

## Post Construction Stormwater Management/Site Restoration Plans Narrative

### Atlantic Sunrise Project Phase 1

Compressor Station 605  
Clinton Township  
Wyoming County  
Pennsylvania

Prepared For:



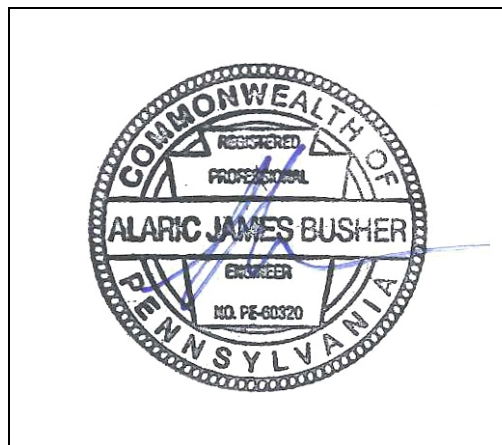
**Transcontinental Gas Pipe Line Company, LLC**  
2800 Post Oak Blvd  
Houston, TX, 77251

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BL Project No. 14C4909

Prepared By:

BL Companies  
4242 Carlisle Pike, Suite 260  
Camp Hill, PA 17011



Alaric J Busher, PE  
P.E. 60320



## CONTENTS

<u>Part</u>	<u>Description</u>	<u>Page</u>
<b>1.0</b>	<b>GENERAL INFORMATION</b> .....	<b>1</b>
1.1	Topographic Features	
	USGS Site Location Map .....	3
	Aerial Location Map .....	4
1.2	Soil Characteristics .....	5
1.3	Earth Disturbance Activity Characterization.....	7
1.4	Stormwater Management Calculation Methodology & Net Change in Volume and Rate of Runoff .....	9
1.5	Surface Water Classification.....	11
1.6	BMP Description Narrative.....	11
1.7	BMP Installation Sequence Narrative .....	12
1.8	Supporting Calculations .....	15
1.9	Plan Drawings.....	15
1.10	Long Term Operation and Maintenance Schedule .....	15
1.11	Material Recycling and Disposal.....	17
1.12	Soil Conditions and Geologic Formations .....	22
1.13	Thermal Impacts.....	22
1.14	Riparian Forest Buffer Management Plan.....	23
1.15	Antidegradation Requirements .....	23
1.16	Preparedness Prevention and Contingency Plan .....	23

## APPENDICES

<u>Part</u>	<u>Description</u>
Appendix A	Compressor Station 605 Supporting Calculations
	A.1 Pre-Development Calculations
	A.2 Post Development Calculations
	A.3 Conveyance Calculations
	A.4 PCSM BMP Calculations
	A.5 Water Quality Worksheets
	A.6 Site Characterization Assessment
	A.7 Supporting Documentation
Appendix B	Preparer Qualifications

## Appendix C

## United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report

## **1.0 GENERAL INFORMATION**

The following narrative was prepared as a supplement to the Transcontinental Gas Pipe Line Company, LLC's (Transco's) Environmental Construction Plan (ECP) provided in Section 4 of the Erosion and Sediment Control General Permit 2 (ESCGP-2) Notice of Intent (NOI), which was prepared for the Atlantic Sunrise Project ("Project"). This narrative is intended to describe the post construction stormwater management/site restoration (PCSM/SR) design for the Compressor Station 605 ("Site") to be constructed as part of the Project, within Clinton Township, Wyoming County, Pennsylvania. Similar narratives were prepared, under separate cover, for facilities in other affected counties, as well as for the pipeline construction.

The facility proposed to be constructed as part of Phase 1 of the Project in Wyoming County is the following:

