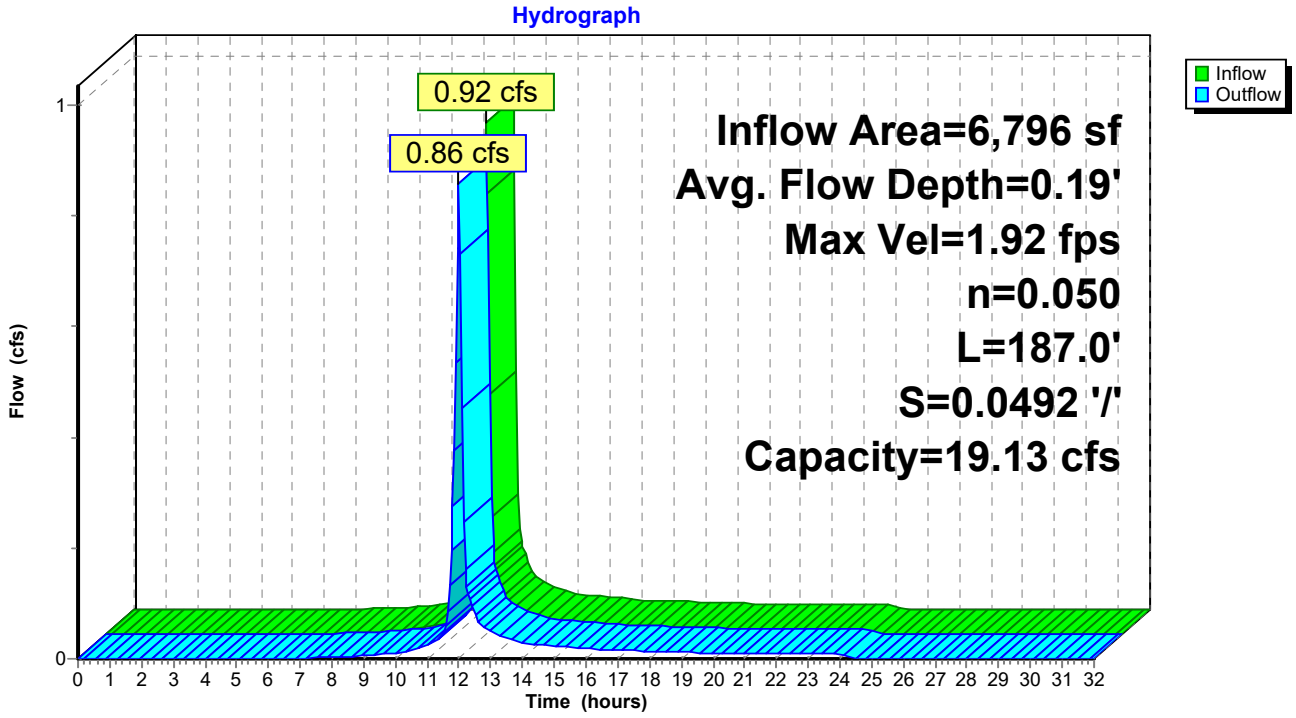
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 6.8 min

Peak Storage= 86 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



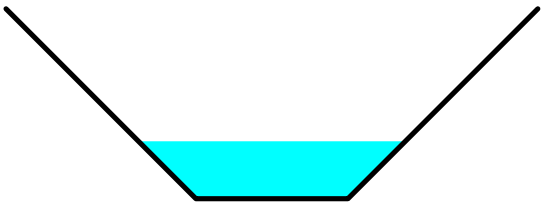
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 4.08" for 25-yr event
Inflow = 0.99 cfs @ 11.95 hrs, Volume= 2,121 cf
Outflow = 0.93 cfs @ 11.98 hrs, Volume= 2,121 cf, Atten= 5%, Lag= 1.7 min

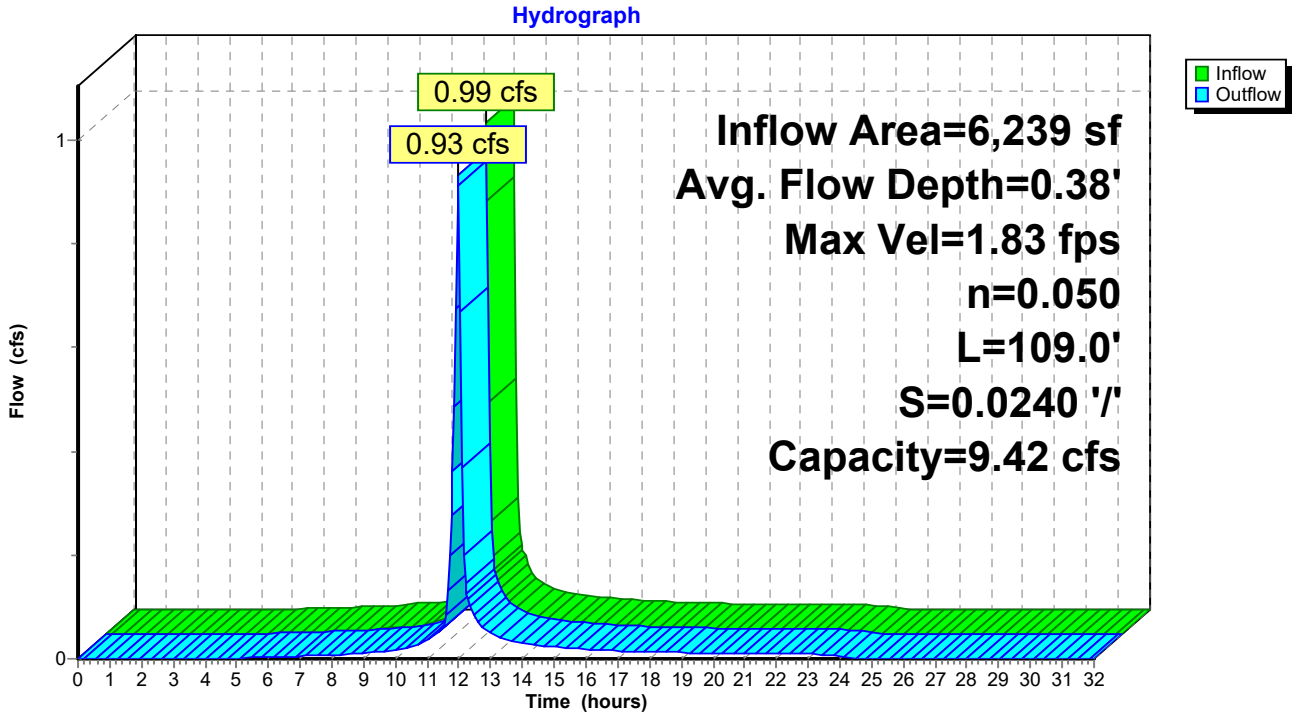
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.83 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 4.0 min

Peak Storage= 57 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.53" for 25-yr event
Inflow = 2.26 cfs @ 11.98 hrs, Volume= 5,068 cf
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 4,385 cf, Atten= 49%, Lag= 6.5 min
Discarded = 0.02 cfs @ 12.09 hrs, Volume= 1,061 cf
Primary = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,425.94' @ 12.09 hrs Surf.Area= 2,234 sf Storage= 1,888 cf

Plug-Flow detention time= 175.6 min calculated for 4,385 cf (87% of inflow)
Center-of-Mass det. time= 111.5 min (918.1 - 806.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

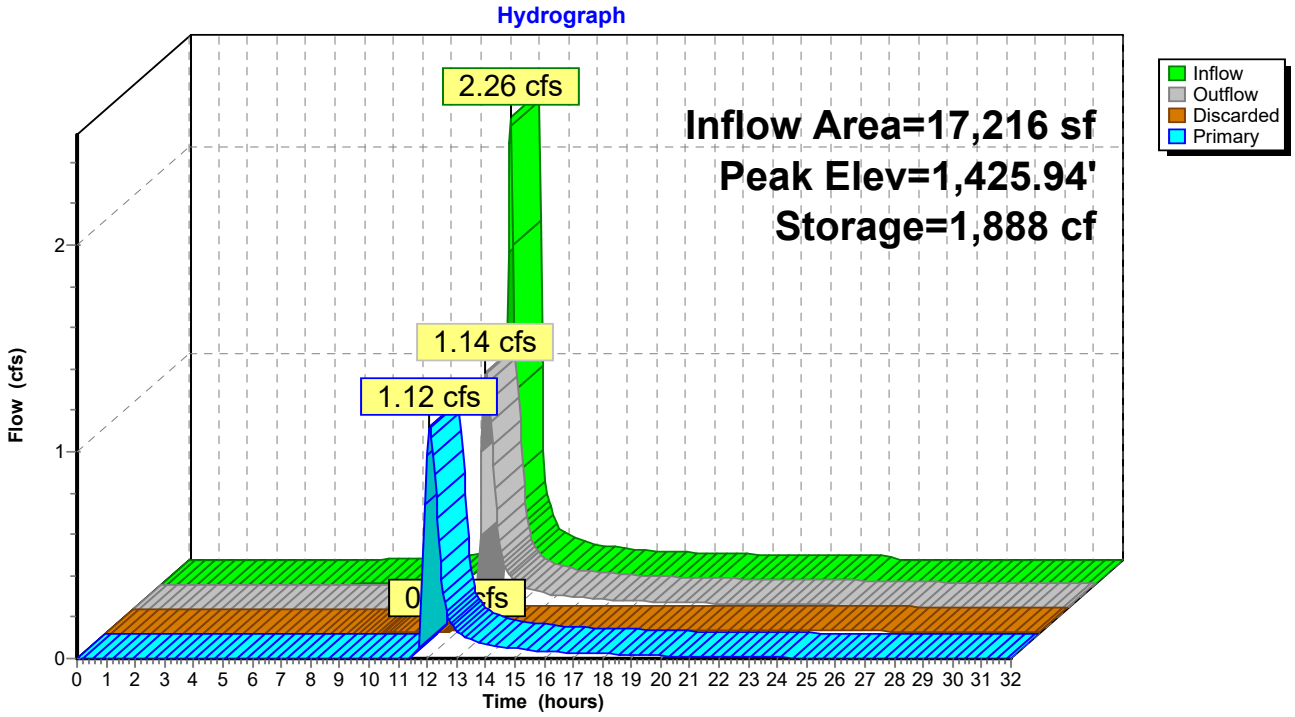
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.09 hrs HW=1,425.93' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.11 cfs @ 12.09 hrs HW=1,425.93' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 1.11 cfs @ 2.27 fps)

Pond 5P: Berm


Hydrograph
2.26 cfs
1.14 cfs
1.12 cfs
Inflow Area=17,216 sf
Peak Elev=1,425.94'
Storage=1,888 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.05'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 2.32" for 25-yr event
Inflow = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf
Outflow = 1.12 cfs @ 12.09 hrs, Volume= 3,324 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.09 hrs, Volume= 4 cf
Primary = 1.12 cfs @ 12.09 hrs, Volume= 3,319 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.05' @ 12.09 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 3,318 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (819.4 - 819.3)

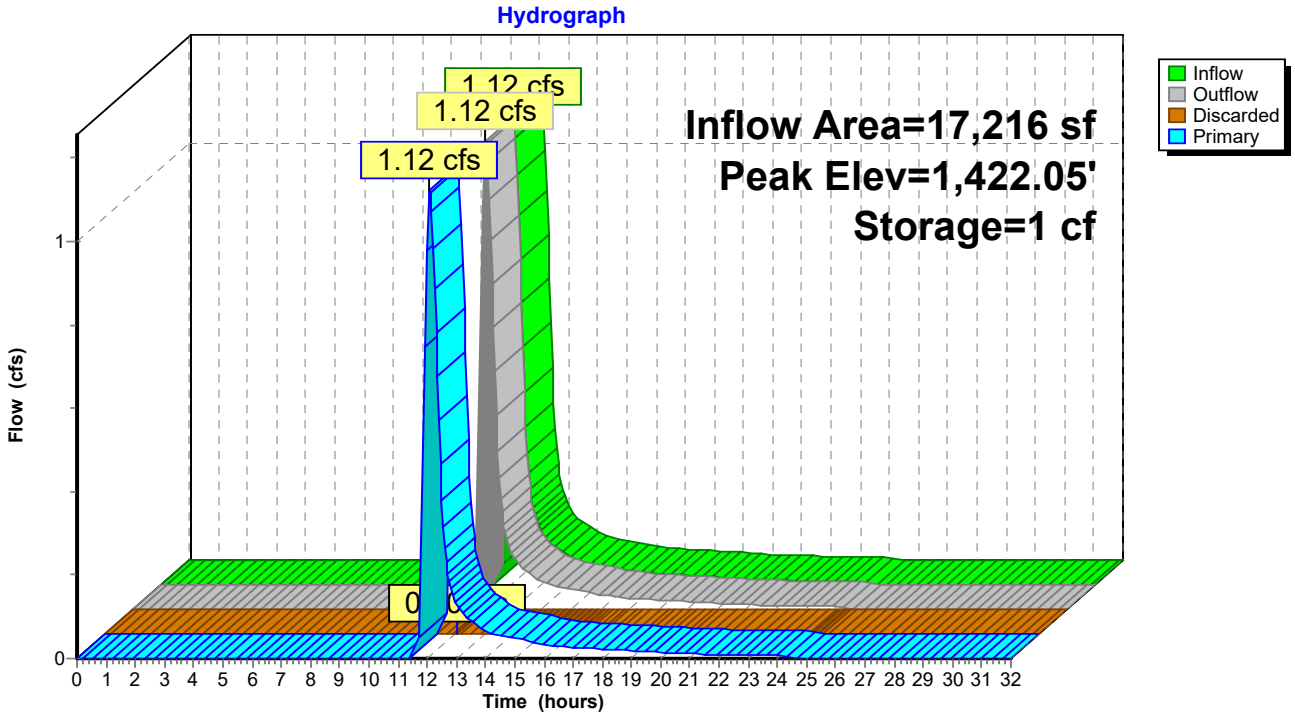
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.09 hrs HW=1,422.05' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.11 cfs @ 12.09 hrs HW=1,422.05' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 0.61 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=3.81"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.65 cfs 1,327 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=3.81"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.60 cfs 1,286 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=3.81"
Tc=5.0 min CN=78 Runoff=2.74 cfs 5,627 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=4.23"
Tc=5.0 min CN=82 Runoff=1.15 cfs 2,394 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=4.99"
Tc=5.0 min CN=89 Runoff=1.19 cfs 2,593 cf

Reach 10: DA Post w/ BMP Total Inflow=4.42 cfs 11,208 cf
Outflow=4.42 cfs 11,208 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.22' Max Vel=2.07 fps Inflow=1.15 cfs 2,394 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=1.07 cfs 2,394 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.42' Max Vel=1.93 fps Inflow=1.19 cfs 2,593 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=1.13 cfs 2,593 cf

Pond 5P: Berm Peak Elev=1,426.00' Storage=2,044 cf Inflow=2.80 cfs 6,314 cf
Discarded=0.02 cfs 1,094 cf Primary=1.29 cfs 4,301 cf Outflow=1.31 cfs 5,395 cf

Pond 6P: Level Spreader Peak Elev=1,422.06' Storage=1 cf Inflow=1.29 cfs 4,301 cf
Discarded=0.00 cfs 5 cf Primary=1.29 cfs 4,296 cf Outflow=1.29 cfs 4,301 cf

Total Runoff Area = 38,991 sf Runoff Volume = 13,227 cf Average Runoff Depth = 4.07"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

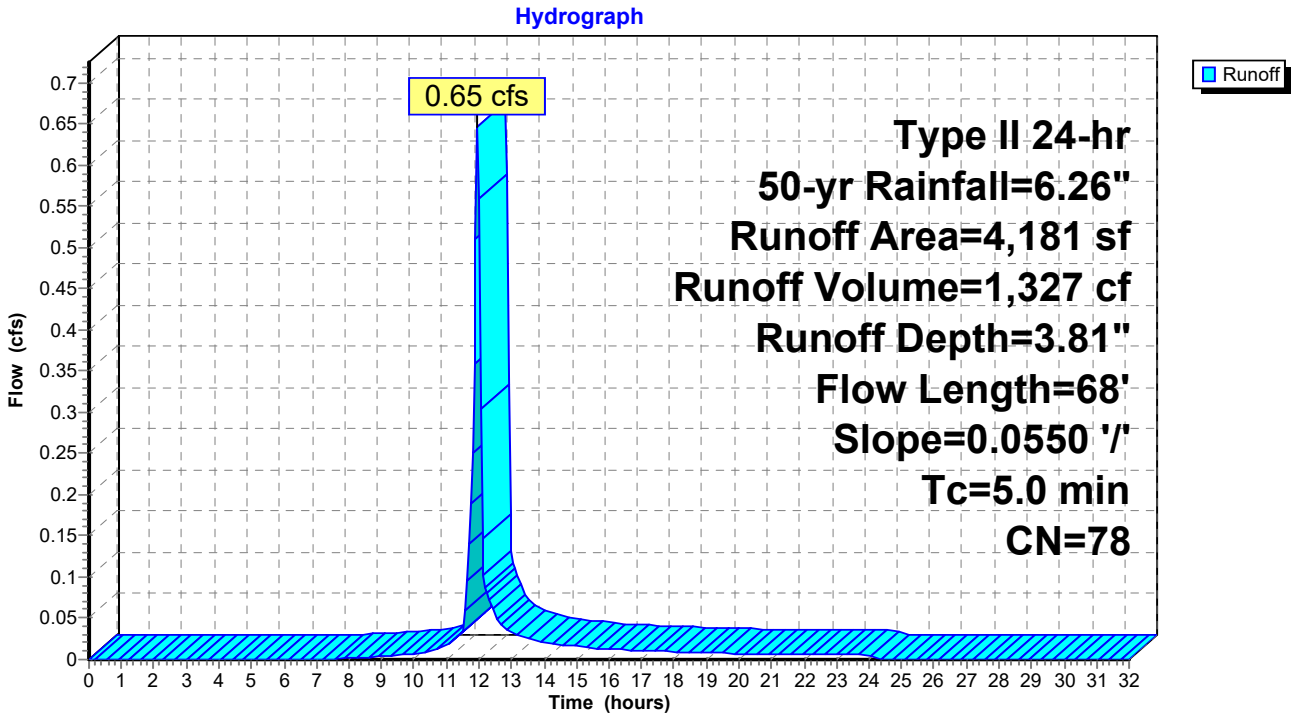
Runoff = 0.65 cfs @ 11.96 hrs, Volume= 1,327 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

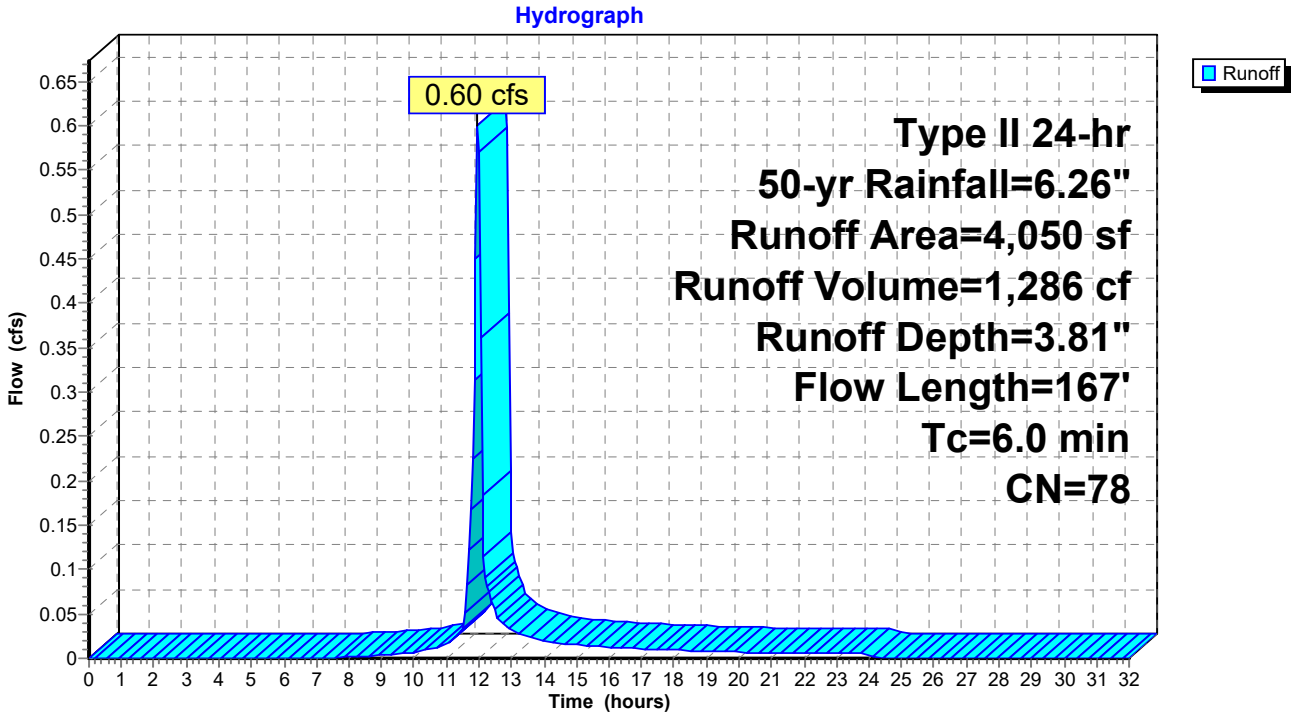
Runoff = 0.60 cfs @ 11.97 hrs, Volume= 1,286 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

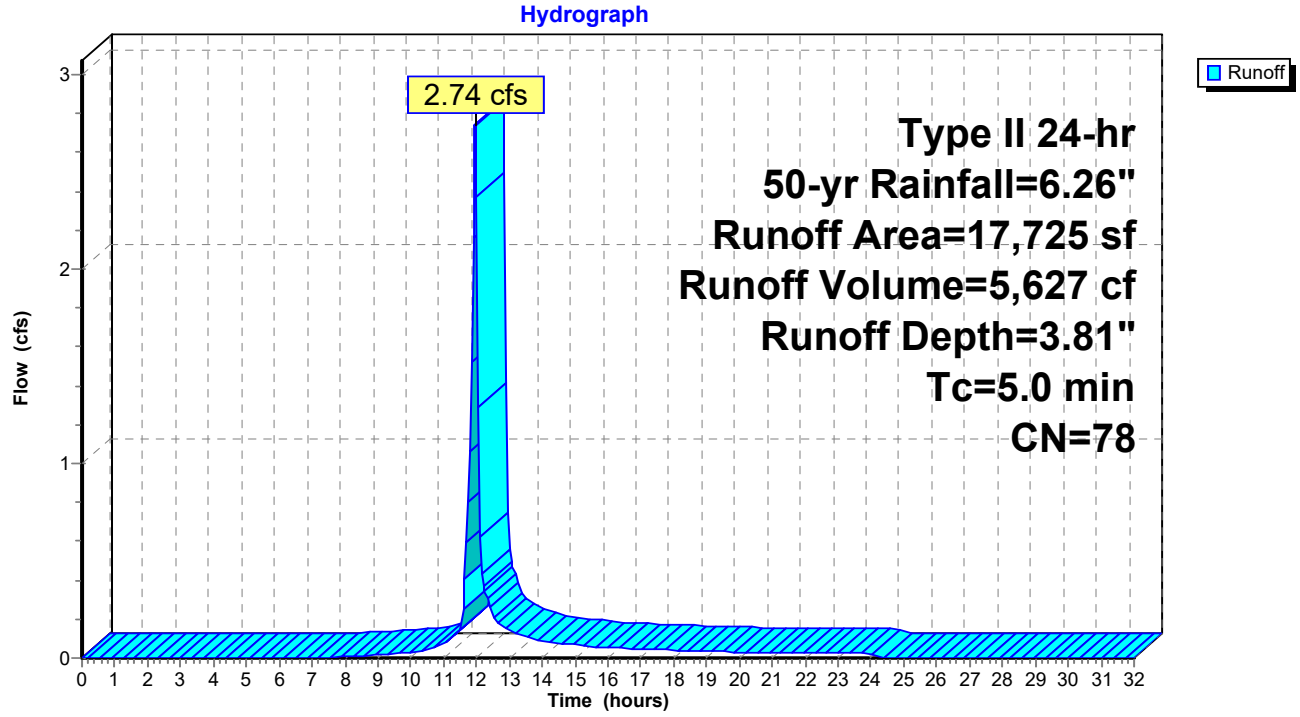
Runoff = 2.74 cfs @ 11.96 hrs, Volume= 5,627 cf, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

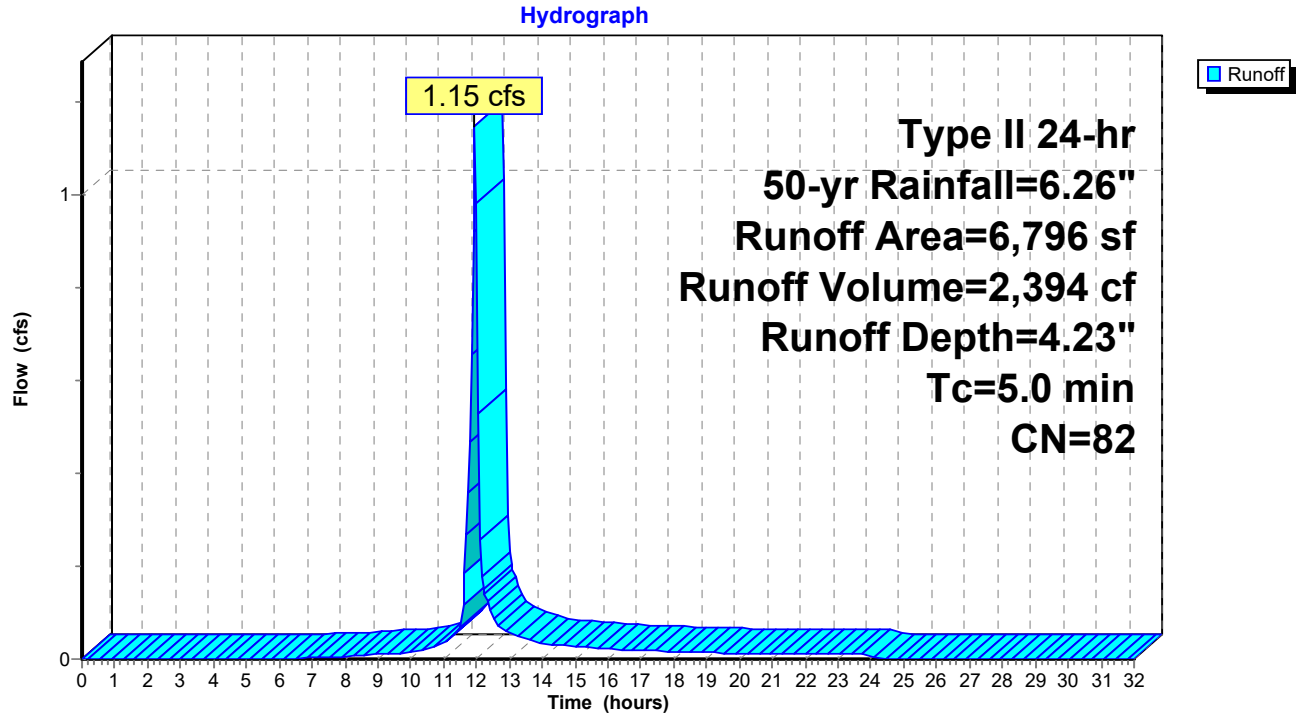
Runoff = 1.15 cfs @ 11.95 hrs, Volume= 2,394 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

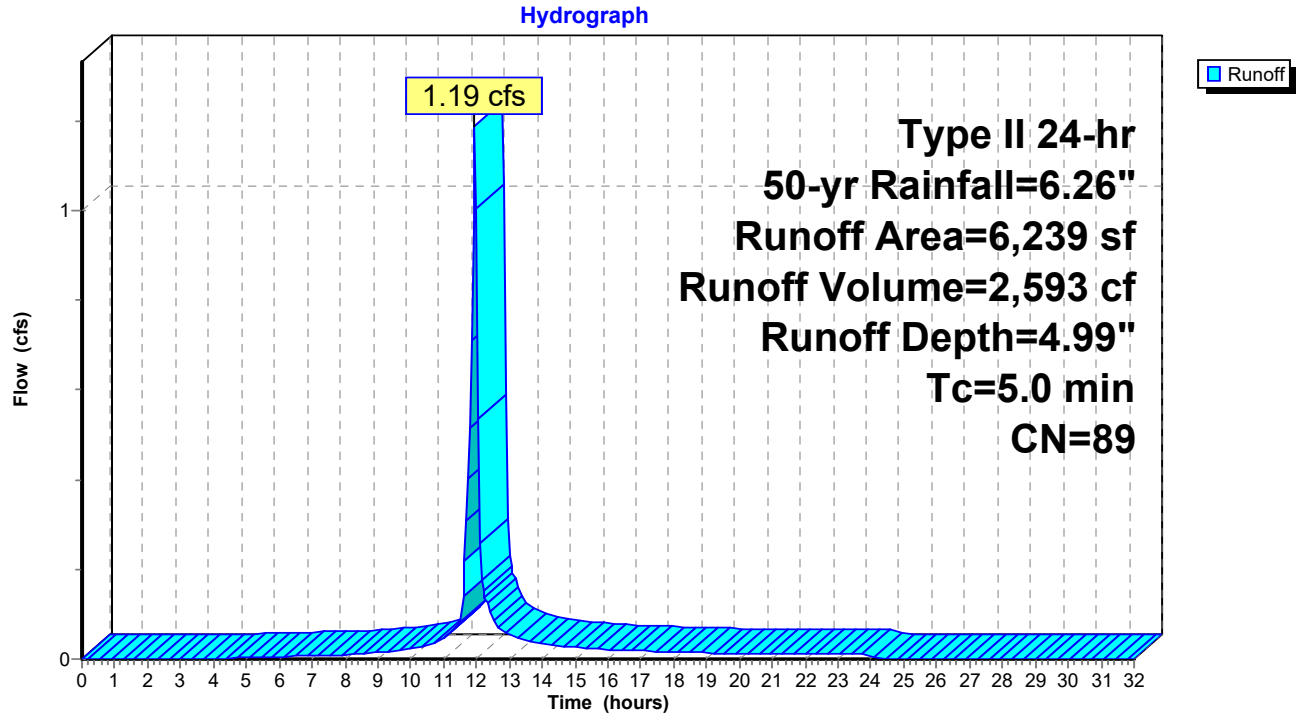
Runoff = 1.19 cfs @ 11.95 hrs, Volume= 2,593 cf, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=6.26"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



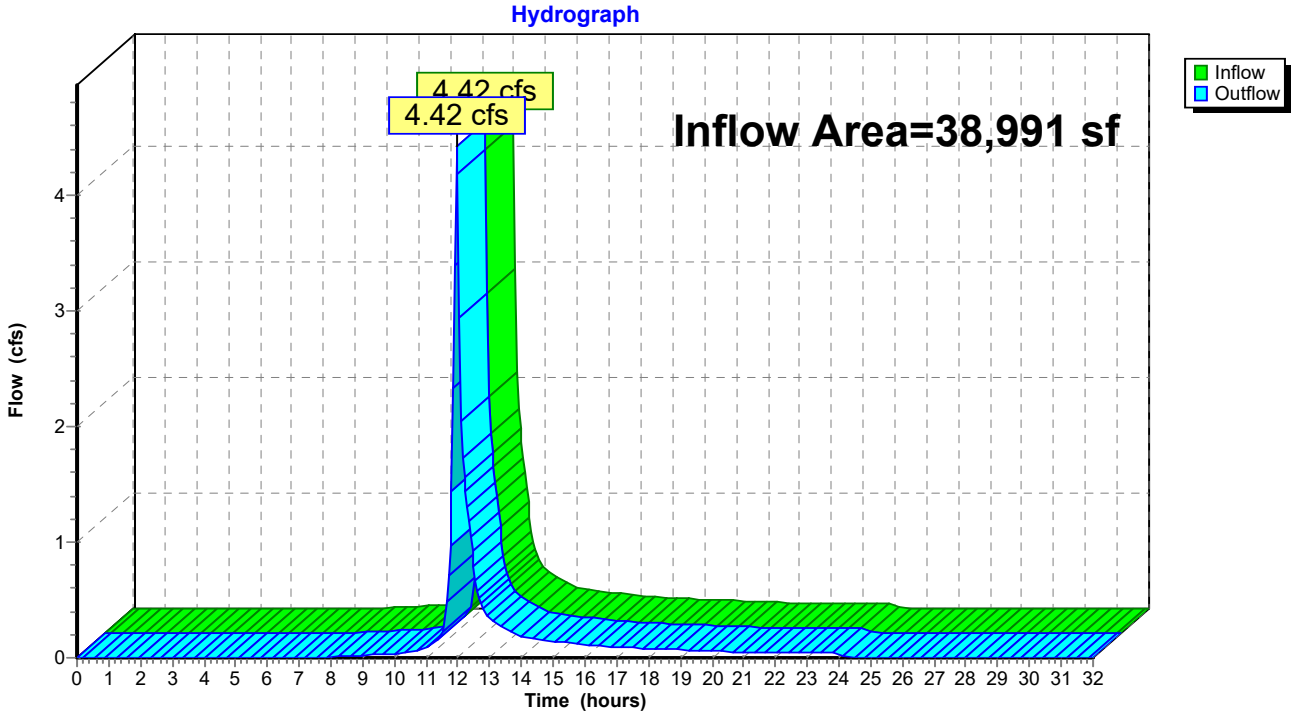
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 3.45" for 50-yr event
Inflow = 4.42 cfs @ 11.97 hrs, Volume= 11,208 cf
Outflow = 4.42 cfs @ 11.97 hrs, Volume= 11,208 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 4.23" for 50-yr event
Inflow = 1.15 cfs @ 11.95 hrs, Volume= 2,394 cf
Outflow = 1.07 cfs @ 12.00 hrs, Volume= 2,394 cf, Atten= 7%, Lag= 2.5 min

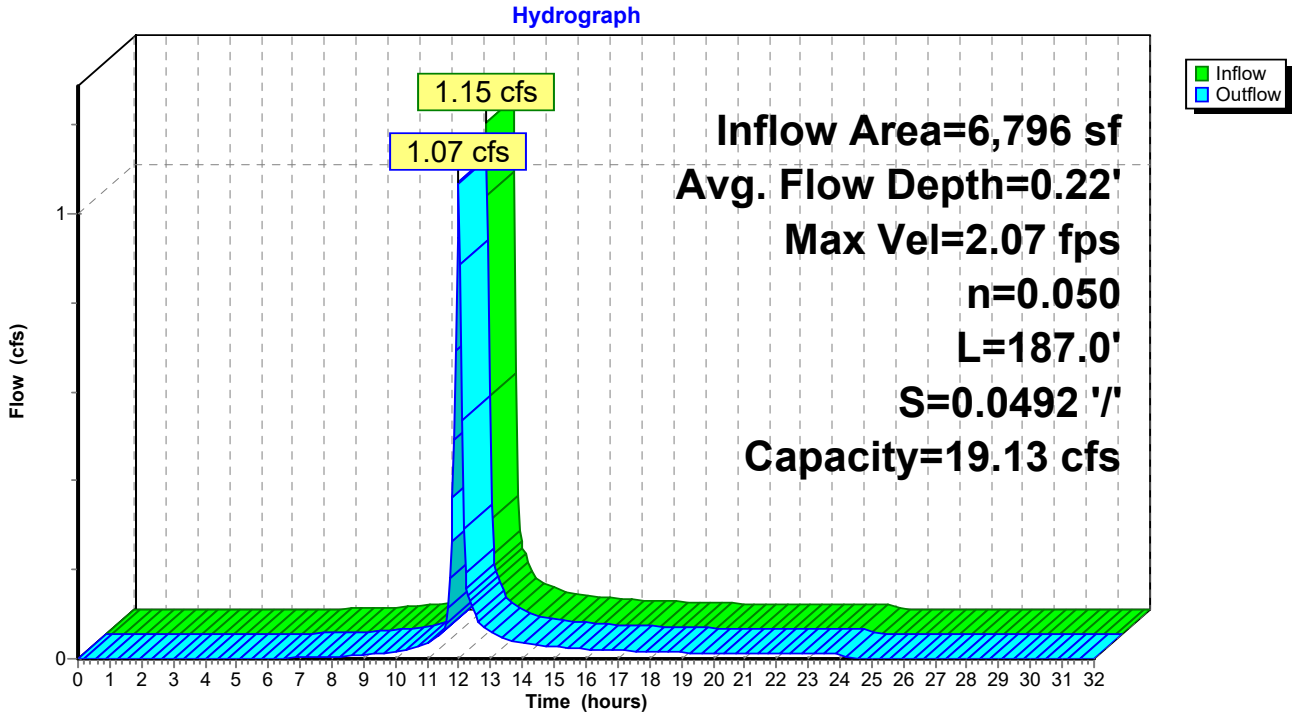
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.07 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 6.4 min

Peak Storage= 99 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



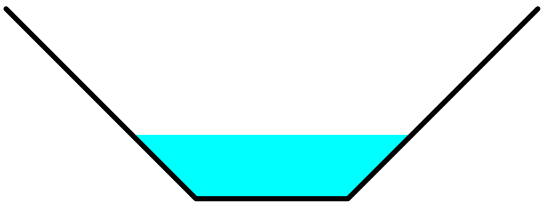
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 4.99" for 50-yr event
Inflow = 1.19 cfs @ 11.95 hrs, Volume= 2,593 cf
Outflow = 1.13 cfs @ 11.98 hrs, Volume= 2,593 cf, Atten= 5%, Lag= 1.6 min

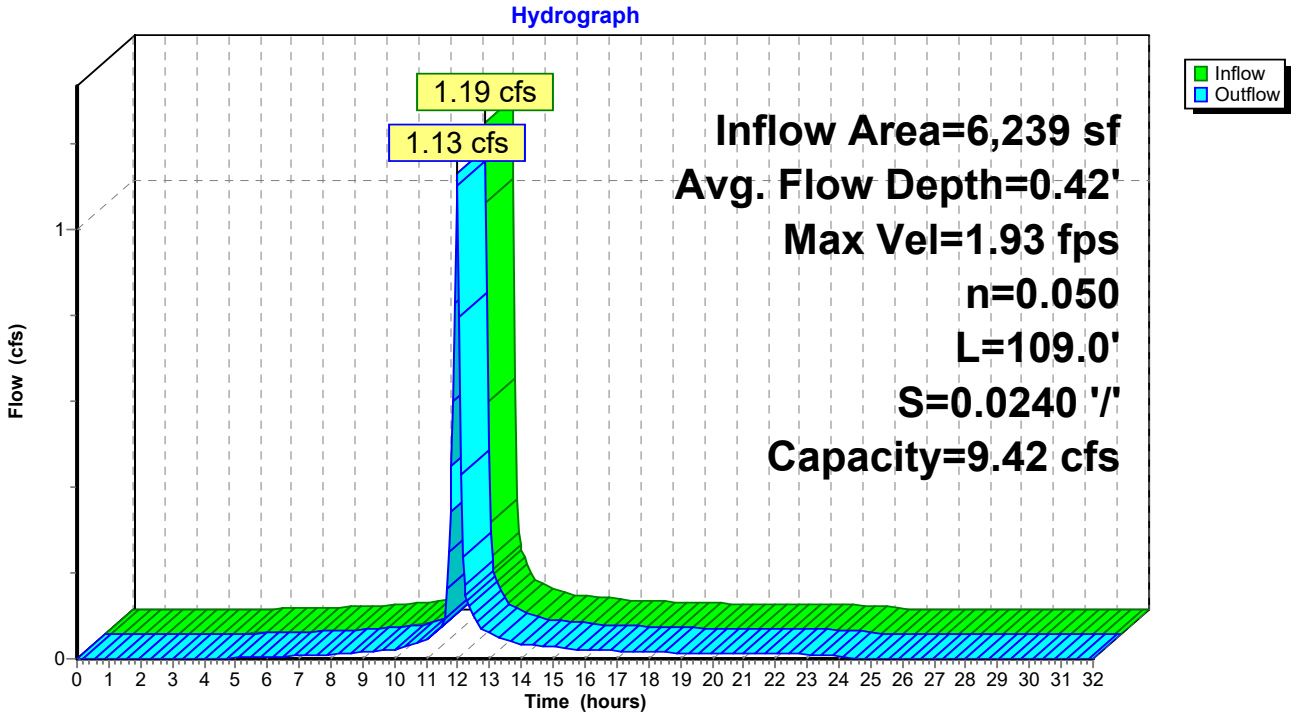
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.93 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 3.8 min

Peak Storage= 65 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 4.40" for 50-yr event
Inflow = 2.80 cfs @ 11.98 hrs, Volume= 6,314 cf
Outflow = 1.31 cfs @ 12.05 hrs, Volume= 5,395 cf, Atten= 53%, Lag= 4.0 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 1,094 cf
Primary = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,426.00' @ 12.05 hrs Surf.Area= 2,340 sf Storage= 2,044 cf

Plug-Flow detention time= 166.6 min calculated for 5,387 cf (85% of inflow)
Center-of-Mass det. time= 100.4 min (900.7 - 800.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

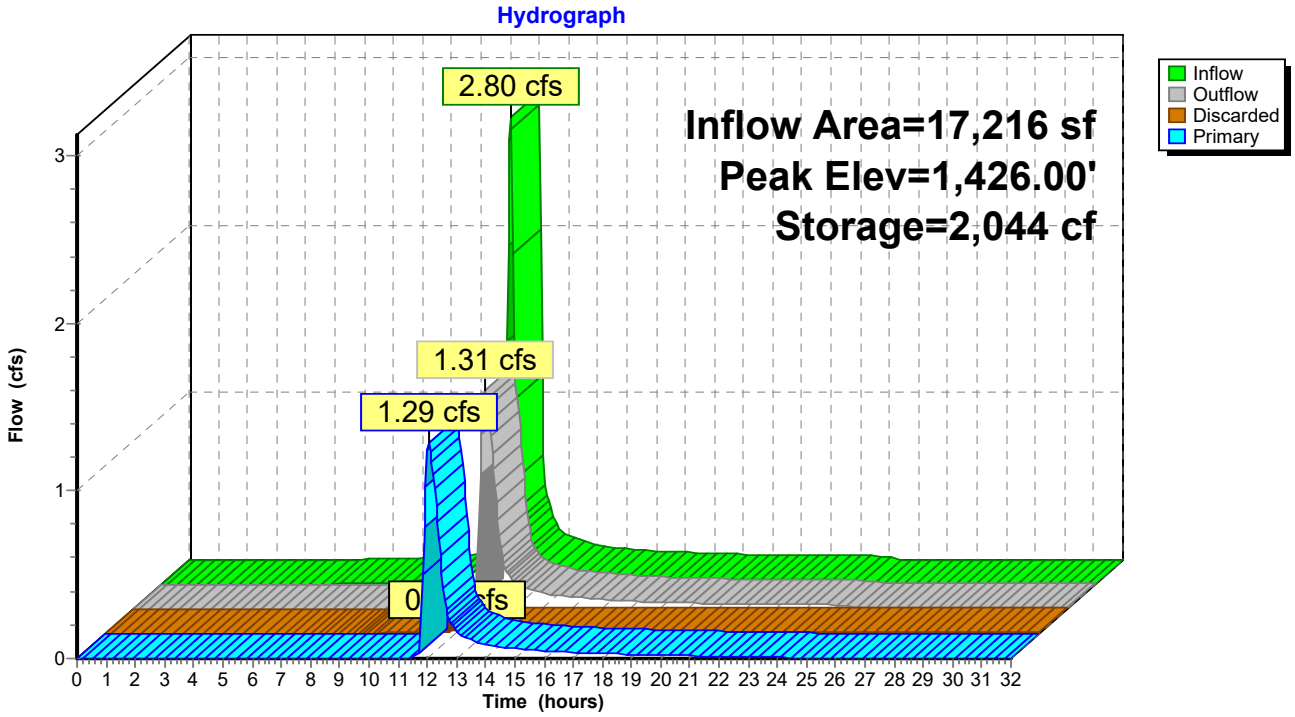
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=1,426.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.26 cfs @ 12.05 hrs HW=1,426.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.04 cfs @ 0.15 fps)
└**3=Culvert** (Inlet Controls 1.22 cfs @ 2.49 fps)

Pond 5P: Berm


Hydrograph
Inflow
Outflow
Discarded
Primary
2.80 cfs
1.31 cfs
1.29 cfs
Inflow Area=17,216 sf
Peak Elev=1,426.00'
Storage=2,044 cf
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.06'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.00" for 50-yr event
Inflow = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf
Outflow = 1.29 cfs @ 12.05 hrs, Volume= 4,301 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.05 hrs, Volume= 5 cf
Primary = 1.29 cfs @ 12.05 hrs, Volume= 4,296 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.06' @ 12.05 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 4,294 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (822.0 - 822.0)

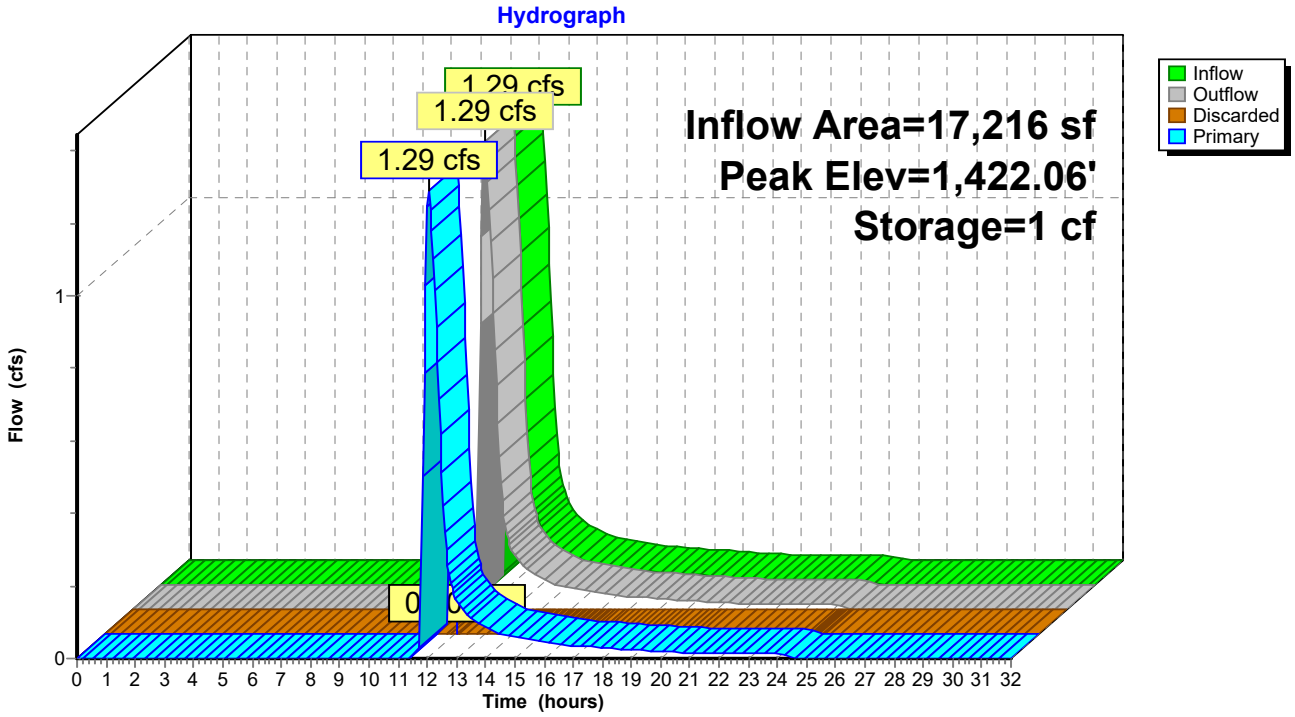
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 12.05 hrs HW=1,422.06' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=1.28 cfs @ 12.05 hrs HW=1,422.06' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.28 cfs @ 0.64 fps)

Pond 6P: Level Spreader



Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA BERM Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=4.83"
Flow Length=68' Slope=0.0550 '/' Tc=5.0 min CN=78 Runoff=0.81 cfs 1,683 cf

Subcatchment 2S: DA Undetained Runoff Area=4,050 sf 0.00% Impervious Runoff Depth=4.83"
Flow Length=167' Tc=6.0 min CN=78 Runoff=0.75 cfs 1,630 cf

Subcatchment 6S: DC-D1 DA Runoff Area=17,725 sf 0.00% Impervious Runoff Depth=4.83"
Tc=5.0 min CN=78 Runoff=3.44 cfs 7,134 cf

Subcatchment 8S: CC-C2 DA Runoff Area=6,796 sf 0.00% Impervious Runoff Depth=5.28"
Tc=5.0 min CN=82 Runoff=1.42 cfs 2,992 cf

Subcatchment 9S: CC-C1 DA Runoff Area=6,239 sf 0.00% Impervious Runoff Depth=6.09"
Tc=5.0 min CN=89 Runoff=1.43 cfs 3,166 cf

Reach 10: DA Post w/ BMP Total Inflow=6.01 cfs 14,164 cf
Outflow=6.01 cfs 14,164 cf

Reach 10R: CC-C2 Avg. Flow Depth=0.25' Max Vel=2.22 fps Inflow=1.42 cfs 2,992 cf
n=0.050 L=187.0' S=0.0492 '/' Capacity=19.13 cfs Outflow=1.32 cfs 2,992 cf

Reach 11R: CC-C1 Avg. Flow Depth=0.47' Max Vel=2.04 fps Inflow=1.43 cfs 3,166 cf
n=0.050 L=109.0' S=0.0240 '/' Capacity=9.42 cfs Outflow=1.36 cfs 3,166 cf

Pond 5P: Berm Peak Elev=1,426.02' Storage=2,059 cf Inflow=3.44 cfs 7,841 cf
Discarded=0.02 cfs 1,132 cf Primary=1.85 cfs 5,405 cf Outflow=1.87 cfs 6,537 cf

Pond 6P: Level Spreader Peak Elev=1,422.07' Storage=1 cf Inflow=1.85 cfs 5,405 cf
Discarded=0.00 cfs 6 cf Primary=1.85 cfs 5,399 cf Outflow=1.85 cfs 5,405 cf

Total Runoff Area = 38,991 sf Runoff Volume = 16,605 cf Average Runoff Depth = 5.11"
100.00% Pervious = 38,991 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: DA BERM

[49] Hint: Tc<2dt may require smaller dt

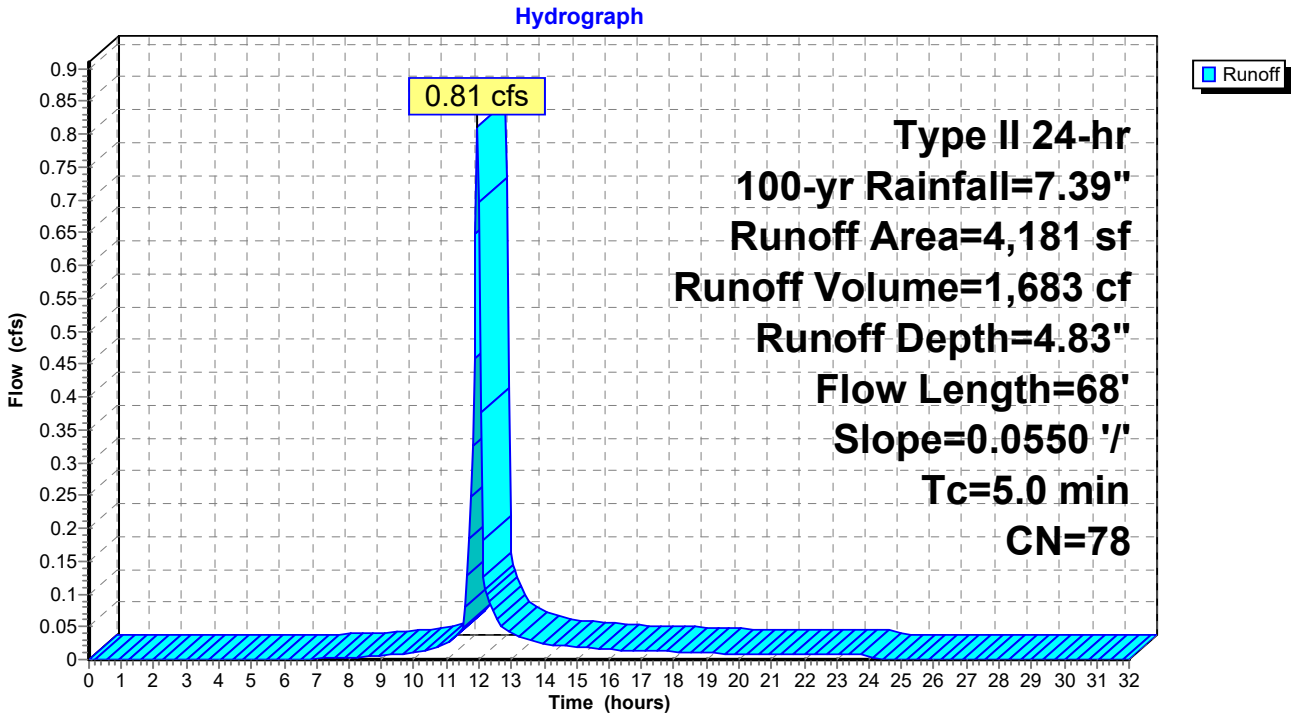
Runoff = 0.81 cfs @ 11.95 hrs, Volume= 1,683 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
4,181	78	Meadow, non-grazed, HSG D
4,181		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	68	0.0550	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"

Subcatchment 1S: DA BERM



Summary for Subcatchment 2S: DA Undetained

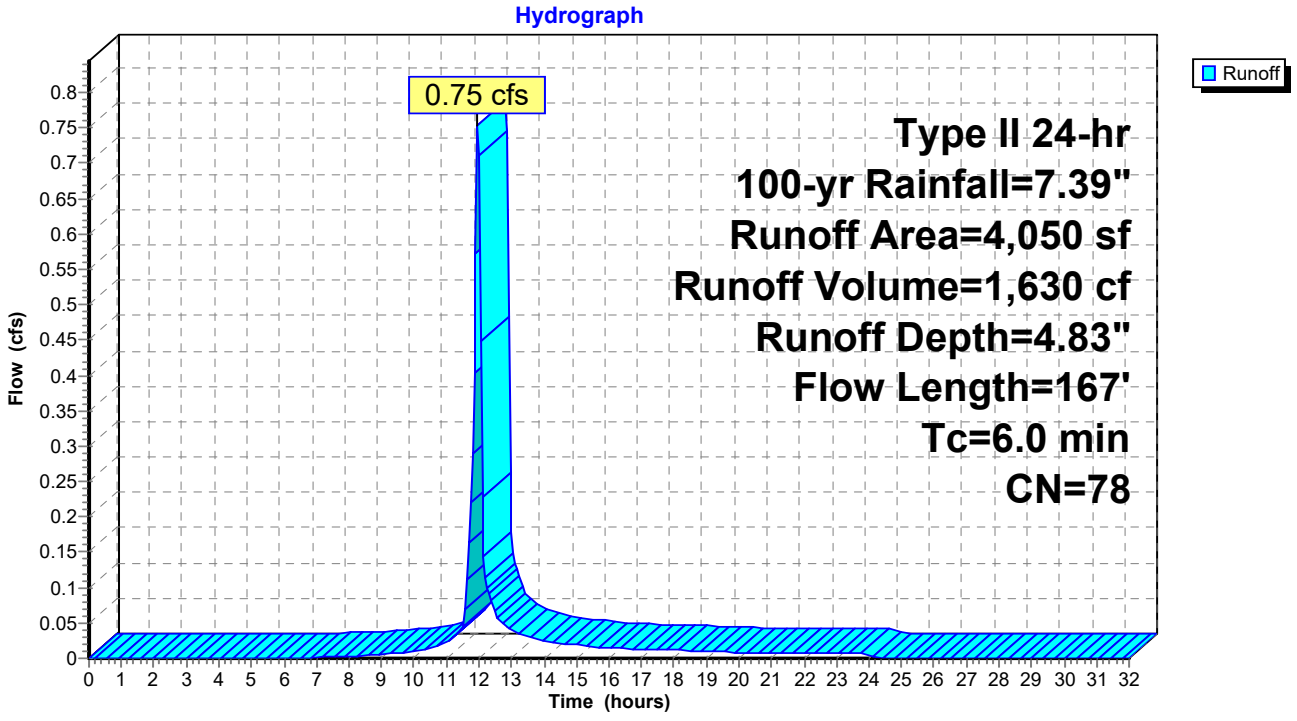
Runoff = 0.75 cfs @ 11.97 hrs, Volume= 1,630 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
4,050	78	Meadow, non-grazed, HSG D
4,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1000	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.95"
0.6	67	0.0746	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	167	Total			

Subcatchment 2S: DA Undetained



Summary for Subcatchment 6S: DC-D1 DA

[49] Hint: Tc<2dt may require smaller dt

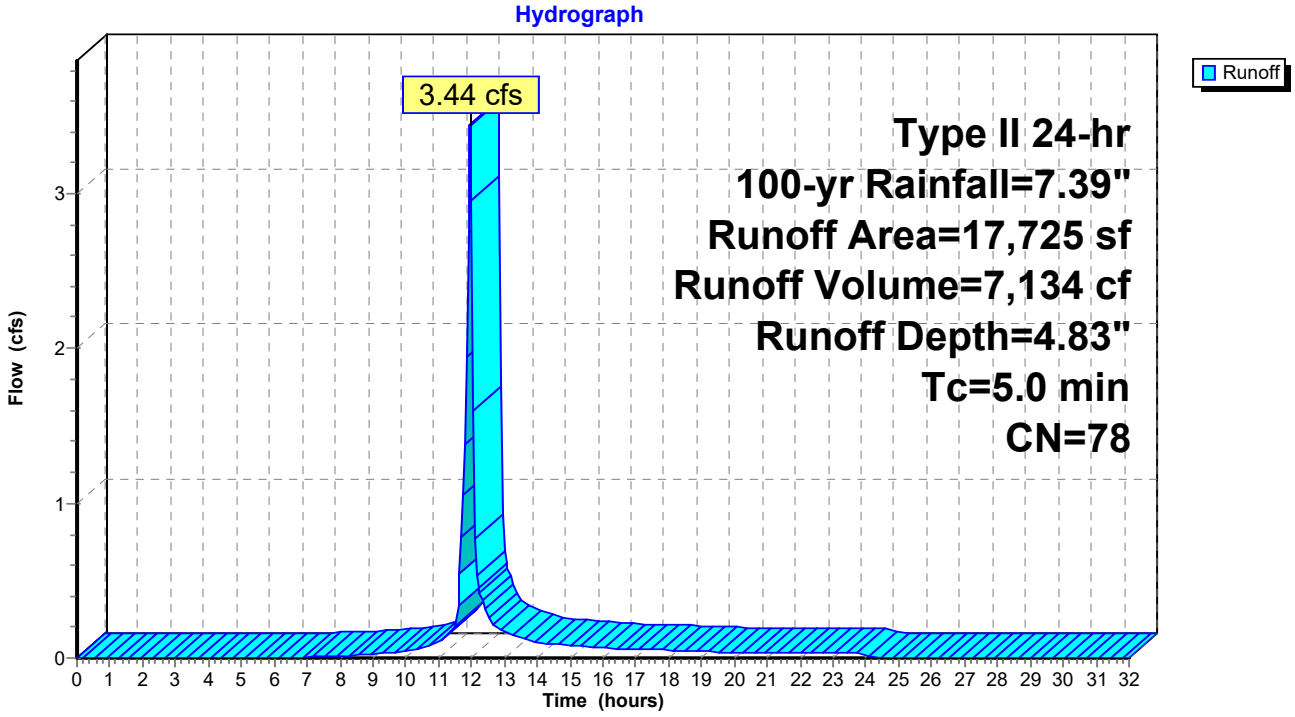
Runoff = 3.44 cfs @ 11.95 hrs, Volume= 7,134 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
17,725	78	Meadow, non-grazed, HSG D
17,725		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 min minimum**

Subcatchment 6S: DC-D1 DA



Summary for Subcatchment 8S: CC-C2 DA

[49] Hint: Tc<2dt may require smaller dt

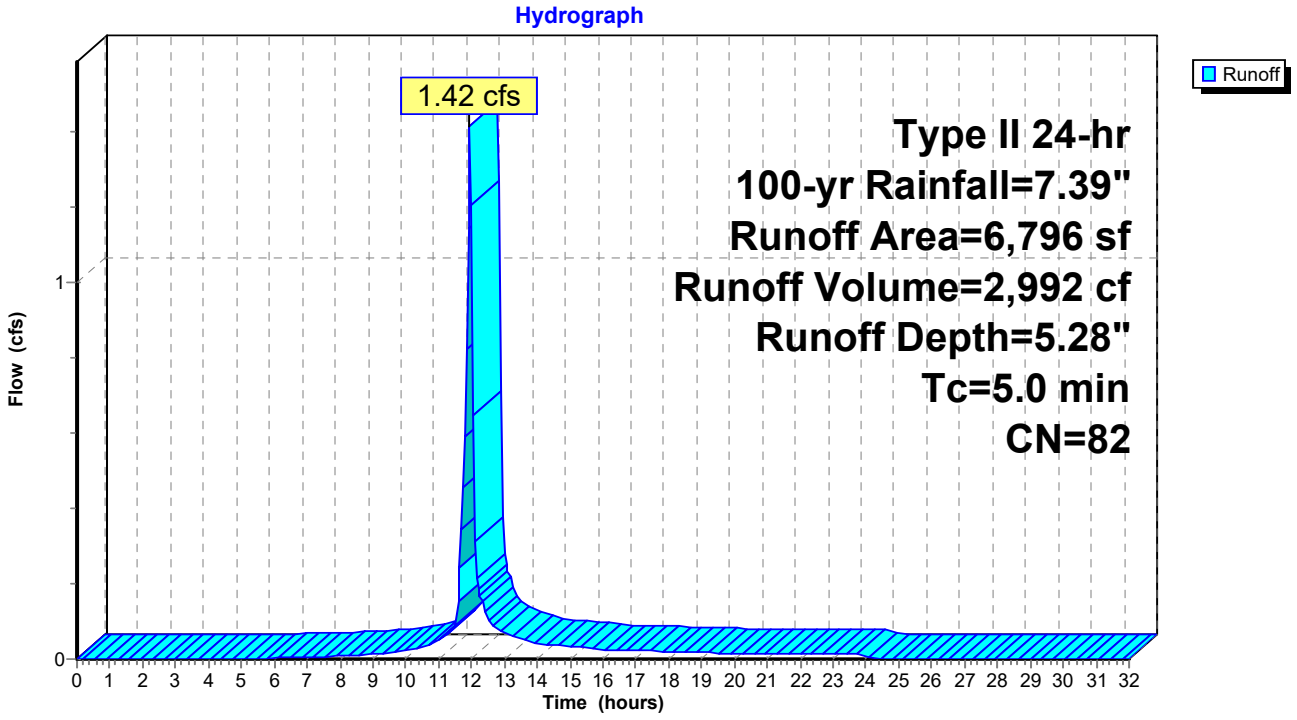
Runoff = 1.42 cfs @ 11.95 hrs, Volume= 2,992 cf, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
1,917	91	Gravel roads, HSG D
4,879	78	Meadow, non-grazed, HSG D
6,796	82	Weighted Average
6,796		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 8S: CC-C2 DA



Summary for Subcatchment 9S: CC-C1 DA

[49] Hint: Tc<2dt may require smaller dt

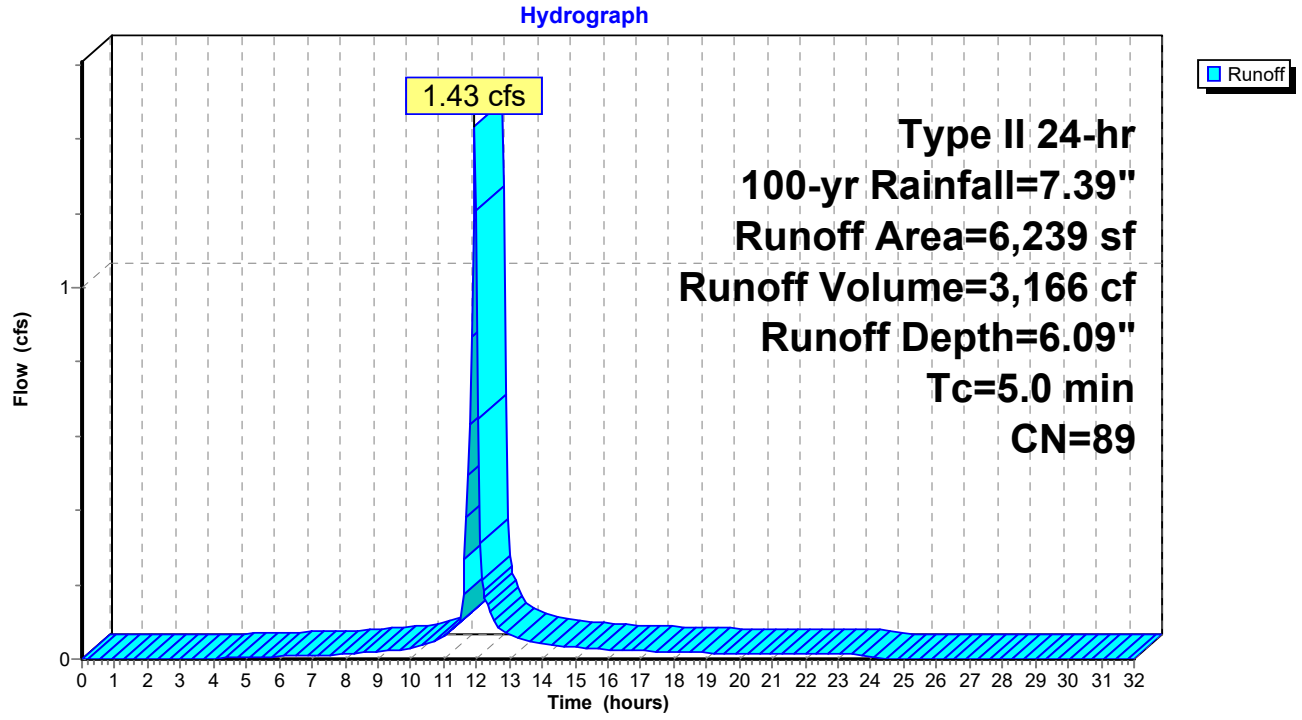
Runoff = 1.43 cfs @ 11.95 hrs, Volume= 3,166 cf, Depth= 6.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.39"

Area (sf)	CN	Description
5,040	91	Gravel roads, HSG D
1,199	78	Meadow, non-grazed, HSG D
6,239	89	Weighted Average
6,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5min min.**

Subcatchment 9S: CC-C1 DA



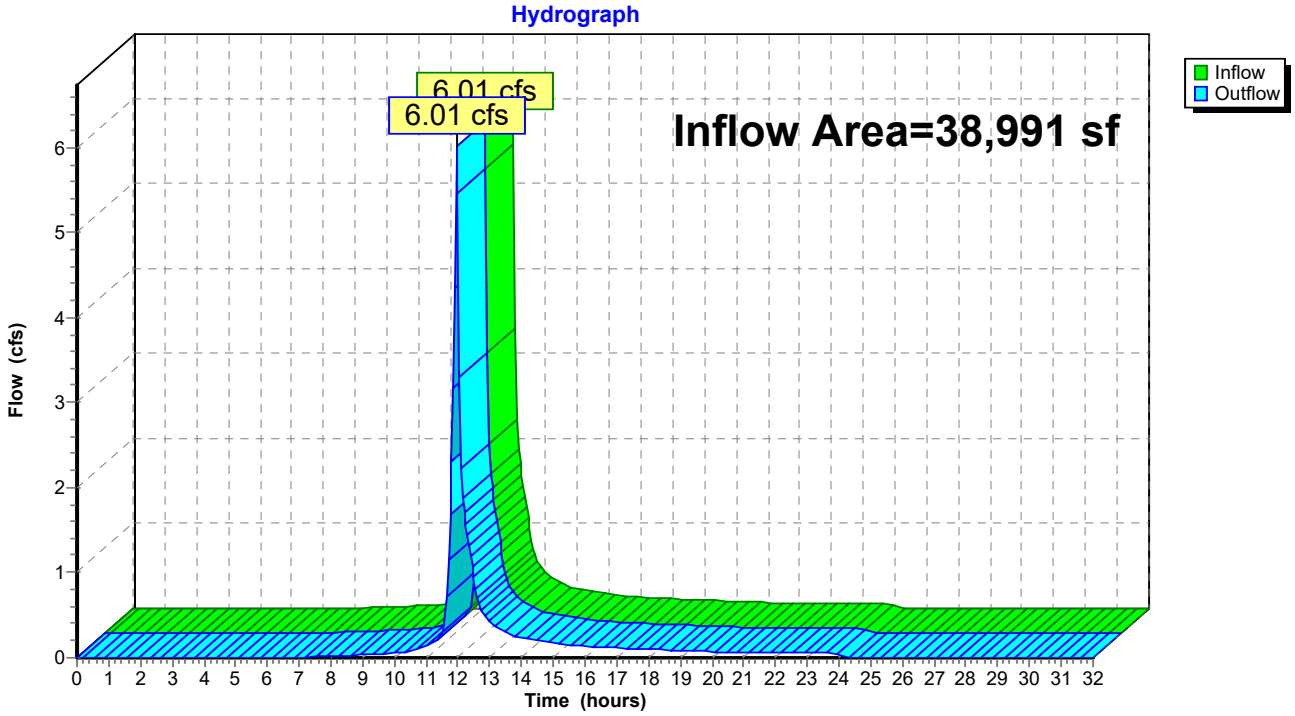
Summary for Reach 10: DA Post w/ BMP Total

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

Inflow Area = 38,991 sf, 0.00% Impervious, Inflow Depth = 4.36" for 100-yr event
Inflow = 6.01 cfs @ 11.96 hrs, Volume= 14,164 cf
Outflow = 6.01 cfs @ 11.96 hrs, Volume= 14,164 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs

Reach 10: DA Post w/ BMP Total



Summary for Reach 10R: CC-C2

Inflow Area = 6,796 sf, 0.00% Impervious, Inflow Depth = 5.28" for 100-yr event
Inflow = 1.42 cfs @ 11.95 hrs, Volume= 2,992 cf
Outflow = 1.32 cfs @ 11.99 hrs, Volume= 2,992 cf, Atten= 7%, Lag= 2.3 min

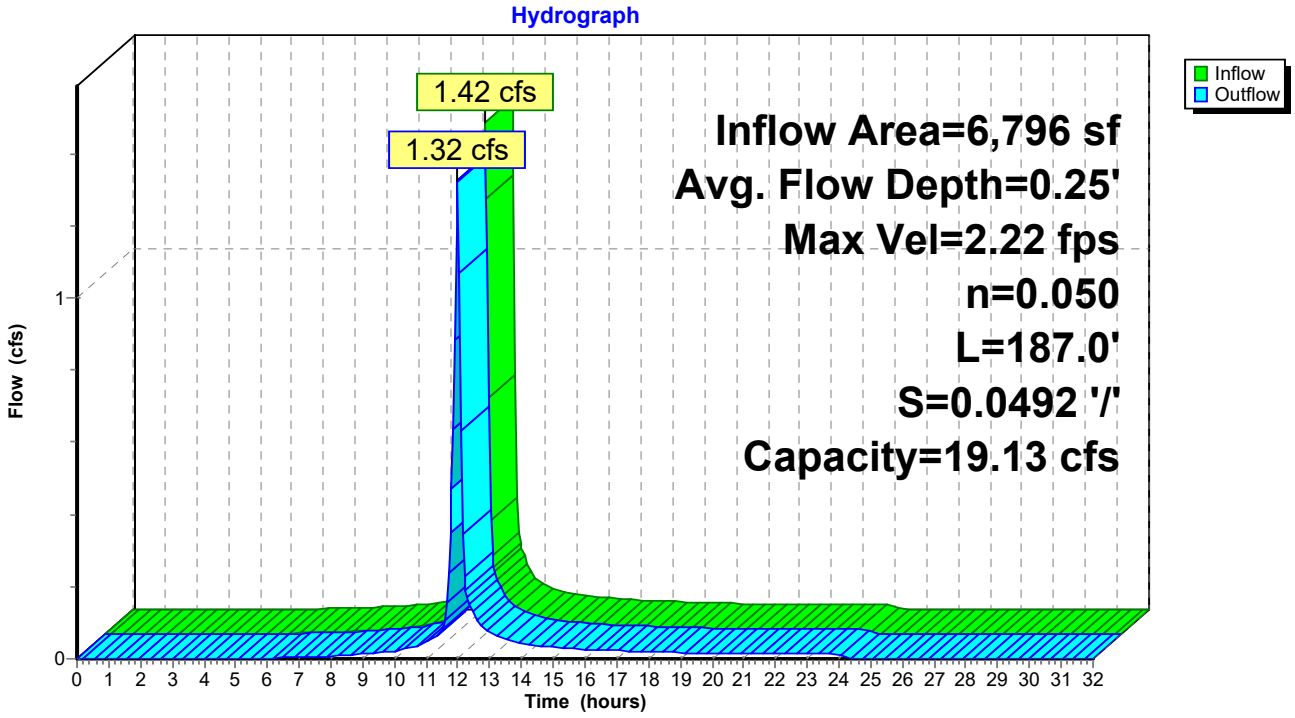
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 6.0 min

Peak Storage= 114 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 19.13 cfs

2.00' x 1.00' deep channel, n= 0.050
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 187.0' Slope= 0.0492 '/'
Inlet Invert= 1,436.00', Outlet Invert= 1,426.80'



Reach 10R: CC-C2



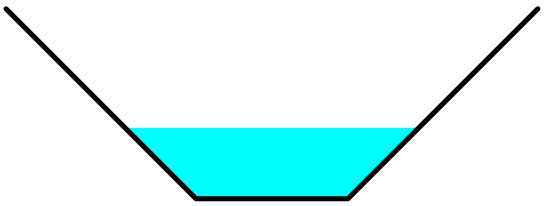
Summary for Reach 11R: CC-C1

Inflow Area = 6,239 sf, 0.00% Impervious, Inflow Depth = 6.09" for 100-yr event
Inflow = 1.43 cfs @ 11.95 hrs, Volume= 3,166 cf
Outflow = 1.36 cfs @ 11.98 hrs, Volume= 3,166 cf, Atten= 5%, Lag= 1.6 min

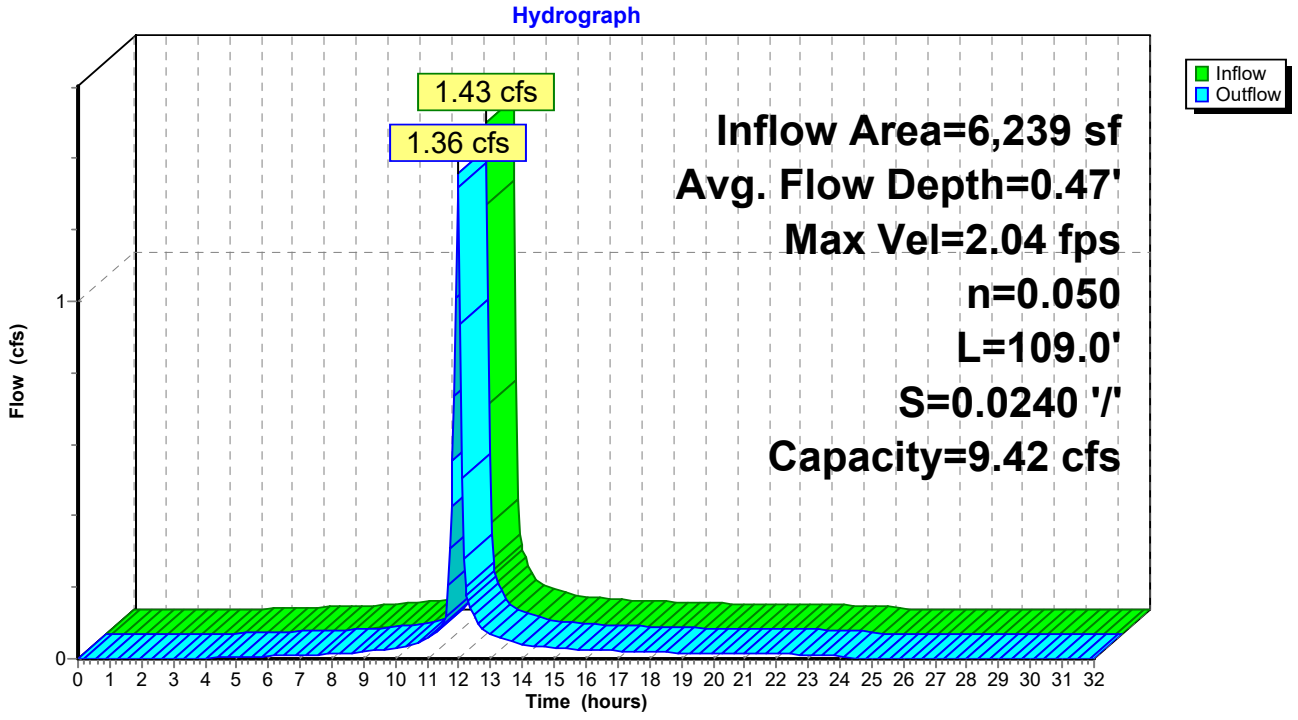
Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 3.5 min

Peak Storage= 75 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.25' Flow Area= 2.8 sf, Capacity= 9.42 cfs

1.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 3.50'
Length= 109.0' Slope= 0.0240 '/'
Inlet Invert= 1,429.20', Outlet Invert= 1,426.58'



Reach 11R: CC-C1



Summary for Pond 5P: Berm

[93] Warning: Storage range exceeded by 0.01'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 5.47" for 100-yr event
Inflow = 3.44 cfs @ 11.98 hrs, Volume= 7,841 cf
Outflow = 1.87 cfs @ 11.98 hrs, Volume= 6,537 cf, Atten= 46%, Lag= 0.1 min
Discarded = 0.02 cfs @ 11.98 hrs, Volume= 1,132 cf
Primary = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,426.02' @ 11.98 hrs Surf.Area= 2,340 sf Storage= 2,059 cf

Plug-Flow detention time= 166.4 min calculated for 6,537 cf (83% of inflow)
Center-of-Mass det. time= 93.4 min (887.6 - 794.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,424.00'	2,059 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

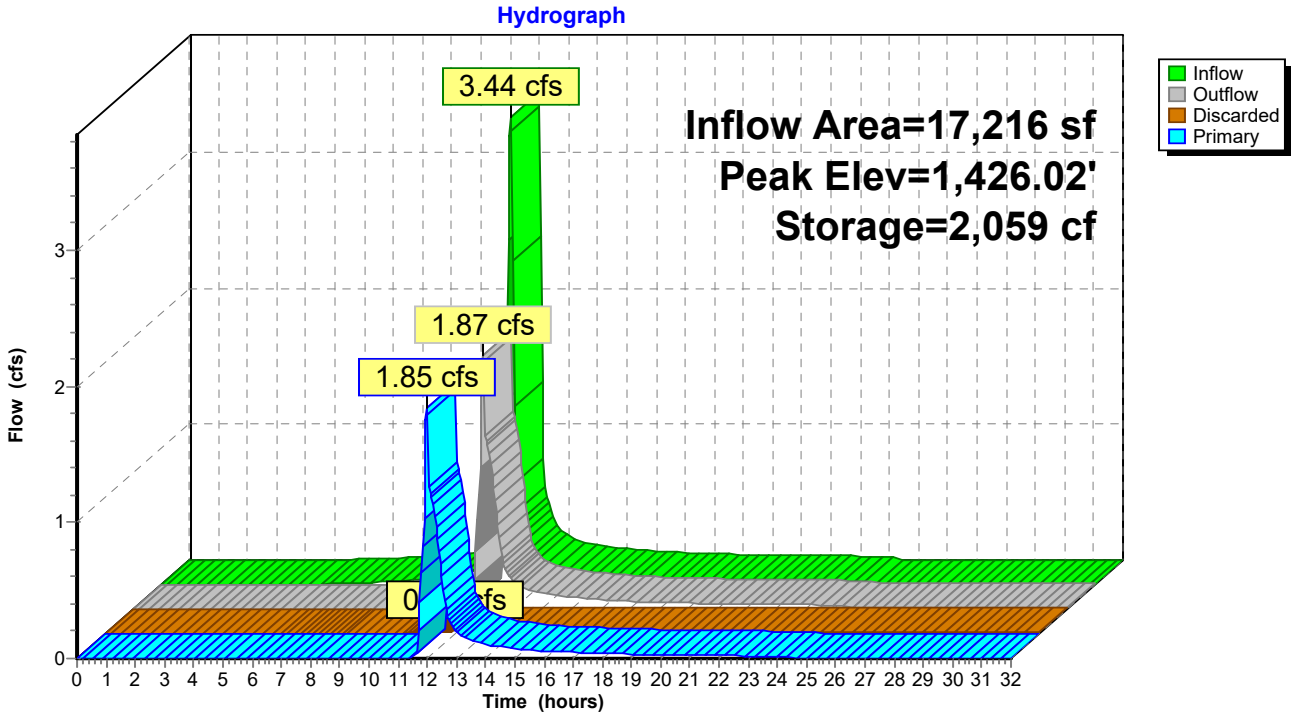
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,424.00	0	0	0
1,424.50	633	158	158
1,425.00	709	336	494
1,425.25	1,204	239	733
1,425.45	1,437	264	997
1,426.00	2,340	1,039	2,036
1,426.01	2,340	23	2,059

Device	Routing	Invert	Outlet Devices
#1	Primary	1,426.00'	**78.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	1,424.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,422.00'
#3	Primary	1,425.45'	**3.0" Round Culvert X 10.00** L= 13.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,425.45' / 1,422.00' S= 0.2654 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.02 cfs @ 11.98 hrs HW=1,426.02' (Free Discharge)
└**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.73 cfs @ 11.98 hrs HW=1,426.02' (Free Discharge)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.48 cfs @ 0.34 fps)
└**3=Culvert** (Inlet Controls 1.24 cfs @ 2.53 fps)

Pond 5P: Berm


Hydrograph
3.44 cfs
1.87 cfs
1.85 cfs
Inflow Area=17,216 sf
Peak Elev=1,426.02'
Storage=2,059 cf
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
2
3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Time (hours)

Summary for Pond 6P: Level Spreader

[79] Warning: Submerged Pond 5P Primary device # 3 OUTLET by 0.07'

Inflow Area = 17,216 sf, 0.00% Impervious, Inflow Depth = 3.77" for 100-yr event
Inflow = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf
Outflow = 1.85 cfs @ 11.98 hrs, Volume= 5,405 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.98 hrs, Volume= 6 cf
Primary = 1.85 cfs @ 11.98 hrs, Volume= 5,399 cf

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Peak Elev= 1,422.07' @ 11.98 hrs Surf.Area= 35 sf Storage= 1 cf

Plug-Flow detention time= 0.0 min calculated for 5,397 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (824.0 - 824.0)

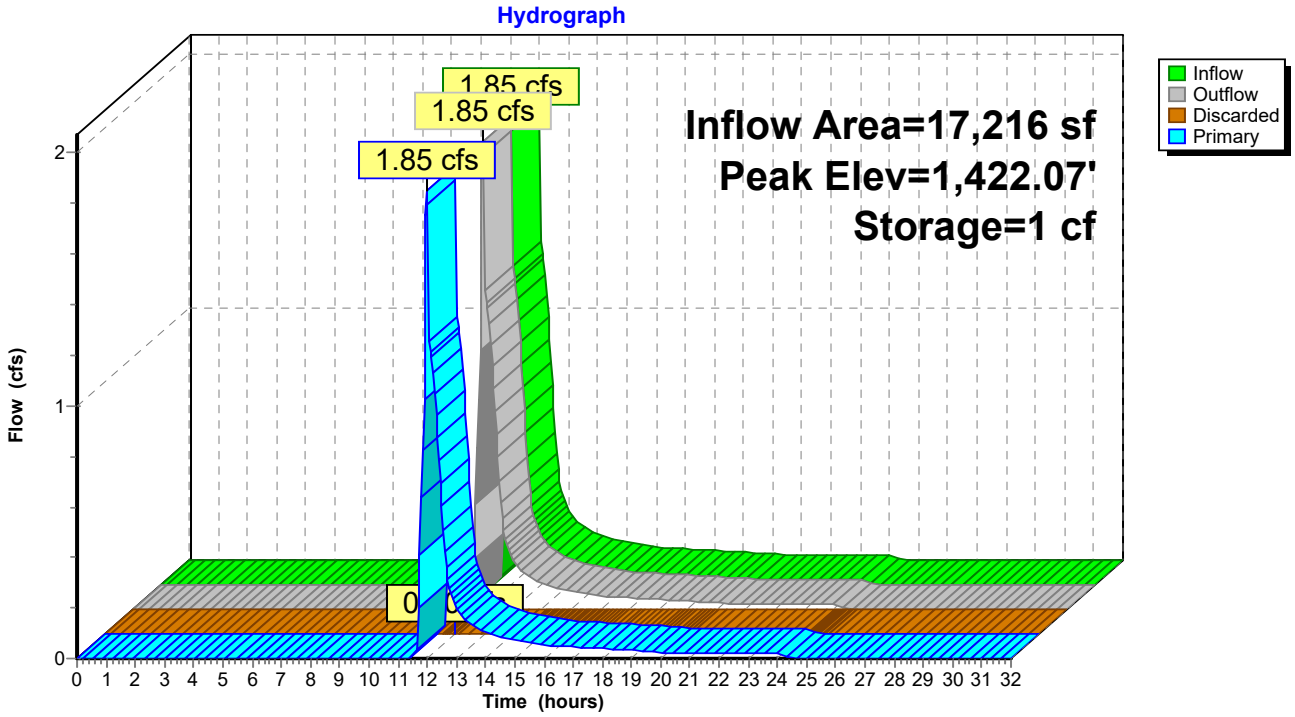
Volume	Invert	Avail.Storage	Storage Description
#1	1,422.00'	14 cf	**1.00'W x 35.00'L x 1.00'H Prismatoid** 35 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,422.00'	**0.315 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1,420.00'
#2	Primary	1,422.00'	**35.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=1,422.07' (Free Discharge)
1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=1.78 cfs @ 11.98 hrs HW=1,422.07' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.78 cfs @ 0.72 fps)

Pond 6P: Level Spreader



ATTACHMENT 4.18

CHANNEL DESIGN WORKSHEETS – LOWER DEMUNDS REL TIE-IN

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE – Lower Demunds REL Tie-in
LOCATION: Luzerne County, PA
PREPARED BY: CD DATE: 03/02/2021
CHECKED BY: PW DATE: 03/02/2022

DIRECT ENTRY METHOD:

Path Number	Length (ft)	Time (min)	Tc Total (min)
D - 2 Rch A	100	6.0	6.0
D - 2 Rch B	100	6.0	6.0

Channel Dimensions:

Path Number	Bottom Width (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Total Depth (ft)	Top Width (ft)
D - 2 Rch A	0	2	2	1.0	4.0
D - 2 Rch B	0	2	2	1.25	5.0

STANDARD E&S WORKSHEET # 11
Channel Design Data

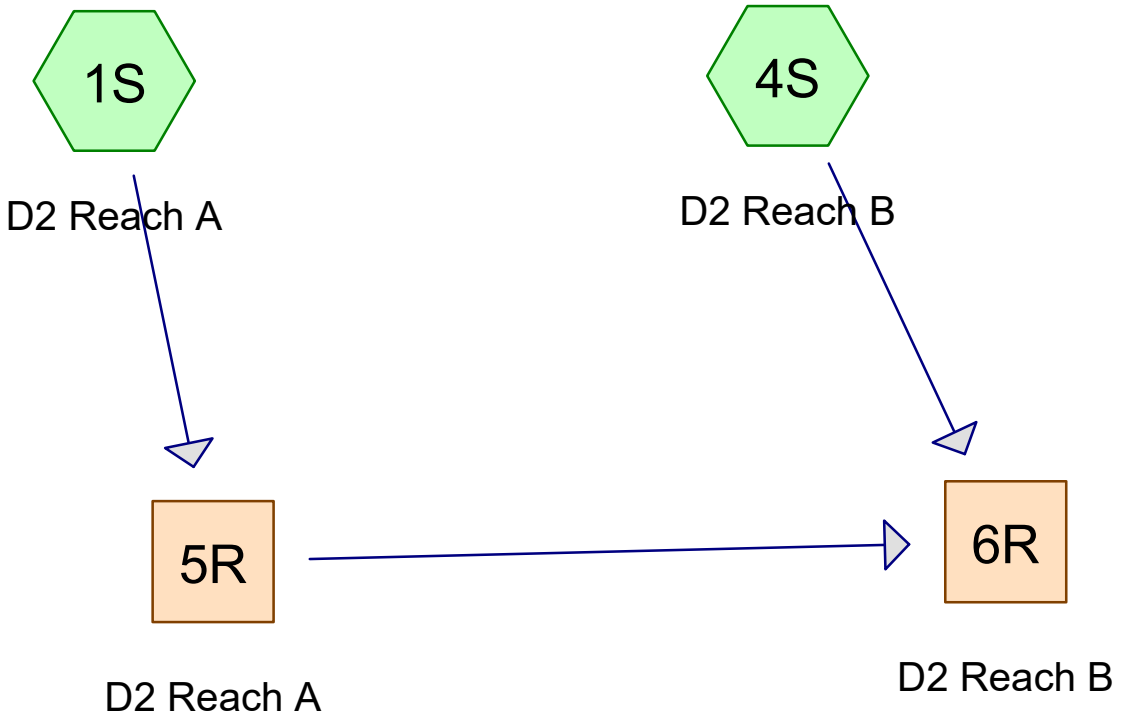
PROJECT NAME: Williams REAE – Lower Demunds REL Tie-in
LOCATION: Luzerne County, PA
PREPARED BY: CD DATE: 02/28/2022
CHECKED BY: PW DATE: 02/28/2022

CHANNEL OR CHANNEL SECTION		D-2 Reach A	D-2 Reach A	D-2 Reach B		
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P		
DESIGN STORM	(2, 5, OR 10 YR)	10 YR	10 YR	10 YR		
ACRES	(AC)	0.33	0.33	0.1		
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A		
Q_r (REQUIRED CAPACITY)	(CFS)	1.28	1.28	1.57		
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	1.32	1.30	1.60		
PROTECTIVE LINING[2]		SC150BN	Grass	R-3 Riprap		
n (MANNING'S COEFFICIENT)[2]		0.05	0.088	0.0412		
V_a (ALLOWABLE VELOCITY)	(FPS)	8.0	3.0	6.5		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.8	1.2	2.1		
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-	-	-		
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	-	-	-		
CHANNEL BOTTOM WIDTH	(FT)	0	0	0		
CHANNEL LEFT SIDE SLOPE	(H:V)	10	10	2		
CHANNEL RIGHT SIDE SLOPE	(H:V)	2	2	2		
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.25		
CHANNEL TOP WIDTH @ D	(FT)	4.0	4.0	5.0		
d (CALCULATED FLOW DEPTH)	(FT)	0.35	0.43	0.61		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	1.4	1.72	2.44		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	0	0	0		
d_{50} STONE SIZE	(IN)	-	-	3		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.735	1.109	0.744		
R (HYDRAULIC RADIUS)	(FT)	0.470	0.577	0.273		
S (BED SLOPE)[3]	(FT/FT)	0.01	0.01	0.02		
S_c (CRITICAL SLOPE)	(FT/FT)	0.052	0.151	0.043		
$.7S_c$	(FT/FT)	0.037	0.106	0.03		
$1.3S_c$	(FT/FT)	0.07	0.20	0.06		
STABLE FLOW?	(Y/N)	Y	Y	Y		
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	-	-		
FREEBOARD BASED ON STABLE FLOW	(FT)	0.65	0.57	0.64		
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5		
DESIGN METHOD FOR PROTECTIVE LINING[5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		V	V	V		

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

ATTACHMENT 4.19

CHANNEL HYDROCAD REPORT – LOWER DEMUNDS REL TIE-IN



Subcat Reach Pond Link

Routing Diagram for Channel D2
Prepared by Microsoft, Printed 3/2/2021
HydroCAD® 10.00-26 s/n 09710 © 2020 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C
Rainfall events imported from "NRCS-Rain.txt" for 7639 PA Luzerne-C

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.370	78	Meadow, non-grazed, HSG D (1S, 4S)
0.060	98	Paved roads w/curbs & sewers, HSG D (1S)
0.430	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.430	HSG D	1S, 4S
0.000	Other	
0.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.370	0.000	0.370	Meadow, non-grazed	1S, 4S
0.000	0.000	0.000	0.060	0.000	0.060	Paved roads w/curbs & sewers	1S
0.000	**0.000**	**0.000**	**0.430**	**0.000**	**0.430**	**TOTAL AREA**	

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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>1.19"
Flow Length=100' Tc=6.0 min CN=82 Runoff=0.55 cfs 0.033 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>0.96"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.13 cfs 0.008 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.28' Max Vel=1.17 fps Inflow=0.55 cfs 0.033 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=0.52 cfs 0.033 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.43' Max Vel=1.72 fps Inflow=0.65 cfs 0.041 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=0.61 cfs 0.041 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.041 af Average Runoff Depth = 1.14"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

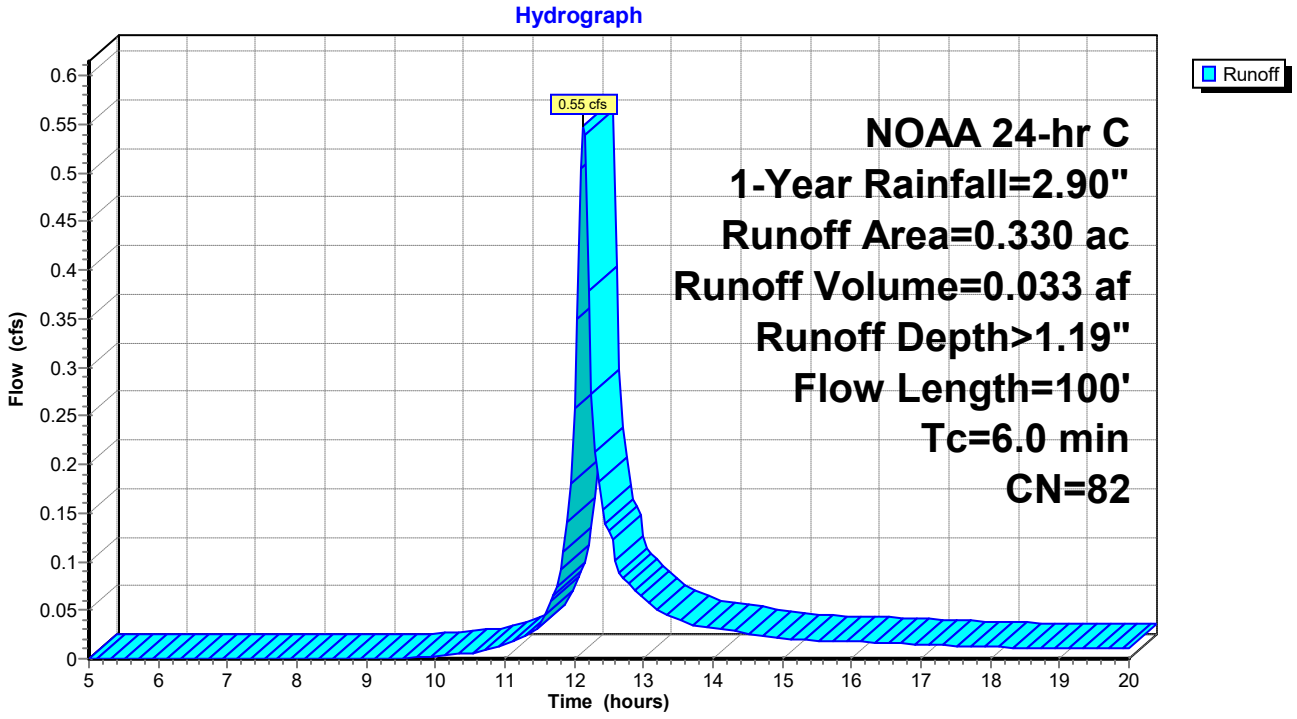
Runoff = 0.55 cfs @ 12.13 hrs, Volume= 0.033 af, Depth> 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

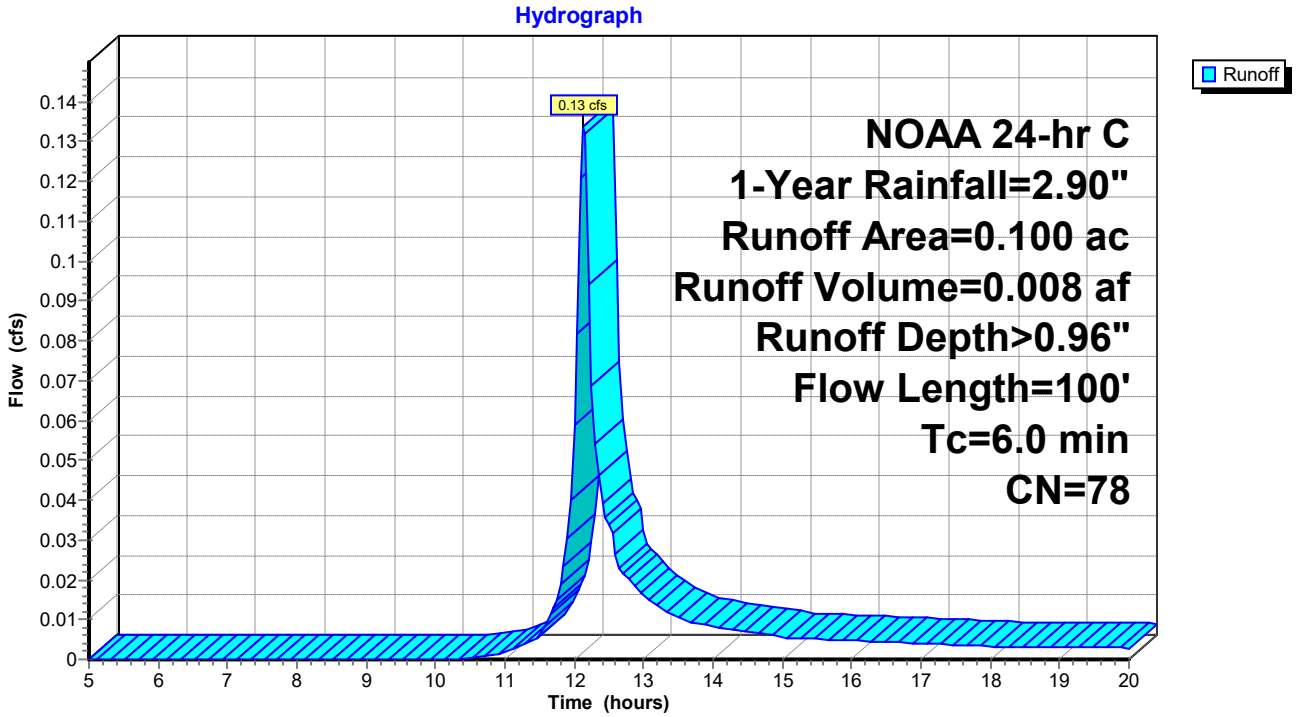
Runoff = 0.13 cfs @ 12.14 hrs, Volume= 0.008 af, Depth> 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-Year Rainfall=2.90"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



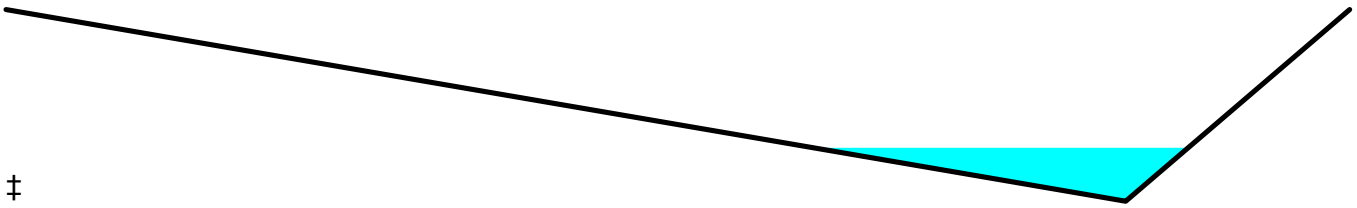
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 1.19" for 1-Year event
Inflow = 0.55 cfs @ 12.13 hrs, Volume= 0.033 af
Outflow = 0.52 cfs @ 12.16 hrs, Volume= 0.033 af, Atten= 5%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.17 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 2.1 min

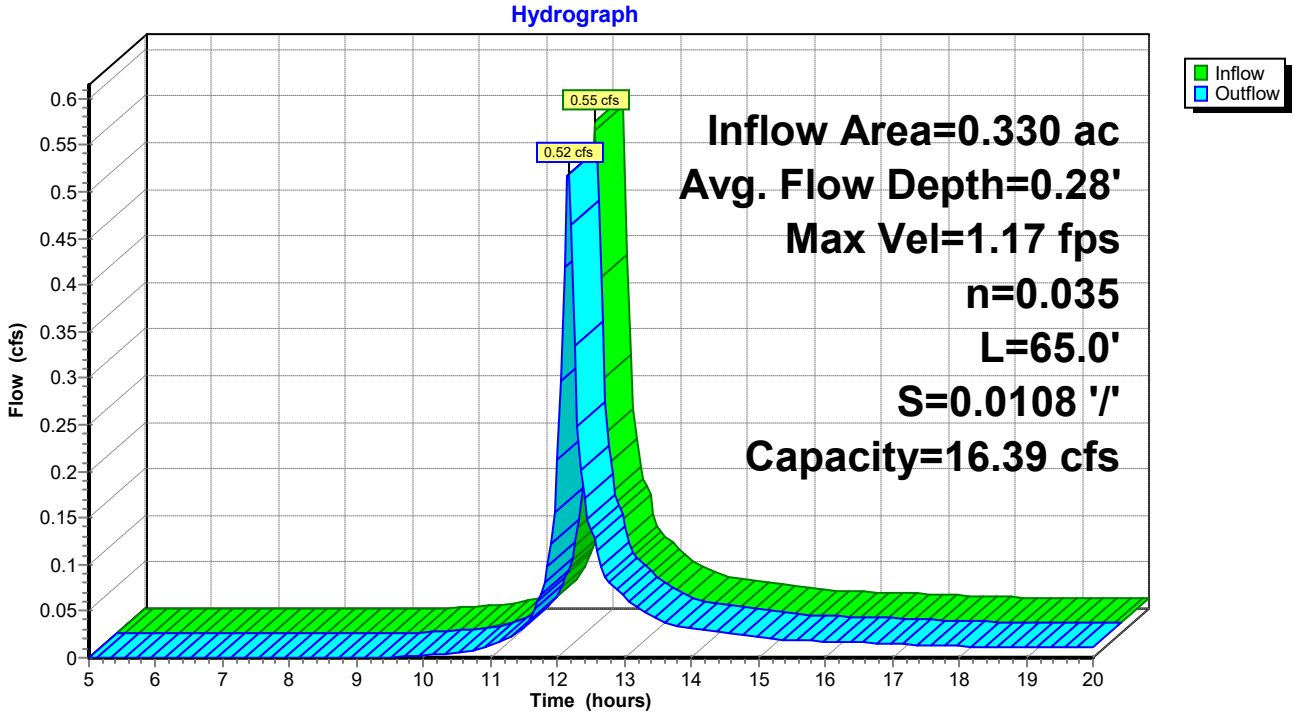
Peak Storage= 30 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

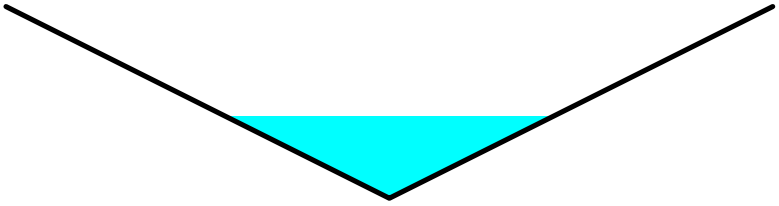
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.16' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 1.13" for 1-Year event
Inflow = 0.65 cfs @ 12.15 hrs, Volume= 0.041 af
Outflow = 0.61 cfs @ 12.19 hrs, Volume= 0.041 af, Atten= 6%, Lag= 2.1 min

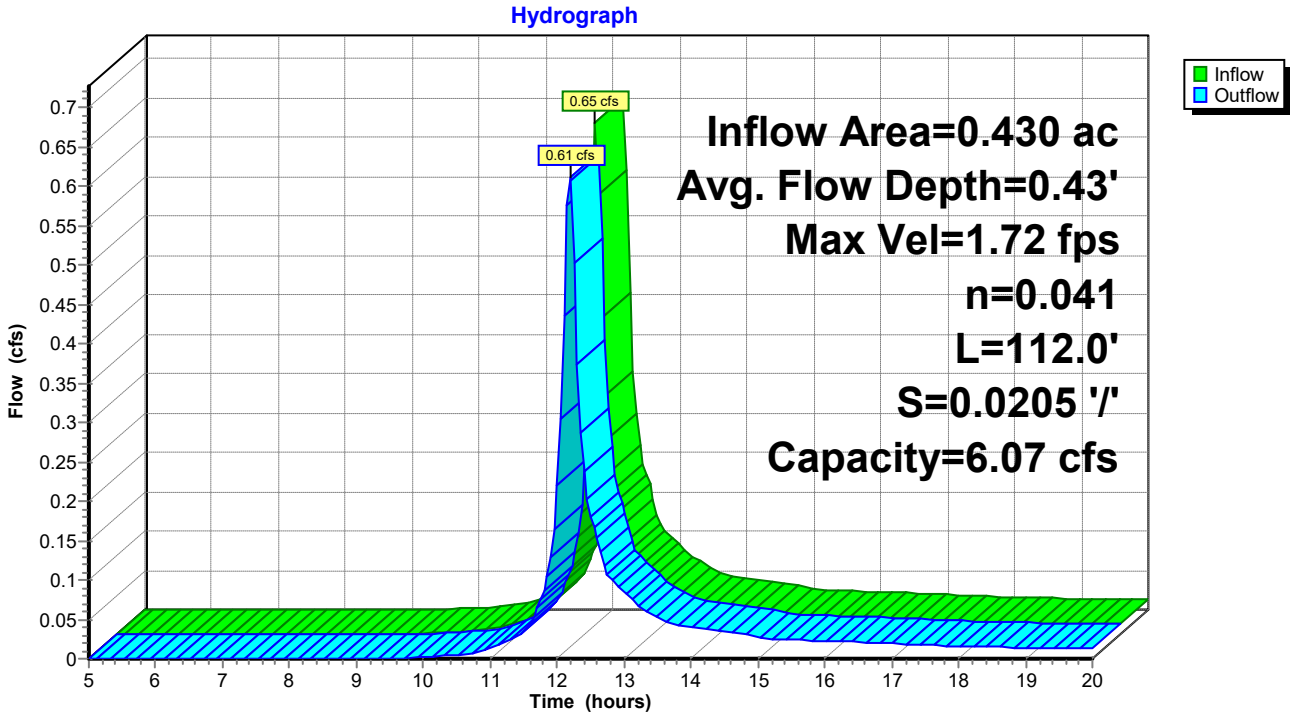
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.72 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 2.4 min

Peak Storage= 41 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>1.56"
Flow Length=100' Tc=6.0 min CN=82 Runoff=0.72 cfs 0.043 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>1.30"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.18 cfs 0.011 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.31' Max Vel=1.25 fps Inflow=0.72 cfs 0.043 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=0.68 cfs 0.043 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.48' Max Vel=1.85 fps Inflow=0.86 cfs 0.054 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=0.81 cfs 0.054 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.054 af Average Runoff Depth = 1.50"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

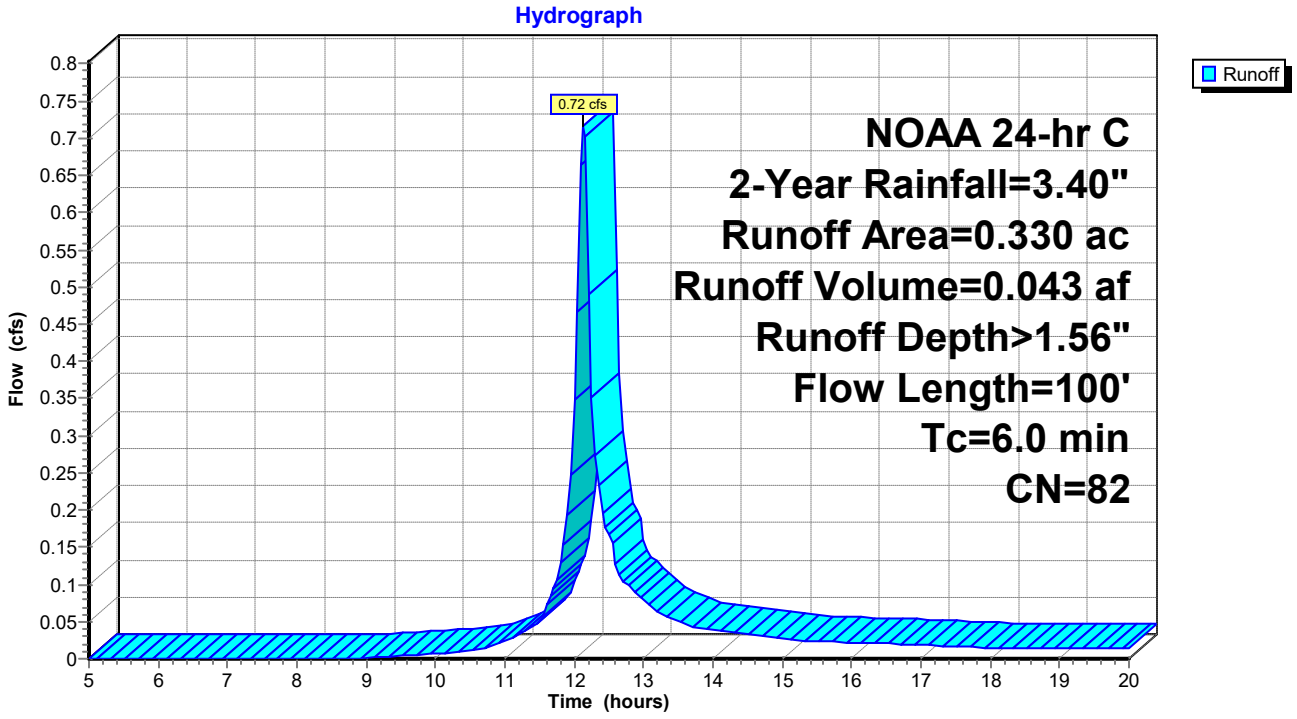
Runoff = 0.72 cfs @ 12.13 hrs, Volume= 0.043 af, Depth> 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

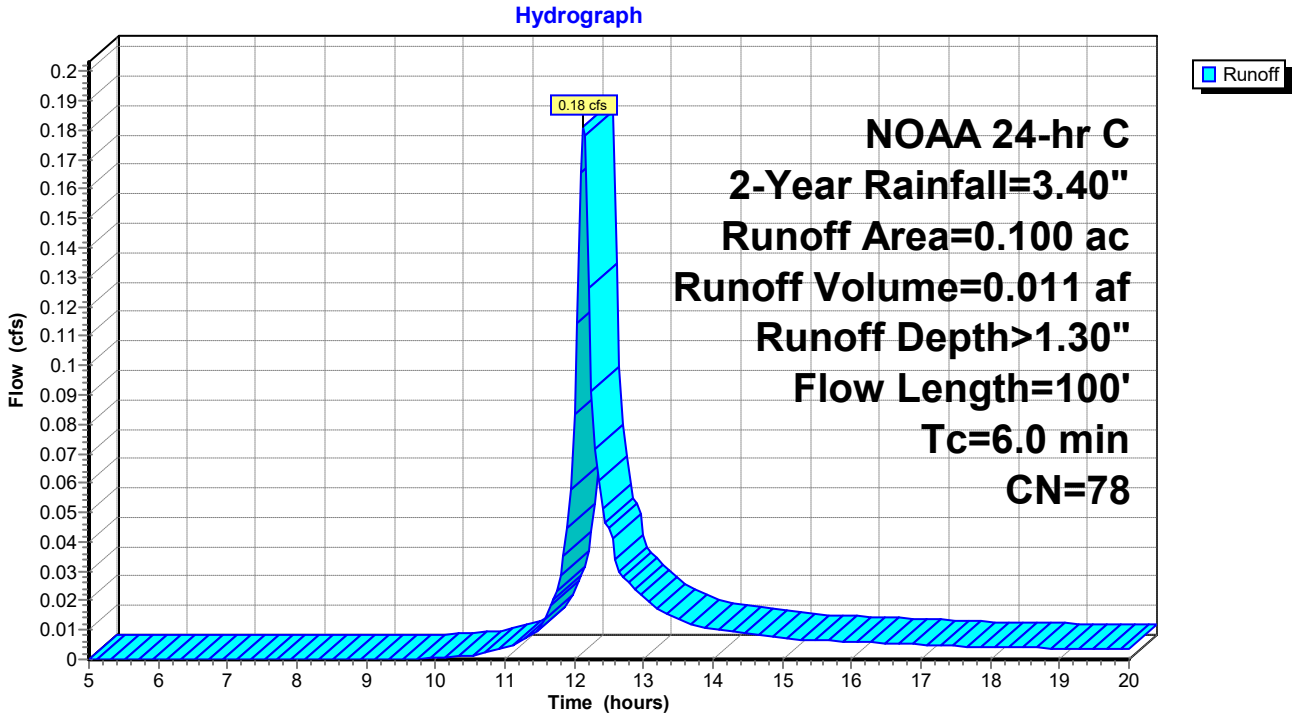
Runoff = 0.18 cfs @ 12.13 hrs, Volume= 0.011 af, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



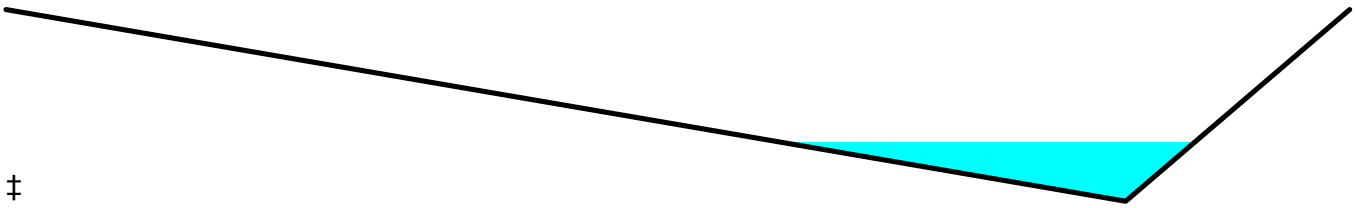
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 1.56" for 2-Year event
Inflow = 0.72 cfs @ 12.13 hrs, Volume= 0.043 af
Outflow = 0.68 cfs @ 12.15 hrs, Volume= 0.043 af, Atten= 5%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.25 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 2.0 min

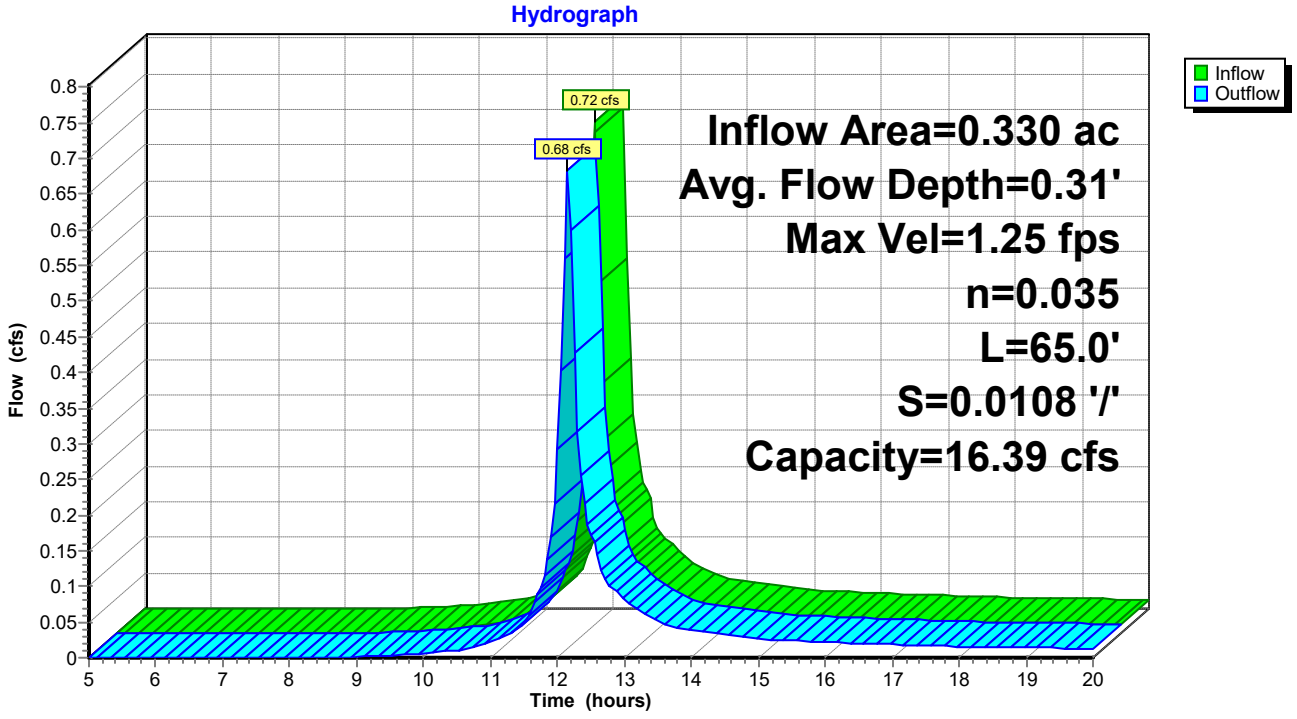
Peak Storage= 37 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

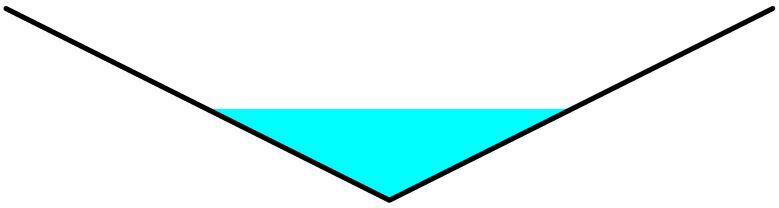
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.18' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 1.50" for 2-Year event
Inflow = 0.86 cfs @ 12.15 hrs, Volume= 0.054 af
Outflow = 0.81 cfs @ 12.18 hrs, Volume= 0.054 af, Atten= 6%, Lag= 1.9 min

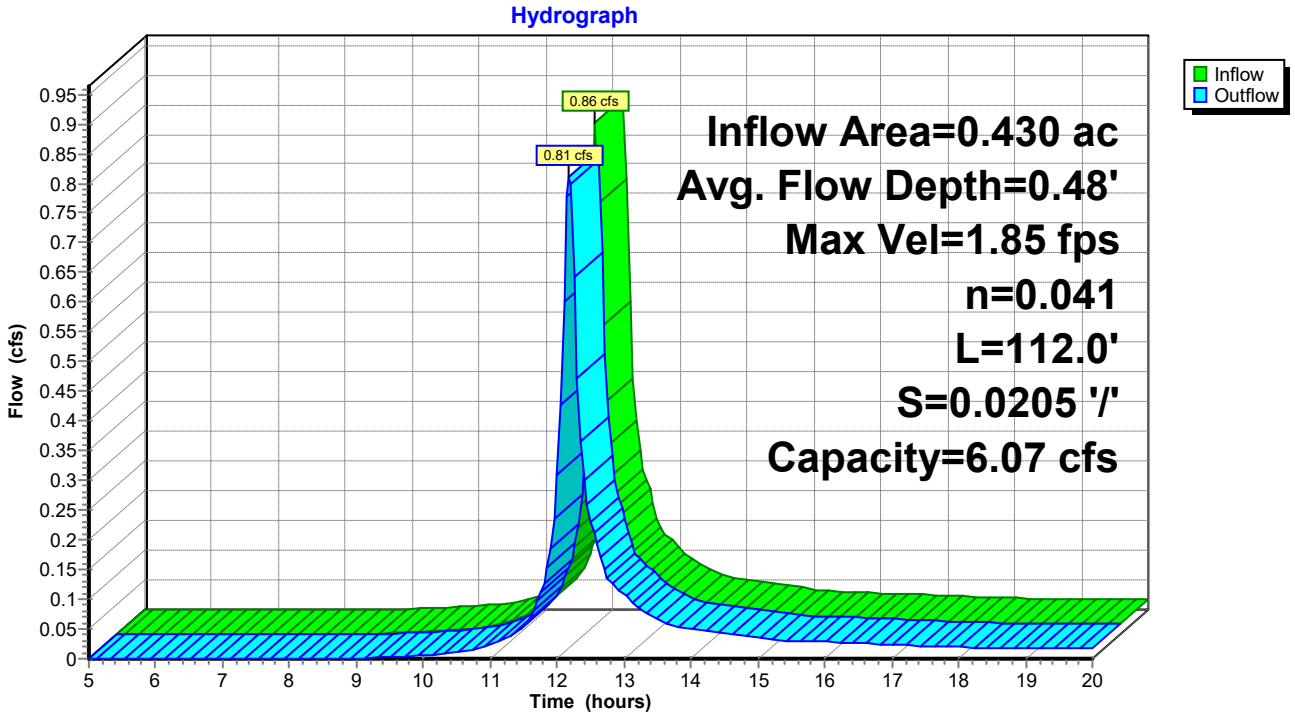
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.85 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 2.3 min

Peak Storage= 51 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>2.28"
Flow Length=100' Tc=6.0 min CN=82 Runoff=1.03 cfs 0.063 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>1.96"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.27 cfs 0.016 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.35' Max Vel=1.37 fps Inflow=1.03 cfs 0.063 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=0.99 cfs 0.063 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.55' Max Vel=2.04 fps Inflow=1.26 cfs 0.079 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=1.19 cfs 0.079 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.079 af Average Runoff Depth = 2.20"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

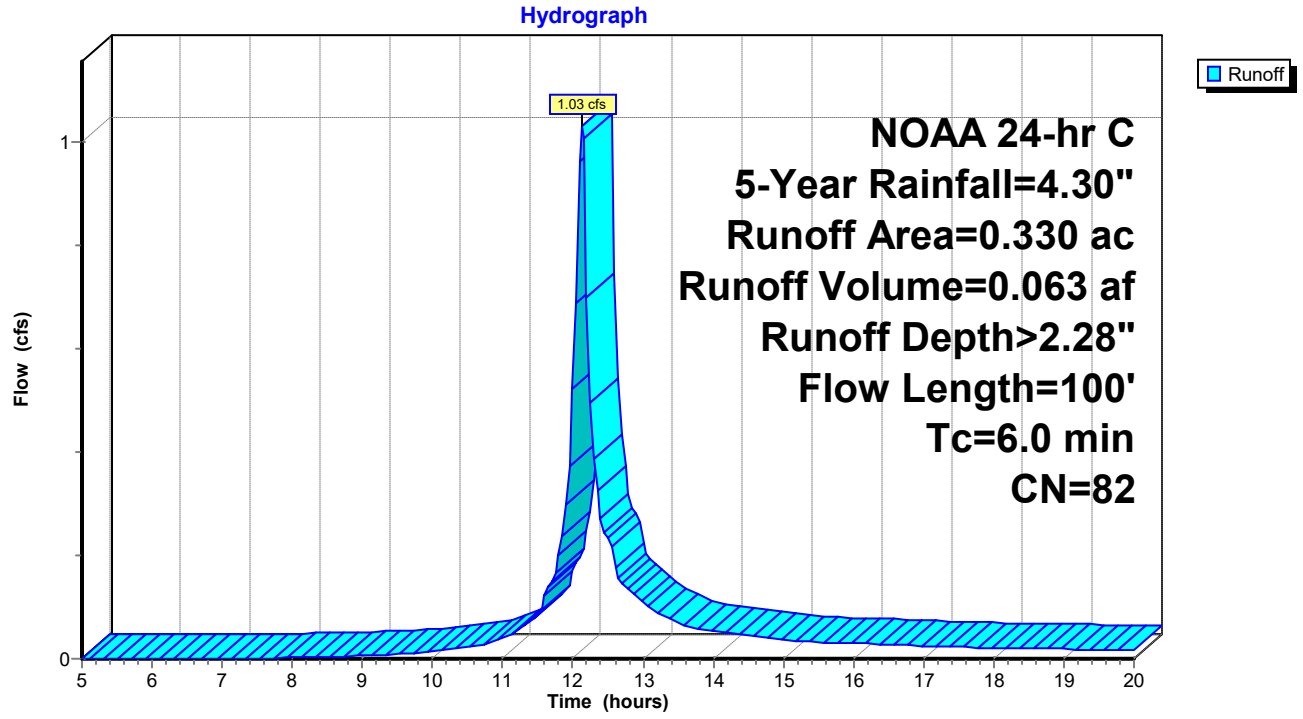
Runoff = 1.03 cfs @ 12.13 hrs, Volume= 0.063 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

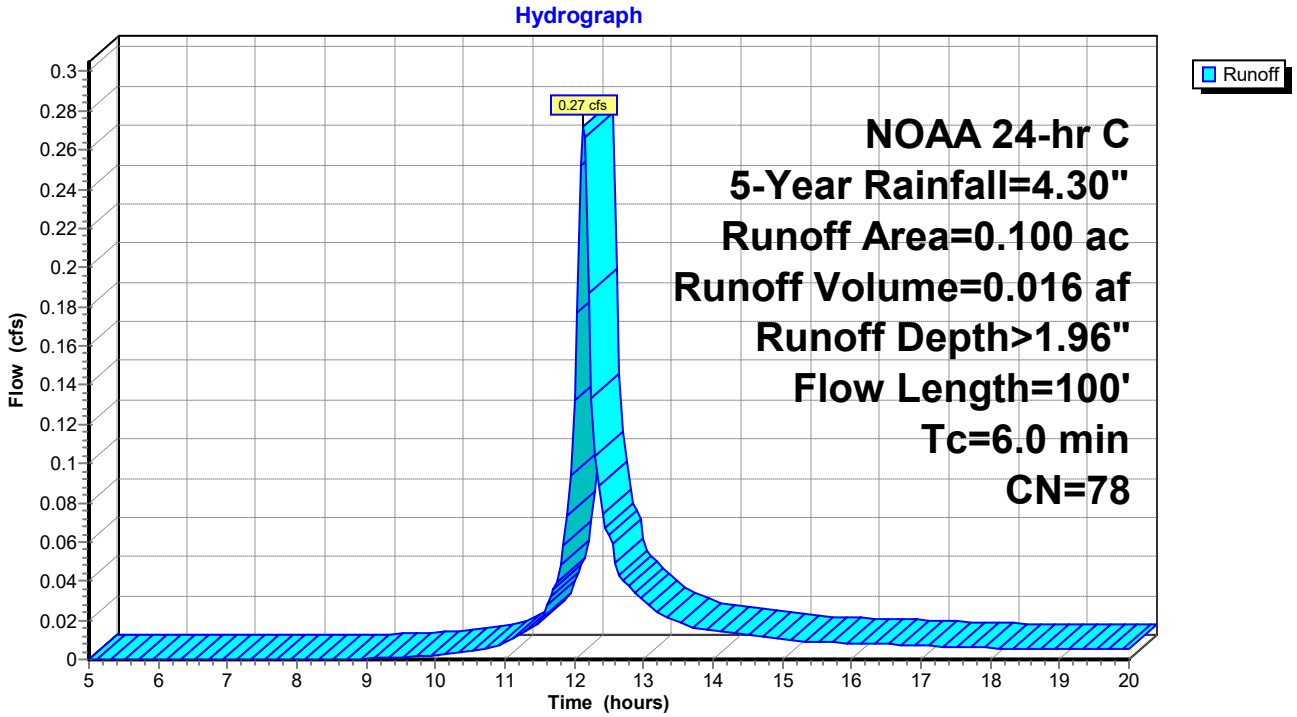
Runoff = 0.27 cfs @ 12.13 hrs, Volume= 0.016 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 5-Year Rainfall=4.30"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



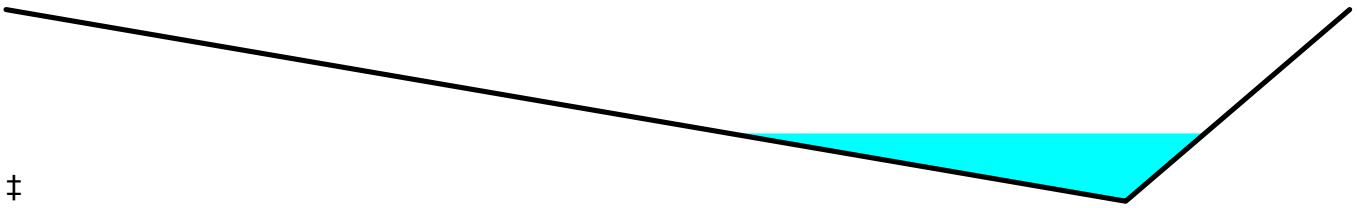
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 2.28" for 5-Year event
Inflow = 1.03 cfs @ 12.13 hrs, Volume= 0.063 af
Outflow = 0.99 cfs @ 12.15 hrs, Volume= 0.063 af, Atten= 4%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.37 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 1.9 min

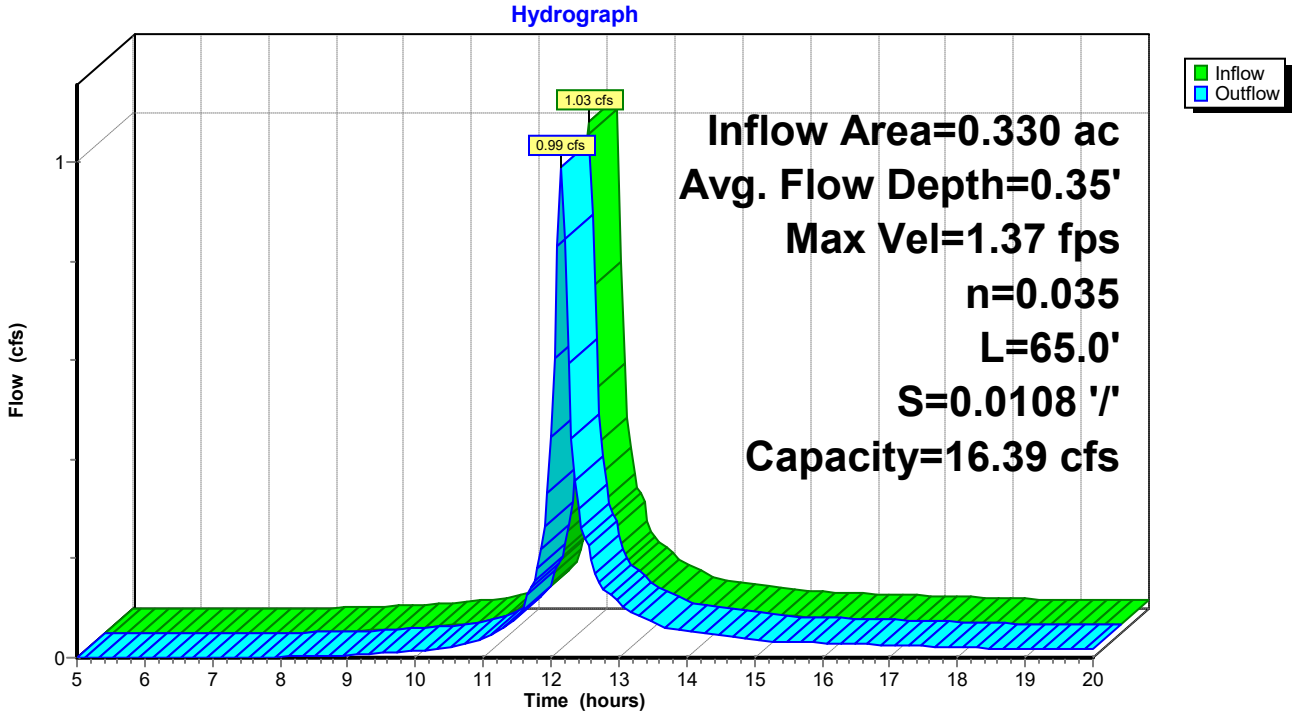
Peak Storage= 49 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

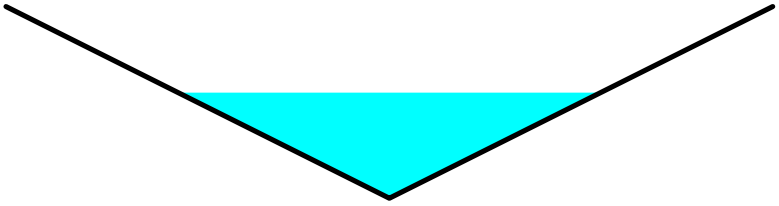
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.21' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 2.20" for 5-Year event
Inflow = 1.26 cfs @ 12.15 hrs, Volume= 0.079 af
Outflow = 1.19 cfs @ 12.17 hrs, Volume= 0.079 af, Atten= 6%, Lag= 1.6 min

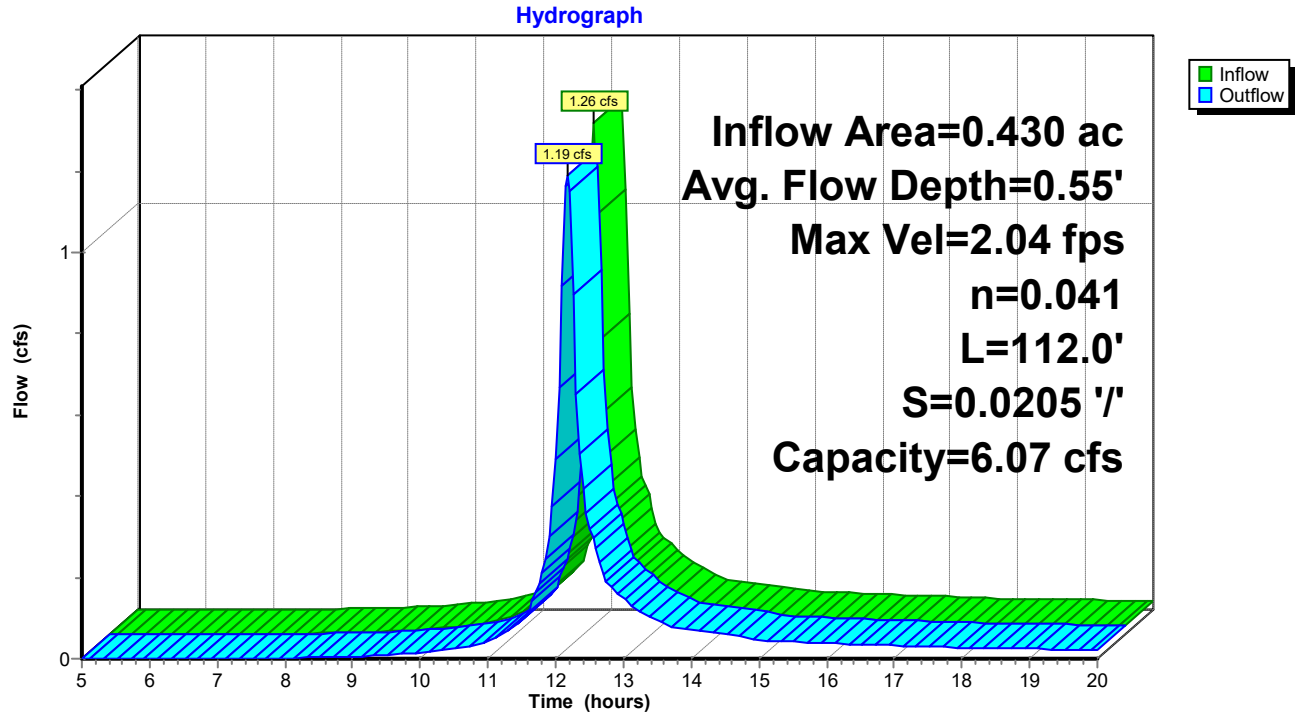
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 2.2 min

Peak Storage= 68 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>2.86"
Flow Length=100' Tc=6.0 min CN=82 Runoff=1.28 cfs 0.079 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>2.50"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.35 cfs 0.021 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.38' Max Vel=1.44 fps Inflow=1.28 cfs 0.079 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=1.23 cfs 0.078 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.60' Max Vel=2.16 fps Inflow=1.57 cfs 0.099 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=1.49 cfs 0.099 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.099 af Average Runoff Depth = 2.77"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

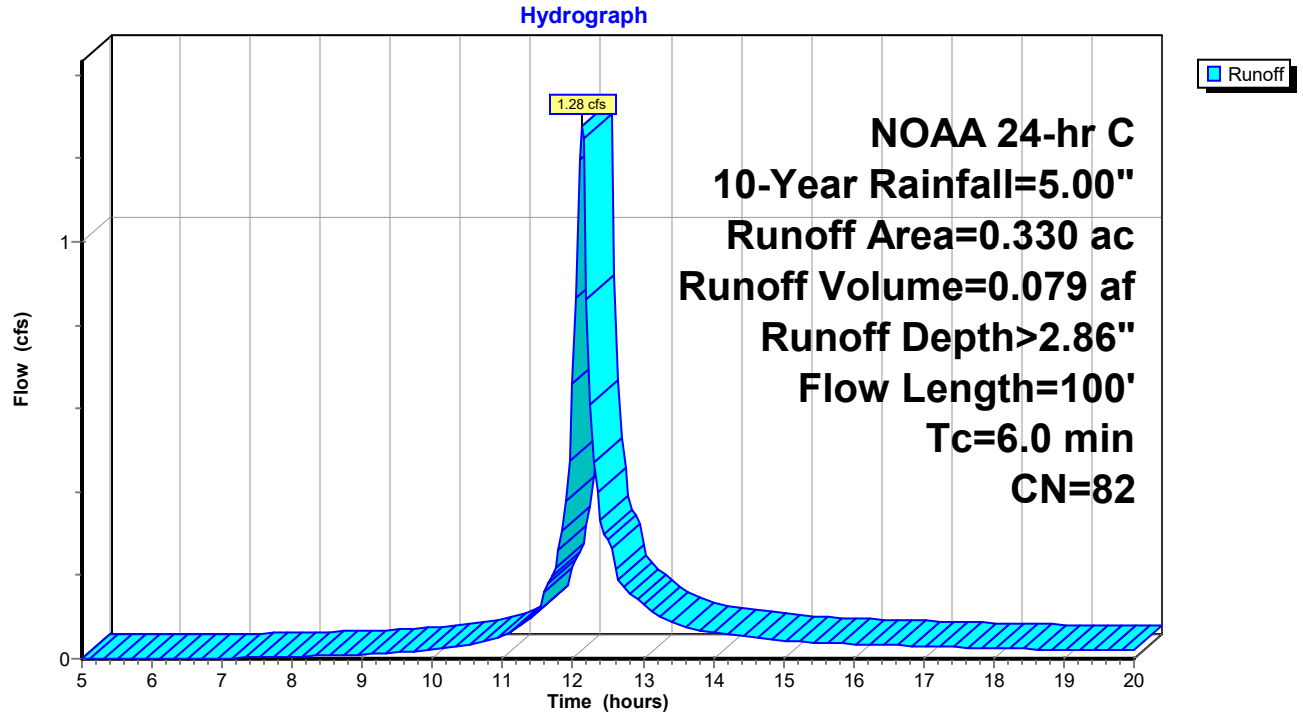
Runoff = 1.28 cfs @ 12.13 hrs, Volume= 0.079 af, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

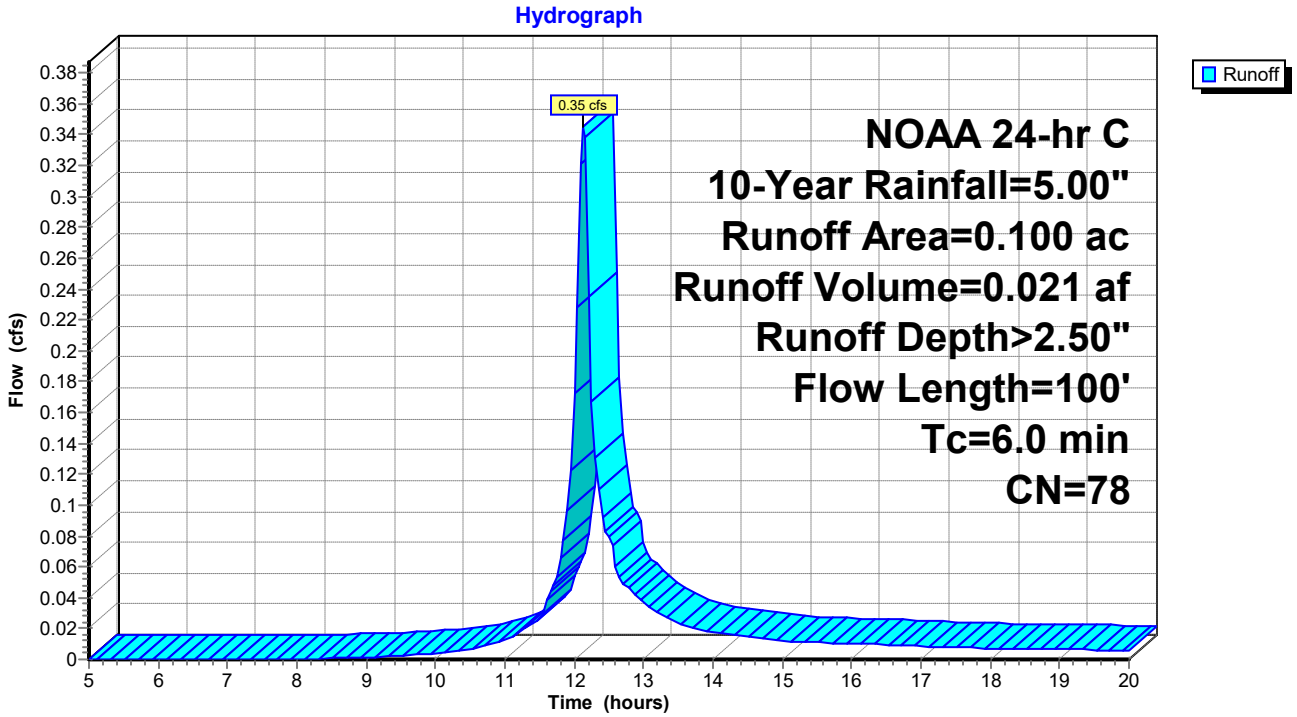
Runoff = 0.35 cfs @ 12.13 hrs, Volume= 0.021 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



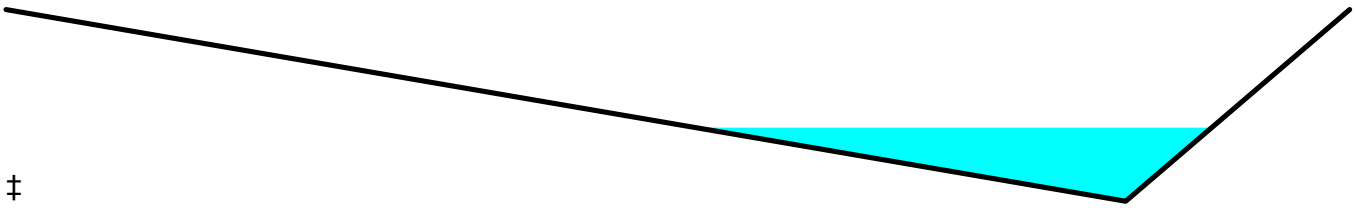
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 2.86" for 10-Year event
Inflow = 1.28 cfs @ 12.13 hrs, Volume= 0.079 af
Outflow = 1.23 cfs @ 12.15 hrs, Volume= 0.078 af, Atten= 4%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.44 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.59 fps, Avg. Travel Time= 1.8 min

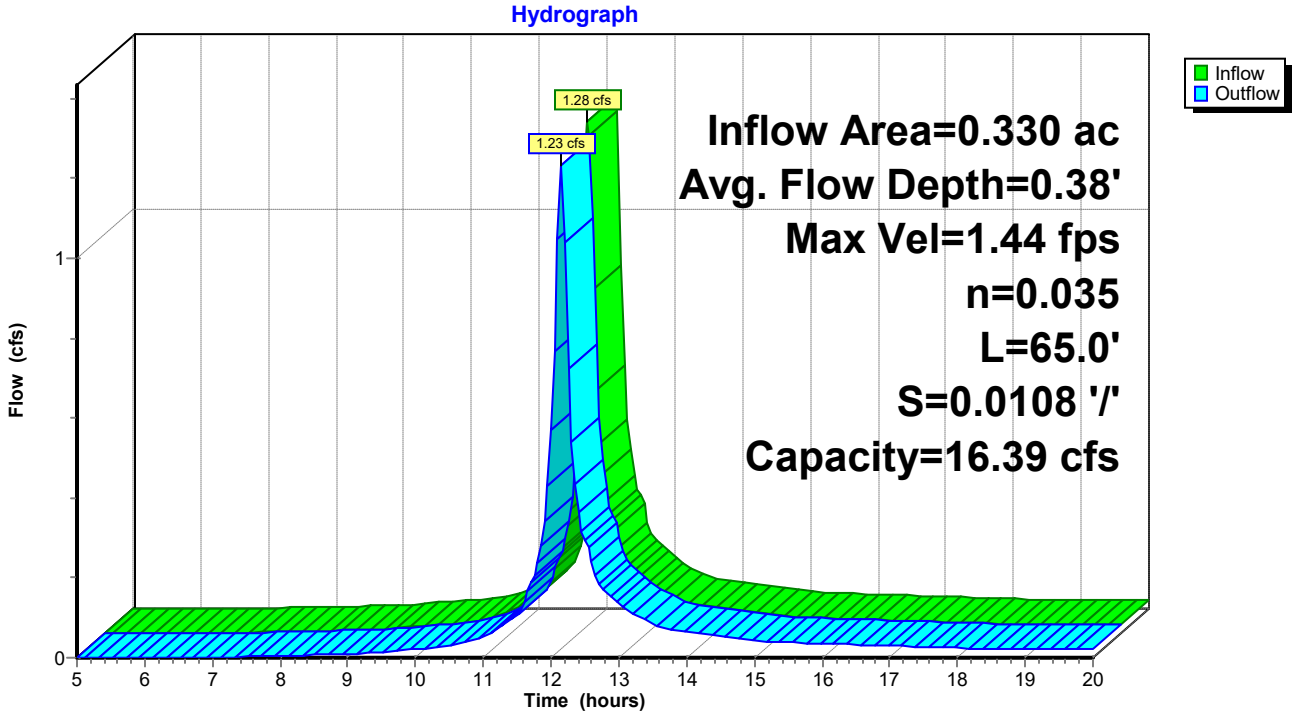
Peak Storage= 58 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

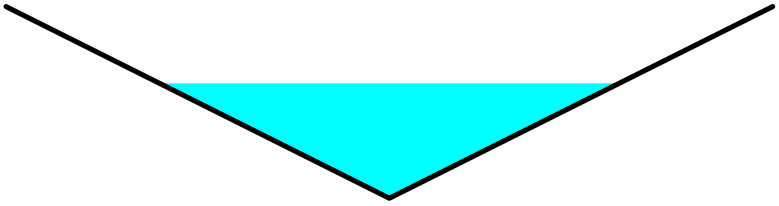
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.23' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 2.77" for 10-Year event
Inflow = 1.57 cfs @ 12.15 hrs, Volume= 0.099 af
Outflow = 1.49 cfs @ 12.17 hrs, Volume= 0.099 af, Atten= 5%, Lag= 1.4 min

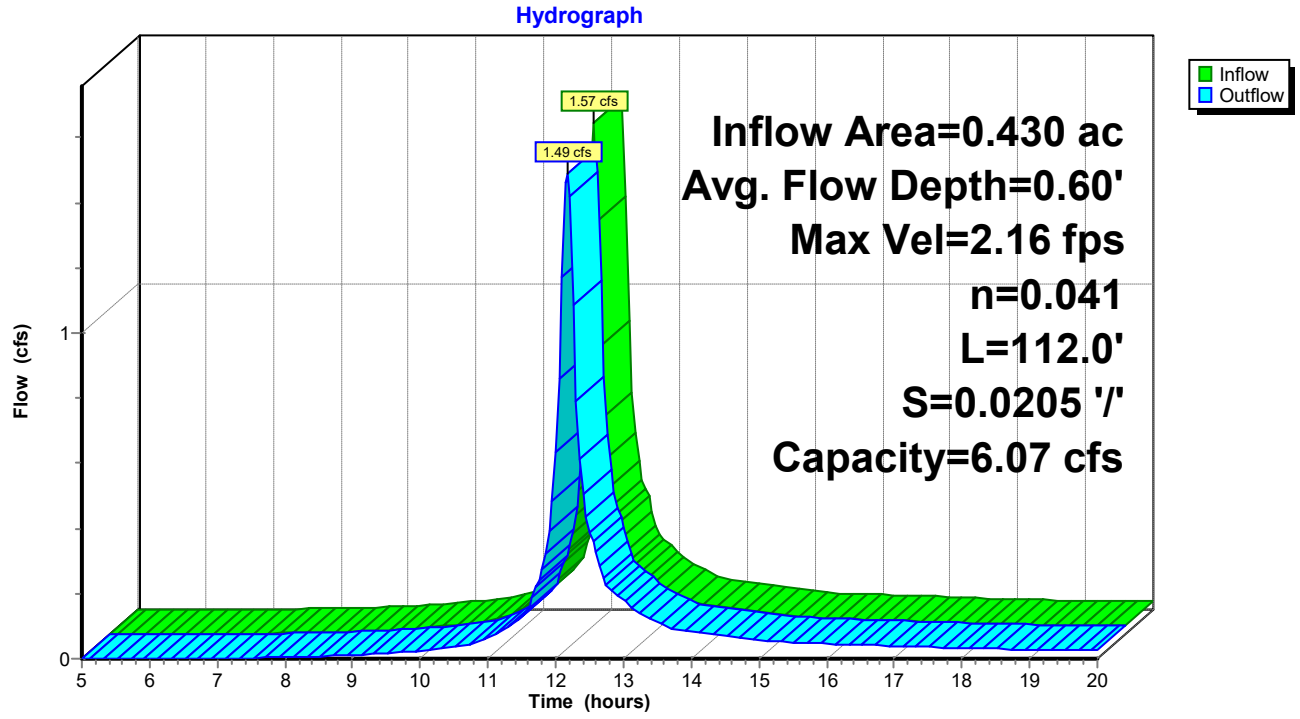
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.16 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 2.1 min

Peak Storage= 80 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>3.89"
Flow Length=100' Tc=6.0 min CN=82 Runoff=1.71 cfs 0.107 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>3.48"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.47 cfs 0.029 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.43' Max Vel=1.55 fps Inflow=1.71 cfs 0.107 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=1.66 cfs 0.107 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.67' Max Vel=2.33 fps Inflow=2.13 cfs 0.136 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=2.02 cfs 0.136 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.136 af Average Runoff Depth = 3.79"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

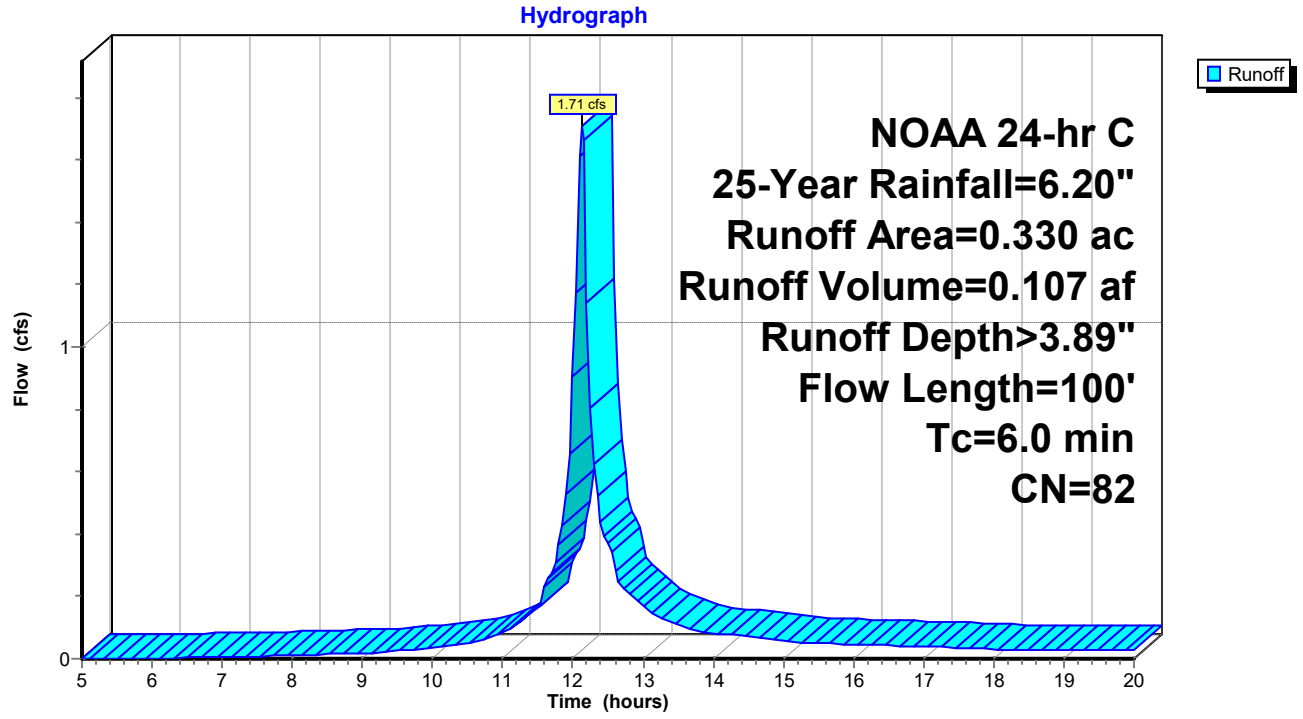
Runoff = 1.71 cfs @ 12.13 hrs, Volume= 0.107 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

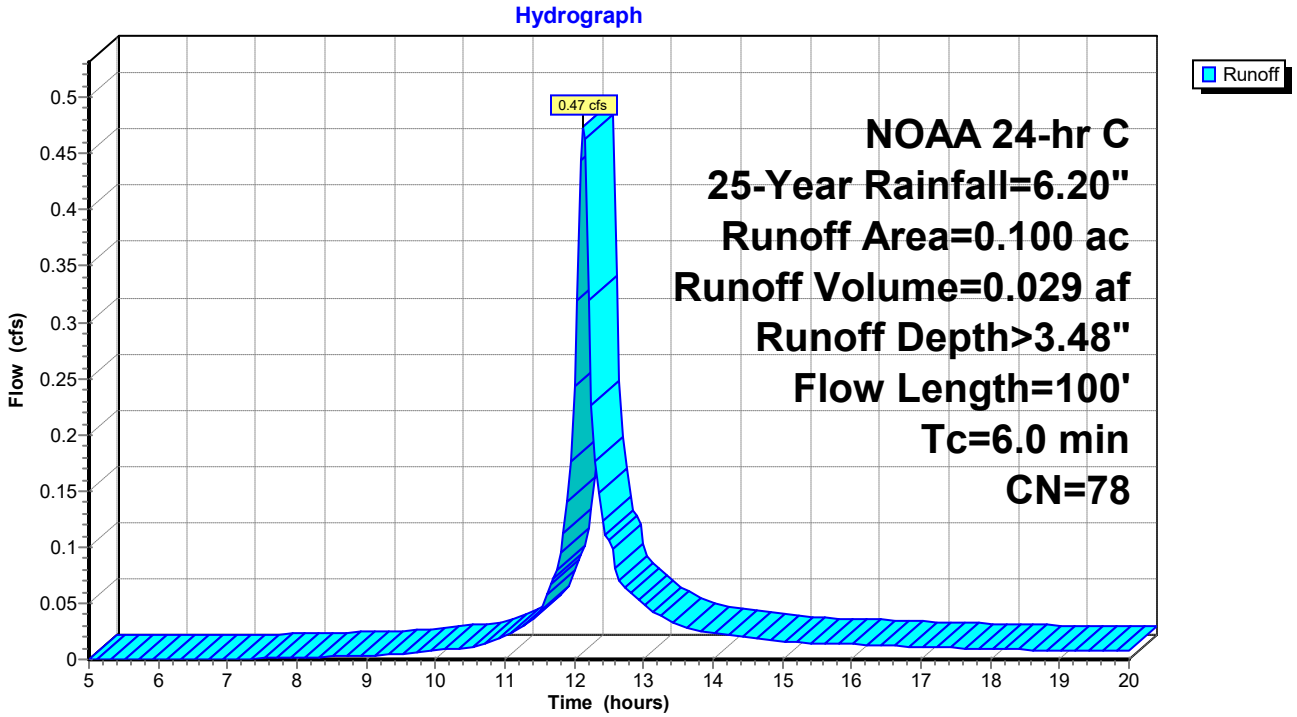
Runoff = 0.47 cfs @ 12.13 hrs, Volume= 0.029 af, Depth> 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.20"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



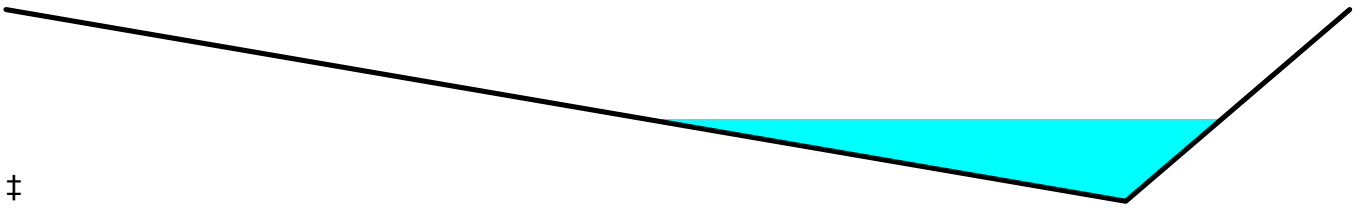
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 3.89" for 25-Year event
Inflow = 1.71 cfs @ 12.13 hrs, Volume= 0.107 af
Outflow = 1.66 cfs @ 12.15 hrs, Volume= 0.107 af, Atten= 3%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.55 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.62 fps, Avg. Travel Time= 1.7 min

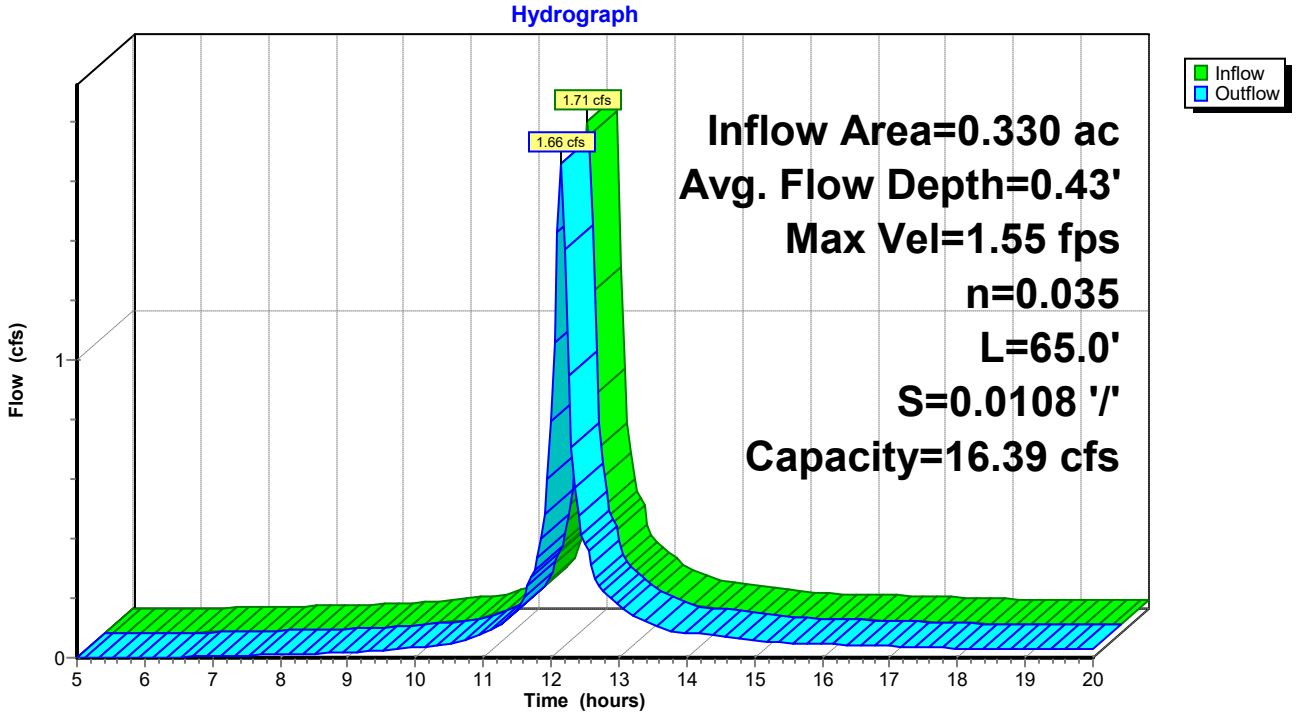
Peak Storage= 72 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

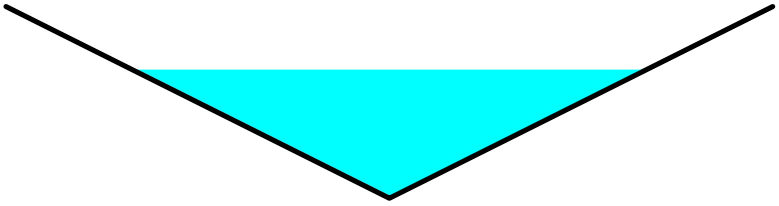
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.25' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 3.79" for 25-Year event
Inflow = 2.13 cfs @ 12.14 hrs, Volume= 0.136 af
Outflow = 2.02 cfs @ 12.16 hrs, Volume= 0.136 af, Atten= 5%, Lag= 1.2 min

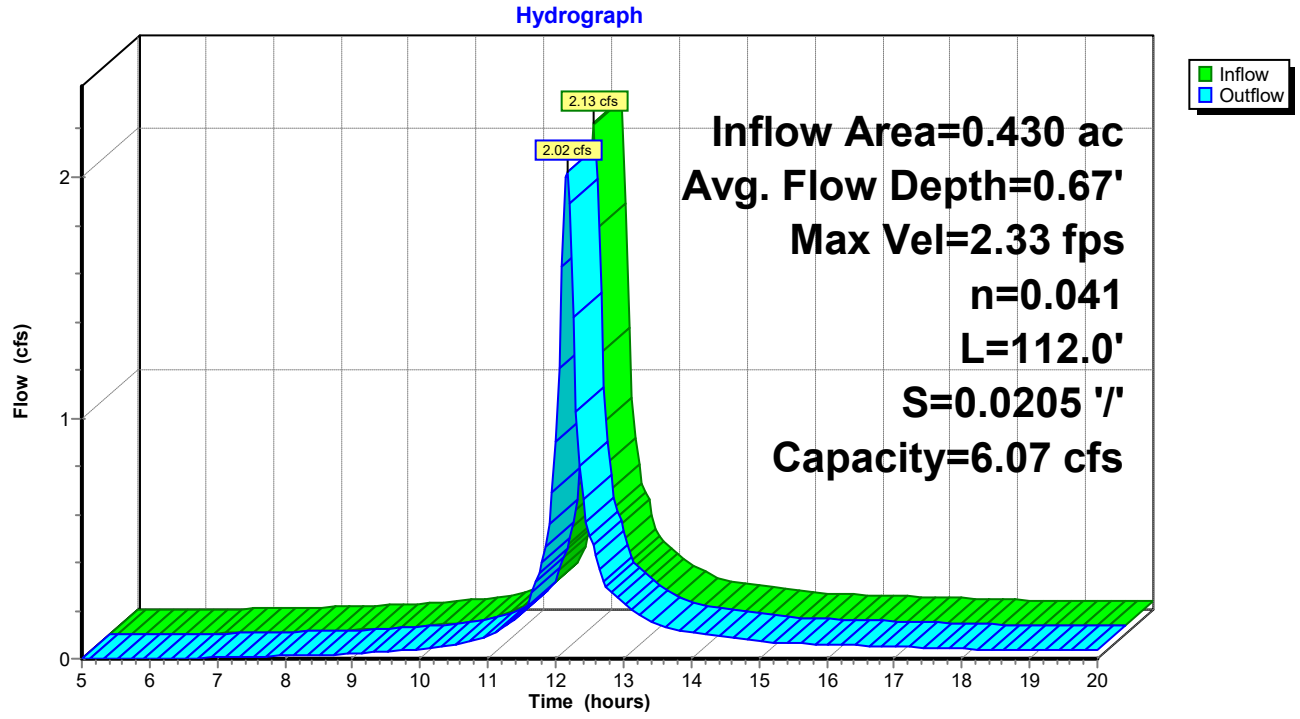
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.33 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.94 fps, Avg. Travel Time= 2.0 min

Peak Storage= 101 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>4.88"
Flow Length=100' Tc=6.0 min CN=82 Runoff=2.12 cfs 0.134 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>4.44"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.60 cfs 0.037 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.46' Max Vel=1.64 fps Inflow=2.12 cfs 0.134 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=2.06 cfs 0.134 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.73' Max Vel=2.46 fps Inflow=2.65 cfs 0.171 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=2.53 cfs 0.171 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.171 af Average Runoff Depth = 4.78"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

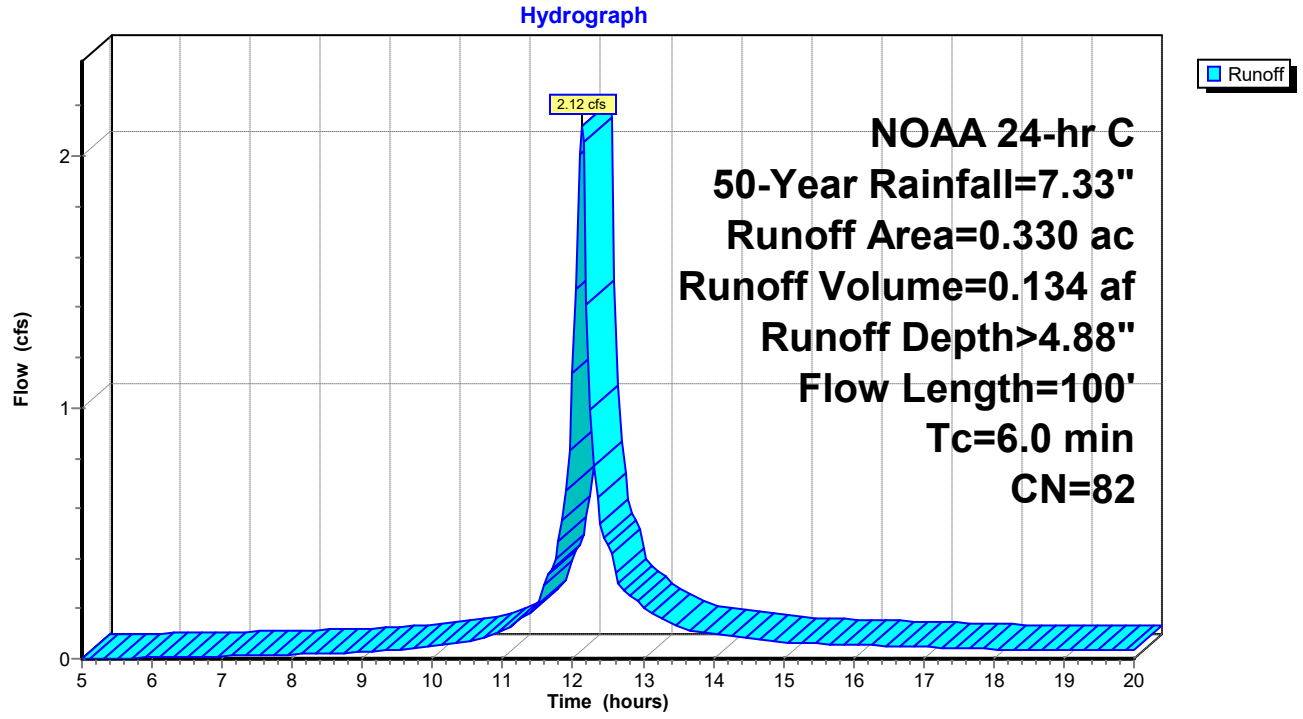
Runoff = 2.12 cfs @ 12.13 hrs, Volume= 0.134 af, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

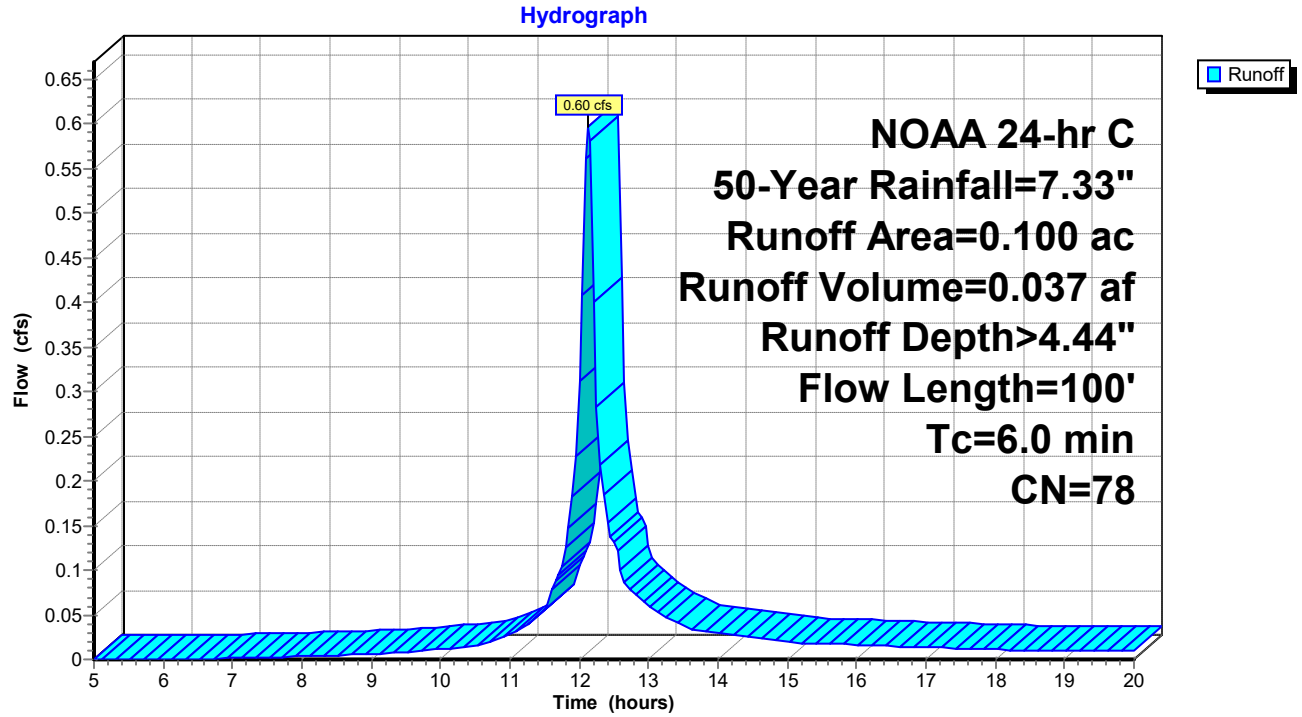
Runoff = 0.60 cfs @ 12.13 hrs, Volume= 0.037 af, Depth> 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 50-Year Rainfall=7.33"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



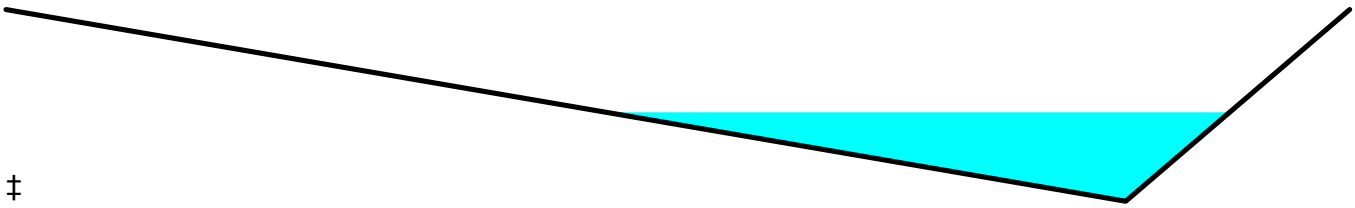
Summary for Reach 5R: D2 Reach A

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 4.88" for 50-Year event
Inflow = 2.12 cfs @ 12.13 hrs, Volume= 0.134 af
Outflow = 2.06 cfs @ 12.15 hrs, Volume= 0.134 af, Atten= 3%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.64 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 1.7 min

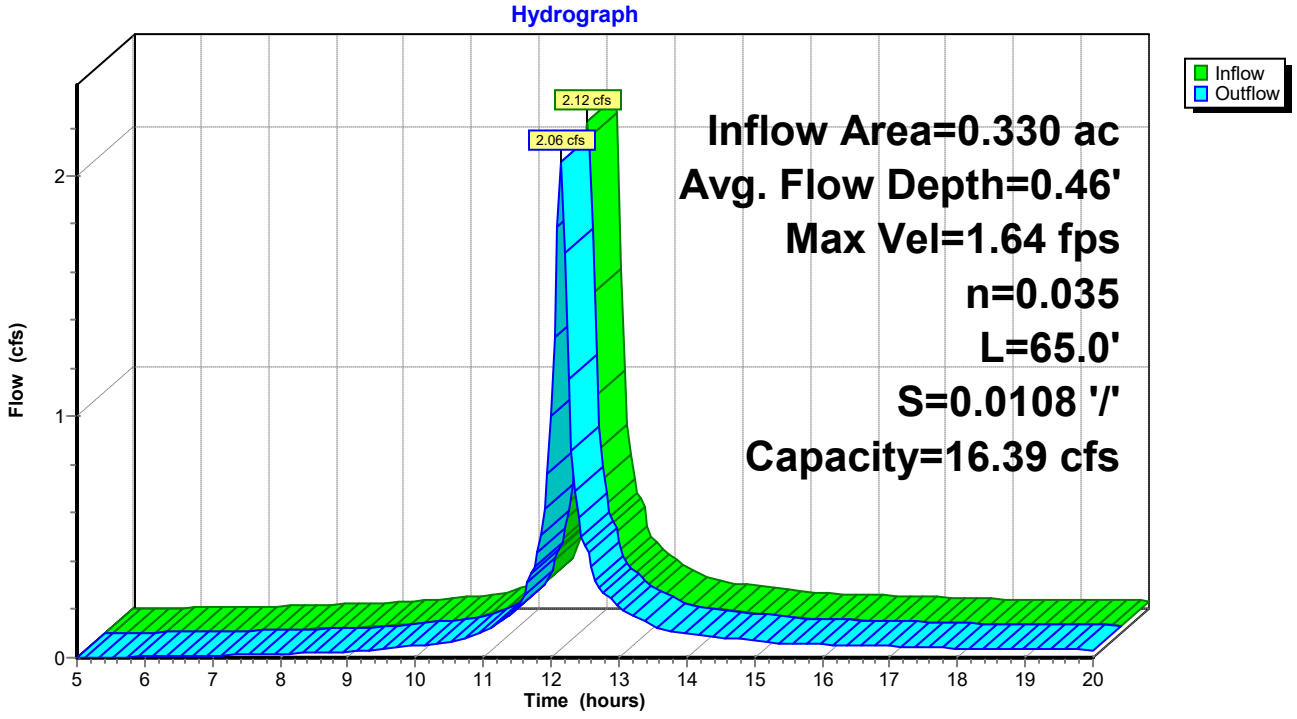
Peak Storage= 84 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

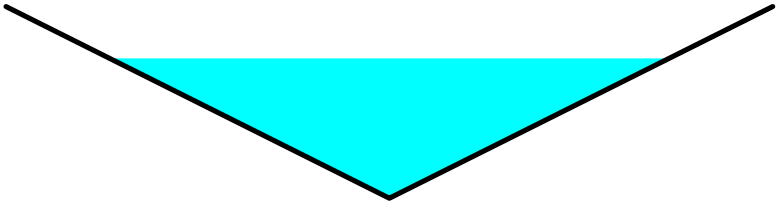
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.27' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 4.78" for 50-Year event
Inflow = 2.65 cfs @ 12.14 hrs, Volume= 0.171 af
Outflow = 2.53 cfs @ 12.16 hrs, Volume= 0.171 af, Atten= 4%, Lag= 1.1 min

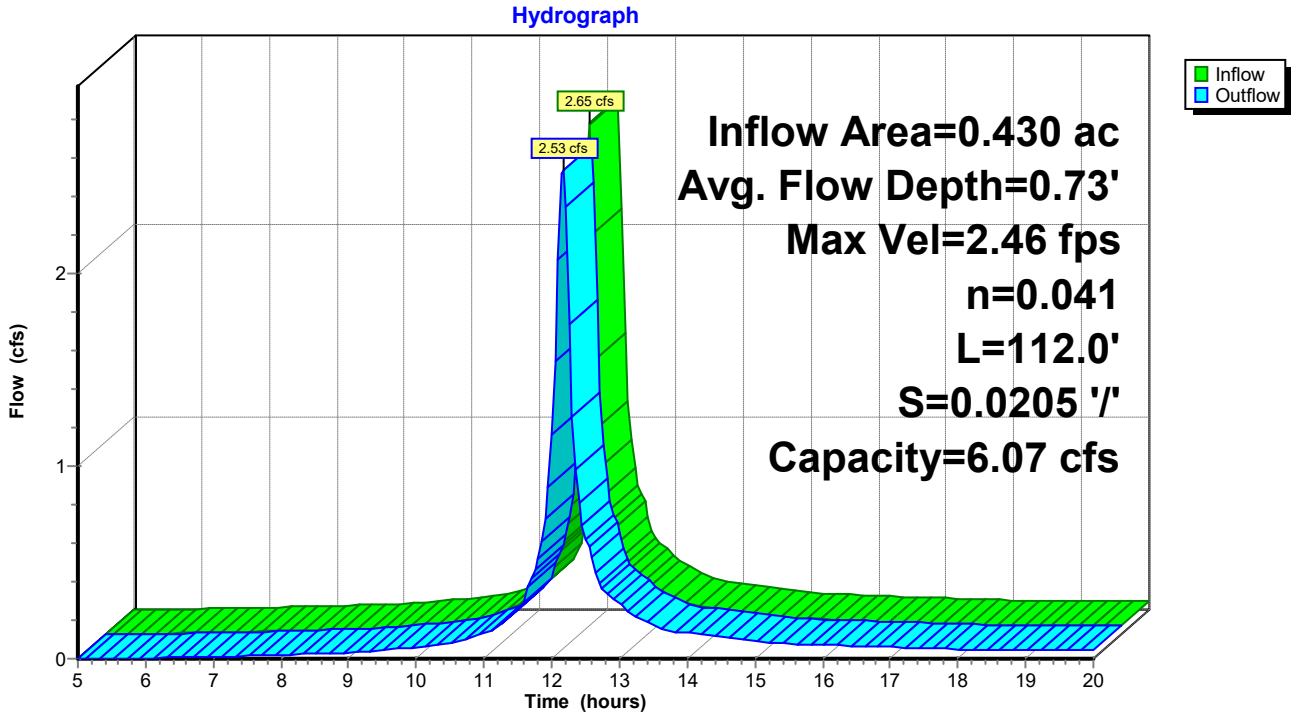
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.46 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 1.9 min

Peak Storage= 119 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



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

Subcatchment 1S: D2 Reach A Runoff Area=0.330 ac 18.18% Impervious Runoff Depth>6.08"
Flow Length=100' Tc=6.0 min CN=82 Runoff=2.61 cfs 0.167 af

Subcatchment 4S: D2 Reach B Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>5.61"
Flow Length=100' Tc=6.0 min CN=78 Runoff=0.74 cfs 0.047 af

Reach 5R: D2 Reach A Avg. Flow Depth=0.50' Max Vel=1.72 fps Inflow=2.61 cfs 0.167 af
n=0.035 L=65.0' S=0.0108 '/' Capacity=16.39 cfs Outflow=2.54 cfs 0.167 af

Reach 6R: D2 Reach B Avg. Flow Depth=0.79' Max Vel=2.60 fps Inflow=3.27 cfs 0.214 af
n=0.041 L=112.0' S=0.0205 '/' Capacity=6.07 cfs Outflow=3.13 cfs 0.214 af

Total Runoff Area = 0.430 ac Runoff Volume = 0.214 af Average Runoff Depth = 5.97"
86.05% Pervious = 0.370 ac 13.95% Impervious = 0.060 ac

Summary for Subcatchment 1S: D2 Reach A

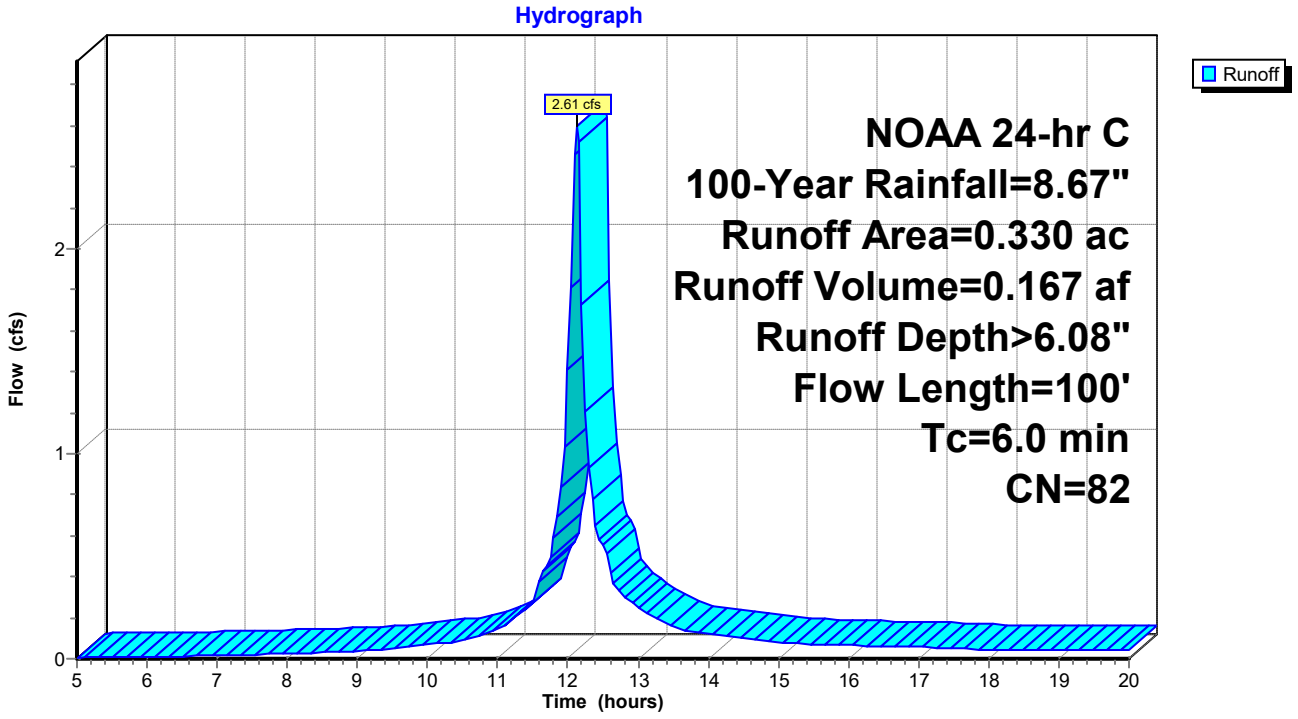
Runoff = 2.61 cfs @ 12.13 hrs, Volume= 0.167 af, Depth> 6.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.060	98	Paved roads w/curbs & sewers, HSG D
0.270	78	Meadow, non-grazed, HSG D
0.330	82	Weighted Average
0.270		81.82% Pervious Area
0.060		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 1S: D2 Reach A



Summary for Subcatchment 4S: D2 Reach B

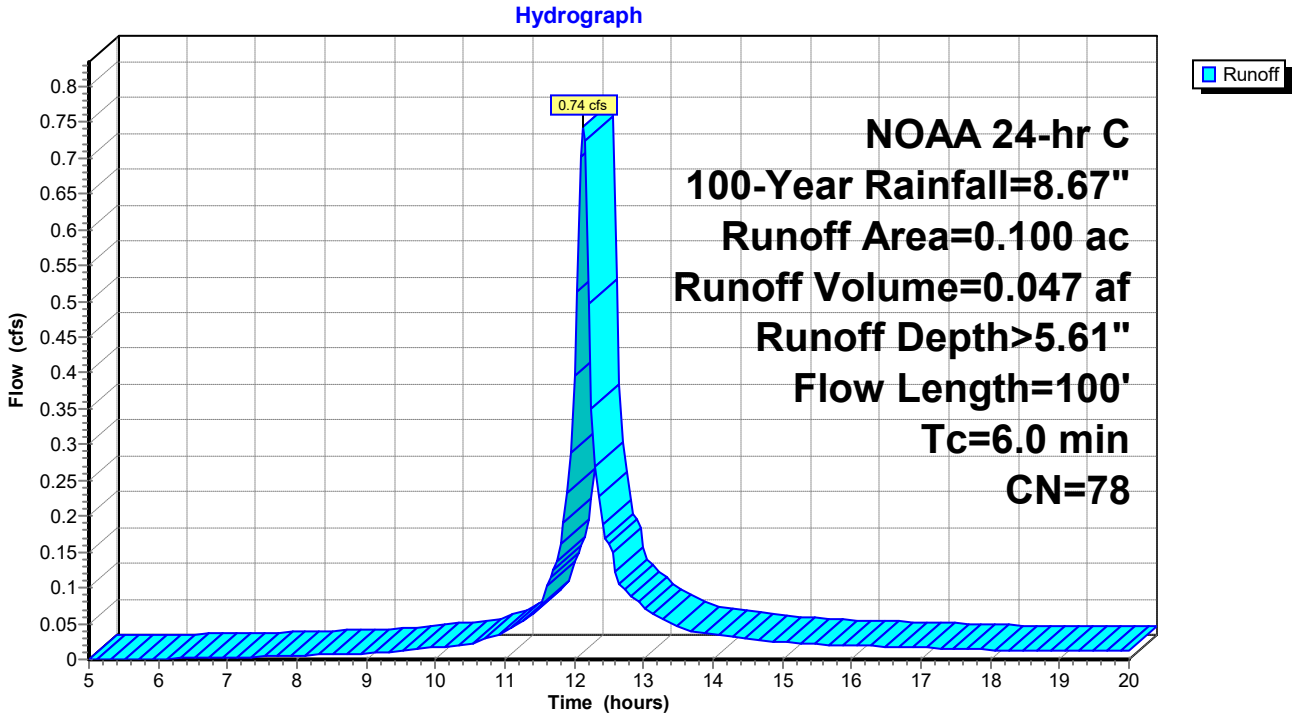
Runoff = 0.74 cfs @ 12.13 hrs, Volume= 0.047 af, Depth> 5.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.67"

Area (ac)	CN	Description
0.100	78	Meadow, non-grazed, HSG D
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		**Direct Entry, Tc**

Subcatchment 4S: D2 Reach B



Summary for Reach 5R: D2 Reach A

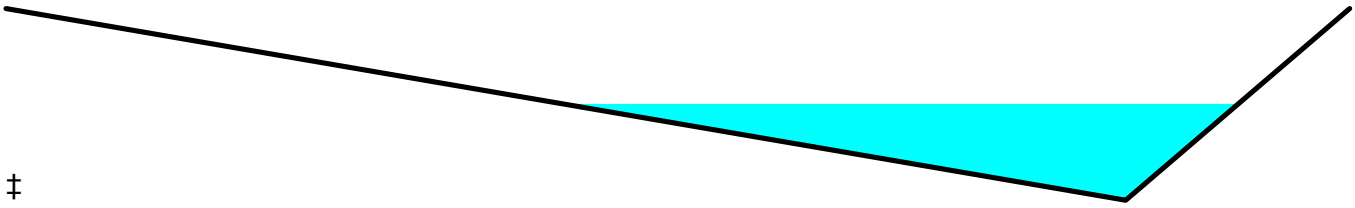
[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.330 ac, 18.18% Impervious, Inflow Depth > 6.08" for 100-Year event
Inflow = 2.61 cfs @ 12.13 hrs, Volume= 0.167 af
Outflow = 2.54 cfs @ 12.14 hrs, Volume= 0.167 af, Atten= 3%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.72 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 1.6 min

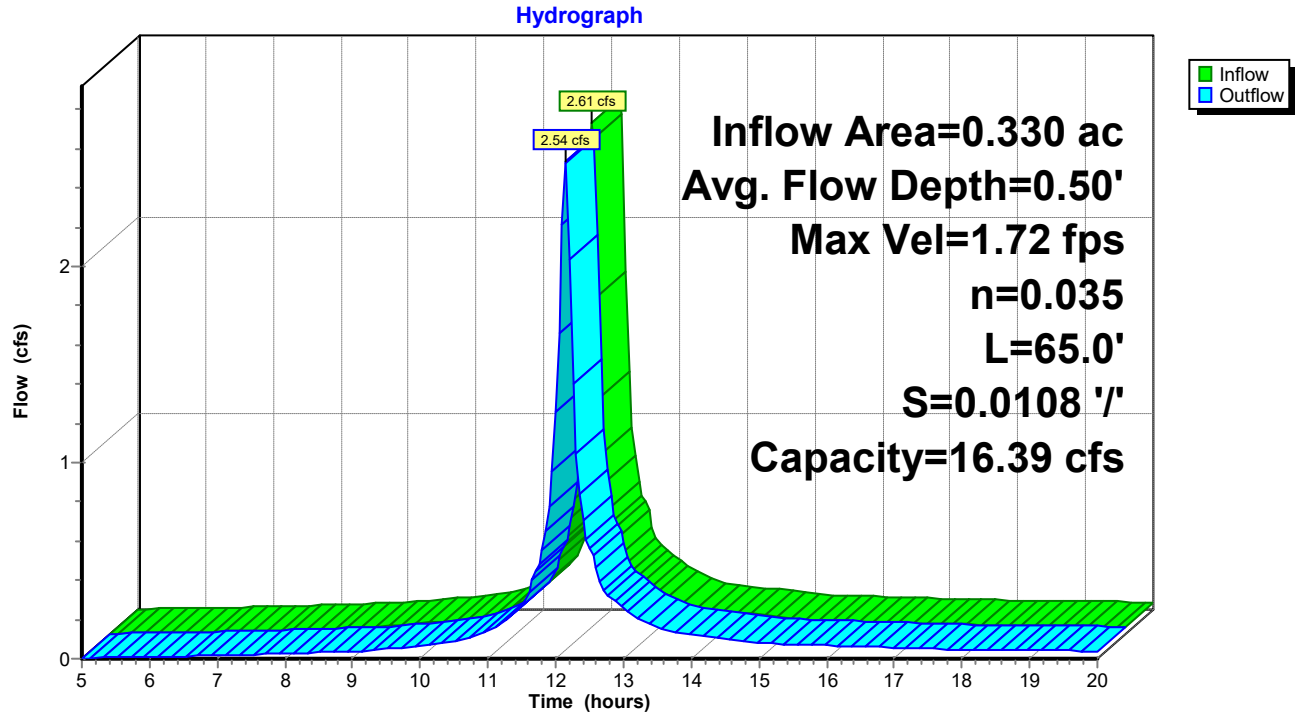
Peak Storage= 98 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 16.39 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 10.0 2.0 '/' Top Width= 12.00'
Length= 65.0' Slope= 0.0108 '/'
Inlet Invert= 1,278.00', Outlet Invert= 1,277.30'



‡

Reach 5R: D2 Reach A



Summary for Reach 6R: D2 Reach B

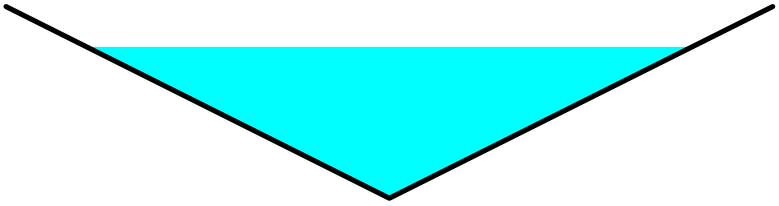
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.30' @ 12.20 hrs

Inflow Area = 0.430 ac, 13.95% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 3.27 cfs @ 12.14 hrs, Volume= 0.214 af
Outflow = 3.13 cfs @ 12.16 hrs, Volume= 0.214 af, Atten= 4%, Lag= 1.0 min

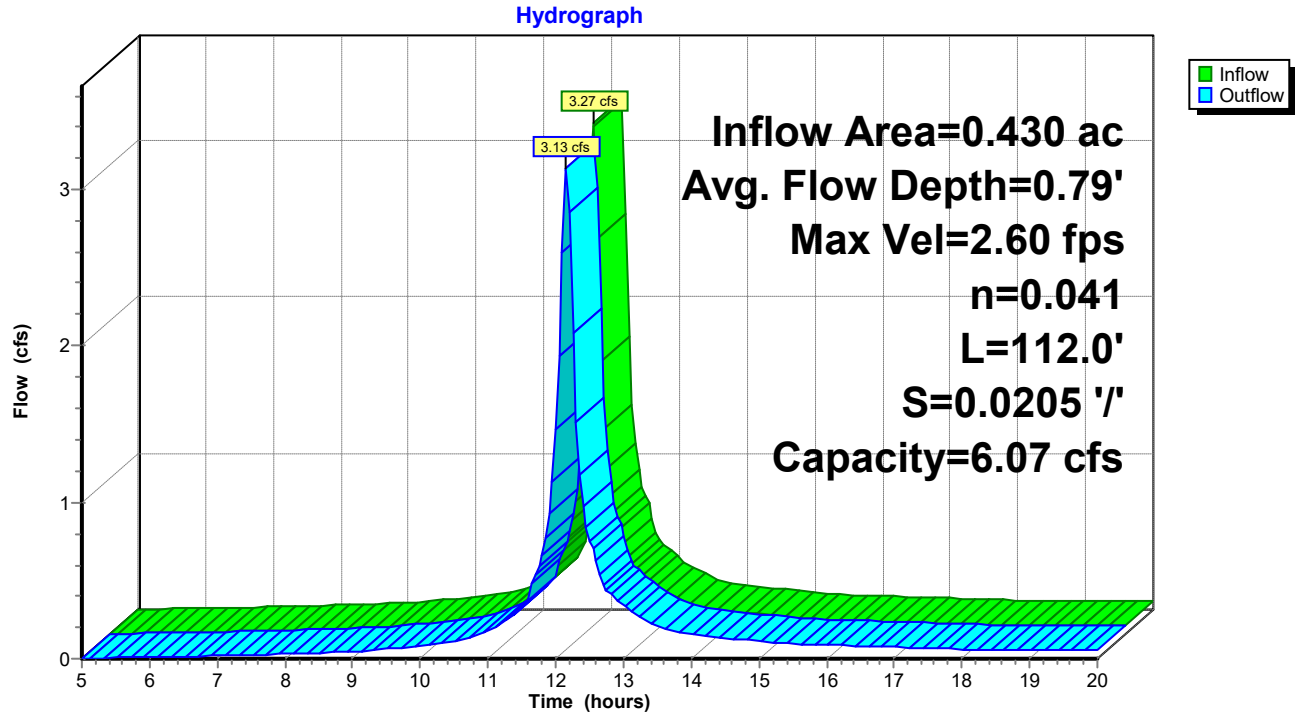
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.60 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 1.8 min

Peak Storage= 140 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 6.07 cfs

0.00' x 1.00' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 112.0' Slope= 0.0205 '/'
Inlet Invert= 1,277.30', Outlet Invert= 1,275.00'



Reach 6R: D2 Reach B



ATTACHMENT 4.20

CHANNEL DESIGN WORKSHEETS – HILDEBRANDT TIE-IN/MLV-515RA40

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE – Hildebrandt Tie-in/MLV-515RA40
LOCATION: Luzerne County, PA
PREPARED BY: CD DATE: 03/02/2021
CHECKED BY: PW DATE: 02/28/2022

OVERLAND FLOW:

Path Number	Length (ft)	"n" Value	Average Slope (ft/ft)	Time (min)
D - 1 Rch A	100	0.4	0.07	0.21
D - 1 Rch B	100	0.4	0.07	0.21

$$T_{c\ (sheet\ flow)} = \left[\frac{2(\quad)(n)}{3(\quad)^{0.5}}\right]^{0.4673}$$

n	Type of Cover
0.02	smooth pavement
0.1	bare parched soil
0.3	poor grass cover
0.4	average grass cover
0.8	dense grass cover

(L = 150' maximum)

SHALLOW CONCENTRATED FLOW:

Path Number	Length (ft)	"n" Value	Average Slope (ft/ft)	Time (min)	Tc Total (min)
D - 1 Rch A	220	0.05	0.04	0.019	0.229
D - 1 Rch B	220	0.05	0.04	0.019	0.229

Channel Dimensions:

Path Number	Bottom Width (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Total Depth (ft)	Top Width (ft)
D - 1 Rch A	2	2	2	1.0	6.0
D - 1 Rch B	2	2	2	1.0	6.0

STANDARD E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Williams REAE – Hildebrandt Tie-in/MLV-515RA40
LOCATION: Luzerne County, PA
PREPARED BY: CD DATE: 02/28/2022
CHECKED BY: PW DATE: 02/28/2022

CHANNEL OR CHANNEL SECTION		D-1-Reach A	D-1-Reach A	D-1-Reach B	D-1-Reach B	
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	P	
DESIGN STORM	(2, 5, OR 10 YR)	25 YR	25 YR	25 YR	25 YR	
ACRES	(AC)	0.22	0.22	0.63	0.63	
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A	
Q_r (REQUIRED CAPACITY)	(CFS)	0.81	0.81	2.34	2.34	
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.83	0.81	2.44	2.35	
PROTECTIVE LINING[2]		SC150BN	Grass	SC150BN	Grass	
n (MANNING'S COEFFICIENT)[2]		0.05	0.091	0.05	0.052	
V_a (ALLOWABLE VELOCITY)	(FPS)	8.0	3.0	8.0	3.0	
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.1	0.7	2.5	2.4	
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-	-	-	-	
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	-	-	-	-	
CHANNEL BOTTOM WIDTH	(FT)	2	2	2	2	
CHANNEL LEFT SIDE SLOPE	(H:V)	2	2	2	2	
CHANNEL RIGHT SIDE SLOPE	(H:V)	2	2	2	2	
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.0	1.0	
CHANNEL TOP WIDTH @ D	(FT)	6.0	6.0	6.0	6.0	
d (CALCULATED FLOW DEPTH)	(FT)	0.29	0.4	0.36	0.36	
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.16	3.60	3.44	3.44	
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	6.9	5.0	5.56	5.56	
d_{50} STONE SIZE	(IN)	-	-	-	-	
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.75	1.12	0.98	0.98	
R (HYDRAULIC RADIUS)	(FT)	0.23	0.30	0.27	0.27	
S (BED SLOPE)[3]	(FT/FT)	0.01	0.01	0.04	0.04	
S_c (CRITICAL SLOPE)	(FT/FT)	0.062	0.19	0.059	0.064	
$.7S_c$	(FT/FT)	0.044	0.133	0.041	0.045	
$1.3S_c$	(FT/FT)	0.08	0.25	0.08	0.08	
STABLE FLOW?	(Y/N)	Y	Y	Y	Y	
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	-	-	-	
FREEBOARD BASED ON STABLE FLOW	(FT)	0.71	0.60	0.64	0.64	
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5	
DESIGN METHOD FOR PROTECTIVE LINING[5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		V	V	V	V	

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

ATTACHMENT 4.21

CHANNEL TR-55 REPORT – HILDEBRANDT TIE-IN/MLV-515RA40

WinTR-55 Current Data Description

--- Identification Data ---

User: PW
Project: Hildebrant
SubTitle: will-265
State: Pennsylvania
County: LUZERNE-C
Filename: Z:\Projects\Williams REA\Hildebrandt\Channel Design D-1.w55

Date: 10/15/2020
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
D-1 Rch B	channel	Outlet	0.63	77	.229
D-1 Rch A	channel	Outlet	0.22	77	.229

Total area: .85 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	-Yr (in)	-Yr (in)	1-Yr (in)
3.4	4.3	5.0	6.2	.0	.0	2.9

Storm Data Source: LUZERNE-C County, PA (NRCS)
Rainfall Distribution Type: Type NO_C
Dimensionless Unit Hydrograph: <standard>

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	-Yr (in)	-Yr (in)	1-Yr (in)
3.4	4.3	5.0	6.2	.0	.0	2.9

Storm Data Source: LUZERNE-C County, PA (NRCS)
Rainfall Distribution Type: Type NO_C
Dimensionless Unit Hydrograph: <standard>

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)
SUBAREAS		
D-1 Rch B	1.68	2.34
D-1 Rch A	0.58	0.81
REACHES		
OUTLET	2.27	3.15

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)
SUBAREAS				
D-1 Rch B	1.68	12.20	2.34	12.19
D-1 Rch A	0.58	12.20	0.81	12.19
REACHES				
OUTLET	2.27		3.15	

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
D-1 Rch B	.63	0.229	77	Outlet	channel
D-1 Rch A	.22	0.229	77	Outlet	channel

Total Area: .85 (ac)

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
D-1 Rch B							
SHEET	100	0.0700	0.400				0.210
SHALLOW	220	0.0400	0.050				0.019
					Time of Concentration		.229
D-1 Rch A							
SHEET	100	0.0700	0.400				0.210
SHALLOW	220	0.0400	0.050				0.019
					Time of Concentration		.229

PW

Hildebrant
will-265
LUZERNE-C County, Pennsylvania

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
D-1 Rch B	Woods (good)	D	.63	77
	Total Area / Weighted Curve Number		.63	77
D-1 Rch A	Woods (good)	D	.22	77
	Total Area / Weighted Curve Number		.22	77

ATTACHMENT 4.22

CHANNEL DESIGN WORKSHEETS – S5-T5/S6-T5 AND S4A-T5/S4-T5 STREAM STABILIZATION

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE – S4A-T5/S4-T5 Stream Stabilization
LOCATION: Laflin, PA
PREPARED BY: CE DATE: 02/21/2022
CHECKED BY: PW DATE: 02/21/2022

OVERLAND FLOW:

PATH NUMBER	LENGTH L (FT)	"n" VALUE	AVERAGE SLOPE (S) (ft/ft)	TIME (minutes)
001	100	0.15	0.070	6.6
002	100	0.15	0.070	6.6
003	100	0.15	0.100	5.7
REACH A	78	0.15	0.077	5.2
REACH B	81	0.15	0.086	5.1
REACH C	100	0.15	0.078	6.3

$$T_{c\ (sheet\ flow)} = \left[\frac{2(\quad)(n)}{3(\quad)^{0.5}}\right]^{0.4673}$$

n	Type of Cover
0.02	smooth pavement
0.1	bare parched soil
0.3	poor grass cover
0.4	average grass cover
0.8	dense grass cover

(L = 150' maximum)

SHALLOW CONCENTRATED FLOW:

PATH NUMBER	LENGTH (FT)	TYPE OF COVER	AVERAGE SLOPE(S) (ft/ft)	V (ft/sec)	TIME (minutes)	TOTAL TIME (minutes)
001	312	Short Grass Past.	0.095	7.0	2.4	9.4
	180	Paved	0.120	20.3	0.4	
002	797	Short Grass Past.	0.086	7.0	6.5	13.1
003	173	Short Grass Past.	0.110	7.0	1.2	8.9
	740	Short Grass Past.	0.094	20.3	2.0	
REACH A	197	Unpaved	0.264	16.1	0.4	5.6
REACH B	219	Unpaved	0.292	16.1	0.4	5.5
REACH C	234	Unpaved	0.286	16.1	0.5	6.8

CHANNEL DIMENSIONS:

CHANNEL	BOTTOM WIDTH (ft)	LEFT SIDE SLOPE (H:V)	RIGHT SIDE SLOPE (H:V)	TOTAL DEPTH (ft)	TOP WIDTH (ft)
REACH A	4.0	2:1	2:1	1.50	10.0
REACH B	5.0	2:1	2:1	1.25	10.0
REACH C	5.0	2:1	2:1	1.25	10.0

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE – S5-T5 Stream Stabilization
LOCATION: Laflin, PA
PREPARED BY: CE DATE: 02/21/2022
CHECKED BY: PW DATE: 02/21/2022

OVERLAND FLOW:

PATH NUMBER	LENGTH L (FT)	"n" VALUE	AVERAGE SLOPE (S) (ft/ft)	TIME (minutes)
S5-T5	88	0.15	0.068	6.0

$$T_{c\,(sheet\ flow)} = \left[\frac{2(n)}{3(S)^{0.5}}\right]^{0.4673}$$

n	Type of Cover
0.02	smooth pavement
0.1	bare parched soil
0.5	poor grass cover
0.6	average grass cover
0.8	dense grass cover

(L = 150' maximum)

SHALLOW CONCENTRATED FLOW:

PATH NUMBER	LENGTH (FT)	TYPE OF COVER	AVERAGE SLOPE(S) (ft/ft)	V (ft/sec)	TIME (minutes)	TOTAL TIME (minutes)
S5-T5	268	Unpaved	0.216	16.1	0.6	6.6

CHANNEL DIMENSIONS:

CHANNEL	BOTTOM WIDTH (ft)	LEFT SIDE SLOPE (H:V)	RIGHT SIDE SLOPE (H:V)	TOTAL DEPTH (ft)	TOP WIDTH (ft)
S5-T5	4.0	2:1	2:1	1.0	10.0

STANDARD E&S WORKSHEET # 9
Time of Concentration

PROJECT NAME: Williams REAE – S6-T5 Stream Stabilization
LOCATION: Laflin, PA
PREPARED BY: CE DATE: 02/21/2022
CHECKED BY: PW DATE: 02/21/2022

OVERLAND FLOW:

PATH NUMBER	LENGTH L (FT)	"n" VALUE	AVERAGE SLOPE (S) (ft/ft)	TIME (minutes)
REACH A	100	0.15	0.03	9.3
REACH B	100	0.15	0.03	9.3
REACH C	100	0.15	0.03	9.3
REACH D	100	0.15	0.03	9.3
REACH E	100	0.15	0.035	8.7
REACH F	100	0.15	0.01	14.4

$$T_{c\,(sheet\,flow)} = \left[\frac{2(\quad)(n)}{3(\quad)^{0.5}}\right]^{0.4673}$$

n	Type of Cover
0.02	smooth pavement
0.1	bare parched soil
0.7	poor grass cover
0.8	average grass cover
0.8	dense grass cover

(L = 150' maximum)

SHALLOW CONCENTRATED FLOW:

PATH NUMBER	LENGTH (FT)	TYPE OF COVER	AVERAGE SLOPE(S) (ft/ft)	V (ft/sec)	TIME (minutes)	TOTAL TIME (minutes)
REACH A	132	Unpaved	0.320	16.1	0.2	9.5
REACH B	180	Unpaved	0.310	16.1	0.3	9.6
REACH C	207	Unpaved	0.310	16.1	0.4	9.7
REACH D	195	Unpaved	0.300	16.1	0.4	9.7
REACH E	291	Unpaved	0.278	16.1	0.6	9.3
REACH F	457	Unpaved	0.175	16.1	1.1	15.5

CHANNEL DIMENSIONS:

CHANNEL	BOTTOM WIDTH (ft)	LEFT SIDE SLOPE (H:V)	RIGHT SIDE SLOPE (H:V)	TOTAL DEPTH (ft)	TOP WIDTH (ft)
REACH A	4.0	2:1	2:1	1.00	10.0
REACH B	4.0	2:1	2:1	1.00	10.0
REACH C	4.0	2:1	2:1	1.00	10.0
REACH D	4.0	2:1	2:1	1.00	10.0
REACH E	4.0	2:1	2:1	1.00	10.0
REACH F	4.0	2:1	2:1	1.00	10.0

STANDARD E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Williams REAE – S4A-T5/S4-T5
LOCATION: Laflin, PA
PREPARED BY: BM DATE: 02/22/2022
CHECKED BY: PW DATE: 02/22/2022

CHANNEL OR CHANNEL SECTION		REACH A	REACH B	REACH C	
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	
DESIGN STORM		10 YR	10 YR	10 YR	
ACRES	(AC)	1.119	1.448	1.606	
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	
Q_r (REQUIRED CAPACITY)	(CFS)	24.2	24.2	24.3	
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	24.2	24.2	24.3	
PROTECTIVE LINING[2]		R-3 RIPRAP	R-4 RIPRAP	R-4 RIPRAP	
n (MANNING'S COEFFICIENT)[2]		0.0381	0.0566	0.0611	
V_a (ALLOWABLE VELOCITY)	(FPS)	6.5	9.0	9.0	
V (CALCULATED AT FLOW DEPTH d)	(FPS)	4.9	5.9	7.3	
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-	2.0	2.0	
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	1.3	1.5	1.0	
CHANNEL BOTTOM WIDTH	(FT)	4	5	5	
CHANNEL SIDE SLOPES	(H:V)	2	2	2	
D (TOTAL DEPTH)	(FT)	1.5	1.25	1.25	
CHANNEL TOP WIDTH @ D	(FT)	10.0	10.0	10.0	
d (CALCULATED FLOW DEPTH)	(FT)	0.86	0.65	0.54	
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	7.46	7.59	7.18	
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	4.63	7.72	9.19	
d_{50} STONE SIZE	(IN)	3	6	6	
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	4.955	4.080	3.313	
R (HYDRAULIC RADIUS)	(FT)	0.630	0.517	0.466	
S (BED SLOPE)[3]	(FT/FT)	0.029	0.123	0.267	
S_c (CRITICAL SLOPE)	(FT/FT)	0.026	0.060	0.074	
$.7S_c$	(FT/FT)	0.0182	0.0423	0.0515	
$1.3S_c$	(FT/FT)	0.03	0.08	0.10	
STABLE FLOW?	(Y/N)	N	Y	Y	
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.64	-	-	
FREEBOARD BASED ON STABLE FLOW	(FT)	-	0.6	0.71	
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		S	S	S	

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

STANDARD E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Williams REAE – S6-T5 and S5-T5
LOCATION: Laflin, PA
PREPARED BY: BM DATE: 02/22/2022
CHECKED BY: PW DATE: 02/22/2022

CHANNEL OR CHANNEL SECTION		REACH A	REACH B	REACH C	REACH D
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	P
DESIGN STORM		10 YR	10 YR	10 YR	10 YR
ACRES	(AC)	0.262	0.354	0.529	0.658
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A
Q_r (REQUIRED CAPACITY)	(CFS)	0.59	0.89	1.35	1.66
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	17.9	18.0	12.8	15.9
PROTECTIVE LINING[2]		R-4 RIPRAP	R-4 RIPRAP	R-4 RIPRAP	R-4 RIPRAP
n (MANNING'S COEFFICIENT)[2]		0.0636	0.0636	0.0636	0.0636
V_a (ALLOWABLE VELOCITY)	(FPS)	9.0	9.0	9.0	9.0
V (CALCULATED AT FLOW DEPTH d)	(FPS)	7.2	7.2	5.1	6.3
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.0	2.0	2.0	2.0
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.5	0.5	0.5	0.4
CHANNEL BOTTOM WIDTH	(FT)	4.0	4.0	4.0	4.0
CHANNEL SIDE SLOPES	(H:V)	2.0	2.0	2.0	2.0
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.0	1.0
CHANNEL TOP WIDTH @ D	(FT)	8.0	8.0	8.0	8.0
d (CALCULATED FLOW DEPTH)	(FT)	0.5	0.5	0.5	0.5
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	6.0	6.0	6.0	6.0
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	8.0	8.0	8.0	8.0
d_{50} STONE SIZE	(IN)	6	6	6	6
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	2.5	2.5	2.5	2.5
R (HYDRAULIC RADIUS)	(FT)	0.401	0.401	0.401	0.401
S (BED SLOPE)[3]	(FT/FT)	0.318	0.320	0.162	0.250
S_c (CRITICAL SLOPE)	(FT/FT)	0.083	0.083	0.083	0.083
$.7S_c$	(FT/FT)	0.0582	0.0582	0.0582	0.0582
$1.3S_c$	(FT/FT)	0.11	0.11	0.11	0.11
STABLE FLOW?	(Y/N)	Y	Y	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	-	-	-
FREEBOARD BASED ON STABLE FLOW	(FT)	0.5	0.5	0.5	0.5
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		S	S	S	S

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

STANDARD E&S WORKSHEET # 11
Channel Design Data

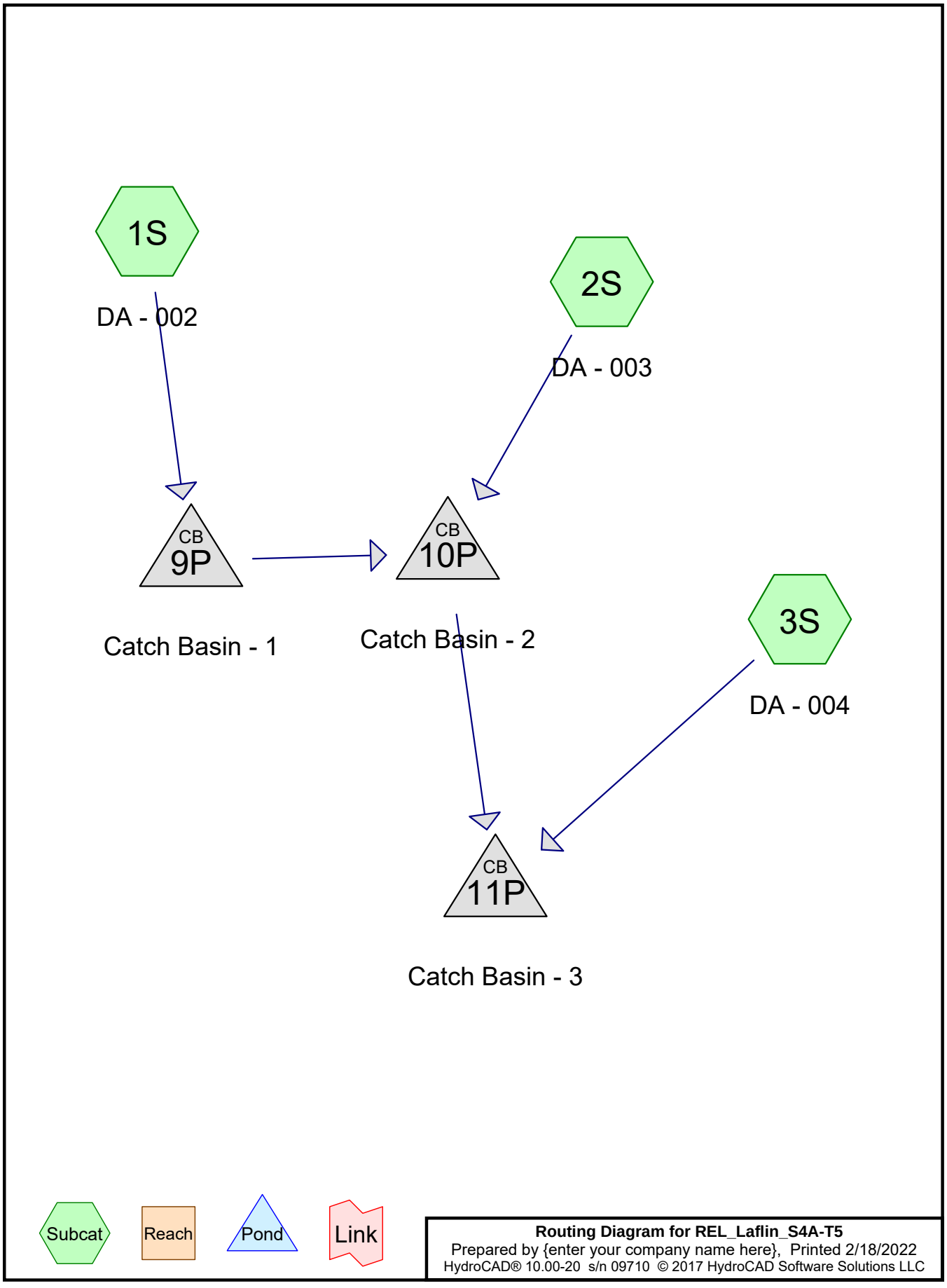
PROJECT NAME: Williams REAE – S6-T5 and S6-T5
LOCATION: Laflin, PA
PREPARED BY: BM DATE: 02/22/2022
CHECKED BY: PW DATE: 02/22/2022

CHANNEL OR CHANNEL SECTION		REACH E	REACH F	S5-T5	
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	
DESIGN STORM		10 YR	10 YR	10 YR	
ACRES	(AC)	1.426	1.642	1.147	
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	
Q_r (REQUIRED CAPACITY)	(CFS)	4.88	5.17	2.76	
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	21.3	14.2	11.0	
PROTECTIVE LINING[2]		R-4 RIPRAP	R-4 RIPRAP	R-4 RIPRAP	
n (MANNING'S COEFFICIENT)[2]		0.0636	0.0636	0.0636	
V_a (ALLOWABLE VELOCITY)	(FPS)	9.0	9.0	9.0	
V (CALCULATED AT FLOW DEPTH d)	(FPS)	8.5	5.7	4.4	
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.0	2.0	2	
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.7	0.3	0.2	
CHANNEL BOTTOM WIDTH	(FT)	4.0	4.0	4	
CHANNEL SIDE SLOPES	(H:V)	2.0	2.0	2	
D (TOTAL DEPTH)	(FT)	1.0	1.0	1.0	
CHANNEL TOP WIDTH @ D	(FT)	8.0	8.0	8	
d (CALCULATED FLOW DEPTH)	(FT)	0.5	0.5	0.5	
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	6.0	6.0	6.0	
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	8.0	8.0	8.0	
d_{50} STONE SIZE	(IN)	6	6	6	
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	2.5	2.5	2.500	
R (HYDRAULIC RADIUS)	(FT)	0.401	0.401	0.401	
S (BED SLOPE)[3]	(FT/FT)	0.450	0.200	0.120	
S_c (CRITICAL SLOPE)	(FT/FT)	0.083	0.083	0.083	
$.7S_c$	(FT/FT)	0.0582	0.0582	0.0582	
$1.3S_c$	(FT/FT)	0.11	0.11	0.11	
STABLE FLOW?	(Y/N)	Y	Y	Y	
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	-	-	
FREEBOARD BASED ON STABLE FLOW	(FT)	0.5	0.5	0.5	
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		S	S	S	

6. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
7. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
8. Slopes may not be averaged.
9. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
10. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

ATTACHMENT 4.23

CHANNEL HYDROCAD REPORT – S5-T5/S6-T5 AND S4A-T5/S4-T5 STREAM STABILIZATION



Routing Diagram for REL_Laflin_S4A-T5
Prepared by {enter your company name here}, Printed 2/18/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.012	39	>75% Grass cover, Good, HSG A (2S)
0.370	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
3.555	80	>75% Grass cover, Good, HSG D (1S, 2S, 3S)
0.010	72	Dirt roads, HSG A (3S)
2.754	98	Impervious (1S, 2S, 3S)
6.701	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.022	HSG A	2S, 3S
0.000	HSG B	
0.370	HSG C	1S, 2S, 3S
3.555	HSG D	1S, 2S, 3S
2.754	Other	1S, 2S, 3S
6.701		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.012	0.000	0.370	3.555	0.000	3.937	>75% Grass cover, Good	1S, 2S, 3S
0.010	0.000	0.000	0.000	0.000	0.010	Dirt roads	3S
0.000	0.000	0.000	0.000	2.754	2.754	Impervious	1S, 2S, 3S
0.022	**0.000**	**0.370**	**3.555**	**2.754**	**6.701**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	9P	831.46	832.33	27.2	-0.0320	0.025	18.0	0.0	0.0
2	10P	832.33	830.76	40.0	0.0393	0.025	18.0	0.0	0.0
3	11P	830.76	829.00	184.7	0.0095	0.025	18.0	0.0	0.0

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

Subcatchment 1S: DA - 002 Runoff Area=26,425 sf 48.88% Impervious Runoff Depth>2.32"
Flow Length=592' Tc=9.4 min CN=88 Runoff=2.29 cfs 0.117 af

Subcatchment 2S: DA - 003 Runoff Area=194,317 sf 37.48% Impervious Runoff Depth>2.14"
Flow Length=897' Tc=13.1 min CN=86 Runoff=14.02 cfs 0.797 af

Subcatchment 3S: DA - 004 Runoff Area=71,163 sf 48.10% Impervious Runoff Depth>2.32"
Flow Length=1,013' Tc=8.9 min CN=88 Runoff=6.29 cfs 0.316 af

Pond 9P: Catch Basin - 1 Peak Elev=833.13' Inflow=2.29 cfs 0.117 af
18.0" Round Culvert n=0.025 L=27.2' S=-0.0320 '/' Outflow=2.29 cfs 0.117 af

Pond 10P: Catch Basin - 2 Peak Elev=838.84' Inflow=16.13 cfs 0.914 af
18.0" Round Culvert n=0.025 L=40.0' S=0.0393 '/' Outflow=16.13 cfs 0.914 af

Pond 11P: Catch Basin - 3 Peak Elev=864.83' Inflow=21.95 cfs 1.230 af
18.0" Round Culvert n=0.025 L=184.7' S=0.0095 '/' Outflow=21.95 cfs 1.230 af

Total Runoff Area = 6.701 ac Runoff Volume = 1.230 af Average Runoff Depth = 2.20"
58.90% Pervious = 3.947 ac 41.10% Impervious = 2.754 ac

Summary for Subcatchment 1S: DA - 002

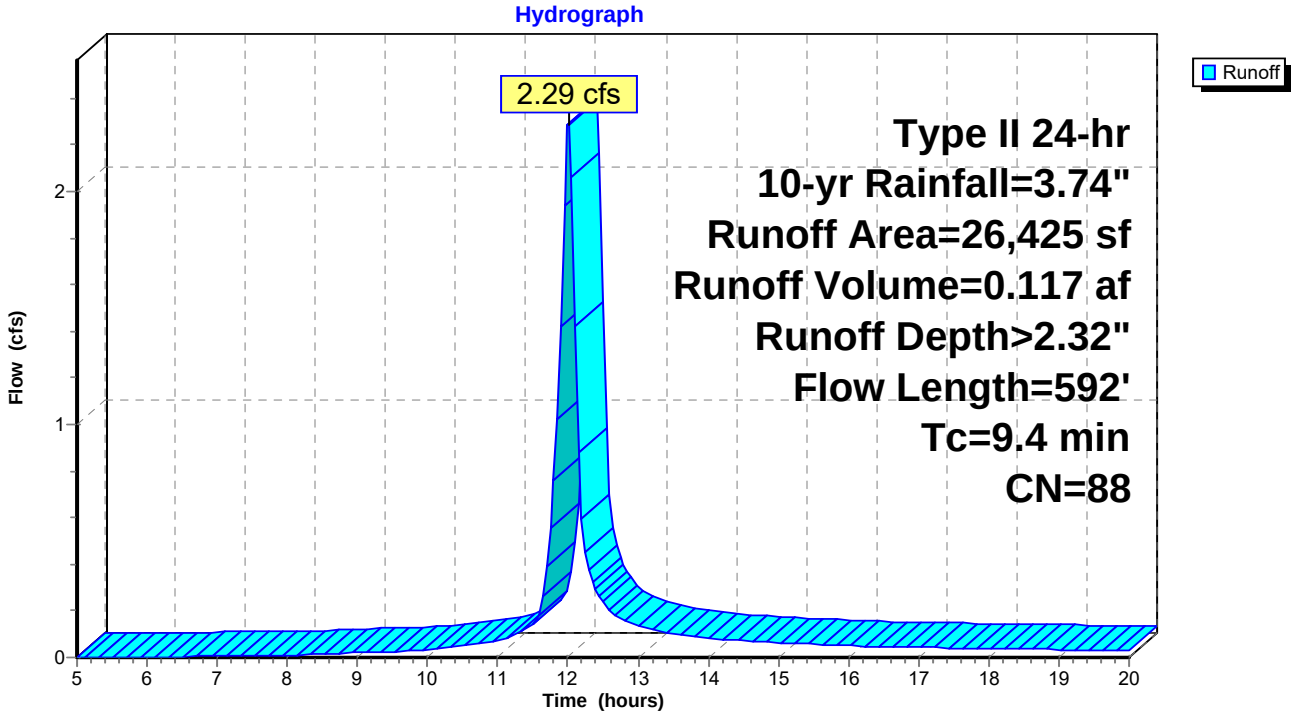
Runoff = 2.29 cfs @ 12.01 hrs, Volume= 0.117 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
*	12,916	98	Impervious
	9,330	80	>75% Grass cover, Good, HSG D
	4,179	74	>75% Grass cover, Good, HSG C
	26,425	88	Weighted Average
	13,509		51.12% Pervious Area
	12,916		48.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0700	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
2.4	312	0.0945	2.15		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	180	0.1200	7.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.4	592	Total			

Subcatchment 1S: DA - 002



Summary for Subcatchment 2S: DA - 003

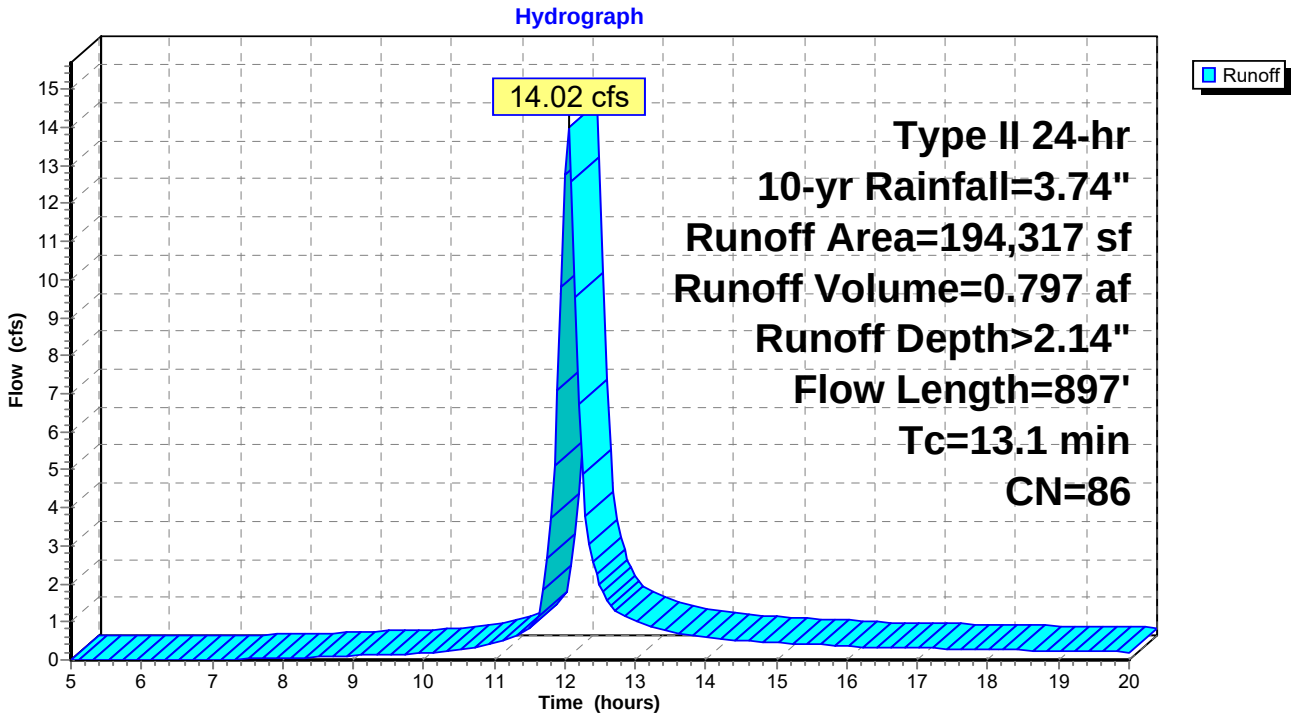
Runoff = 14.02 cfs @ 12.05 hrs, Volume= 0.797 af, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	8,639	74	>75% Grass cover, Good, HSG C
	514	39	>75% Grass cover, Good, HSG A
	112,334	80	>75% Grass cover, Good, HSG D
*	72,830	98	Impervious
	194,317	86	Weighted Average
	121,487		62.52% Pervious Area
	72,830		37.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0700	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
6.5	797	0.0857	2.05		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.1	897	Total			

Subcatchment 2S: DA - 003



Summary for Subcatchment 3S: DA - 004

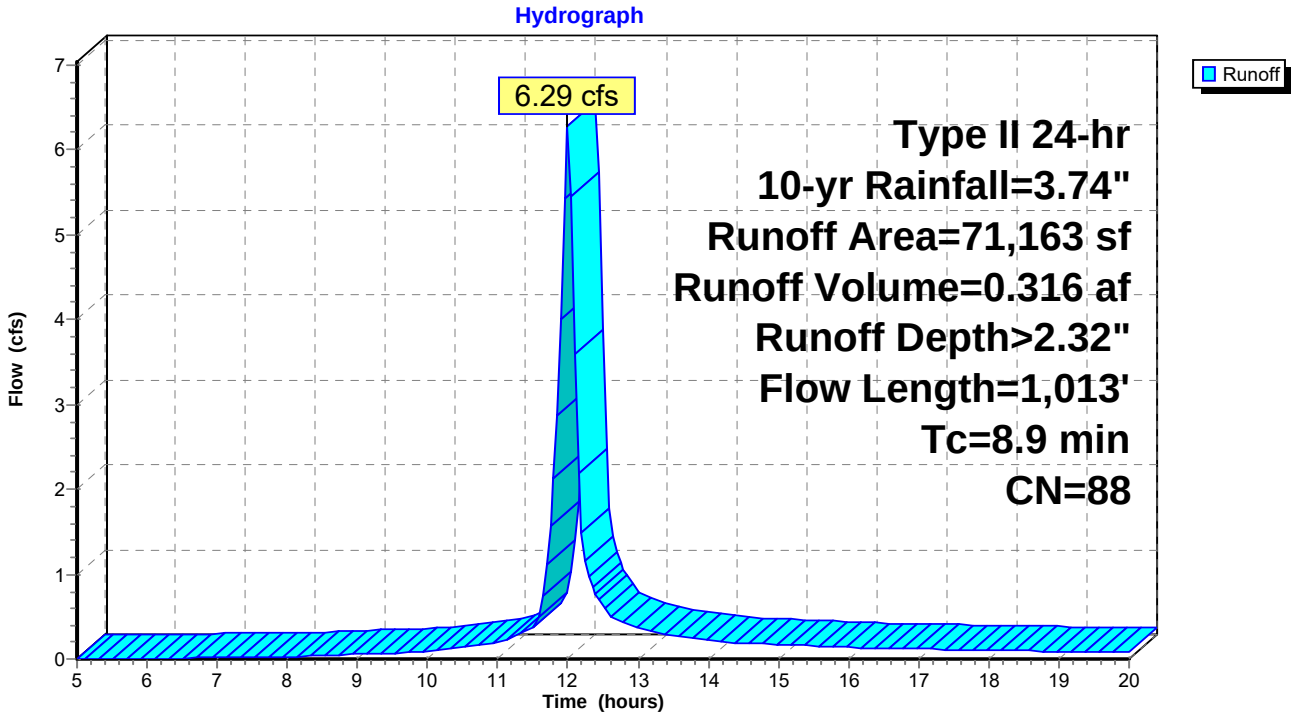
Runoff = 6.29 cfs @ 12.00 hrs, Volume= 0.316 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	3,290	74	>75% Grass cover, Good, HSG C
	33,190	80	>75% Grass cover, Good, HSG D
	455	72	Dirt roads, HSG A
*	34,228	98	Impervious
	71,163	88	Weighted Average
	36,935		51.90% Pervious Area
	34,228		48.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1000	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
1.2	173	0.1096	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.0	740	0.0941	6.23		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	1,013	Total			

Subcatchment 3S: DA - 004



Summary for Pond 9P: Catch Basin - 1

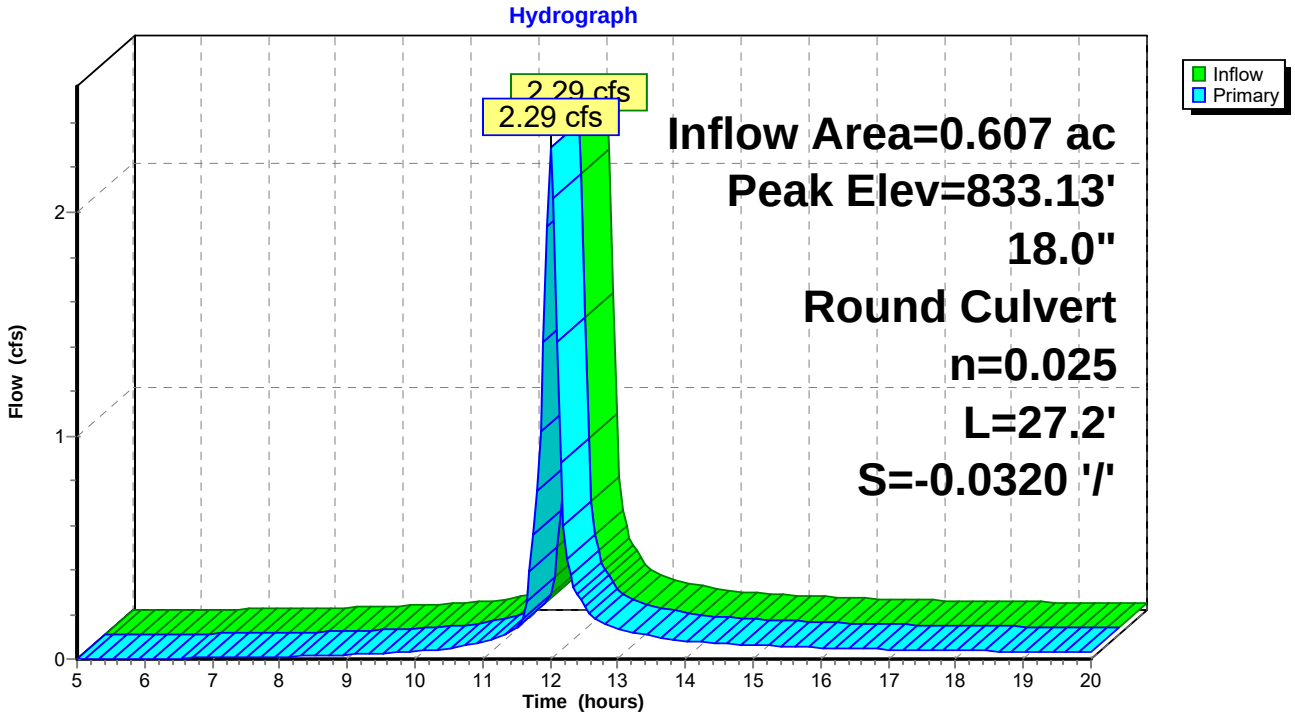
Inflow Area = 0.607 ac, 48.88% Impervious, Inflow Depth > 2.32" for 10-yr event
Inflow = 2.29 cfs @ 12.01 hrs, Volume= 0.117 af
Outflow = 2.29 cfs @ 12.01 hrs, Volume= 0.117 af, Atten= 0%, Lag= 0.0 min
Primary = 2.29 cfs @ 12.01 hrs, Volume= 0.117 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 833.13' @ 12.01 hrs
Flood Elev= 834.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	832.33'	**18.0" Round Culvert** L= 27.2' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 831.46' / 832.33' S= -0.0320 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf

Primary OutFlow Max=2.26 cfs @ 12.01 hrs HW=833.12' (Free Discharge)
1=Culvert (Inlet Controls 2.26 cfs @ 2.39 fps)

Pond 9P: Catch Basin - 1



Summary for Pond 10P: Catch Basin - 2

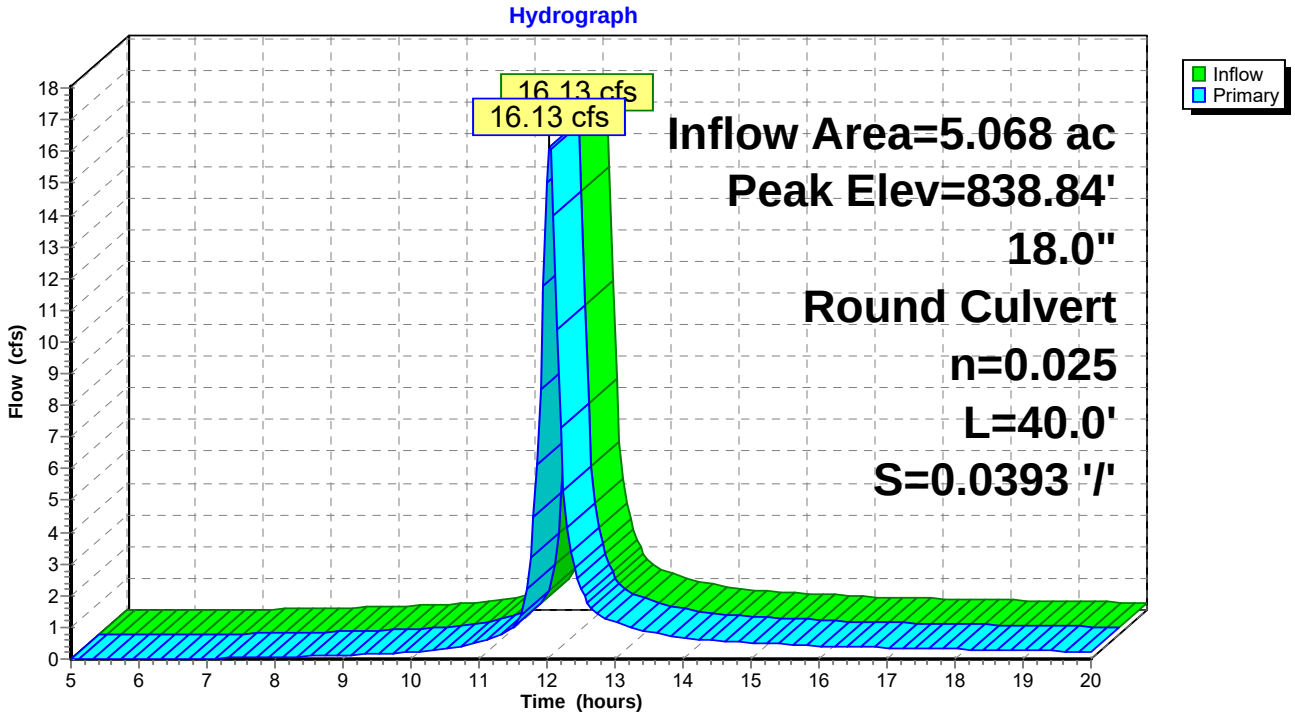
Inflow Area = 5.068 ac, 38.84% Impervious, Inflow Depth > 2.17" for 10-yr event
Inflow = 16.13 cfs @ 12.04 hrs, Volume= 0.914 af
Outflow = 16.13 cfs @ 12.04 hrs, Volume= 0.914 af, Atten= 0%, Lag= 0.0 min
Primary = 16.13 cfs @ 12.04 hrs, Volume= 0.914 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 838.84' @ 12.04 hrs
Flood Elev= 835.11'

Device	Routing	Invert	Outlet Devices
#1	Primary	832.33'	**18.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 832.33' / 830.76' S= 0.0393 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf

Primary OutFlow Max=15.91 cfs @ 12.04 hrs HW=838.69' (Free Discharge)
1=Culvert (Inlet Controls 15.91 cfs @ 9.01 fps)

Pond 10P: Catch Basin - 2



Summary for Pond 11P: Catch Basin - 3

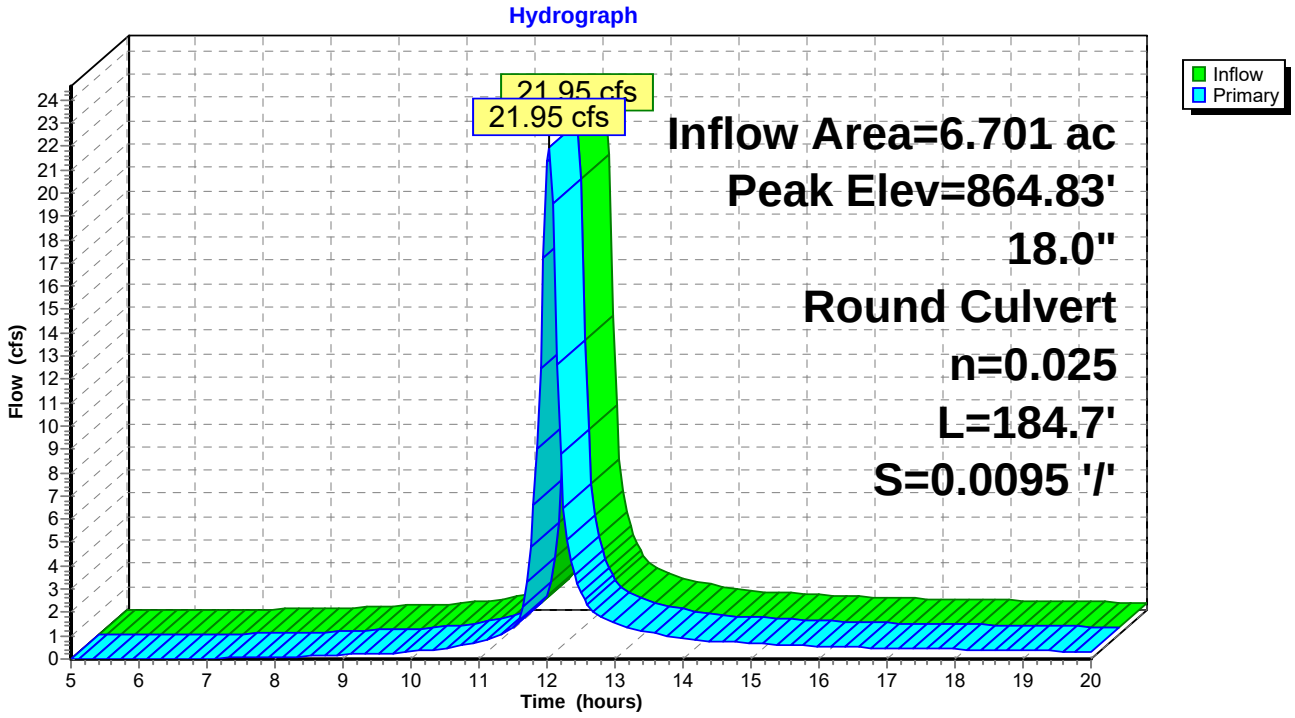
Inflow Area = 6.701 ac, 41.10% Impervious, Inflow Depth > 2.20" for 10-yr event
Inflow = 21.95 cfs @ 12.03 hrs, Volume= 1.230 af
Outflow = 21.95 cfs @ 12.03 hrs, Volume= 1.230 af, Atten= 0%, Lag= 0.0 min
Primary = 21.95 cfs @ 12.03 hrs, Volume= 1.230 af

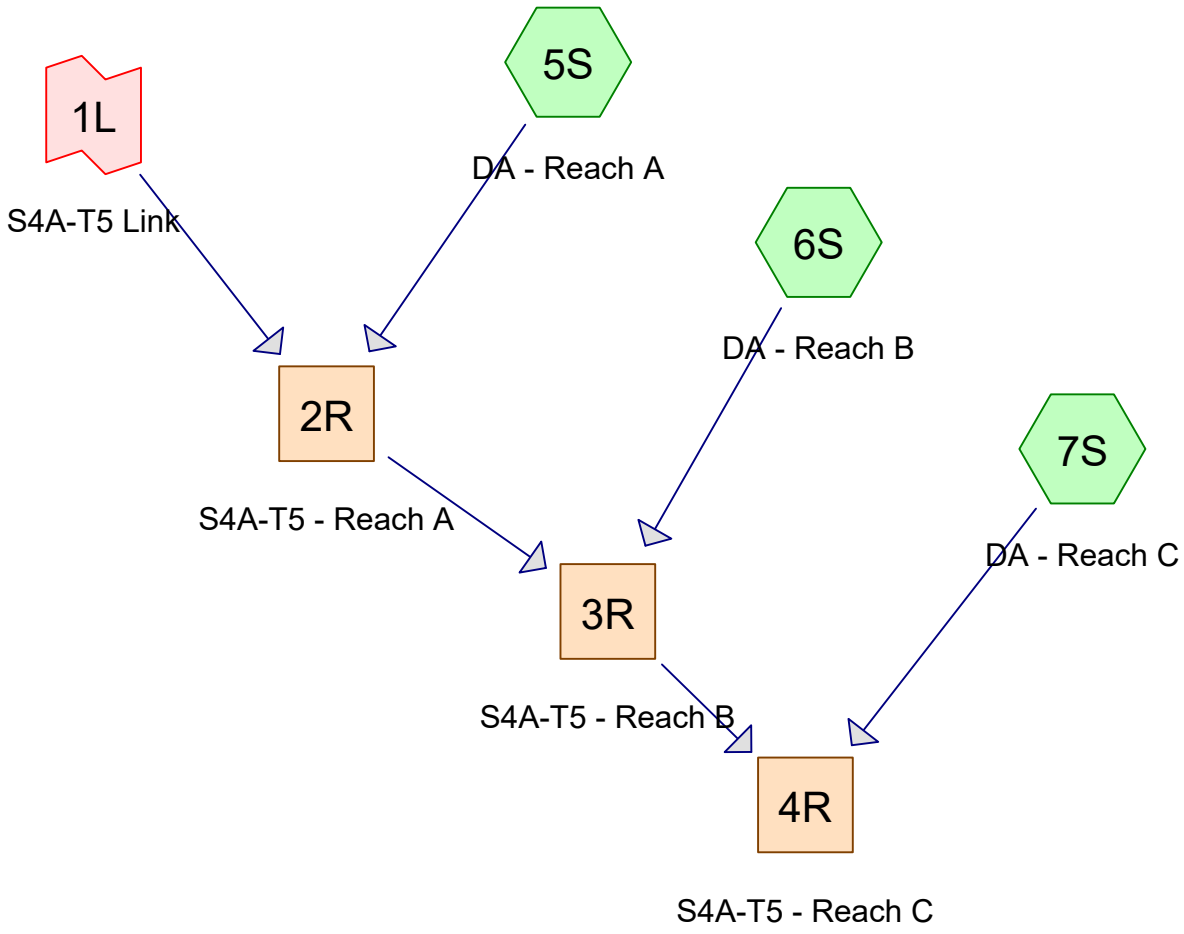
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 864.83' @ 12.03 hrs
Flood Elev= 835.66'

Device	Routing	Invert	Outlet Devices
#1	Primary	830.76'	**18.0" Round Culvert** L= 184.7' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 830.76' / 829.00' S= 0.0095 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf

Primary OutFlow Max=21.44 cfs @ 12.03 hrs HW=863.39' (Free Discharge)
1=Culvert (Barrel Controls 21.44 cfs @ 12.13 fps)

Pond 11P: Catch Basin - 3





Subcat Reach Pond Link

Routing Diagram for REL_Laflin_S4A-T5 - (Reach A-C)
Prepared by {enter your company name here}, Printed 2/18/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.156	98	Impervious (5S, 6S, 7S)
0.484	71	Meadow, non-grazed, HSG C (5S, 6S, 7S)
0.035	78	Meadow, non-grazed, HSG D (5S, 6S, 7S)
0.098	36	Woods, Fair, HSG A (5S, 6S, 7S)
0.833	73	Woods, Fair, HSG C (5S, 6S, 7S)
1.606	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.098	HSG A	5S, 6S, 7S
0.000	HSG B	
1.317	HSG C	5S, 6S, 7S
0.035	HSG D	5S, 6S, 7S
0.156	Other	5S, 6S, 7S
1.606		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.156	0.156	Impervious	5S, 6S, 7S
0.000	0.000	0.484	0.035	0.000	0.519	Meadow, non-grazed	5S, 6S, 7S
0.098	0.000	0.833	0.000	0.000	0.931	Woods, Fair	5S, 6S, 7S
0.098	**0.000**	**1.317**	**0.035**	**0.156**	**1.606**	**TOTAL AREA**	

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

Subcatchment 5S: DA - Reach A Runoff Area=48,750 sf 10.23% Impervious Runoff Depth>1.28"
Flow Length=275' Tc=5.6 min CN=74 Runoff=2.75 cfs 0.119 af

Subcatchment 6S: DA - Reach B Runoff Area=14,301 sf 4.90% Impervious Runoff Depth>0.88"
Flow Length=300' Tc=5.5 min CN=67 Runoff=0.55 cfs 0.024 af

Subcatchment 7S: DA - Reach C Runoff Area=6,904 sf 15.90% Impervious Runoff Depth>1.16"
Flow Length=334' Tc=6.8 min CN=72 Runoff=0.34 cfs 0.015 af

Reach 2R: S4A-T5 - Reach A Avg. Flow Depth=0.87' Max Vel=4.83 fps Inflow=24.21 cfs 1.349 af
n=0.038 L=140.0' S=0.0286 '/' Capacity=68.50 cfs Outflow=23.79 cfs 1.348 af

Reach 3R: S4A-T5 - Reach B Avg. Flow Depth=0.65' Max Vel=5.88 fps Inflow=24.19 cfs 1.372 af
n=0.057 L=65.0' S=0.1231 '/' Capacity=79.05 cfs Outflow=24.08 cfs 1.372 af

Reach 4R: S4A-T5 - Reach C Avg. Flow Depth=0.54' Max Vel=7.32 fps Inflow=24.36 cfs 1.387 af
n=0.061 L=15.0' S=0.2667 '/' Capacity=108.73 cfs Outflow=24.34 cfs 1.387 af

Link 1L: 10-yr Primary Outflow Imported from REL_Laflin_S4A-T5~Pond 11P.hce Inflow=21.95 cfs 1.230 af
Area= 6.701 ac 41.10% Imperv. Primary=21.95 cfs 1.230 af

Total Runoff Area = 1.606 ac Runoff Volume = 0.159 af Average Runoff Depth = 1.19"
90.30% Pervious = 1.450 ac 9.70% Impervious = 0.156 ac

Summary for Subcatchment 5S: DA - Reach A

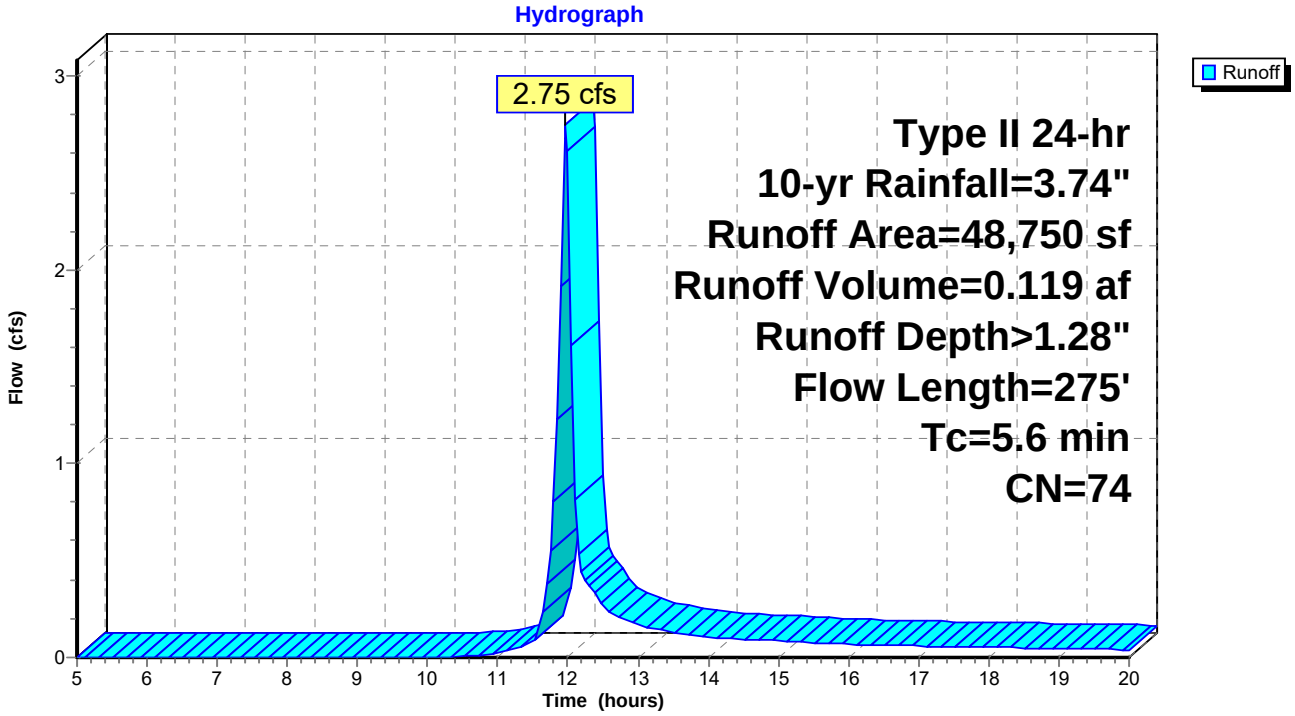
Runoff = 2.75 cfs @ 11.97 hrs, Volume= 0.119 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	813	36	Woods, Fair, HSG A
	26,936	73	Woods, Fair, HSG C
	15,221	71	Meadow, non-grazed, HSG C
	791	78	Meadow, non-grazed, HSG D
*	4,989	98	Impervious
	48,750	74	Weighted Average
	43,761		89.77% Pervious Area
	4,989		10.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	78	0.0770	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.4	197	0.2640	8.27		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.6	275	Total			

Subcatchment 5S: DA - Reach A



Summary for Subcatchment 6S: DA - Reach B

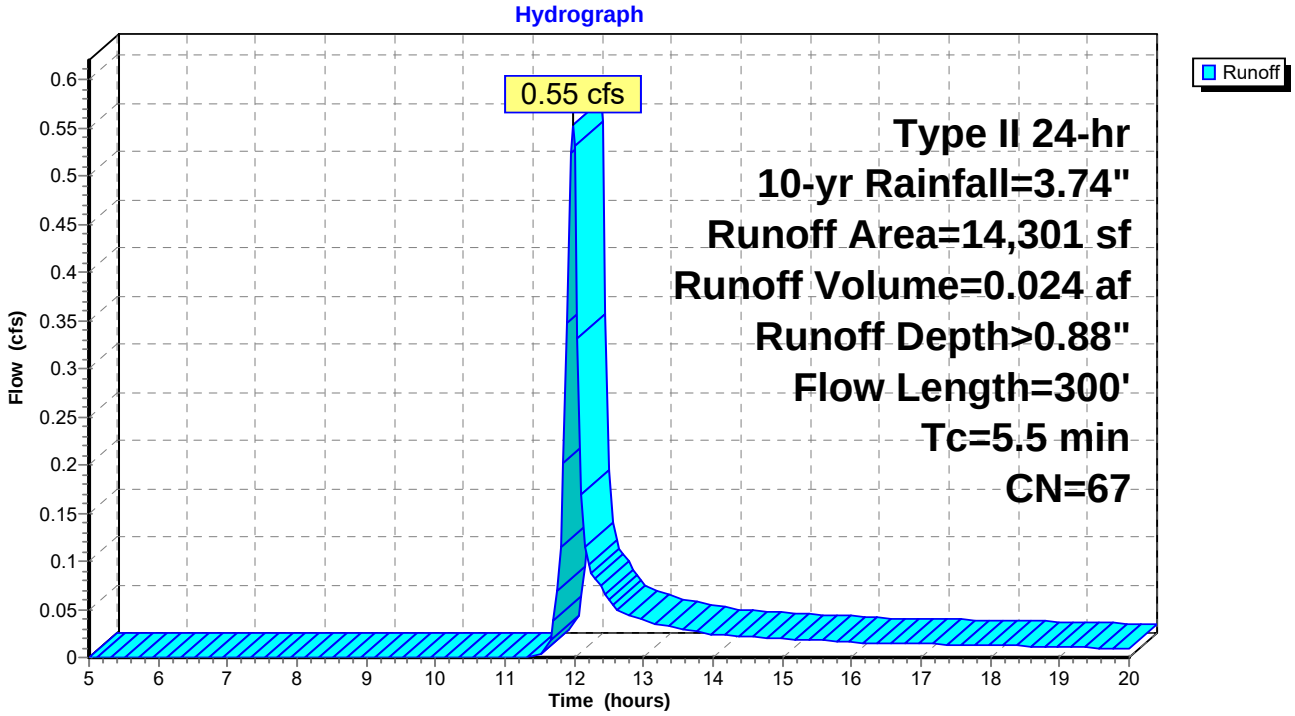
Runoff = 0.55 cfs @ 11.98 hrs, Volume= 0.024 af, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	2,585	36	Woods, Fair, HSG A
	7,482	73	Woods, Fair, HSG C
	3,292	71	Meadow, non-grazed, HSG C
	241	78	Meadow, non-grazed, HSG D
*	701	98	Impervious
	14,301	67	Weighted Average
	13,600		95.10% Pervious Area
	701		4.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	81	0.0860	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.4	219	0.2920	8.70		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.5	300	Total			

Subcatchment 6S: DA - Reach B



Summary for Subcatchment 7S: DA - Reach C

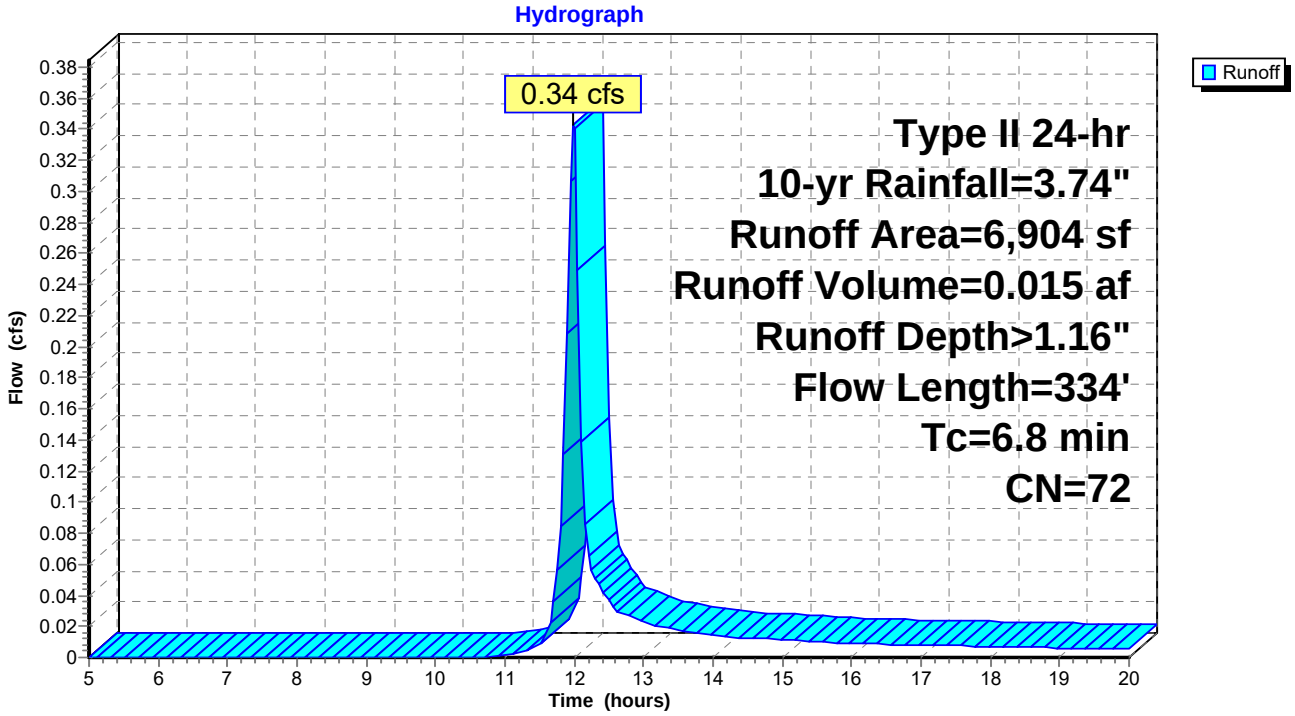
Runoff = 0.34 cfs @ 11.99 hrs, Volume= 0.015 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	863	36	Woods, Fair, HSG A
	1,869	73	Woods, Fair, HSG C
	2,587	71	Meadow, non-grazed, HSG C
	487	78	Meadow, non-grazed, HSG D
*	1,098	98	Impervious
	6,904	72	Weighted Average
	5,806		84.10% Pervious Area
	1,098		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0780	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.5	234	0.2860	8.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.8	334	Total			

Subcatchment 7S: DA - Reach C



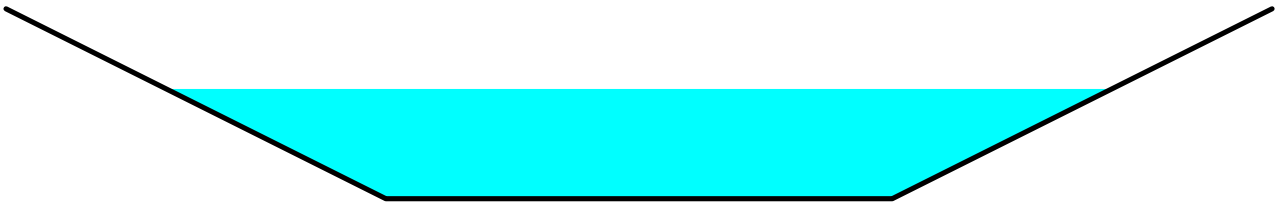
Summary for Reach 2R: S4A-T5 - Reach A

Inflow Area = 7.820 ac, 36.68% Impervious, Inflow Depth > 2.07" for 10-yr event
Inflow = 24.21 cfs @ 12.02 hrs, Volume= 1.349 af
Outflow = 23.79 cfs @ 12.03 hrs, Volume= 1.348 af, Atten= 2%, Lag= 0.9 min

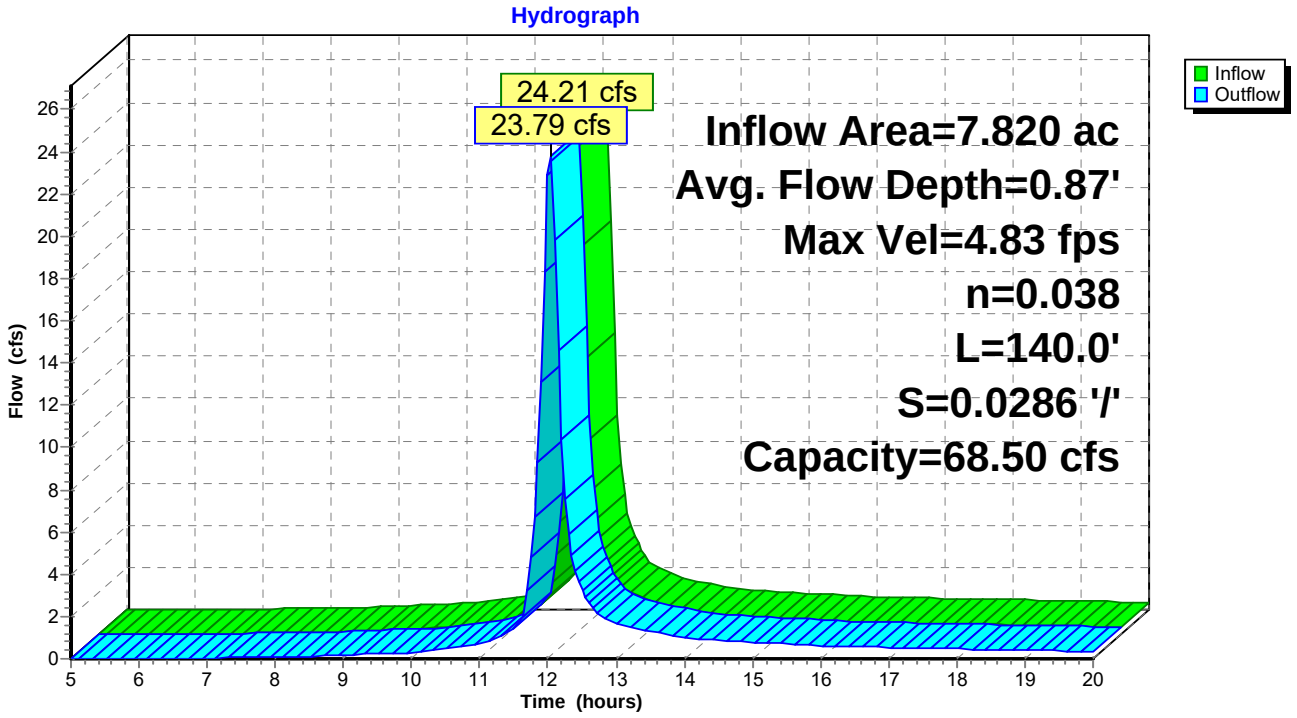
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.83 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 1.7 min

Peak Storage= 695 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 1.50' Flow Area= 10.5 sf, Capacity= 68.50 cfs

4.00' x 1.50' deep channel, n= 0.038
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 140.0' Slope= 0.0286 '/'
Inlet Invert= 810.00', Outlet Invert= 806.00'



Reach 2R: S4A-T5 - Reach A



Summary for Reach 3R: S4A-T5 - Reach B

Inflow Area = 8.149 ac, 35.40% Impervious, Inflow Depth > 2.02" for 10-yr event
Inflow = 24.19 cfs @ 12.03 hrs, Volume= 1.372 af
Outflow = 24.08 cfs @ 12.04 hrs, Volume= 1.372 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.88 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 0.7 min

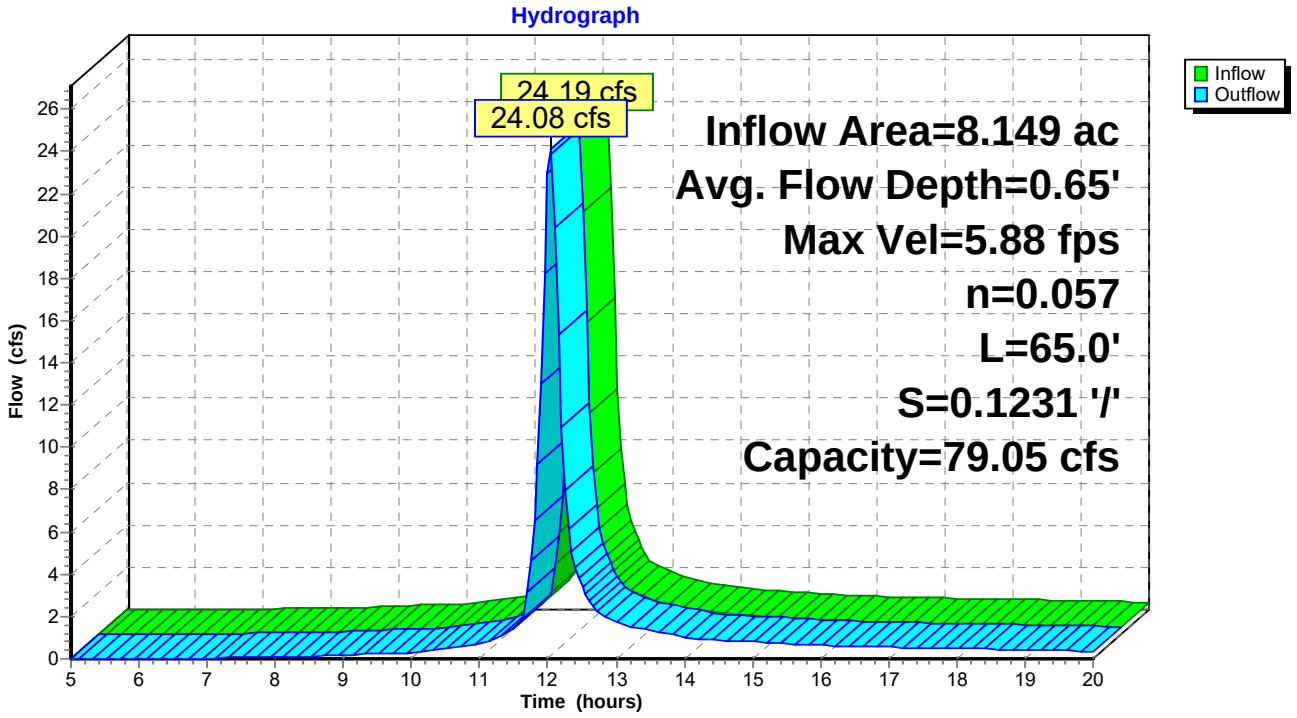
Peak Storage= 267 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.25' Flow Area= 9.4 sf, Capacity= 79.05 cfs

5.00' x 1.25' deep channel, n= 0.057
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 65.0' Slope= 0.1231 '/'
Inlet Invert= 806.00', Outlet Invert= 798.00'



‡

Reach 3R: S4A-T5 - Reach B



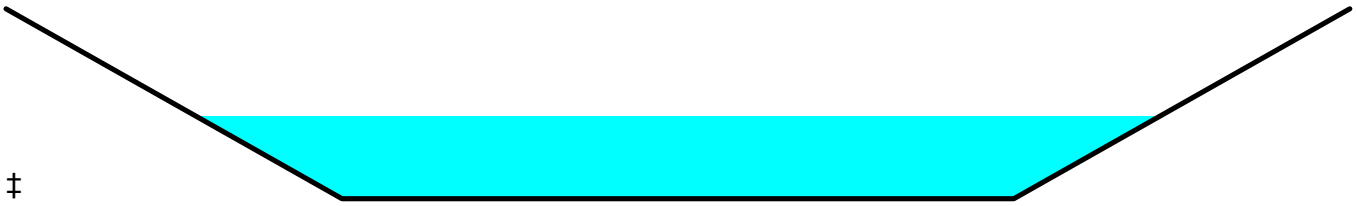
Summary for Reach 4R: S4A-T5 - Reach C

Inflow Area = 8.307 ac, 35.03% Impervious, Inflow Depth > 2.00" for 10-yr event
Inflow = 24.36 cfs @ 12.03 hrs, Volume= 1.387 af
Outflow = 24.34 cfs @ 12.04 hrs, Volume= 1.387 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.32 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 0.1 min

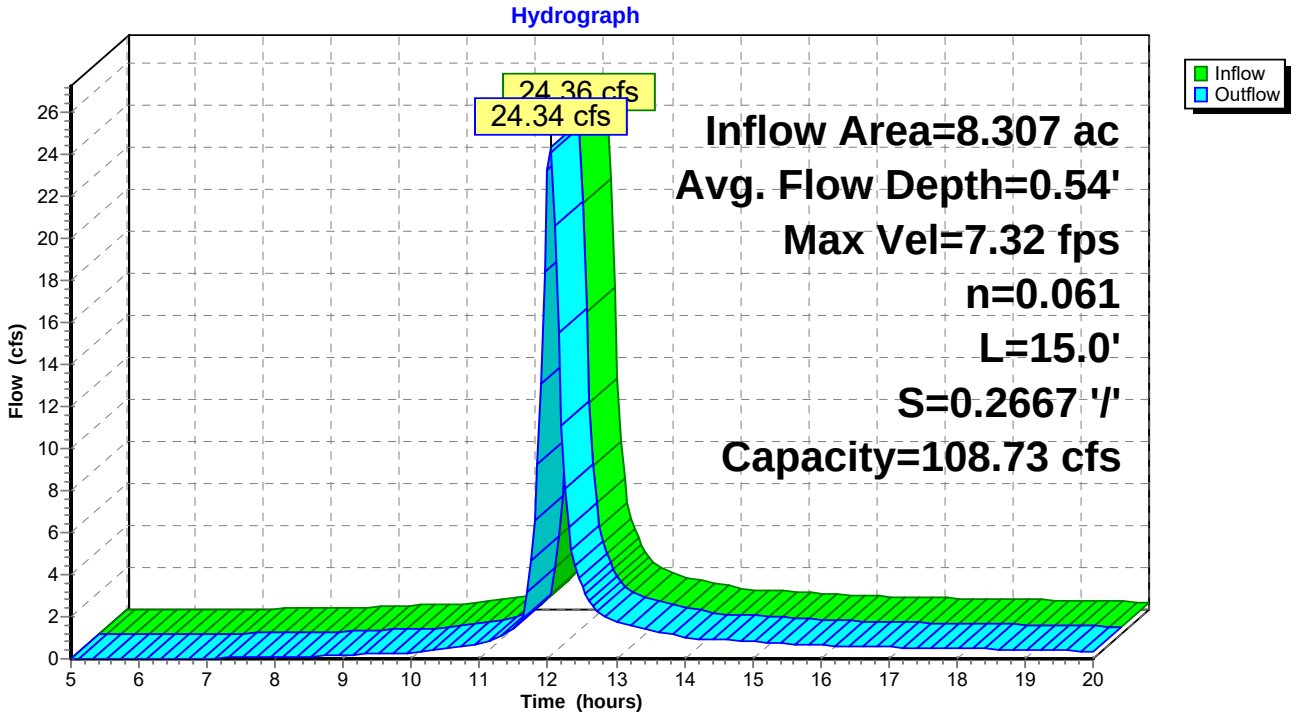
Peak Storage= 50 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.25' Flow Area= 9.4 sf, Capacity= 108.73 cfs

5.00' x 1.25' deep channel, n= 0.061
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 15.0' Slope= 0.2667 '/'
Inlet Invert= 798.00', Outlet Invert= 794.00'



‡

Reach 4R: S4A-T5 - Reach C



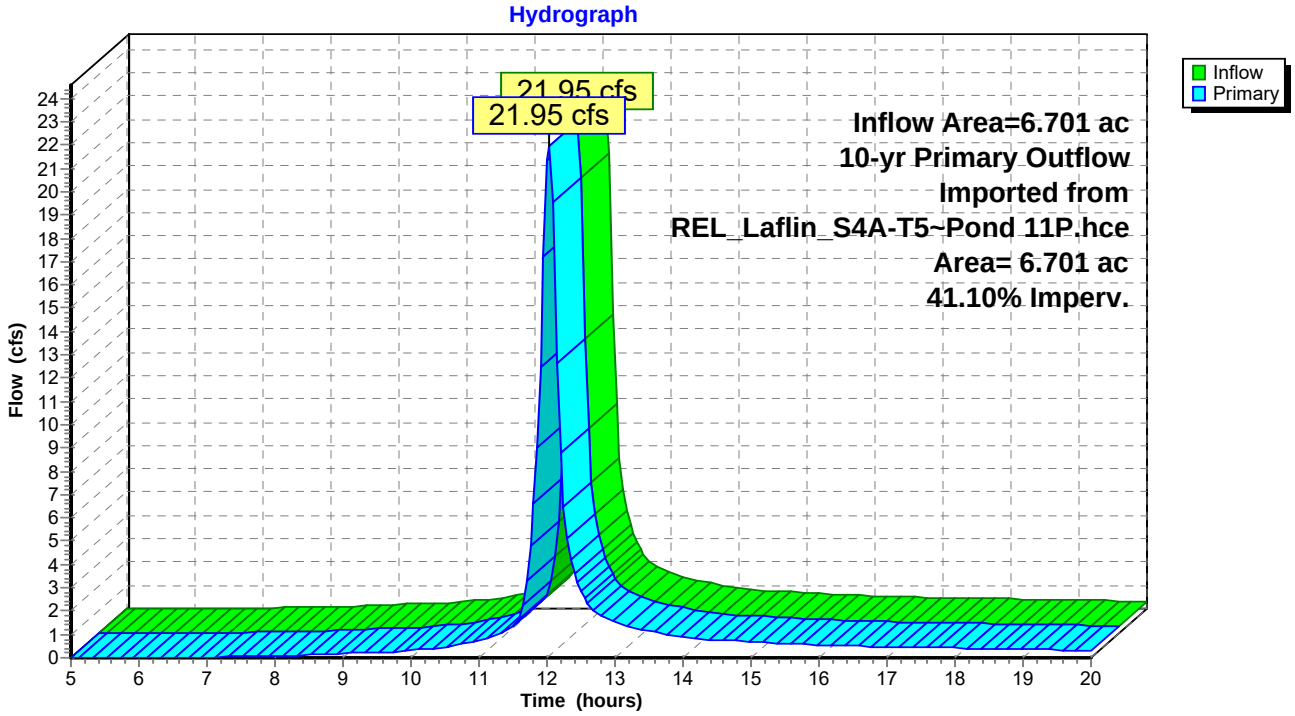
Summary for Link 1L: S4A-T5 Link

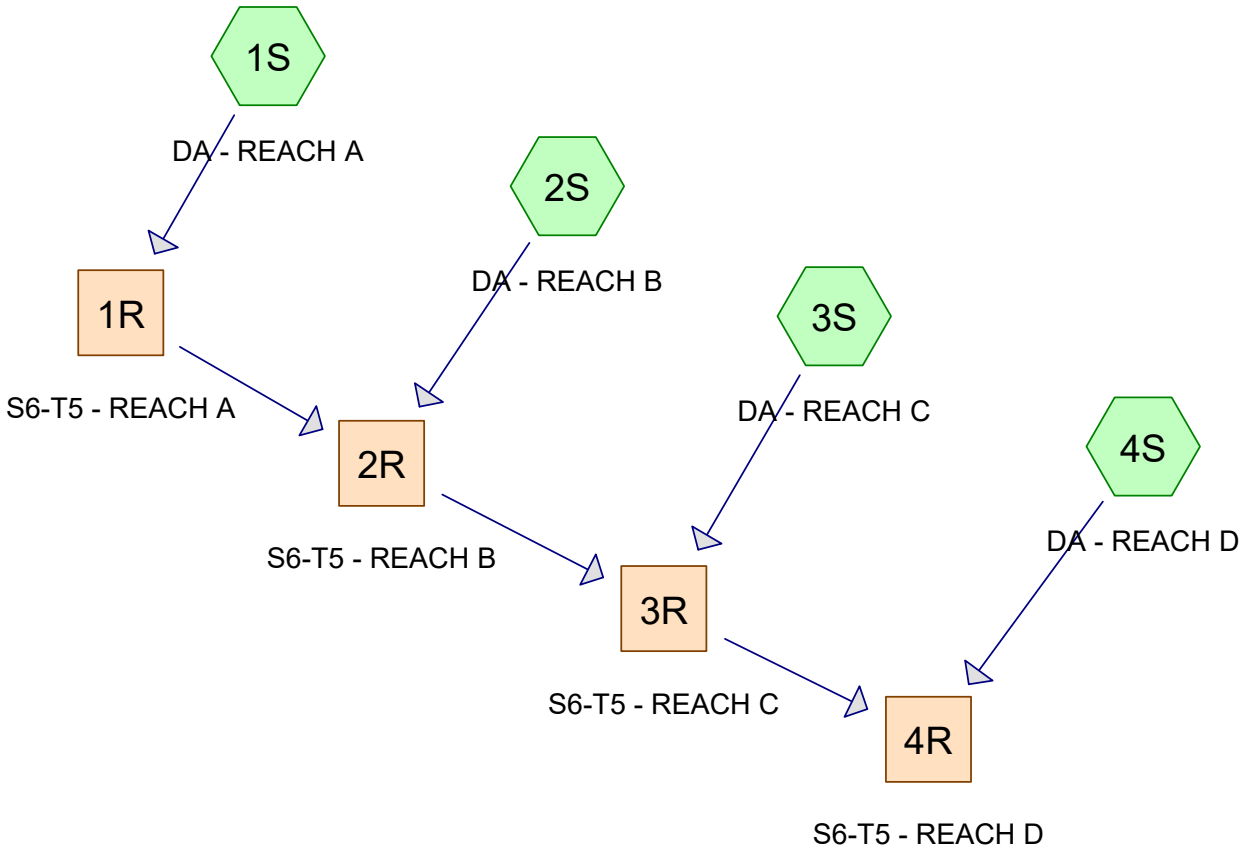
Inflow Area = 6.701 ac, 41.10% Impervious, Inflow Depth > 2.20" for 10-yr event
Inflow = 21.95 cfs @ 12.03 hrs, Volume= 1.230 af
Primary = 21.95 cfs @ 12.03 hrs, Volume= 1.230 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

10-yr Primary Outflow Imported from REL_Laflin_S4A-T5~Pond 11P.hce

Link 1L: S4A-T5 Link





Subcat Reach Pond Link

Routing Diagram for REL_Laflin_S6-T5 (Reach A-D)
Prepared by {enter your company name here}, Printed 2/18/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,359	98	Impervious (1S, 2S, 3S, 4S)
6,976	71	Meadow, non-grazed, HSG C (1S, 2S, 3S, 4S)
15,301	73	Woods, Fair, HSG C (1S, 2S, 3S, 4S)
28,636	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
22,277	HSG C	1S, 2S, 3S, 4S
0	HSG D	
6,359	Other	1S, 2S, 3S, 4S
28,636		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	0	6,359	6,359	Impervious	
0	0	6,976	0	0	6,976	Meadow, non-grazed	
0	0	15,301	0	0	15,301	Woods, Fair	
0	**0**	**22,277**	**0**	**6,359**	**28,636**	**TOTAL AREA**	

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

Subcatchment 1S: DA - REACH A Runoff Area=11,404 sf 10.74% Impervious Runoff Depth>1.34"
Flow Length=232' Tc=9.5 min CN=75 Runoff=0.59 cfs 1,274 cf

Subcatchment 2S: DA - REACH B Runoff Area=4,018 sf 44.97% Impervious Runoff Depth>1.98"
Flow Length=260' Tc=9.6 min CN=84 Runoff=0.30 cfs 664 cf

Subcatchment 3S: DA - REACH C Runoff Area=7,611 sf 23.69% Impervious Runoff Depth>1.61"
Flow Length=307' Tc=9.7 min CN=79 Runoff=0.47 cfs 1,020 cf

Subcatchment 4S: DA - REACH D Runoff Area=5,603 sf 27.20% Impervious Runoff Depth>1.61"
Flow Length=295' Tc=9.7 min CN=79 Runoff=0.35 cfs 751 cf

Reach 1R: S6-T5 - REACH A Avg. Flow Depth=0.07' Max Vel=2.08 fps Inflow=0.59 cfs 1,274 cf
n=0.064 L=23.0' S=0.3043 '/' Capacity=61.06 cfs Outflow=0.59 cfs 1,273 cf

Reach 2R: S6-T5 - REACH B Avg. Flow Depth=0.08' Max Vel=2.56 fps Inflow=0.89 cfs 1,937 cf
n=0.064 L=22.0' S=0.3636 '/' Capacity=66.75 cfs Outflow=0.88 cfs 1,937 cf

Reach 3R: S6-T5 - REACH C Avg. Flow Depth=0.14' Max Vel=2.24 fps Inflow=1.35 cfs 2,957 cf
n=0.064 L=72.0' S=0.1458 '/' Capacity=42.27 cfs Outflow=1.32 cfs 2,953 cf

Reach 4R: S6-T5 - REACH D Avg. Flow Depth=0.10' Max Vel=3.84 fps Inflow=1.66 cfs 3,704 cf
n=0.064 L=4.0' S=0.6250 '/' Capacity=87.51 cfs Outflow=1.66 cfs 3,704 cf

Total Runoff Area = 28,636 sf Runoff Volume = 3,709 cf Average Runoff Depth = 1.55"
77.79% Pervious = 22,277 sf 22.21% Impervious = 6,359 sf

Summary for Subcatchment 1S: DA - REACH A

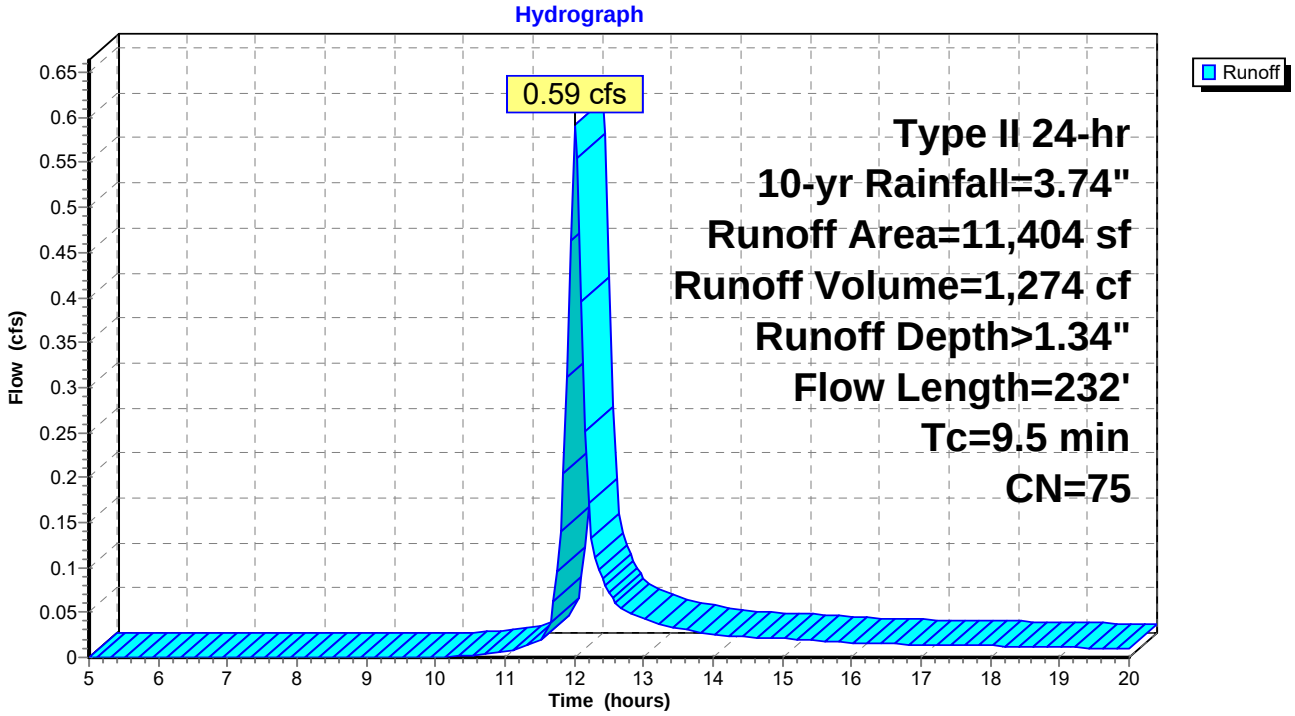
Runoff = 0.59 cfs @ 12.01 hrs, Volume= 1,274 cf, Depth> 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	6,877	73	Woods, Fair, HSG C
	3,302	71	Meadow, non-grazed, HSG C
*	1,225	98	Impervious
	11,404	75	Weighted Average
	10,179		89.26% Pervious Area
	1,225		10.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.2	132	0.3200	9.11		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.5	232	Total			

Subcatchment 1S: DA - REACH A



Summary for Subcatchment 2S: DA - REACH B

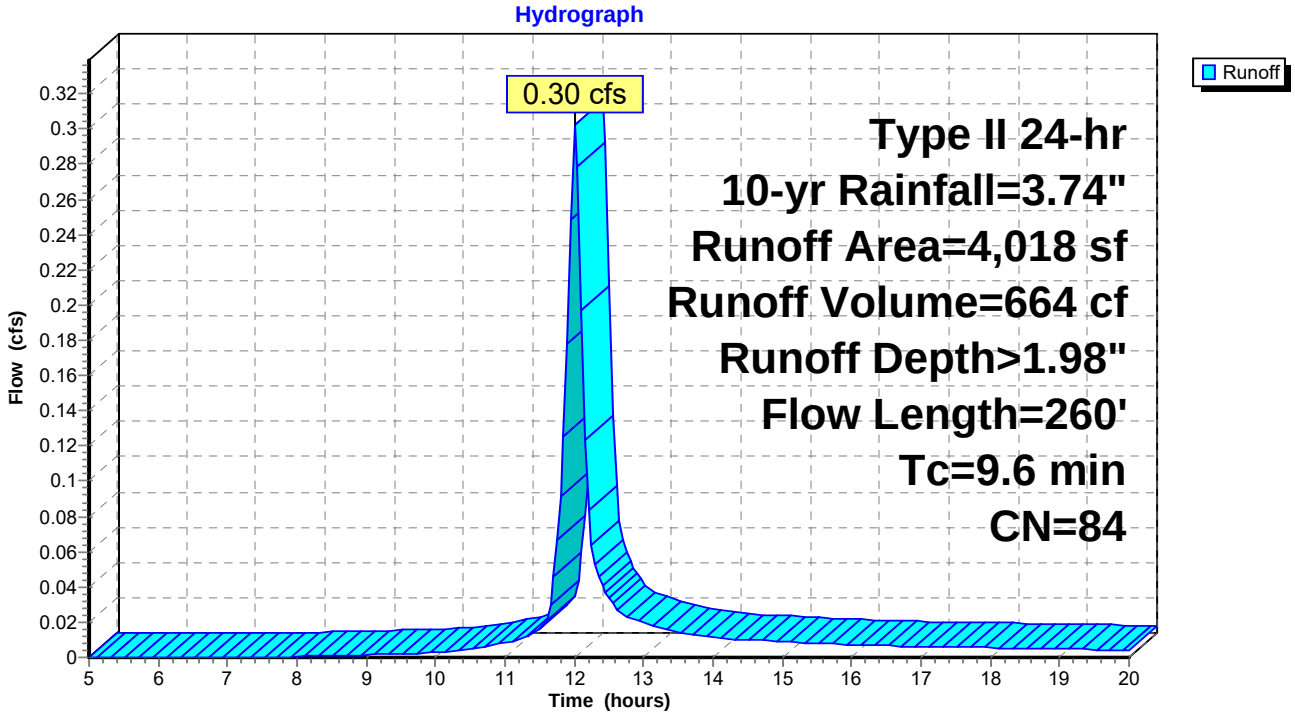
Runoff = 0.30 cfs @ 12.01 hrs, Volume= 664 cf, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	1,786	73	Woods, Fair, HSG C
	425	71	Meadow, non-grazed, HSG C
*	1,807	98	Impervious
	4,018	84	Weighted Average
	2,211		55.03% Pervious Area
	1,807		44.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.3	160	0.3100	8.96		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.6	260	Total			

Subcatchment 2S: DA - REACH B



Summary for Subcatchment 3S: DA - REACH C

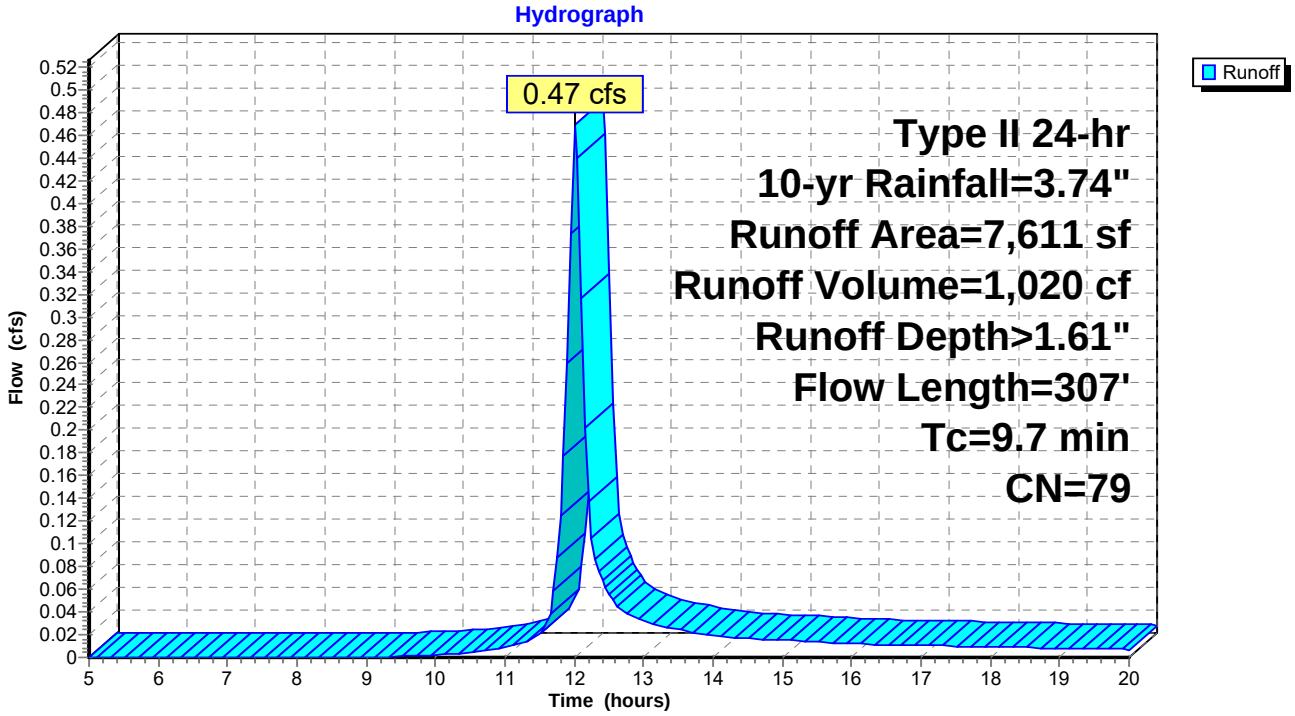
Runoff = 0.47 cfs @ 12.01 hrs, Volume= 1,020 cf, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	4,863	73	Woods, Fair, HSG C
	945	71	Meadow, non-grazed, HSG C
*	1,803	98	Impervious
	7,611	79	Weighted Average
	5,808		76.31% Pervious Area
	1,803		23.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.4	207	0.3100	8.96		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	307	Total			

Subcatchment 3S: DA - REACH C



Summary for Subcatchment 4S: DA - REACH D

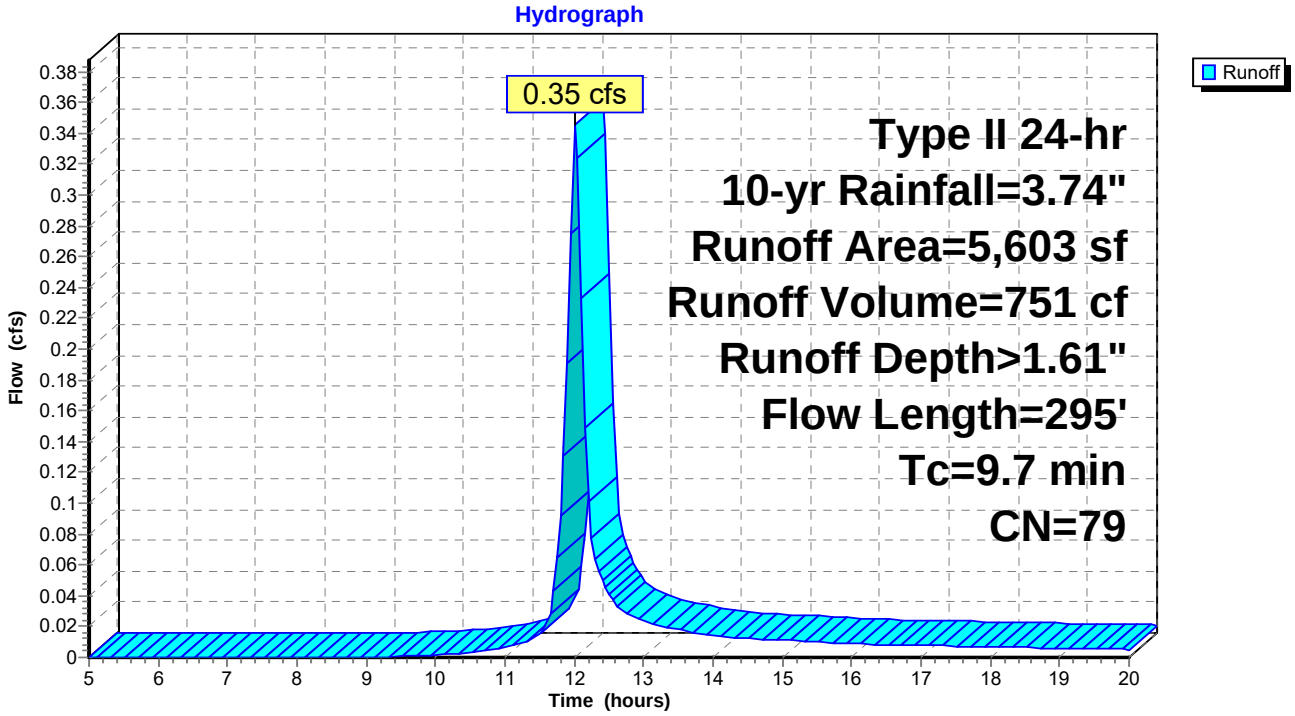
Runoff = 0.35 cfs @ 12.01 hrs, Volume= 751 cf, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	1,775	73	Woods, Fair, HSG C
	2,304	71	Meadow, non-grazed, HSG C
*	1,524	98	Impervious
	5,603	79	Weighted Average
	4,079		72.80% Pervious Area
	1,524		27.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.4	195	0.3000	8.82		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	295	Total			

Subcatchment 4S: DA - REACH D



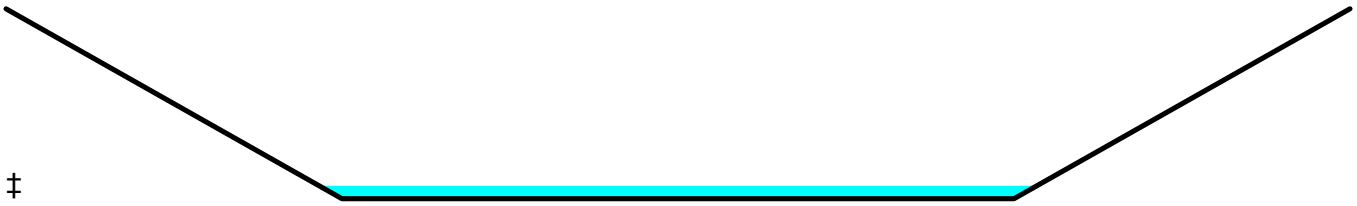
Summary for Reach 1R: S6-T5 - REACH A

Inflow Area = 11,404 sf, 10.74% Impervious, Inflow Depth > 1.34" for 10-yr event
Inflow = 0.59 cfs @ 12.01 hrs, Volume= 1,274 cf
Outflow = 0.59 cfs @ 12.02 hrs, Volume= 1,273 cf, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.08 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 0.6 min

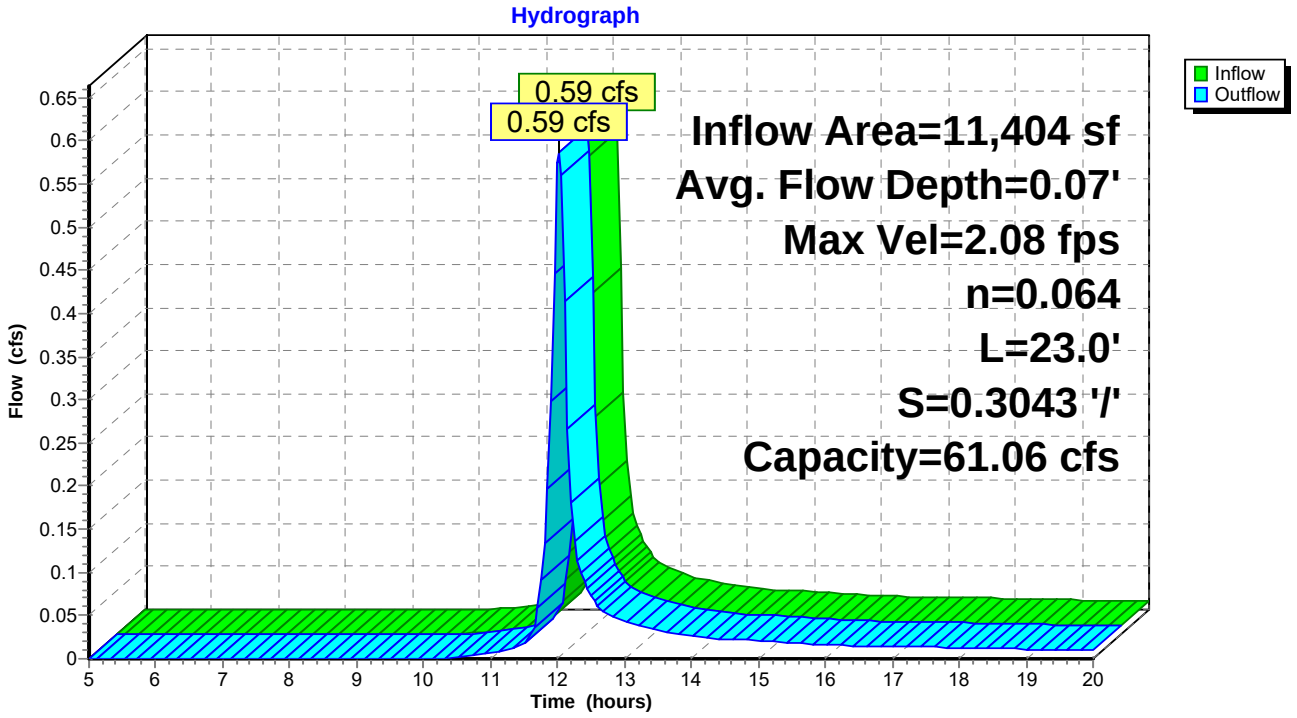
Peak Storage= 7 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 61.06 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 23.0' Slope= 0.3043 '/'
Inlet Invert= 796.00', Outlet Invert= 789.00'



‡

Reach 1R: S6-T5 - REACH A



Summary for Reach 2R: S6-T5 - REACH B

Inflow Area = 15,422 sf, 19.66% Impervious, Inflow Depth > 1.51" for 10-yr event
Inflow = 0.89 cfs @ 12.02 hrs, Volume= 1,937 cf
Outflow = 0.88 cfs @ 12.02 hrs, Volume= 1,937 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.56 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.76 fps, Avg. Travel Time= 0.5 min

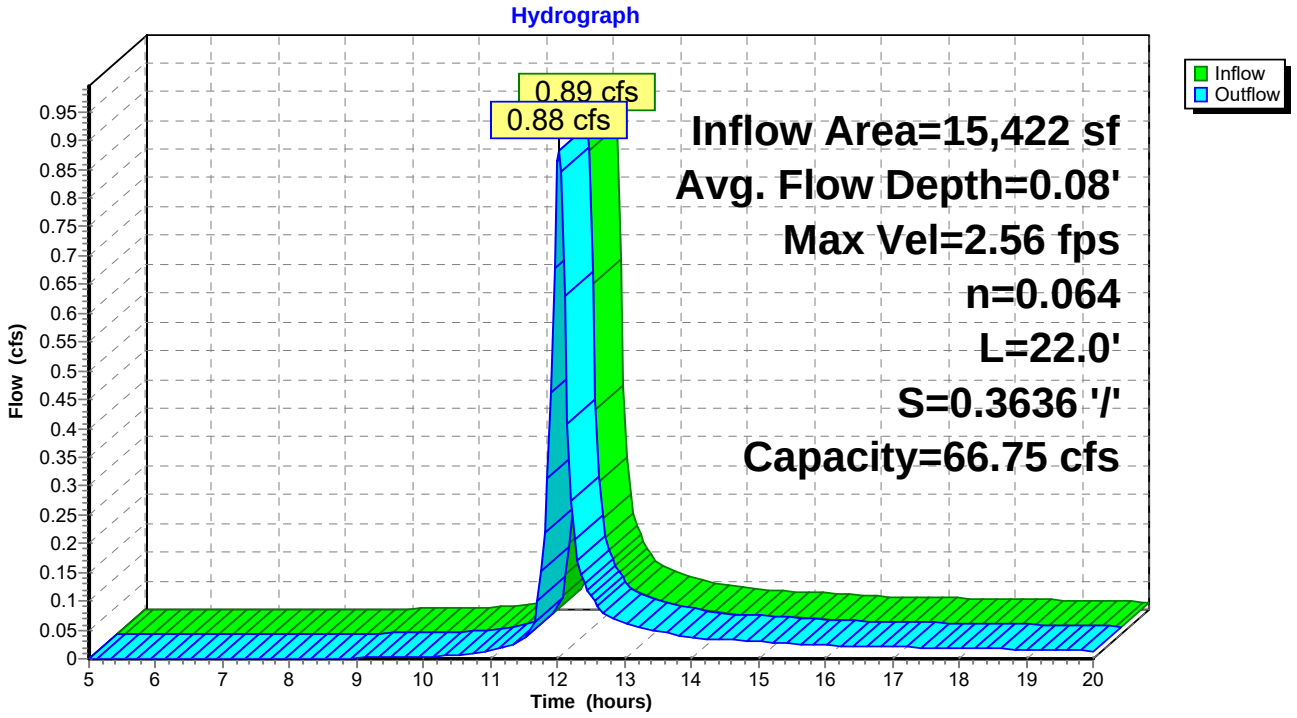
Peak Storage= 8 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 66.75 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 22.0' Slope= 0.3636 '/'
Inlet Invert= 789.00', Outlet Invert= 781.00'



‡

Reach 2R: S6-T5 - REACH B



Summary for Reach 3R: S6-T5 - REACH C

Inflow Area = 23,033 sf, 20.99% Impervious, Inflow Depth > 1.54" for 10-yr event
Inflow = 1.35 cfs @ 12.02 hrs, Volume= 2,957 cf
Outflow = 1.32 cfs @ 12.03 hrs, Volume= 2,953 cf, Atten= 2%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.24 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 2.0 min

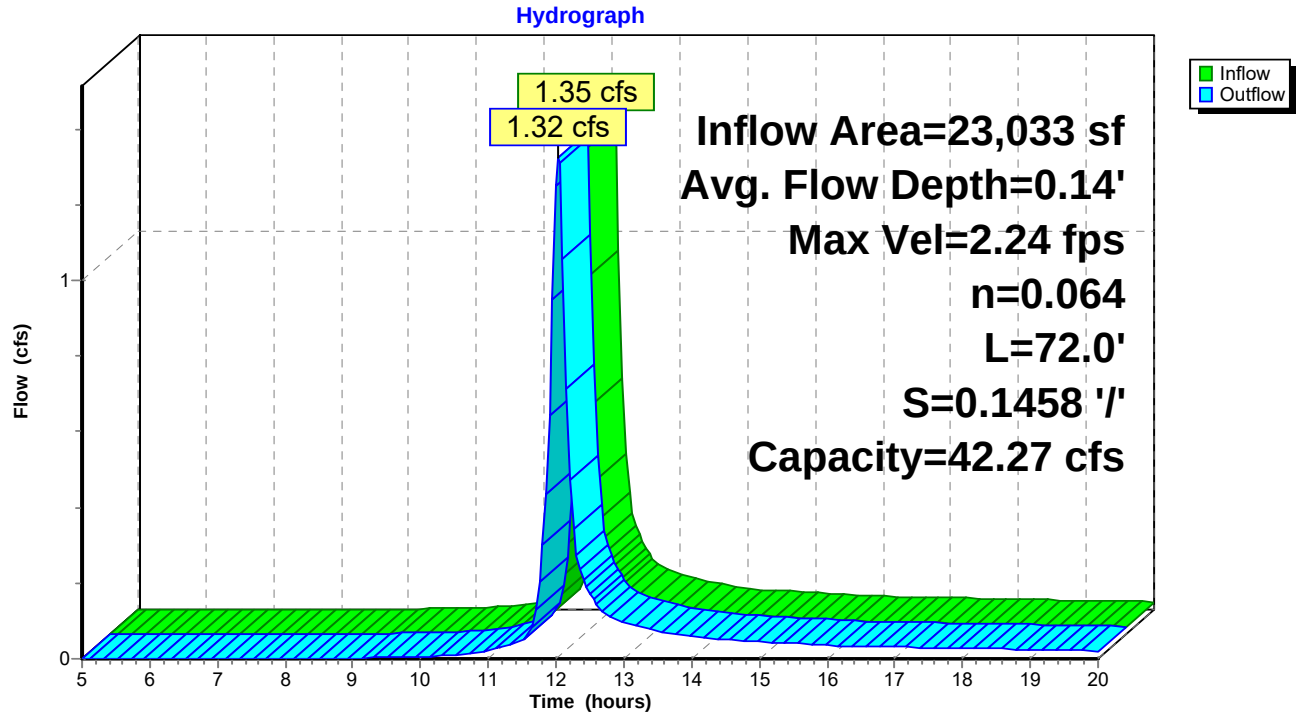
Peak Storage= 43 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 42.27 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 72.0' Slope= 0.1458 '/'
Inlet Invert= 781.00', Outlet Invert= 770.50'

‡



Reach 3R: S6-T5 - REACH C



Summary for Reach 4R: S6-T5 - REACH D

Inflow Area = 28,636 sf, 22.21% Impervious, Inflow Depth > 1.55" for 10-yr event
Inflow = 1.66 cfs @ 12.03 hrs, Volume= 3,704 cf
Outflow = 1.66 cfs @ 12.03 hrs, Volume= 3,704 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.84 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 0.1 min

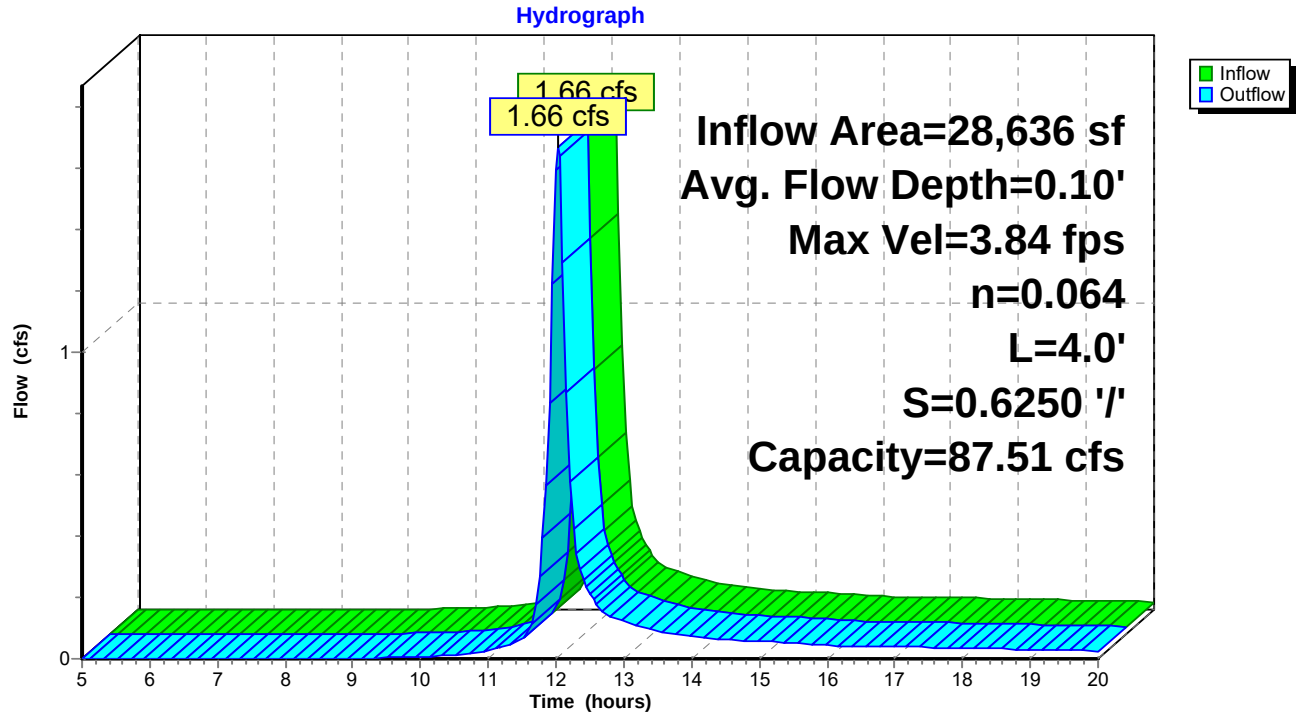
Peak Storage= 2 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 87.51 cfs

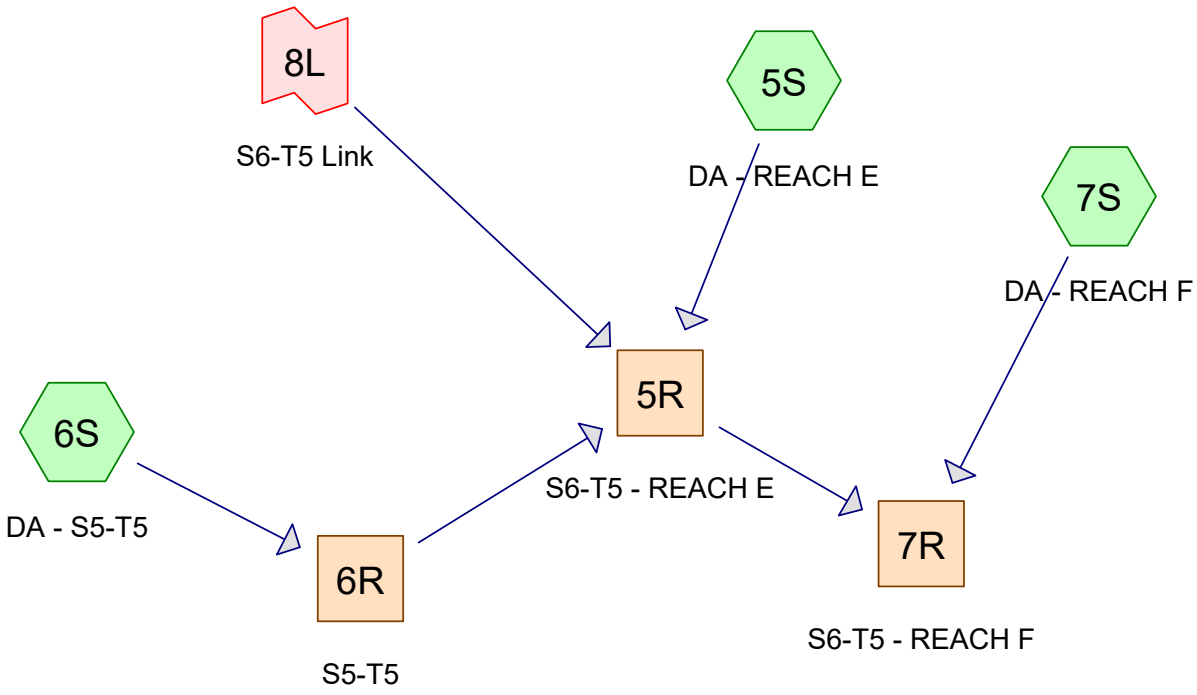
4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 4.0' Slope= 0.6250 '/'
Inlet Invert= 770.50', Outlet Invert= 768.00'

‡



Reach 4R: S6-T5 - REACH D





Subcat Reach Pond Link

Routing Diagram for REL_Laflin_S6-T5 (Reach E-F) AND S5-T5
Prepared by {enter your company name here}, Printed 2/18/2022
HydroCAD® 10.00-20 s/n 09710 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
4,327	98	Impervious (5S, 6S, 7S)
41,356	71	Meadow, non-grazed, HSG C (5S, 6S, 7S)
3,162	78	Meadow, non-grazed, HSG D (6S)
21,654	73	Woods, Fair, HSG C (5S, 6S, 7S)
1,109	79	Woods, Fair, HSG D (6S)
71,608	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
63,010	HSG C	5S, 6S, 7S
4,271	HSG D	6S
4,327	Other	5S, 6S, 7S
71,608		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Numbers
0	0	0	0	4,327	4,327	Impervious	
0	0	41,356	3,162	0	44,518	Meadow, non-grazed	
0	0	21,654	1,109	0	22,763	Woods, Fair	
0	**0**	**63,010**	**4,271**	**4,327**	**71,608**	**TOTAL AREA**	

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

Subcatchment 5S: DA - REACH E Runoff Area=12,174 sf 2.21% Impervious Runoff Depth>1.22"
Flow Length=391' Tc=9.3 min CN=73 Runoff=0.58 cfs 1,234 cf

Subcatchment 6S: DA - S5-T5 Runoff Area=49,978 sf 6.60% Impervious Runoff Depth>1.28"
Flow Length=356' Tc=6.6 min CN=74 Runoff=2.76 cfs 5,328 cf

Subcatchment 7S: DA - REACH F Runoff Area=9,456 sf 8.04% Impervious Runoff Depth>1.27"
Flow Length=557' Tc=15.5 min CN=74 Runoff=0.38 cfs 1,004 cf

Reach 5R: S6-T5 - REACH E Avg. Flow Depth=0.22' Max Vel=5.08 fps Inflow=4.88 cfs 10,263 cf
n=0.064 L=42.0' S=0.4286 '/' Capacity=72.46 cfs Outflow=4.84 cfs 10,260 cf

Reach 6R: S5-T5 Avg. Flow Depth=0.23' Max Vel=2.74 fps Inflow=2.76 cfs 5,328 cf
n=0.064 L=25.0' S=0.1200 '/' Capacity=38.34 cfs Outflow=2.74 cfs 5,325 cf

Reach 7R: S6-T5 - REACH F Avg. Flow Depth=0.28' Max Vel=4.03 fps Inflow=5.14 cfs 11,264 cf
n=0.064 L=30.0' S=0.2000 '/' Capacity=49.50 cfs Outflow=5.11 cfs 11,261 cf

Link 8L: 10-yr Outflow Imported from REL_Laflin_S6-T5 (Reach A-D)~Reach 4R.hce Inflow=1.66 cfs 3,704 cf
Area= 28,636 sf 22.21% Imperv. Primary=1.66 cfs 3,704 cf

Total Runoff Area = 71,608 sf Runoff Volume = 7,566 cf Average Runoff Depth = 1.27"
93.96% Pervious = 67,281 sf 6.04% Impervious = 4,327 sf

Summary for Subcatchment 5S: DA - REACH E

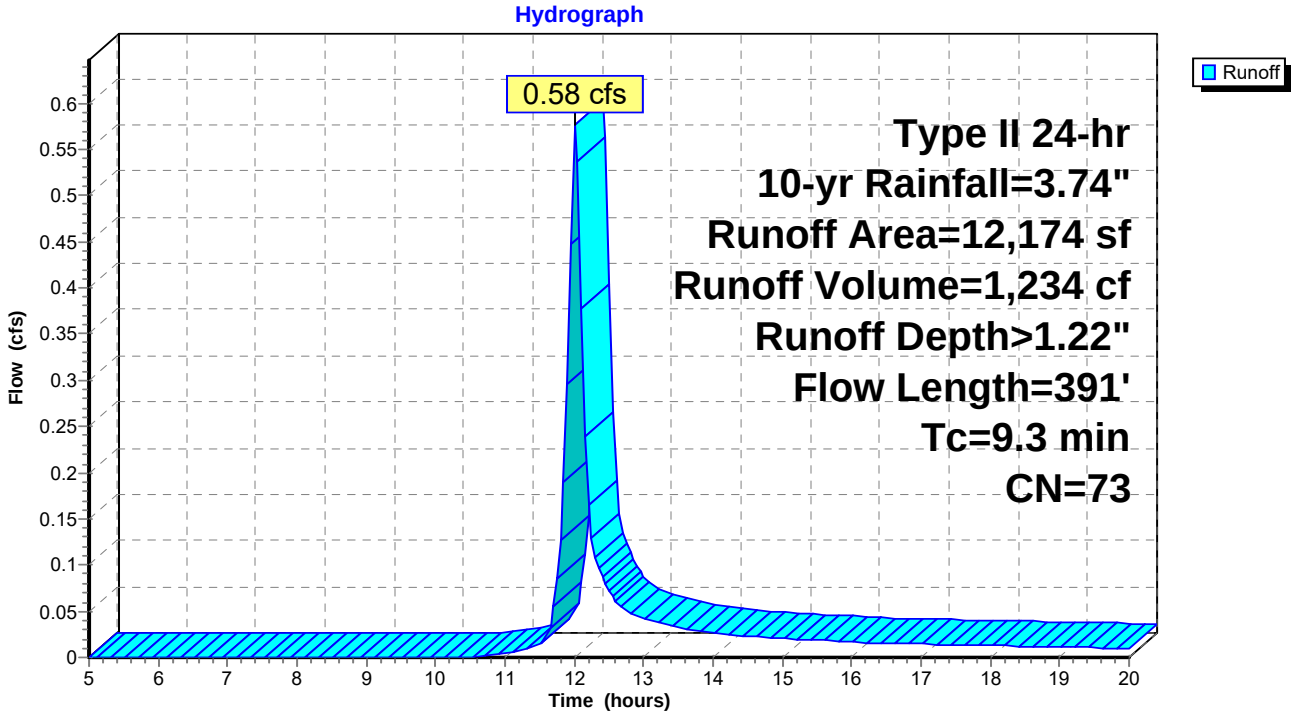
Runoff = 0.58 cfs @ 12.01 hrs, Volume= 1,234 cf, Depth> 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	7,703	73	Woods, Fair, HSG C
	4,202	71	Meadow, non-grazed, HSG C
*	269	98	Impervious
	12,174	73	Weighted Average
	11,905		97.79% Pervious Area
	269		2.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0350	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.6	291	0.2780	8.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.3	391	Total			

Subcatchment 5S: DA - REACH E



Summary for Subcatchment 6S: DA - S5-T5

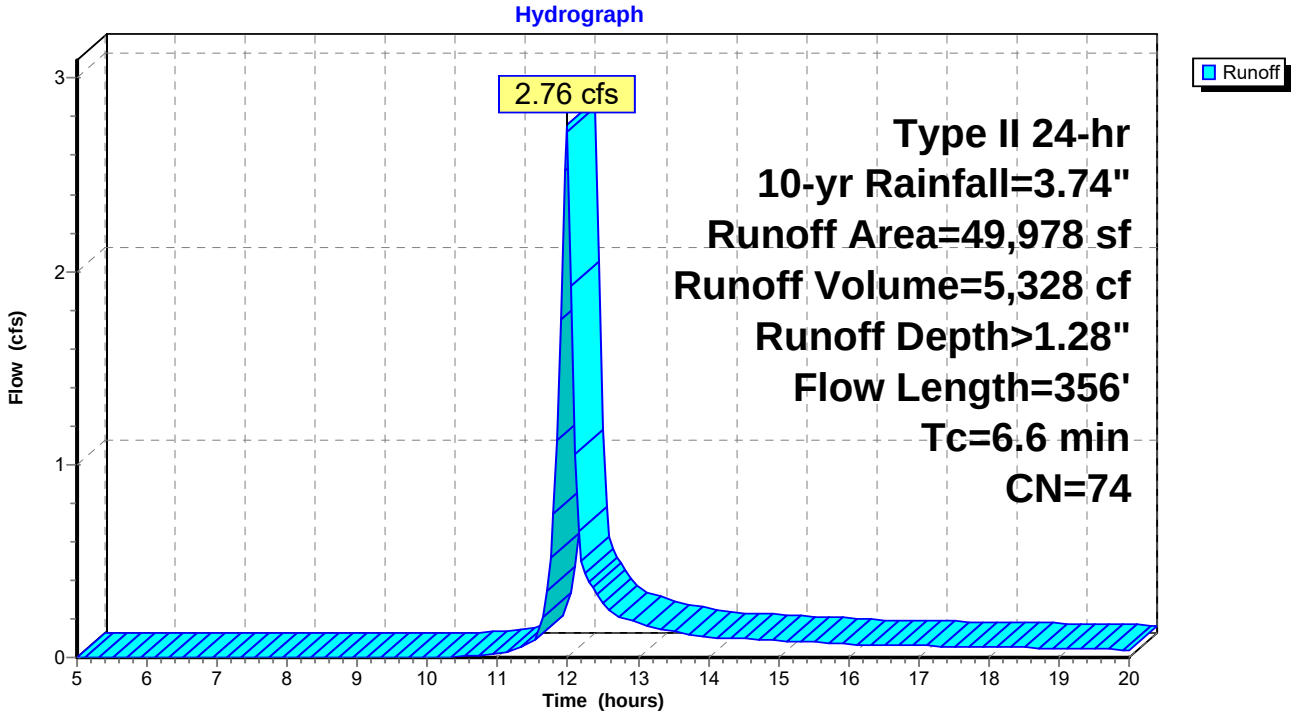
Runoff = 2.76 cfs @ 11.98 hrs, Volume= 5,328 cf, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	12,070	73	Woods, Fair, HSG C
	1,109	79	Woods, Fair, HSG D
	30,339	71	Meadow, non-grazed, HSG C
	3,162	78	Meadow, non-grazed, HSG D
*	3,298	98	Impervious
	49,978	74	Weighted Average
	46,680		93.40% Pervious Area
	3,298		6.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	88	0.0680	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
0.6	268	0.2160	7.48		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.6	356	Total			

Subcatchment 6S: DA - S5-T5



Summary for Subcatchment 7S: DA - REACH F

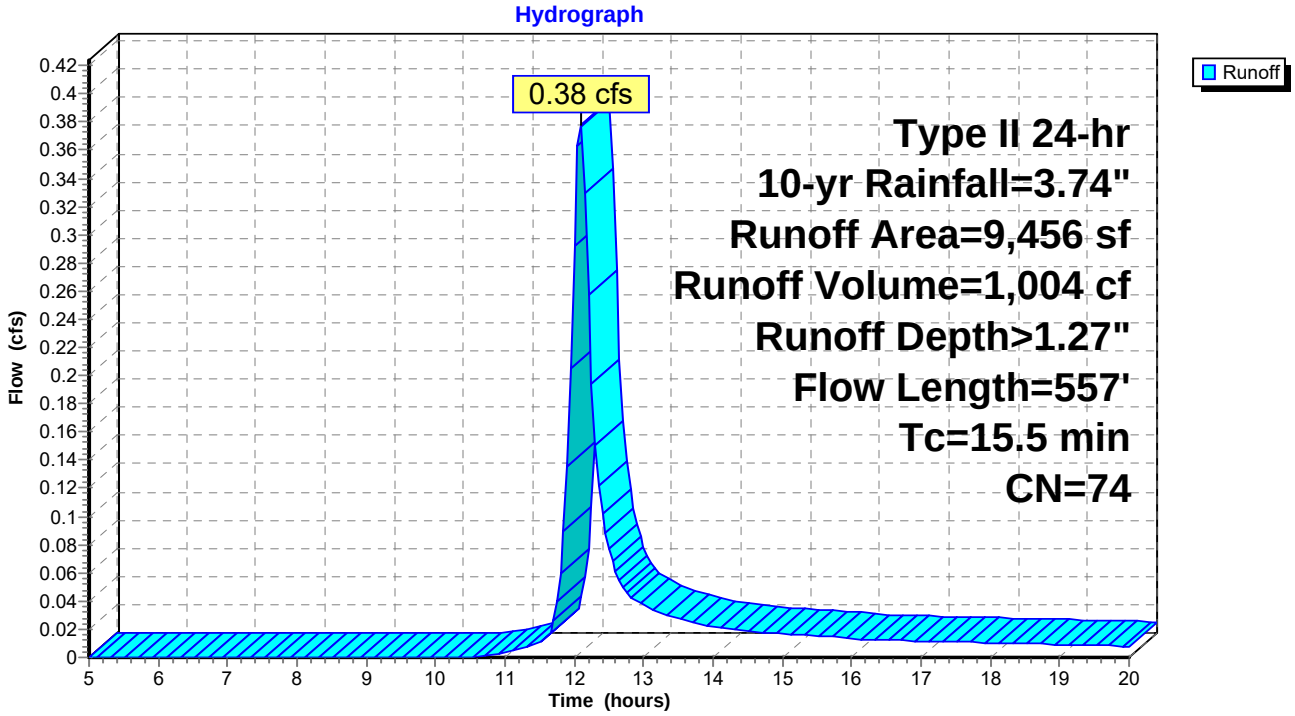
Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,004 cf, Depth> 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (sf)	CN	Description
	1,881	73	Woods, Fair, HSG C
	6,815	71	Meadow, non-grazed, HSG C
*	760	98	Impervious
	9,456	74	Weighted Average
	8,696		91.96% Pervious Area
	760		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.58"
1.1	457	0.1750	6.74		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.5	557	Total			

Subcatchment 7S: DA - REACH F



Summary for Reach 5R: S6-T5 - REACH E

Inflow Area = 90,788 sf, 10.93% Impervious, Inflow Depth > 1.36" for 10-yr event
Inflow = 4.88 cfs @ 12.00 hrs, Volume= 10,263 cf
Outflow = 4.84 cfs @ 12.00 hrs, Volume= 10,260 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.08 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.31 fps, Avg. Travel Time= 0.5 min

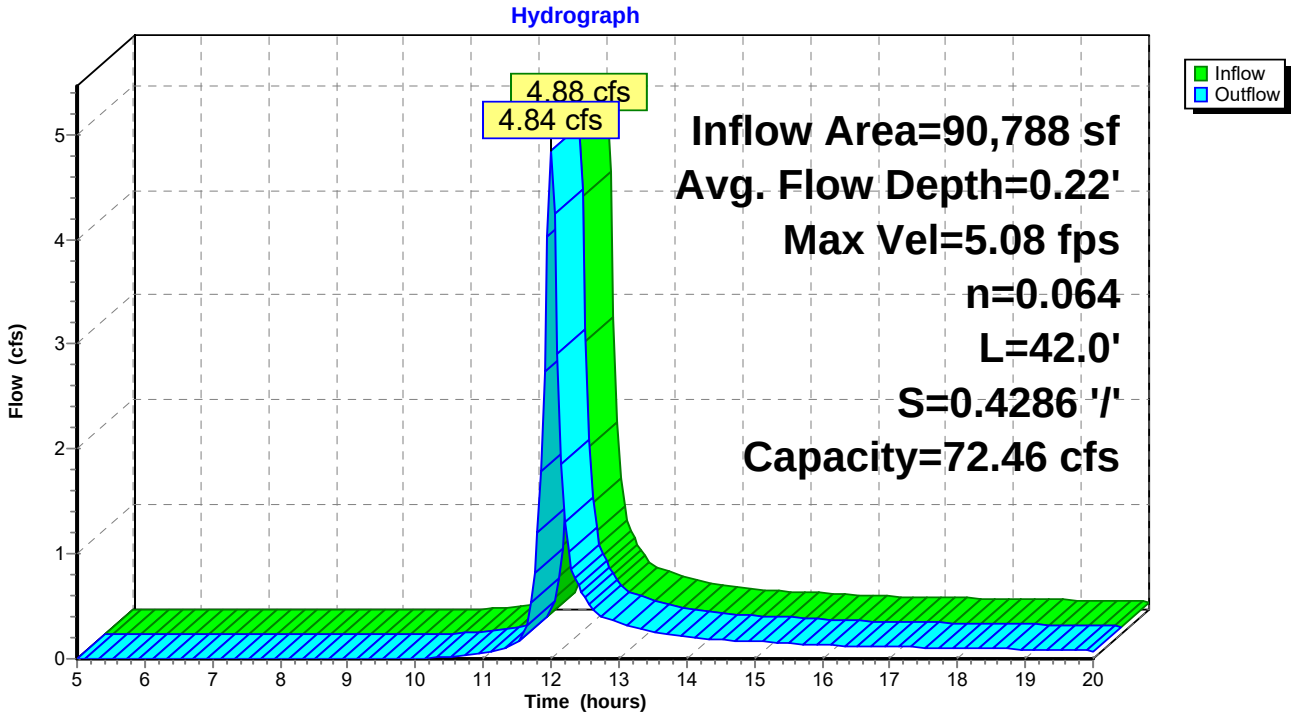
Peak Storage= 40 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 72.46 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 42.0' Slope= 0.4286 '/'
Inlet Invert= 768.00', Outlet Invert= 750.00'



‡

Reach 5R: S6-T5 - REACH E



Summary for Reach 6R: S5-T5

Inflow Area = 49,978 sf, 6.60% Impervious, Inflow Depth > 1.28" for 10-yr event
Inflow = 2.76 cfs @ 11.98 hrs, Volume= 5,328 cf
Outflow = 2.74 cfs @ 11.99 hrs, Volume= 5,325 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.74 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 0.5 min

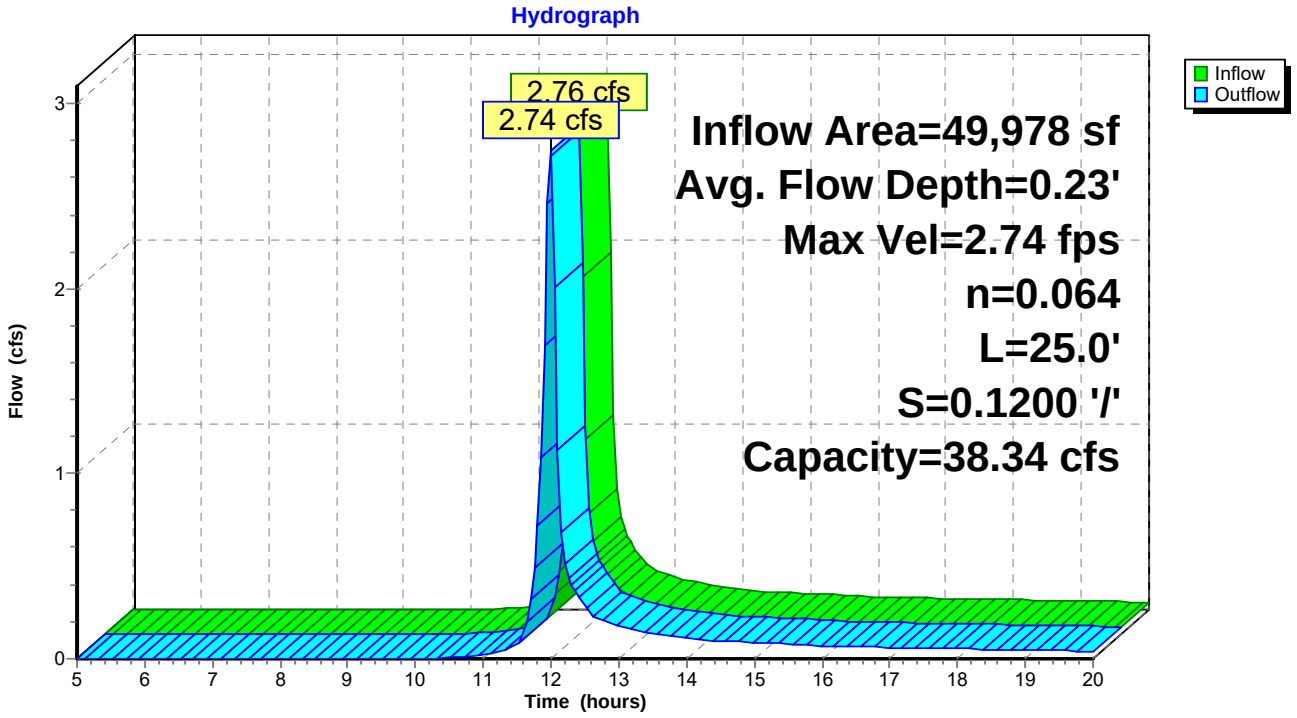
Peak Storage= 25 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 38.34 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 25.0' Slope= 0.1200 '/'
Inlet Invert= 776.00', Outlet Invert= 773.00'



‡

Reach 6R: S5-T5



Summary for Reach 7R: S6-T5 - REACH F

Inflow Area = 100,244 sf, 10.66% Impervious, Inflow Depth > 1.35" for 10-yr event
Inflow = 5.14 cfs @ 12.01 hrs, Volume= 11,264 cf
Outflow = 5.11 cfs @ 12.01 hrs, Volume= 11,261 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.03 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 0.5 min

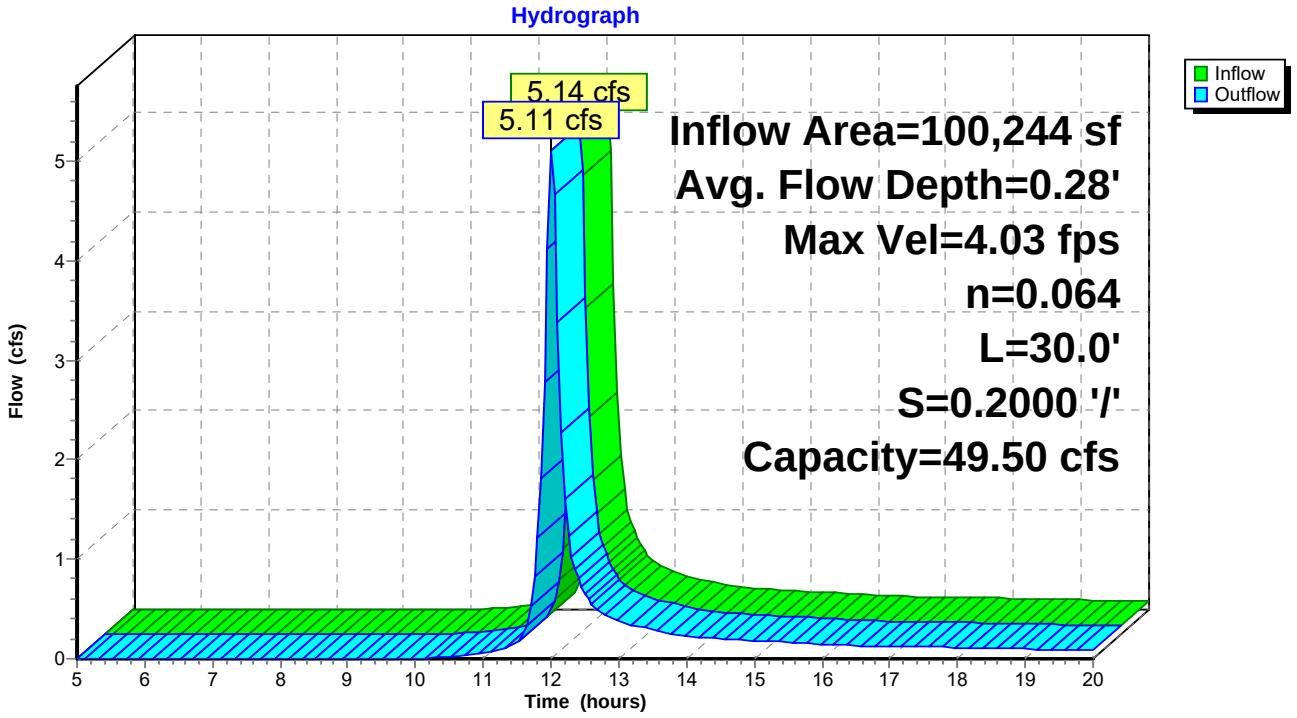
Peak Storage= 38 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 49.50 cfs

4.00' x 1.00' deep channel, n= 0.064
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 30.0' Slope= 0.2000 '/'
Inlet Invert= 750.00', Outlet Invert= 744.00'



‡

Reach 7R: S6-T5 - REACH F



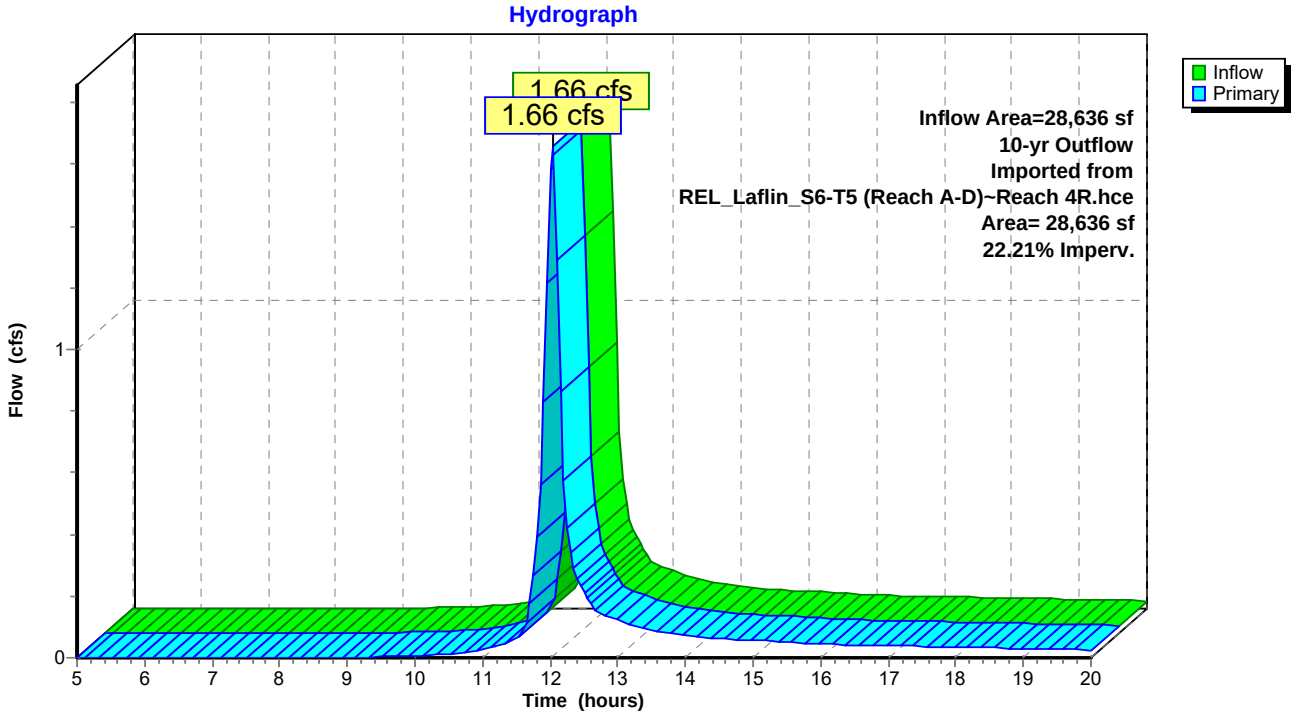
Summary for Link 8L: S6-T5 Link

Inflow Area = 28,636 sf, 22.21% Impervious, Inflow Depth > 1.55" for 10-yr event
Inflow = 1.66 cfs @ 12.03 hrs, Volume= 3,704 cf
Primary = 1.66 cfs @ 12.03 hrs, Volume= 3,704 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

10-yr Outflow Imported from REL_Laflin_S6-T5 (Reach A-D)~Reach 4R.hce

Link 8L: S6-T5 Link

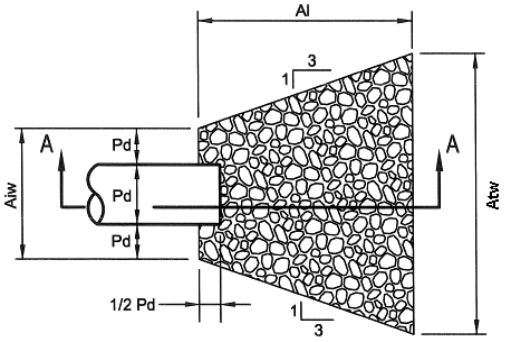


ATTACHMENT 4.24

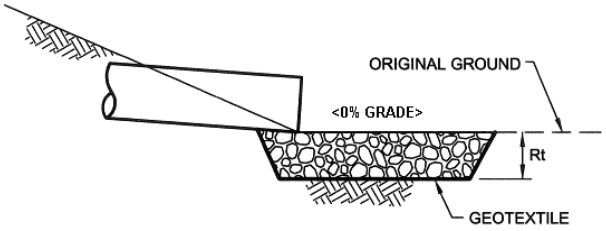
RIPRAP APRON WORKSHEET – MLV-515RA20

STANDARD E&S WORKSHEET # 20
Riprap Apron Outlet Protection

PROJECT NAME: Williams REAE – MLV-515RA20
LOCATION: Luzerne County, PA
PREPARED BY: BM DATE: 07/08/2022
CHECKED BY: PW DATE: 07/08/2022



PLAN VIEW

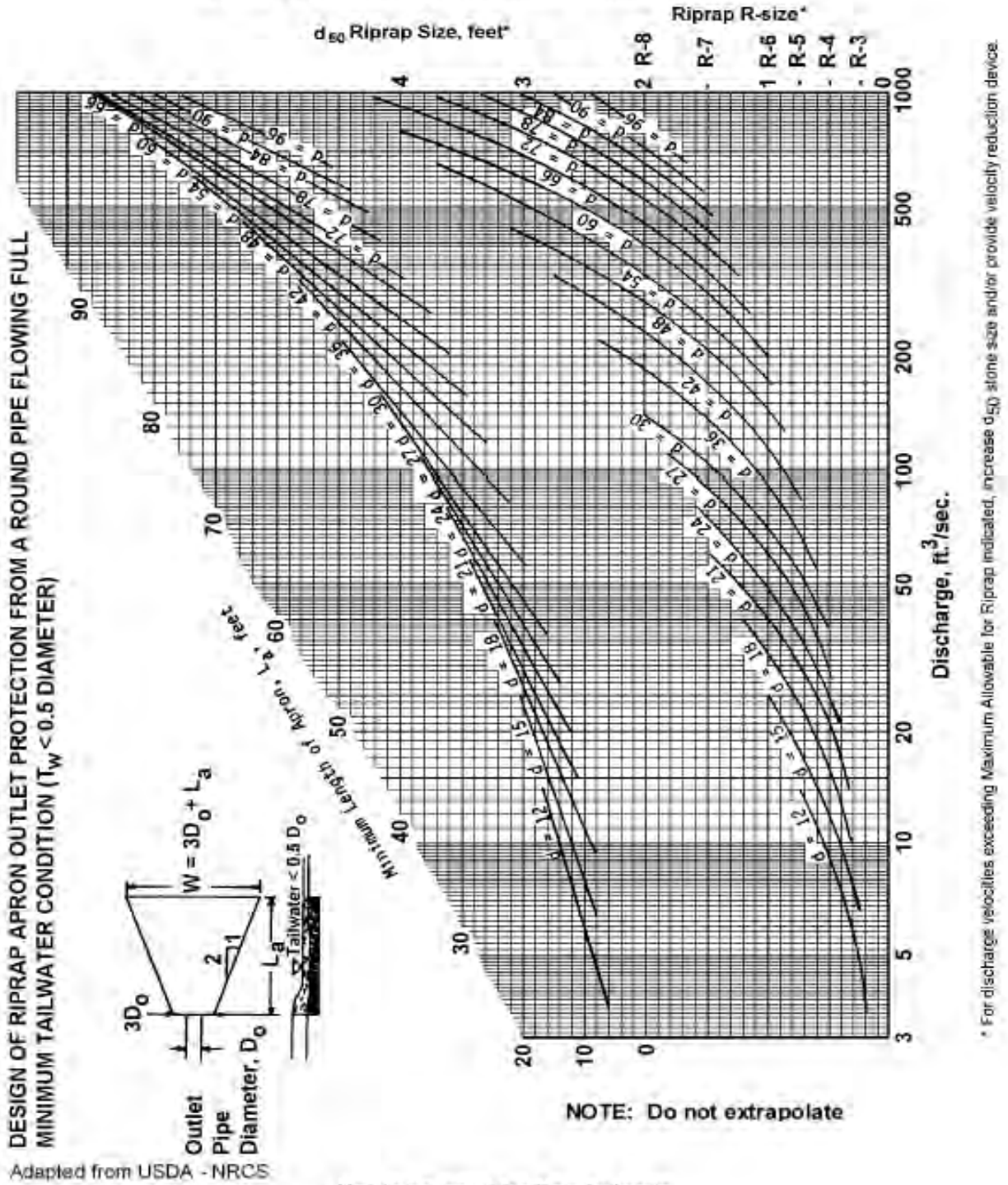


SECTION A - A

NO.	PIPE DIA. Do (in.)	TAIL WATER COND. (Max or Min)	MAN. "n" FOR PIPE	PIPE SLOPE (FT/FT)	Q (CFS)	V* (FPS)	RIPRAP SIZE	Rt (in)	Al (ft)	Aiw (ft)	Atw (ft)
OP1	**REMOVED**										
OP2	42	MIN	0.05	0.024	1.43	2.1	R-3	9	15	10.5	25.5
OP3	72	MIN	0.05	0.049	1.41	2.3	R-3	9	15	18	33
OP4	(10) -3"	MIN	0.01	0.25	2.03	2.91	R-3	9	6	33	39

***:The anticipated velocity (V) should not exceed the maximum permissible shown in Table 6.6 for the proposed riprap protection. Adjust for less than full pipe flow. Use Manning's equation to calculate velocity for pipe slopes ≥ 0.05 ft/ft.**

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

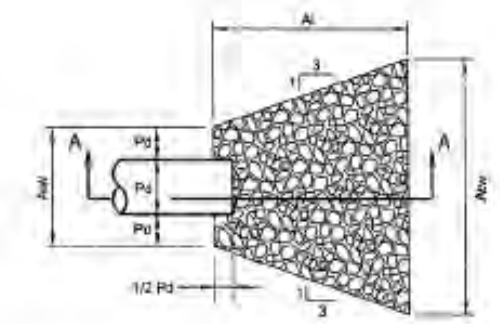
Not to be used for Box Culverts

ATTACHMENT 4.25

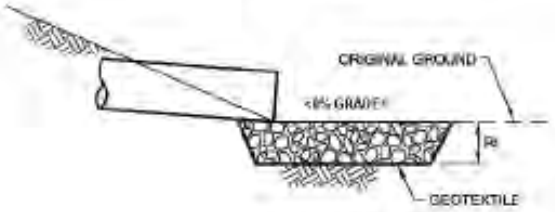
RIPRAP APRON WORKSHEET – LOWER DEMUNDS REL TIE-IN

STANDARD E&S WORKSHEET #20
Riprap Apron Outlet Protection

PROJECT NAME: Williams REAE – Lower Demunds REL Tie-in
LOCATION: Dallas Township, Luzerne County, Pennsylvania
PREPARED BY: CD DATE: 02/2021
CHECKED BY: PW DATE: 02/2022



PLAN VIEW

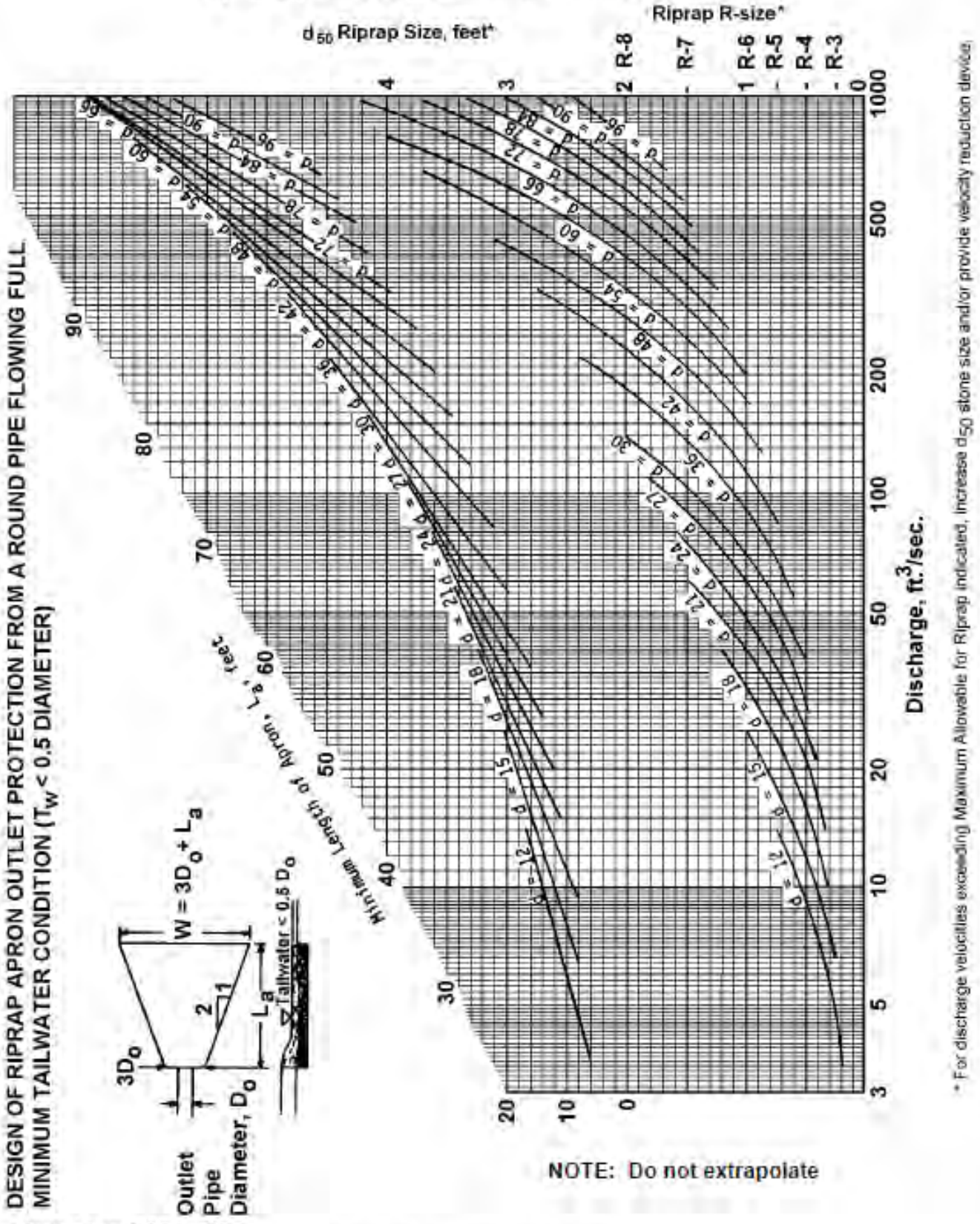


SECTION A - A

Location	Pipe Dia. Do (in)	Tail Water Cond. (Max or Min)	Man. "n" For Pipe	Pipe Slope (ft/ft)	Q (cfs)	V* (fps)	Riprap Size	Rt (in)	Al (ft)	Aiw (ft)	Atw (ft)
Channel D2	12	MIN	0.04	0.02	1.57	2.6	R-3	9	6	3	7
Pad BMP	60	MIN	0.035	0.01	0.31	0.43	R-3	9	6	10	14

*: The anticipated velocity (V) should not exceed the maximum permissible shown in Table 6.6 for the proposed riprap protection. Adjust for less than full pipe flow. Use Manning's equation to calculate velocity for pipe slopes $\geq$ 0.05 ft/ft.

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

ATTACHMENT 4.26

BMP EROSION CONTROL BLANKET REPORT – MLV-515RA20

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

SPILLWAY ANALYSIS

> > > Zenker Berm

Name	Zenker Berm
Discharge	0.05
Peak Flow Period	12
Channel Slope	0.5
Channel Bottom Width	78
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	0.05 cfs	0.27 ft/s	0 ft	0.067	2 lbs/ft2	0.07 lbs/ft2	28.36	STABLE	D
Underlying Substrate	Straight	0.05 cfs	0.27 ft/s	0 ft	0.067	1.47 lbs/ft2	0.07 lbs/ft2	20.78	STABLE	D

Unreinforced Vegetation - Class C - Sod Former - Good 65-79%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	0.05 cfs	0.2 ft/s	0 ft	0.117	4 lbs/ft2	0.1 lbs/ft2	39.35	STABLE	--
Underlying Substrate	Straight	0.05 cfs	0.2 ft/s	0 ft	0.117	17.95 lbs/ft2	0.1 lbs/ft2	176.56	STABLE	--

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CHANNEL ANALYSIS

> > > ZEN-CC-C1

Name	ZEN-CC-C1
Discharge	1.43
Channel Slope	0.024
Channel Bottom Width	1
Left Side Slope	1
Right Side Slope	1
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	1.43 cfs	2.05 ft/s	0.47 ft	0.05	2 lbs/ft2	0.71 lbs/ft2	2.83	STABLE	D
Underlying Substrate	Straight	1.43 cfs	2.05 ft/s	0.47 ft	0.05	1.47 lbs/ft2	0.45 lbs/ft2	3.29	STABLE	D

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	1.43 cfs	2.05 ft/s	0.47 ft	0.05	4 lbs/ft2	0.71 lbs/ft2	5.66	STABLE	--
Underlying Substrate	Straight	1.43 cfs	2.05 ft/s	0.47 ft	0.05	4 lbs/ft2	0.45 lbs/ft2	8.97	STABLE	--

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CHANNEL ANALYSIS

> > > ZEN-CC-C2

Name	ZEN-CC-C2
Discharge	1.41
Channel Slope	0.049
Channel Bottom Width	2
Left Side Slope	2
Right Side Slope	2
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	1.41 cfs	2.25 ft/s	0.25 ft	0.05	2 lbs/ft2	0.76 lbs/ft2	2.62	STABLE	D
Underlying Substrate	Straight	1.41 cfs	2.25 ft/s	0.25 ft	0.05	1.47 lbs/ft2	0.61 lbs/ft2	2.39	STABLE	D

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	1.41 cfs	2.25 ft/s	0.25 ft	0.05	4 lbs/ft2	0.76 lbs/ft2	5.24	STABLE	--
Underlying Substrate	Straight	1.41 cfs	2.25 ft/s	0.25 ft	0.05	4 lbs/ft2	0.61 lbs/ft2	6.53	STABLE	--

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CHANNEL ANALYSIS

> > > ZEN-DC-D1

Name	ZEN-DC-D1
Discharge	0.66
Channel Slope	0.009
Channel Bottom Width	1
Left Side Slope	1
Right Side Slope	1
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	0.66 cfs	1.16 ft/s	0.4 ft	0.05	2 lbs/ft2	0.23 lbs/ft2	8.81	STABLE	D
Underlying Substrate	Straight	0.66 cfs	1.16 ft/s	0.4 ft	0.05	1.47 lbs/ft2	0.15 lbs/ft2	9.85	STABLE	D

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	0.66 cfs	1.16 ft/s	0.4 ft	0.05	4 lbs/ft2	0.23 lbs/ft2	17.62	STABLE	--
Underlying Substrate	Straight	0.66 cfs	1.16 ft/s	0.4 ft	0.05	4 lbs/ft2	0.15 lbs/ft2	26.89	STABLE	--

ATTACHMENT 4.27

BMP EROSION CONTROL BLANKET REPORT – MLV-515RA30

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Poseyville, Indiana 47633
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www.nagreen.com
ECMDS v7.0

SPILLWAY ANALYSIS

> > > MLV-515RA30 Berm

Name	MLV-515RA30 Berm
Discharge	0.1
Peak Flow Period	12
Channel Slope	0.333
Channel Bottom Width	154
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	0.1 cfs	0.24 ft/s	0 ft	0.071	2 lbs/ft2	0.06 lbs/ft2	35.21	STABLE	D
Underlying Substrate	Straight	0.1 cfs	0.24 ft/s	0 ft	0.071	1.47 lbs/ft2	0.06 lbs/ft2	25.79	STABLE	D

Unreinforced Vegetation - Class C - Sod Former - Good 65-79%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	0.1 cfs	0.17 ft/s	0 ft	0.128	4 lbs/ft2	0.08 lbs/ft2	49.28	STABLE	--
Underlying Substrate	Straight	0.1 cfs	0.17 ft/s	0 ft	0.128	21.49 lbs/ft2	0.08 lbs/ft2	264.78	STABLE	--

Please note there is 0.00cfs over topping the berm up to the 100-yr storm.
0.1cfs was used as NAG will not run a value of 0.

ATTACHMENT 4.28

BMP EROSION CONTROL BLANKET REPORT – CARVERTON TIE-IN

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

SPILLWAY ANALYSIS

> > > Carverton Berm

Name	Carverton Berm
Discharge	2.24
Peak Flow Period	11.96
Channel Slope	0.5
Channel Bottom Width	15
Low Flow Liner	
Retardence Class	C 6-12 in
Vegetation Type	Sod Former
Vegetation Density	Good 65-79%
Soil Type	Silt Loam (SM)

SC150BN

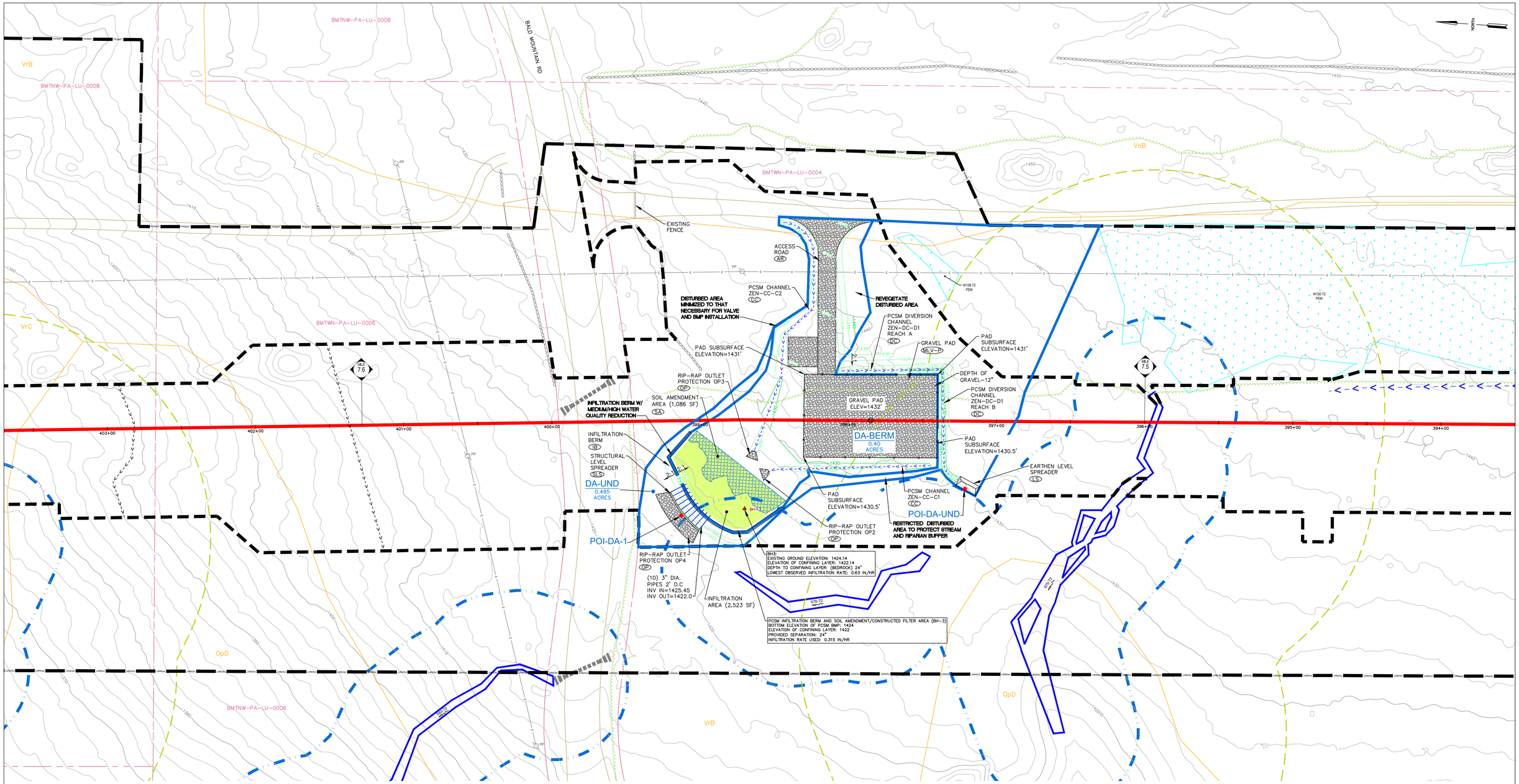
Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC150BN Unvegetated	Straight	2.24 cfs	3.77 ft/s	0.04 ft	0.032	2 lbs/ft2	1.23 lbs/ft2	1.62	STABLE	D
Underlying Substrate	Straight	2.24 cfs	3.77 ft/s	0.04 ft	0.032	1.47 lbs/ft2	1.23 lbs/ft2	1.19	STABLE	D

Unreinforced Vegetation - Class C - Sod Former - Good 65-79%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	2.24 cfs	3.28 ft/s	0.05 ft	0.041	4 lbs/ft2	1.42 lbs/ft2	2.81	STABLE	--
Underlying Substrate	Straight	2.24 cfs	3.28 ft/s	0.05 ft	0.041	2.18 lbs/ft2	1.41 lbs/ft2	1.54	STABLE	--

ATTACHMENT 5

NON-STRUCTURAL AND STRUCTURAL WATER QUALITY BMPS MAP



LEGEND

- PROPERTY LINE
- EXISTING RIGHT-OF-WAY
- ESCP PERMIT BOUNDARY
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXISTING STONE ROW
- EXISTING STRUCTURE
- EXISTING EDGE OF ROAD
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING WATERBAR AND OUTLET STRUCTURE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- EXISTING LEIDY / TGPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- EXISTING WELL
- PROPOSED CONSTRUCTION FENCE
- PROPOSED PIPELINE
- PROPOSED PIPELINE GROUNDBED
- GEOHAZARD ALONG PIPELINE
- PROPOSED WATERBAR AND OUTLET STRUCTURE
- PROPOSED CHANNEL AND DIVERSION CHANNEL
- PROPOSED FENCE
- PROPOSED GRAVEL
- PROPOSED GRADE MAJOR CONTOURS (10' C.I.)
- PROPOSED GRADE MINOR CONTOURS (2' C.I.)
- POST-CONSTRUCTION DRAINAGE AREA
- PROPOSED INFILTRATION AREA
- TEST PIT/INFILTRATION TEST LOCATION
- PROPOSED SOIL AMENDMENT AREA/ CONSTRUCTED FILTER AREA

SOIL LEGEND

LcD LACKAWANNA CHANNERY SILT LOAM, 8 TO 25 PERCENT SLOPES, EXTREMELY STONY
OpD OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 8 TO 25 PERCENT SLOPES
VoB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES
VoC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES
VrB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY
VrC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES, EXTREMELY STONY

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" =30'

BAM GROUP
WHM consulting, LLC

PATRICK A. WOZNISKI, P.E.
COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER PATRICK A. WOZNISKI PE078243
PENNSYLVANIA PROFESSIONAL ENGINEER

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
1	06/29/21	RHM	REVISED PER PADEP COMMENTS.			
2	03/01/22	RHM	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			
3	07/08/22	RHM	RESPONSE TO PADEP JUNE 2022 TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA20
POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

ATTACHMENT 5 WATER QUALITY BMP'S MAP

BEAR CREEK TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: AS NOTED		
CHECKED BY: RJN	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:		
APPROVED BY: PW	DATE: 03/31/21			SHEET	1
WO: 1222636	RID: 209	DRAWING NUMBER: 26-1000-70-28-D		OF	1

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Attachment 5

5.1 MLV-515RA20 Water Quality BMP Map

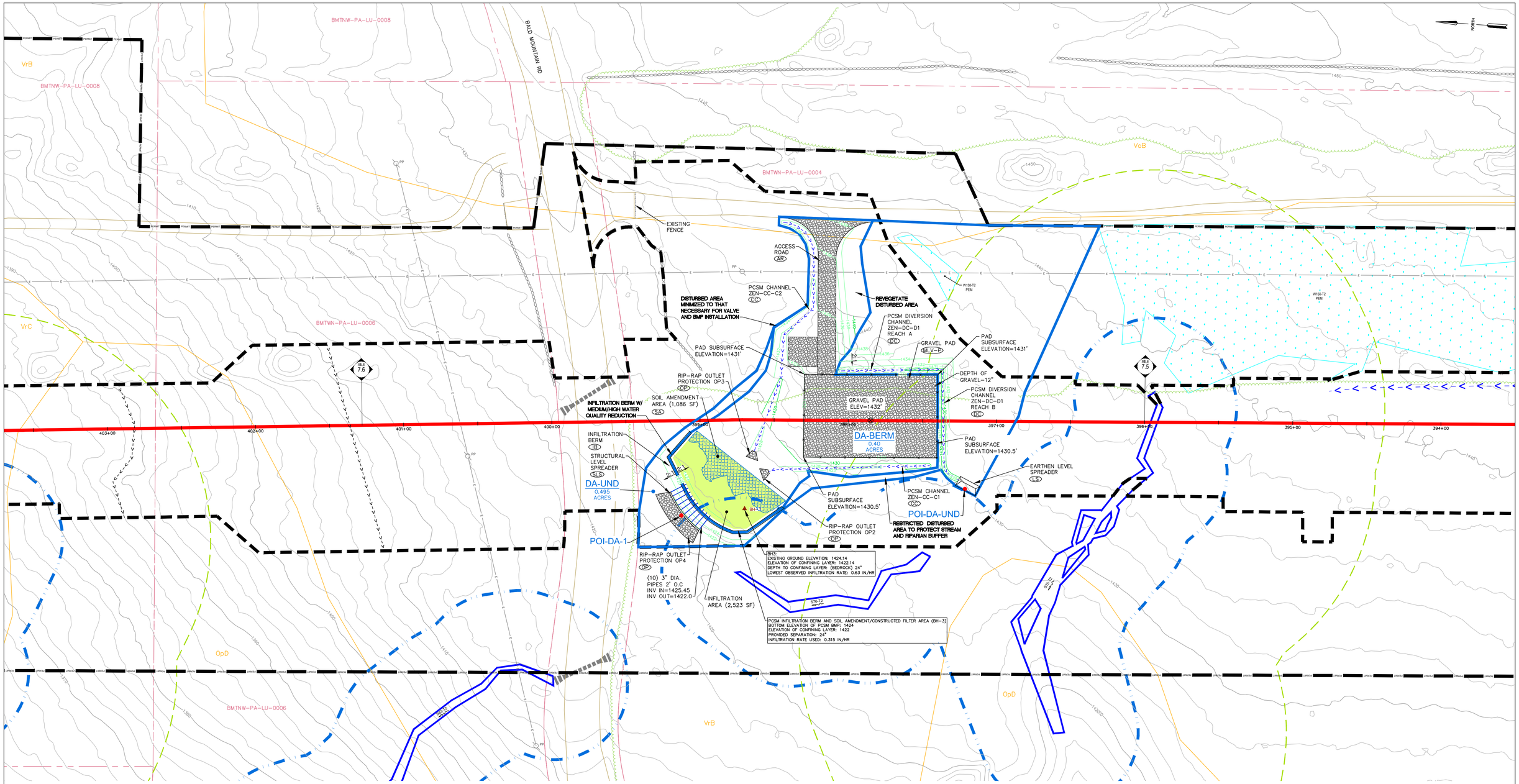
5.2 MLV-515RA30 Water Quality BMP Map

5.3 Carverton Tie-in Water Quality BMP Map

5.4 Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40 Water Quality BMP Map

ATTACHMENT 5.1

MLV-515RA20
WATER QUALITY BMP MAP



LEGEND

- PROPERTY LINE
- EXISTING RIGHT-OF-WAY
- ESCP PERMIT BOUNDARY
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXISTING STONE ROW
- EXISTING STRUCTURE
- EXISTING EDGE OF ROAD
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING WATERBAR AND OUTLET STRUCTURE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- EXISTING LEIDY / TGPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- EXISTING WELL
- PROPOSED CONSTRUCTION FENCE
- PROPOSED PIPELINE
- PROPOSED PIPELINE GROUNDBED
- GEOHAZARD ALONG PIPELINE
- PROPOSED WATERBAR AND OUTLET STRUCTURE
- PROPOSED CHANNEL AND DIVERSION CHANNEL
- PROPOSED FENCE
- PROPOSED GRAVEL
- PROPOSED GRADE MAJOR CONTOURS (10' C.I.)
- PROPOSED GRADE MINOR CONTOURS (2' C.I.)
- POST-CONSTRUCTION DRAINAGE AREA
- PROPOSED INFILTRATION AREA
- TEST PIT/INFILTRATION TEST LOCATION
- PROPOSED SOIL AMENDMENT AREA/ CONSTRUCTED FILTER AREA

SOIL LEGEND

LcD LACKAWANNA CHANNERY SILT LOAM, 8 TO 25 PERCENT SLOPES, EXTREMELY STONY
OpD OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 8 TO 25 PERCENT SLOPES
VoB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES
VoC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES
VrB VOLUSIA CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY
VrC VOLUSIA CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES, EXTREMELY STONY

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
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SCALE
30 15 0 30
SCALE 1" =30'

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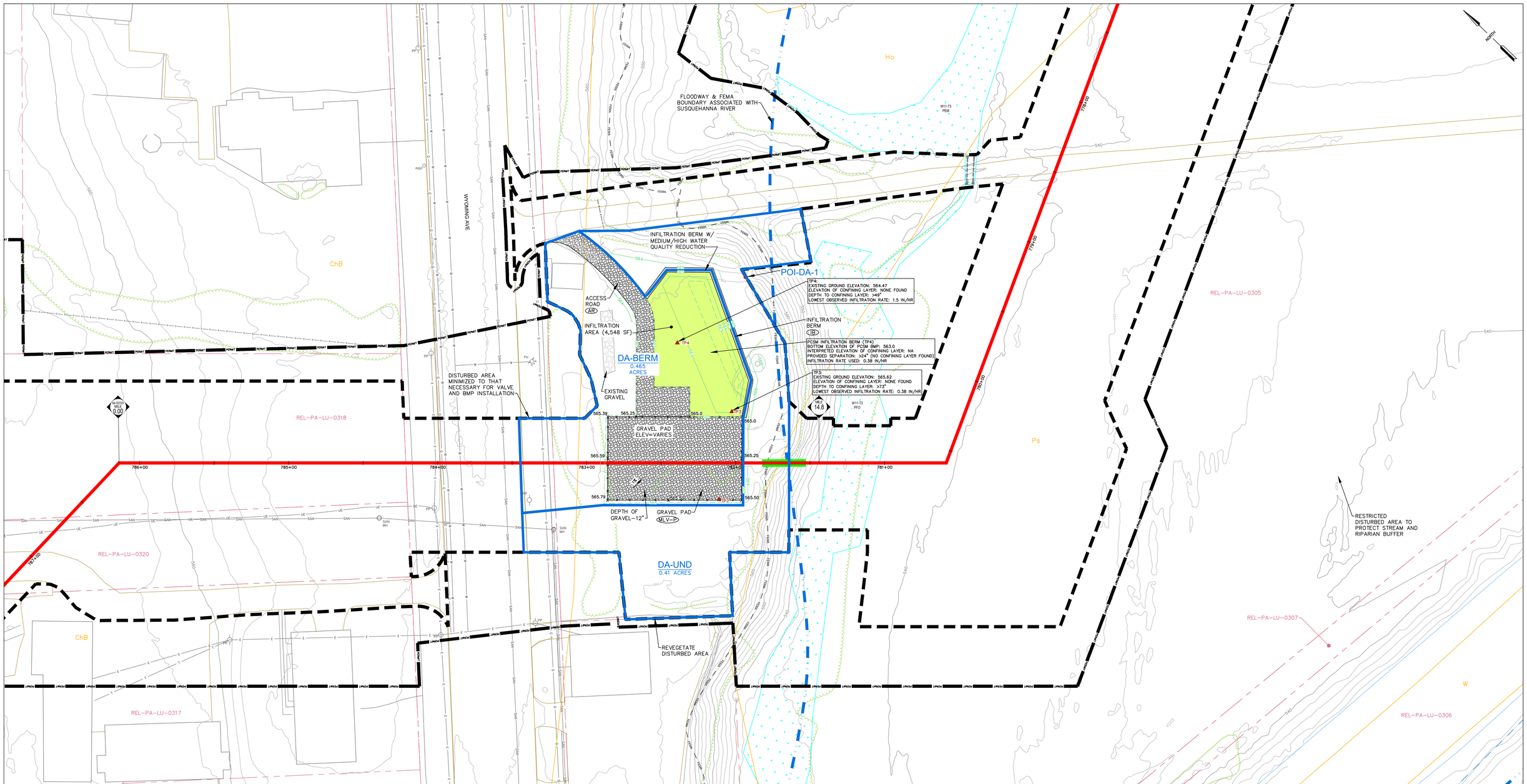
ATTACHMENT 5 WATER QUALITY BMP'S MAP

BEAR CREEK TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

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CHECKED BY: RJN	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:		
APPROVED BY: PW	DATE: 03/31/21			SHEET	1
WO: 1222636	RID: 209	DRAWING NUMBER: 26-1000-70-28-D		OF	1

ATTACHMENT 5.2

MLV-515RA30
WATER QUALITY BMP MAP



LEGEND

- PROPERTY LINE
- EXISTING RIGHT-OF-WAY
- ESCP PERMIT BOUNDARY
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXISTING STONE ROW
- EXISTING STRUCTURE
- EXISTING EDGE OF ROAD
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING WATERBAR AND OUTLET STRUCTURE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- EXISTING LEIDY / TGPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
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- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- EXISTING WELL
- PROPOSED CONSTRUCTION FENCE
- PROPOSED PIPELINE
- PROPOSED PIPELINE GROUNDBED
- GEOHAZARD ALONG PIPELINE
- PROPOSED WATERBAR AND OUTLET STRUCTURE
- PROPOSED CHANNEL AND DIVERSION CHANNEL
- PROPOSED FENCE
- PROPOSED GRAVEL
- PROPOSED GRADE MAJOR CONTOURS (10' C.I.)
- PROPOSED GRADE MINOR CONTOURS (2' C.I.)
- POST-CONSTRUCTION DRAINAGE AREA
- PROPOSED INFILTRATION AREA
- TEST PIT/INFILTRATION TEST LOCATION
- PAD SPOT ELEVATION
- SUBGRADE SPOT ELEVATION

SOIL LEGEND

ChB CHENANGO GRAVELLY LOAM, 3 TO 8 PERCENT SLOPES
Ho HOLLY SILT LOAM
Ps POPE SOILS
W WATER

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
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5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

BAI GROUP

WHM consulting, INC. designs, permits, resolutions

PATRICK A. WOZINSKI, P.E.

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL PATRICK A. WOZINSKI ENGINEER PE076243

PENNSYLVANIA PROFESSIONAL ENGINEER

REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
1	06/29/21	RHM	REVISED PER PADEP COMMENTS.			
2	03/01/22	RHM	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA30
POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

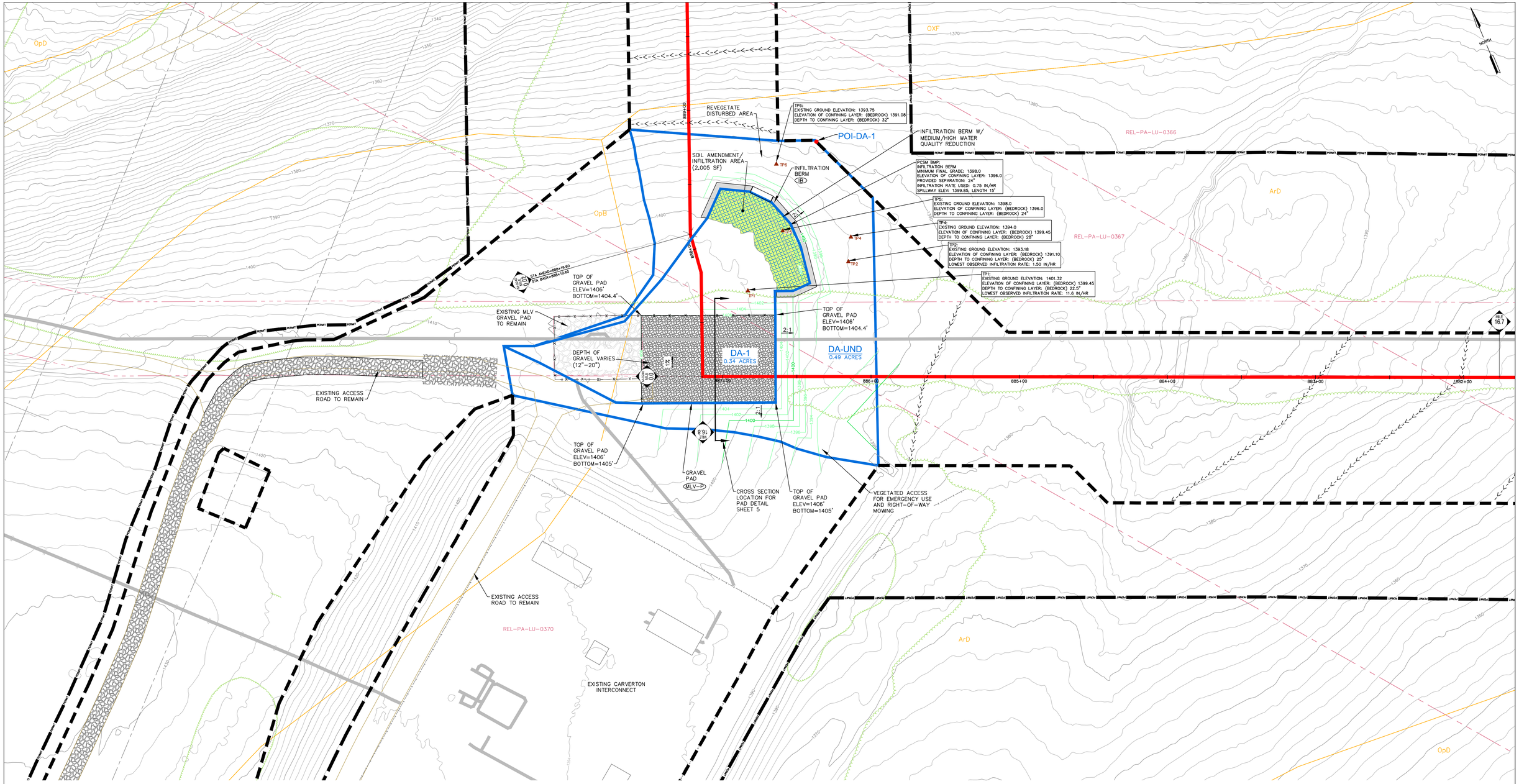
ATTACHMENT 5 WATER QUALITY BMP'S MAP

WYOMING BOROUGH, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY: RJN	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:
APPROVED BY: PW	DATE: 03/31/21		SHEET 1
WO: 1222636	RID: 209	DRAWING NUMBER: 26-1000-70-28-D	OF 1

ATTACHMENT 5.3

CARVERTON TIE-IN
WATER QUALITY BMP MAP



LEGEND

- PROPERTY LINE
- EXISTING RIGHT-OF-WAY
- ESCP PERMIT BOUNDARY
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXISTING STONE ROW
- EXISTING STRUCTURE
- EXISTING EDGE OF ROAD
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING WATERBAR AND OUTLET STRUCTURE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- EXISTING LEIDY / TOPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- EXISTING WELL
- PROPOSED CONSTRUCTION FENCE
- PROPOSED PIPELINE
- PROPOSED PIPELINE GROUNDBED
- GEOHAZARD ALONG PIPELINE
- PROPOSED WATERBAR AND OUTLET STRUCTURE
- PROPOSED CHANNEL AND DIVERSION CHANNEL
- PROPOSED FENCE
- PROPOSED GRAVEL
- PROPOSED GRADE MAJOR CONTOURS (10' C.I.)
- PROPOSED GRADE MINOR CONTOURS (2' C.I.)
- POST-CONSTRUCTION DRAINAGE AREA
- PROPOSED INFILTRATION AREA
- TEST PIT/INFILTRATION TEST LOCATION
- PROPOSED SOIL AMENDMENT AREA/ CONSTRUCTED FILTER AREA

SOIL LEGEND

ArD ARNOT-ROCK OUTCROP COMPLEX, 8 TO 25 PERCENT SLOPES
OpB OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 3 TO 8 PERCENT SLOPES
OpD OQUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, 8 TO 25 PERCENT SLOPES
OXF OPUAGA AND LORDSTOWN EXTREMELY STONY SILT LOAMS, STEEP

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" =30'

BA GROUP
WHM consulting, LLC

PATRICK A. WOZINSKI, P.E.
COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL PATRICK A. WOZINSKI ENGINEER PE076243
PENNSYLVANIA PROFESSIONAL ENGINEER

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
CARVERTON TIE-IN
POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

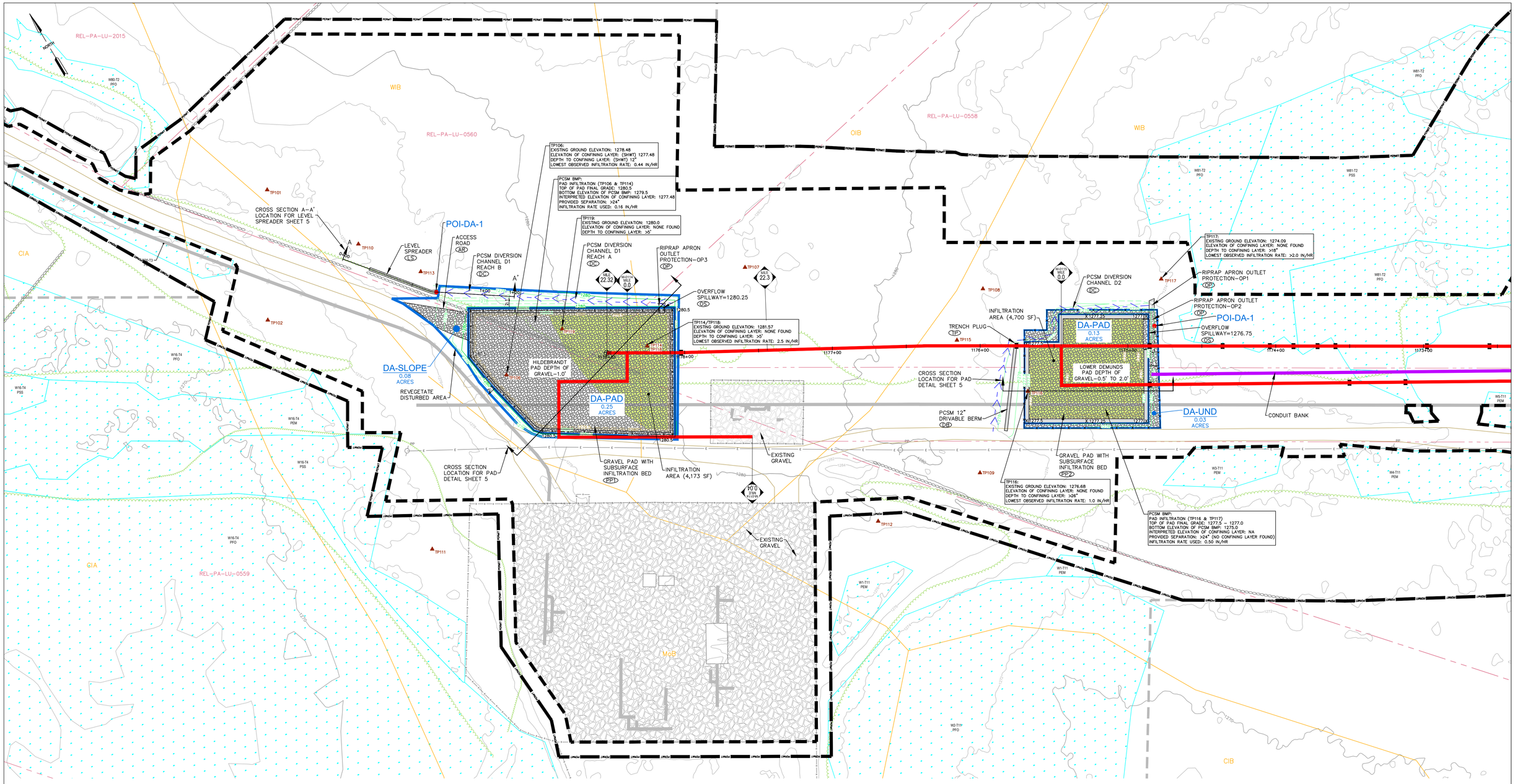
ATTACHMENT 5 WATER QUALITY BMP'S MAP

WEST WYOMING BOROUGH, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY: RJN	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:
APPROVED BY: PW	DATE: 03/31/21		SHEET 1
WO: 123278	RID: 305	DRAWING NUMBER: 26-1000-70-28-D	OF 1

ATTACHMENT 5.4

LOWER DEMUNDS REL TIE-IN AND
HILDEBRANDT TIE-IN/MLV-515RA40
WATER QUALITY BMP MAP



LEGEND

- PROPERTY LINE
- EXISTING RIGHT-OF-WAY
- ESCP PERMIT BOUNDARY
- LIMITS OF DISTURBANCE
- EXISTING FENCE
- EXISTING STONE ROW
- EXISTING STRUCTURE
- EXISTING EDGE OF ROAD
- EXISTING GRADE MAJOR CONTOURS (10' C.I.)
- EXISTING GRADE MINOR CONTOURS (2' C.I.)
- EXISTING WATERBAR AND OUTLET STRUCTURE
- APPROX. ENVIRONMENTAL STUDY LIMITS
- DELINEATED WETLAND
- DELINEATED WATERWAY / STREAM (TOP OF BANK)
- STREAM FLOW DIRECTION
- RIPARIAN BUFFER
- 50'/FEMA FLOODWAY
- FEMA 100-YEAR FLOODPLAIN
- SOIL BOUNDARY / TYPE
- EXISTING TREELINE / TREE/SHRUB
- EXISTING LEIDY / TGPL PIPELINES
- EXISTING FOREIGN PIPELINES
- EXISTING UTILITY POLE / TOWER
- EXISTING VALVE
- EXISTING CULVERT
- EXISTING ELECTRIC LINE
- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING SANITARY LINE
- EXISTING STORM SEWER
- EXISTING TELEPHONE LINE
- EXISTING FIBER OPTIC LINE
- EXISTING UNDERGROUND CABLE LINE
- EXISTING STORM INLET
- EXISTING SANITARY MANHOLE
- EXISTING COMMUNICATION/ELECTRIC MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING POWER POLE
- EXISTING WELL
- PROPOSED CONSTRUCTION FENCE
- PROPOSED PIPELINE
- PROPOSED PIPELINE GROUNDBED
- GEOHAZARD ALONG PIPELINE
- PROPOSED WATERBAR AND OUTLET STRUCTURE
- PROPOSED CHANNEL AND DIVERSION CHANNEL
- PROPOSED FENCE
- PROPOSED GRAVEL
- PROPOSED GRADE MAJOR CONTOURS (10' C.I.)
- PROPOSED GRADE MINOR CONTOURS (2' C.I.)
- POST-CONSTRUCTION DRAINAGE AREA
- PROPOSED INFILTRATION AREA
- TEST PIT/INFILTRATION TEST LOCATION

SOIL LEGEND

CIA CHIPPEWA SILT LOAM, 0 TO 3 PERCENT SLOPES
MoB MORRIS CHANNERY SILT LOAM, 0 TO 8 PERCENT SLOPES
OIB OPUAGA AND LORDSTOWN CHANNERY SILT LOAMS, 3 TO 8 PERCENT SLOPES
WIB WELLSBORO CHANNERY SILT LOAM, 3 TO 8 PERCENT SLOPES
WIC WELLSBORO CHANNERY SILT LOAM, 8 TO 15 PERCENT SLOPES
WID WELLSBORO CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES

EXISTING CONDITION NOTES/SOURCES

1. EXISTING ROADWAYS, CONTOURS, PROPERTY LINE, TREE LINE, ETC. ARE DERIVED FROM A FIELD SURVEY PERFORMED BY TRANSCO BETWEEN 2019 AND 2020.
2. PROPERTY BOUNDARIES BASED EITHER ON TAX PARCEL INFORMATION PROVIDED BY TRANSCO OR A COMBINATION OF DEED REFERENCE AND FIELD LOCATED EVIDENCE. PROPERTY BOUNDARY LOCATIONS BASED ON TAX PARCEL INFORMATION ARE APPROXIMATE.
3. PIPELINE ALIGNMENTS AND LIMITS OF DISTURBANCE PROVIDED BY TRANSCO.
4. STREAM AND WETLAND BOUNDARIES BASED ON SURVEYS CONDUCTED BY WHM CONSULTING FROM MARCH 2020 TO OCTOBER 2020.
5. DATUM BASED ON PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, NAD 83 NORTH ZONE, NAVD88, ELEVATION MSL, DERIVED FROM GPS OBSERVATION.

SCALE
30 15 0 30
SCALE 1" =30'

BA GROUP
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COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
PATRICK A. WOZINSKI
ENGINEER
PE076243
PENNSYLVANIA PROFESSIONAL ENGINEER

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
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2	03/01/22	RHM	RESPONSE TO PADEP TECHNICAL DEFICIENCY LETTER			

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
HILDEBRANDT TIE-IN/MLV-515RA40 AND LOWER DEMUNDS REL TIE-IN SITE PLAN
POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

ATTACHMENT 5 WATER QUALITY BMP'S MAP

DALLAS TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

DRAWN BY: RHM	DATE: 03/31/21	ISSUED FOR BID:	SCALE: AS NOTED		
CHECKED BY: RJN	DATE: 03/31/21	ISSUED FOR CONSTRUCTION:	REVISION:		
APPROVED BY: PW	DATE: 03/31/21			SHEET	1
WO: 1232585/1232586	RID: 305	DRAWING NUMBER: 26-1000-70-28-D		OF	1

ATTACHMENT 6
OFFSITE DISCHARGE REPORTS

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Attachment 6

6.1 Offsite Discharge Report – MLV-515RA20

6.2 Offsite Discharge Report – MLV-515RA30

6.3 Offsite Discharge Report – Carverton Tie-in

6.4 Offsite Discharge Report – Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40

ATTACHMENT 6.1

OFFSITE DISCHARGE REPORT –
MLV-515RA20

Transcontinental Gas Pipe Line Company, LLC

Offsite Discharge Report

Regional Energy Access Expansion Project

Regional Energy Lateral

MLV-515RA20

April 2021
(Revised July 2022)

1.0 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), a subsidiary of The Williams Companies, Inc., is proposing the Regional Energy Lateral (Project). The mainline valve, MLV-515RA20, is proposed as part of the overall Project. MLV-515RA20 is located along the REL in Bear Creek Township, Luzerne County at Milepost 7.54. It is proposed as a means to isolate gas flows along sections of a pipeline. Pig launchers/receivers and communication equipment may be located at the MLV facility. The facility will include a 104 foot long gravel access road, 55 ft x 90 ft gravel pad, various diversion channels and an infiltration berm PCSM BMP. This facility will require Erosion and Sediment (E&S) Control and Post Construction Stormwater Management (PCSM) Best Management Practices (BMPs) to manage stormwater runoff during and after construction.

Transco has developed an Offsite Discharge Report for the discharges associated with the proposed BMPs. An Offsite Discharge Report is performed to ensure that no offsite erosion will occur downstream of the proposed activities. The analysis conducted for this project followed the sequence outlined in PaDEP's factsheet for offsite discharges (Document #3930-FS-DEP4124).

2.0 Conveyance Best Management Practices

Erosion and Sediment Control and Post Construction Stormwater Management BMPs are proposed to manage stormwater runoff during and after construction. PCSM channels collect and direct stormwater from the gravel pad and access road toward an infiltration berm on the west side of the mainline valve yard. The infiltration berm will manage the net increase in volume between the pre- and post-development 2-year storm events and mitigate the increase (pre-post development) in peak runoff for the 2-, 10-, 50-, and 100-year storm events. Stormwater collected by the infiltration berm is discharged offsite via a level spreader and riprap apron. A clean water diversion channel, PCSM Diversion Channel DC-D1 flows to an earthen level spreader and diverts the stormwater as sheet flow along a vegetative flow path.

2.1 Infiltration Berm and Outlet Protection (OP) 2, 3 and 4

The infiltration berm will utilize ten (10) - 3 inch outlet pipes, which discharge to a structural level spreader and riprap apron during larger storm events. During larger storm events some water will overtop the berm and discharge to the same area as the level spreader and riprap apron. The flow from the pipes and berm flows into the adjacent

forested area located west of the Limits of Disturbance. The stormwater is discharged as sheet flow and travels along a vegetative flow path until it reaches a Bald Mountain Road culvert and then a delineated stream, S83-T2. The flow path is depicted on Exhibit 1.0. Soil types and the erodibility factors within the flow path are shown on Table 1.

Table 1 – Soils Mapped within Flow Path	
Soil Mapping Unit	**Soil Erodibility Factor, K_f**
VrB	**K_f = 0.28**

The soil erodibility factor is shown in Table 1. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. VrB soils have a moderate susceptibility to erosion (0.28). Photos were taken around the site, including along the flow path of the downstream area to show the vegetative cover.



Photo 1: Adjacent to the proposed pad and diversion channel.



Photo 2: Area Downgradient of the Proposed OP 2 and 3



Photo 3: Area Downgradient of the Proposed OP 4

Photo 1 shows the existing condition of the site adjacent to the proposed gravel pad and channel (DC-D1, described in Section 2.2). Photo 2 shows the infiltration berm area and portions down gradient of OP 2 and 3. Photo 3 shows the areas downgradient of the proposed level spreader and riprap apron (OP4) and berm, which is over 90% vegetated. This area is also downgradient of the isolated delineated stream channel S76-T2. At this location, sheet flow from the S76-T2 flows toward the delineated S83-T2. S76-T2 is discussed further in Section 2.2. as it relates to Diversion Channel DC-D1 and earthen level spreader.

In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the

discharge velocities at the proposed structural level spreader and riprap apron (OP-4) is 0.72 feet per second for the 100 year, 24-hour storm event.

2.2 PCSM Diversion Channel DC-D1 and Earthen Level Spreader

The Diversion Channel DC-D1 discharges water through an earthen level spreader. The stormwater is discharged as sheet flow and travels along a vegetative and rocky flow path until it reaches delineated stream, S76-T2. S76-T2 is an isolated delineated stream channel. S76-T2 maintains concentrated flow for approximately 150'. The downstream portions of this channel change from concentrated flow to sheet flow, and meet with the flow path described in Section 2.1 downstream of the infiltration berm and OP-4, where it travels to delineated stream channel S83-T2. The flow path is depicted on Exhibit 1.0. Soil types and the erodibility factors within the flow path are shown on Table 2.

The soil erodibility factor is shown in Table 1 above. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. VrB soils have a moderate susceptibility to erosion (0.28). Photos were taken along the flow path of the downstream area to show the vegetative cover.



Photo 4: Area Downgradient of the Proposed Level Spreader



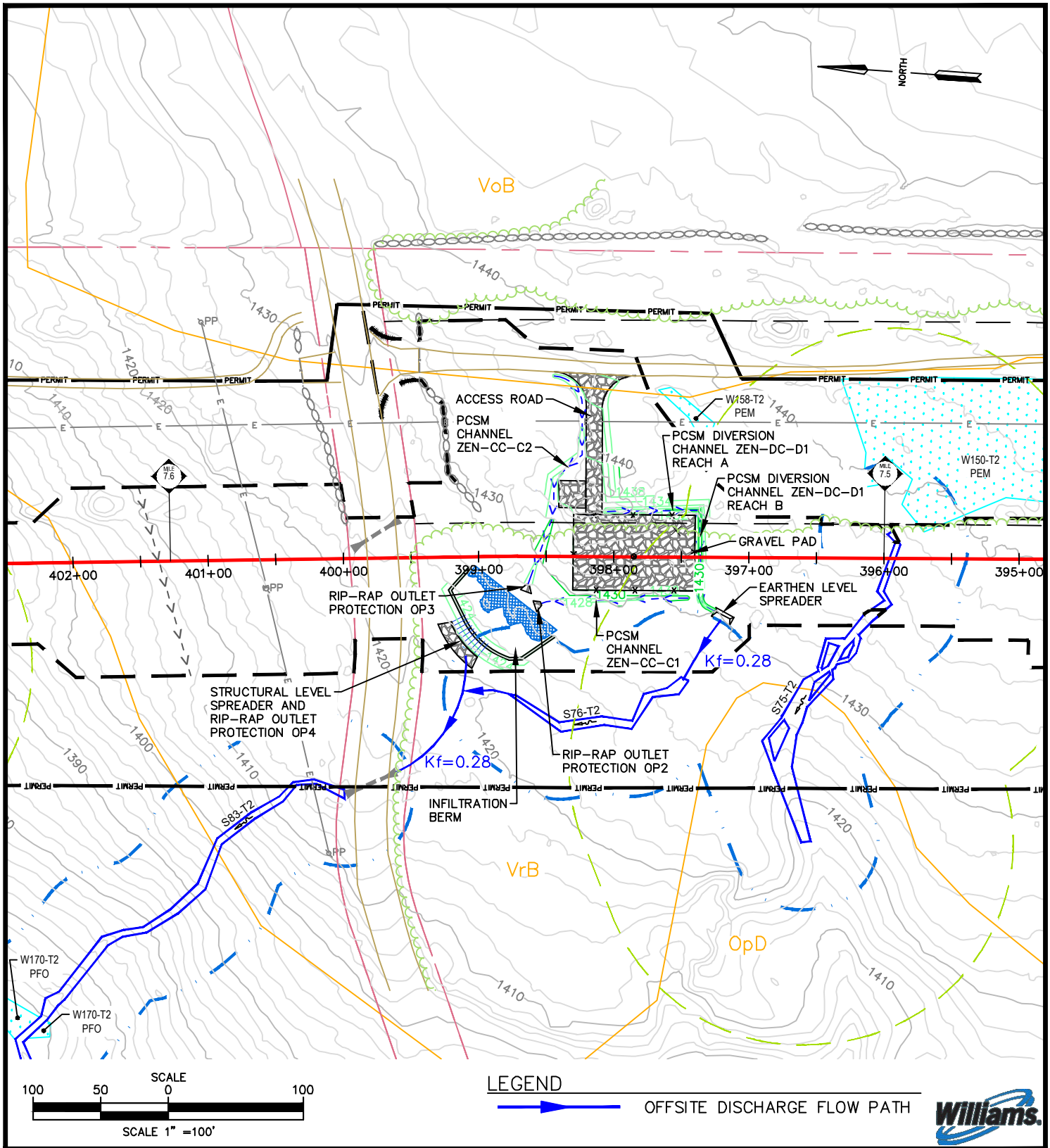
Photo 5: Area Downgradient of S76-T2

Photo 4 shows the existing condition immediately downstream where the earthen level spreader is proposed. Photo 5 shows the area immediately down gradient of S76-T2 where sheet flow begins. Both photos represent the forested vegetated conditions of the site.

In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed earthen level spreader is 1.35 feet per second for the for the 100 year, 24-hour storm event.

3.0 Conclusion

Based on the existing vegetative conditions, low discharge velocities from the BMPs, and reduced peak flow rates and volumes from the site, downgradient soil erosion is not anticipated as a result of the proposed development of this site.



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366 WALKER DRIVE, SUITE 300
STATE COLLEGE, PA 16801
TELEPHONE: (814)-689-1650 FAX: (814)-689-1557

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA20

EROSION AND SEDIMENTATION CONTROL PLAN

FLOW PATH

BEAR CREEK TWP LUZERNE COUNTY PENNSYLVANIA

DATE: 06/29/22
DRAWN BY: RHM
CHECKED: PW
WHM DRAWING NO: FLOW PATH

EXHIBIT 1.0

ATTACHMENT 6.2

OFFSITE DISCHARGE REPORT –
MLV-515RA30

Transcontinental Gas Pipe Line Company, LLC

Offsite Discharge Report

Regional Energy Access Expansion Project

Regional Energy Lateral

MLV-515RA30

April 2021
(Revised March 2022)

1.0 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), a subsidiary of The Williams Companies, Inc., is proposing the Regional Energy Lateral (Project). The mainline valve, MLV515-RA30, is proposed as part of the overall Project. MLV-515RA30 is located along the REL in Wyoming Borough, Luzerne County at Milepost 14.84. It is proposed as a means to isolate gas flows along sections of a pipeline. This new facility will require Erosion and Sediment (E&S) Control and Post Construction Stormwater Management (PCSM) Best Management Practices (BMP's) to manage stormwater runoff during and after construction.

Transco has developed an Offsite Discharge Report for the discharges associated with the proposed BMP's. An Offsite Discharge Report is performed to ensure that no offsite erosion will occur downstream of the proposed activities. The analysis conducted for this project followed the sequence outlined in PaDEP's factsheet for offsite discharges (Document #3930-FS-DEP4124).

2.0 Conveyance Best Management Practices

Erosion and Sediment Control and Post Construction Stormwater Management BMP's are proposed to manage stormwater runoff during and after construction. An infiltration berm will also be installed to manage the net increase in volume between the pre and post development 2-year storm events and mitigate the increase (pre-post development) in peak runoff for the 2-, 10-, 50-, and 100-year storm events.

2.1 Infiltration Berm

The infiltration berm does not discharge any water during any storm event mentioned above. If it were to discharge water, the water would overtop the berm and flow into the adjacent wetland and agricultural areas located southwest of the Limits of Disturbance. If the berm were to discharge, the stormwater would be discharged as sheet flow and travel along a vegetative flow path until it reached Abrahams Creek, upstream of the Susquehanna River. The flow path is depicted on Exhibit 1.0. Soil types and the erodibility factors within the flow path are shown on Table 1.

Table 1 – Soils Mapped within Flow Path

Soil Mapping Unit	Soil Erodibility Factor, K_f
Ho	**K_f = 0.28**
Ps	**K_f = 0.43**

The soil erodibility factors are shown in Table 1. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. Ho and Ps soils have a moderate susceptibility to erosion (0.28, 0.43). Photos were taken along the flow path of the downstream area to show the vegetative cover.



Photo 1: Existing Area near proposed Infiltration Berm.

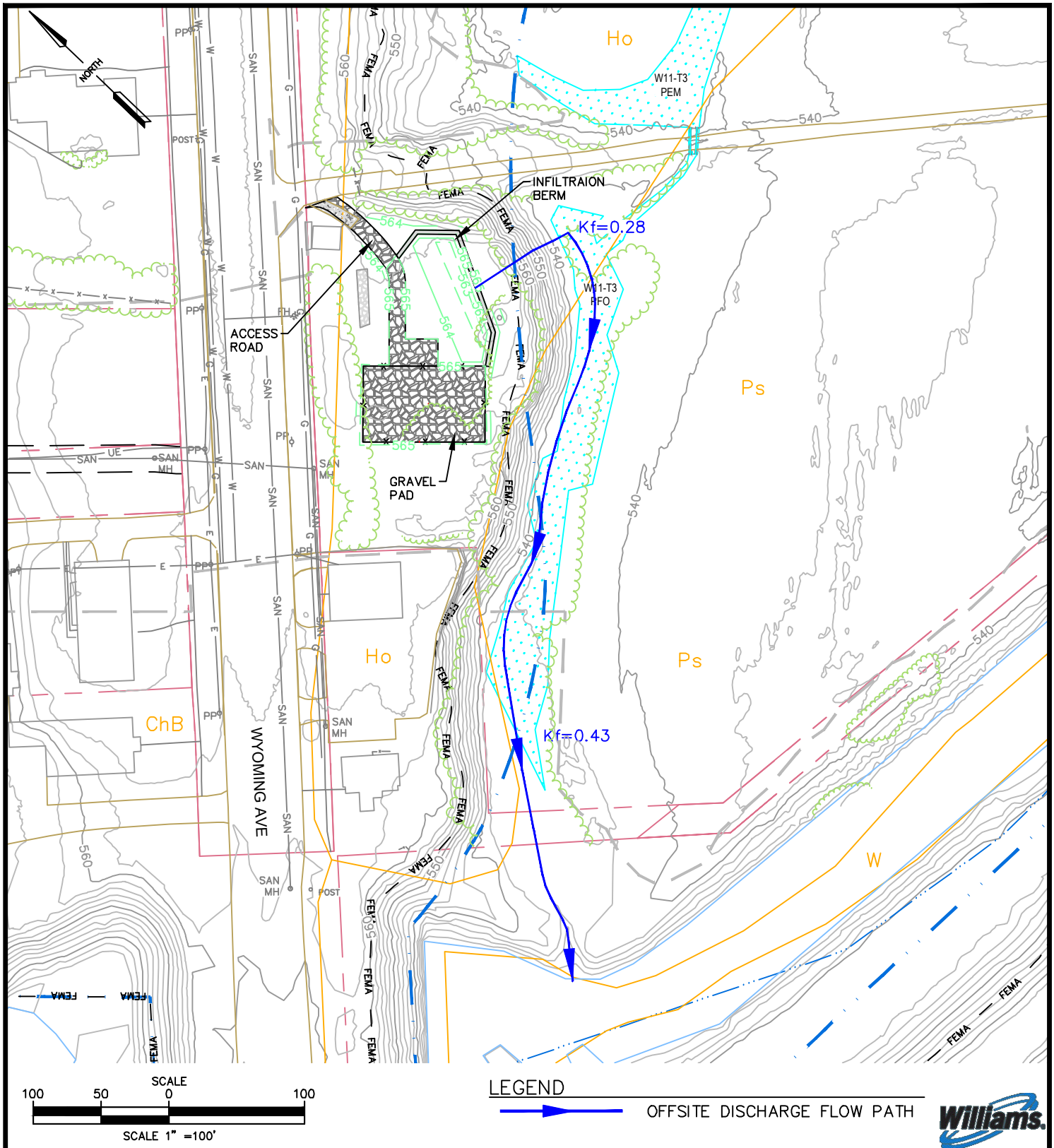


Photo 2: Area Downgradient of the Proposed Infiltration Berm

Photo 1 shows the existing conditions at the approximate location of the infiltration berm. Photo 2 shows the areas downgradient of the site, which is over 90% vegetated. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity over the berm is 0.0 feet per second for the 100 year, 24-hour storm event.

3.0 Conclusion

Based on the existing vegetative conditions, low discharge velocities from the BMPs, and reduced peak flow rates and volumes from the site, downgradient soil erosion is not anticipated as a result of the proposed development of this site.



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366 WALKER DRIVE, SUITE 300
STATE COLLEGE, PA 16801
TELEPHONE: (814)-689-1650 FAX: (814)-689-1557

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
MLV-515RA30

EROSION AND SEDIMENTATION CONTROL PLAN

FLOW PATH

WYOMING BOROUGH LUZERNE COUNTY PENNSYLVANIA

DATE:	02/22/22
DRAWN BY:	RHM
CHECKED:	PW
WHM DRAWING NO:	FLOW PATH

EXHIBIT 1.0

ATTACHMENT 6.3

OFFSITE DISCHARGE REPORT – CARVERTON TIE-IN

Transcontinental Gas Pipe Line Company, LLC

Offsite Discharge Report

Regional Energy Access Expansion Project

Regional Energy Lateral

Carverton Tie-in

April 2021
(Revised March 2022)

1.0 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), a subsidiary of The Williams Companies, Inc., is proposing the Regional Energy Lateral (Project). The Carverton Tie-in is proposed as part of the overall Project. The Carverton Tie-in is a receipt Tie-in proposed in West Wyoming Borough, Luzerne County at Milepost 16.8. Proposed is the installation of new tie-in piping into the proposed REL, valves, and aboveground tie-in piping for an annubar meter. The facility will include a 55 ft x 90 ft gravel pad, and an infiltration berm PCSM BMP. The new facility will require Erosion and Sediment (E&S) Control and Post Construction Stormwater Management (PCSM) Best Management Practices (BMP's) to manage stormwater runoff during and after construction.

Transco has developed an Offsite Discharge Report for the discharges associated with the proposed BMP's. An Offsite Discharge Report is performed to ensure that no offsite erosion will occur downstream of the proposed activities. The analysis conducted for this project followed the sequence outlined in PaDEP's factsheet for offsite discharges (Document #3930-FS-DEP4124).

2.0 Conveyance Best Management Practices

Erosion and Sediment Control and Post Construction Stormwater Management BMP's are proposed to manage stormwater runoff during and after construction. An infiltration berm will be installed to convey the net increase in volume between the pre- and post-development 2-year storm events and mitigate the increase (pre-post development) in peak runoff for the 2-, 10-, 50-, and 100-year storm events. The infiltration berm, which allows water to flow to an offsite area, is proposed as the discharge structure at this location.

2.1 Infiltration Berm

The infiltration berm discharges water, and it flows into the adjacent forested area located east of the Limits of Disturbance. The stormwater is being discharged as sheet flow and travels along a vegetative flow path until it reaches an unnamed blue line stream. The flow path is depicted on Exhibit 1.0. Soil types and the erodibility factors within the flow path are shown on Table 1.

Table 1 – Soils Mapped within Flow Path	
Soil Mapping Unit	**Soil Erodibility Factor, K_f**
ArD	**K_f = N/a**
OXF	**K_f = 0.10**
OpD	**K_f = 0.10**

The soil erodibility factors are shown in Table 1. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. Soil erodibility data is not provided for ArD soils. OXF and OpD soils have a low susceptibility to erosion (0.10). Photos were taken along the flow path of the downstream area to show the vegetative cover.



Photo 1: Existing Area at Proposed Infiltration Berm

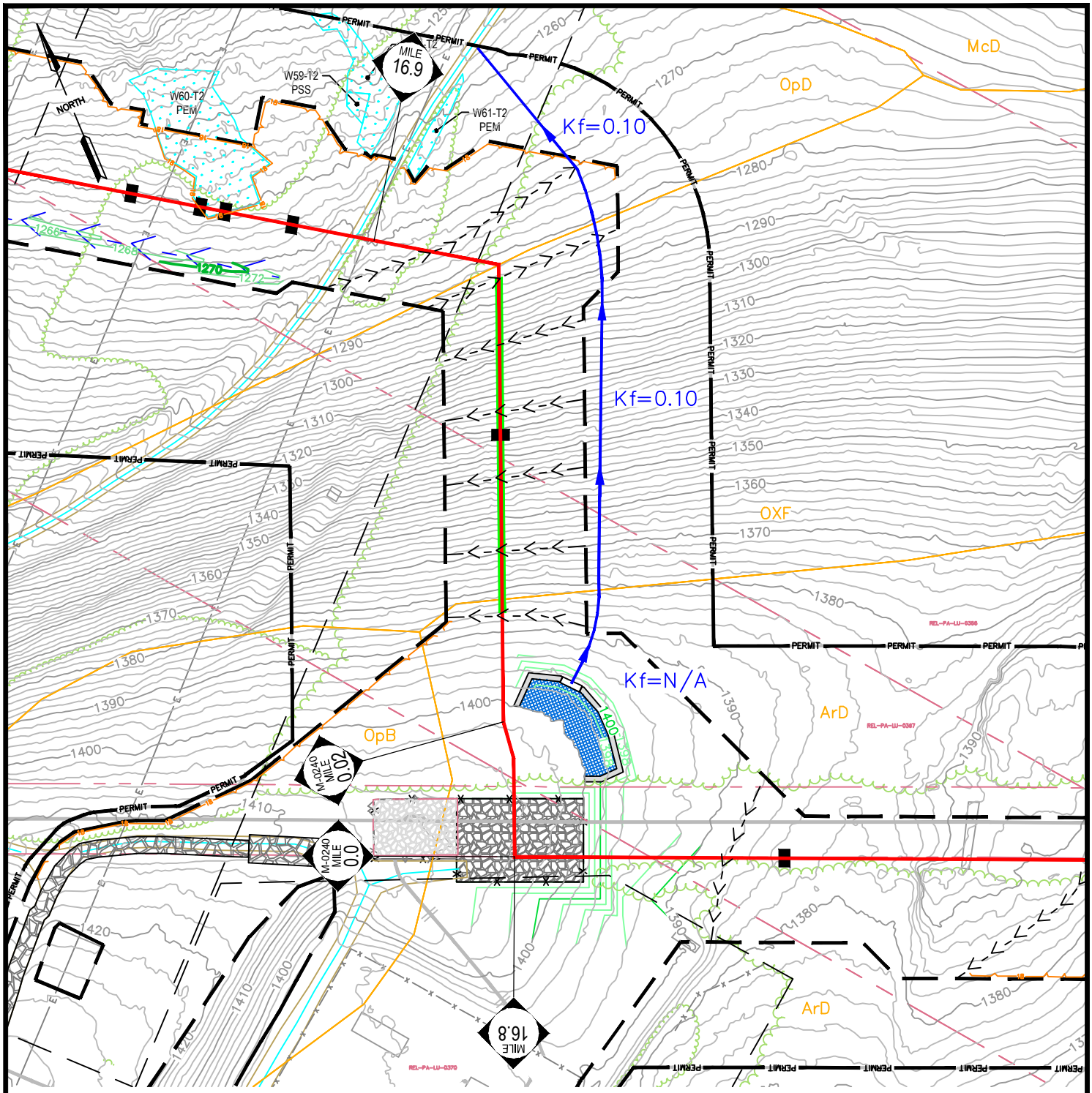


Photo 2: Area Downgradient of the Proposed Infiltration Berm

Photo 1 shows the existing condition where the infiltration berm is proposed. The area will be graded to facilitate the installation of the infiltration berm and revegetated. Photo 2 shows the areas downgradient of the proposed infiltration berm, which is over 90% vegetated. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed infiltration berm is 0.97 feet per second for the for the 100 year, 24-hour storm event.

3.0 Conclusion

Based on the existing vegetative conditions, low discharge velocities from the BMPs, reduced peak flow rates and volumes from the site, and the low soil erodibility values associated with the property, downgradient soil erosion is not anticipated as a result of the proposed development of this site.



SCALE
200 100 0 200
SCALE 1" =200'

LEGEND

OFFSITE DISCHARGE FLOW PATH

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366 WALKER DRIVE, SUITE 300
STATE COLLEGE, PA 16801

TELEPHONE: (814)-689-1650 FAX: (814)-689-1557

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
CARVERTON TIE-IN

EROSION AND SEDIMENTATION CONTROL PLAN

FLOW PATH

WEST WYOMING BOROUGH LUZERNE COUNTY PENNSYLVANIA

DATE:	02/23/22
DRAWN BY:	RWS
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WHM DRAWING NO:	FLOW PATH

EXHIBIT 1.0

ATTACHMENT 6.4

OFFSITE DISCHARGE REPORT –
LOWER DEMUNDS REL TIE-IN AND
HILDEBRANDT TIE-IN/MLV-515RA40

Transcontinental Gas Pipe Line Company, LLC

Offsite Discharge Report

Regional Energy Access Expansion Project

Regional Energy Lateral

Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40

April 2021
(Revised March 2022)

1.0 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), a subsidiary of The Williams Companies, Inc., is proposing the Regional Energy Lateral (Project). The Lower Demunds REL Tie-in and Hildebrandt Tie-in/MLV-515RA40 are proposed as part of the overall Project. These new facilities will require Erosion and Sediment (E&S) Control and Post Construction Stormwater Management (PCSM) Best Management Practices (BMP's) to manage stormwater runoff during and after construction.

The Lower Demunds REL Tie-in is located in Dallas Township, Luzerne County near the terminus of the Regional Energy Lateral at Milepost 22.1. Proposed is the installation of approximately 400 feet of new 20-inch-diameter tie-in piping from Transco's existing Leidy Line A tie-in site to the new proposed REL tie-in site, valves, and new aboveground tie-in piping for an annubar meter. The facility will include a 74.5 ft x 84 ft gravel pad. With limited run-on to the pad area due to construction of upgradient diversion channels, stormwater management will be accomplished by infiltration within the pad area itself.

The Hildebrandt Tie-in/MLV-515RA40 is a receipt Tie-in located in Dallas Township, Luzerne County, at the terminus of the Regional Energy Lateral at Milepost 22.34. Proposed is the installation of new aboveground tie-in piping, valves, and aboveground piping for an annubar meter, and associated pig trap. The facility will include an 80 ft x 140 ft gravel pad. With run-on to the pad area diverted by an upgradient channel, stormwater management will be accomplished by infiltration within the pad area itself.

Transco has developed an Offsite Discharge Report for the discharges associated with the proposed BMP's. An Offsite Discharge Report is performed to ensure that no offsite erosion will occur downstream of the proposed activities. The analysis conducted for this project followed the sequence outlined in PaDEP's factsheet for offsite discharges (Document #3930-FS-DEP4124).

2.0 Conveyance Best Management Practices

Erosion and Sediment Control and Post Construction Stormwater Management BMPs are proposed to manage stormwater runoff during and after construction. At both Lower Demunds REL Tie-in and Hildebrant Ties-in sites, a subsurface infiltration bed lays beneath each gravel pad where water accumulates and flows away from the pads. At the Lower Demunds Tie-in, a diversion berm will prevent run-on drainage, and there will be a berm around the exterior of the

pad to retain stormwater for infiltration. An overflow spillway will be used to discharge excess flow to a riprap apron on the east side of the pad. At the Hildebrant Tie-in, the pad will be bermed around the exterior to retain stormwater for infiltration. An overflow spillway on the east side of the pad will be used to discharge excess flow to the diversion channel. The water will then be directed northwest to a level spreader. These subsurface infiltration beds will be installed to manage the net increase in volumes between the pre- and post-development 2-year storm events and mitigate the increase (pre-post development) in peak runoff for the 2-, 10-, 50-, and 100-year storm events. Level spreaders, which allow water to flow to an offsite area, are proposed as the discharge structures at these locations. The runoff rates have been reduced by 40% of the pre-construction flow rates.

2.1 Subsurface Infiltration Bed – Lower Demunds REL Tie-in

The subsurface infiltration bed releases water to an overflow spillway which discharges the excess flow to a riprap apron on the east side of the pad and flows into a wetland complex southeast of the site and Limits of Disturbance. The stormwater is being discharged as sheet flow and travels along a vegetative flow path until it reaches a wetland complex and ultimately to stream S1-T11. The flow path is depicted in Exhibit 1.0A. Soil types and the erodibility factors within the flow path are shown in Table 1.

Table 1 – Soils Mapped within Flow Path

Soil Mapping Unit	Soil Erodibility Factor, K_f
WiB	**K_f = 0.20**
WiC	**K_f = 0.20**

The soil erodibility factors are shown in Table 1. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. WiB and WiC soils have a low susceptibility to erosion (0.20). Photos were taken along the flow path of the downstream area to show the vegetative cover.



Photo 1: Existing Area at Proposed Riprap Apron



Photo 2: Area Downgradient of the Proposed Riprap Apron

Photo 1 shows the existing condition where the riprap apron is proposed. The area will be graded to facilitate the installation of the riprap apron and revegetated. Photo 2 shows the areas downgradient of the proposed riprap apron, which is over 90% vegetated. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed riprap apron is 1.3 feet per second for the for the 25 year, 24-hour storm event.

2.2 Subsurface Infiltration Bed – Hildebrandt Tie-in/MLV-515RA40

The subsurface infiltration bed releases water through the overflow spillway and it flows into a level spreader via a diversion channel on the east side of the pad where it is discharged and flows into the adjacent wetland complex and forested area west of the Limits of Disturbance. The stormwater is being discharged as sheet flow and travels along a vegetative flow path until it reaches an unnamed blueline stream. The flow path is depicted in Exhibit 1.0B. Soil types and the erodibility factors within the flow path are shown in Table 2.

Table 2 – Soils Mapped within Flow Path

Soil Mapping Unit	Soil Erodibility Factor, K_f
WiB	**K_f = 0.20**
MoB	**K_f = 0.24**
CiA	**K_f = 0.32**

The soil erodibility factors are shown in Table 2. A low K value indicates the soil will not easily erode whereas a high K value means the soil will easily erode. The soils in the flow path are considered moderately erodible (0.20, 0.24, 0.32). Photos were taken along the flow path of the downstream area to show the vegetative cover.



Photo 3: Existing Area adjacent to the Proposed Level Spreader

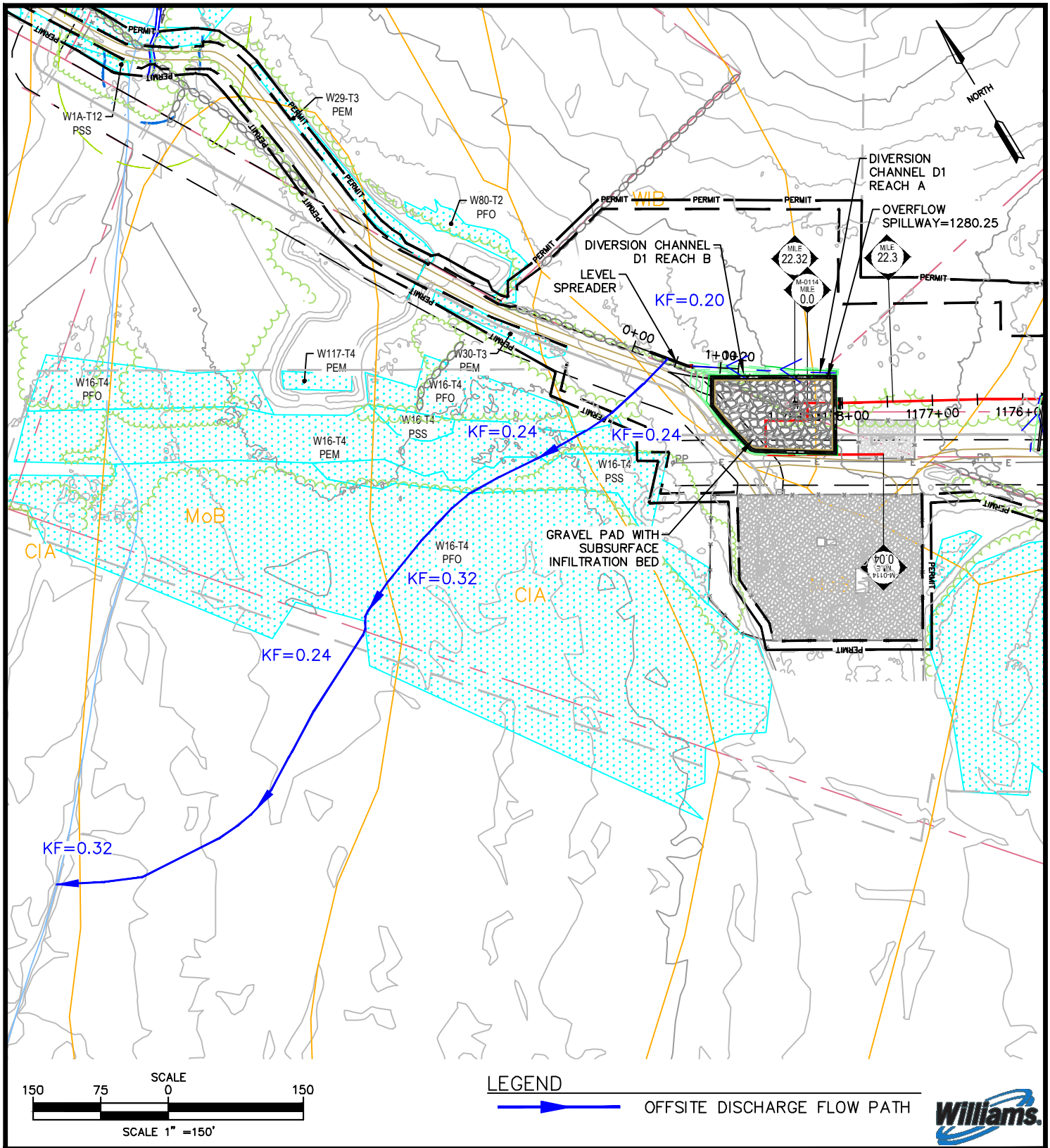


Photo 4: Area Downgradient of the Proposed Level Spreader

Photo 3 shows the existing condition where the level spreader is proposed in the vegetated area to the right of the existing road. The area will be graded to facilitate the installation of the level spreader and revegetated. Photo 4 shows the areas downgradient of the proposed level spreader, which is over 90% vegetated. In the E&S and PCSM Narrative, site calculations are provided that show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed level spreader is 0.95 feet per second for the for the 25 year, 24-hour storm event.

3.0 Conclusion

Based on the existing vegetative conditions, low discharge velocities from the BMPs, and reduced peak flow rates and volumes from the site, downgradient soil erosion is not anticipated as a result of the proposed development of this site.



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HILDEBRANT TIE-IN/ MLV-515RA40

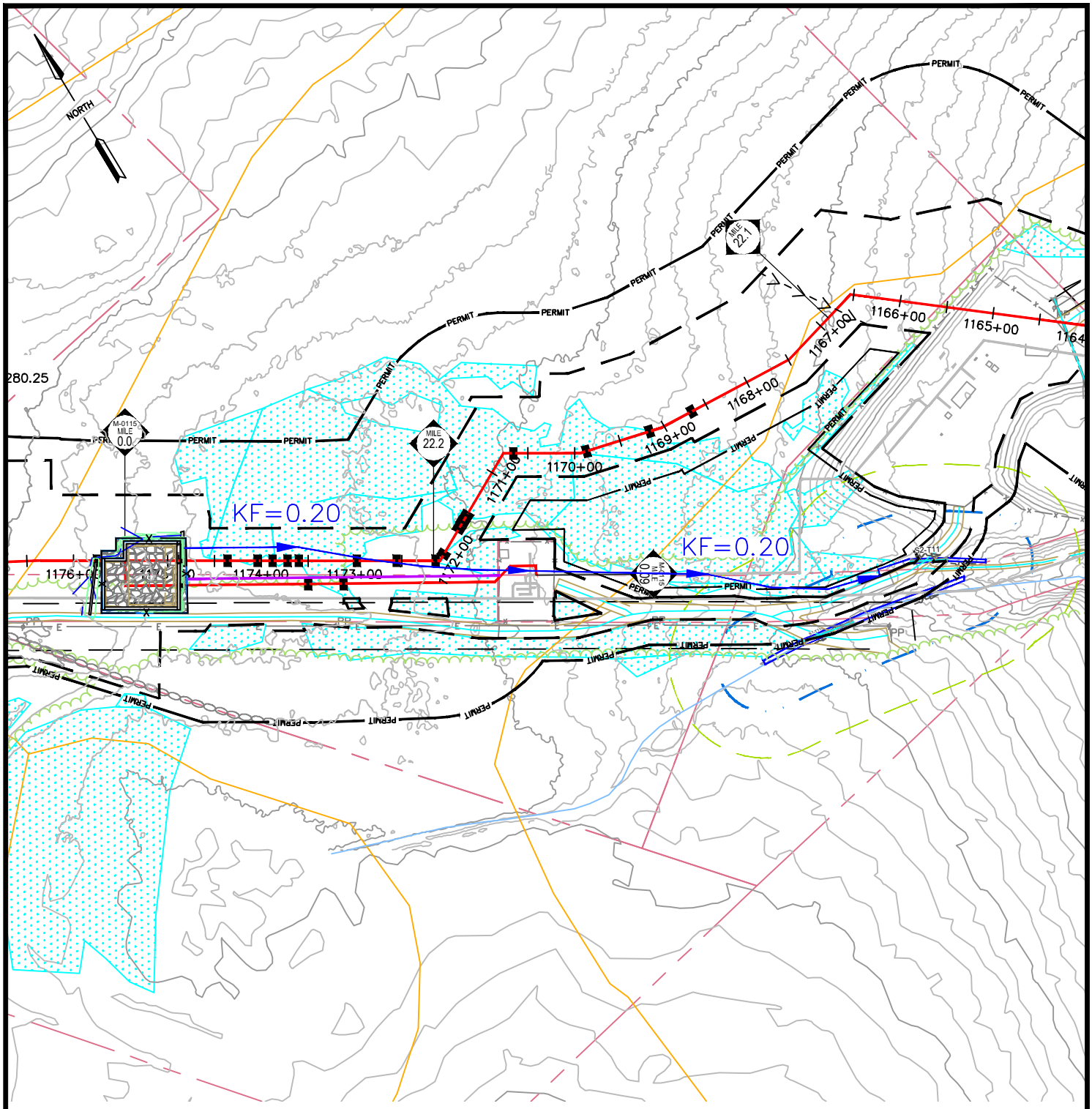
EROSION AND SEDIMENTATION CONTROL PLAN

FLOW PATH

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EXHIBIT 1.0A



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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
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LOWER DEMUNDS REL TIE-IN

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EXHIBIT 1.0B

SECTION 3.1.2
MLV-515RA20 DRAWINGS

SECTION 3.1.3
MLV-515RA30 DRAWINGS

SECTION 3.1.4
CARVERTON TIE-IN DRAWINGS

SECTION 3.1.5

LOWER DEMUNDS REL TIE-IN DRAWINGS

SECTION 3.1.6

HILDEBRANDT TIE-IN/MLV-515RA40 DRAWINGS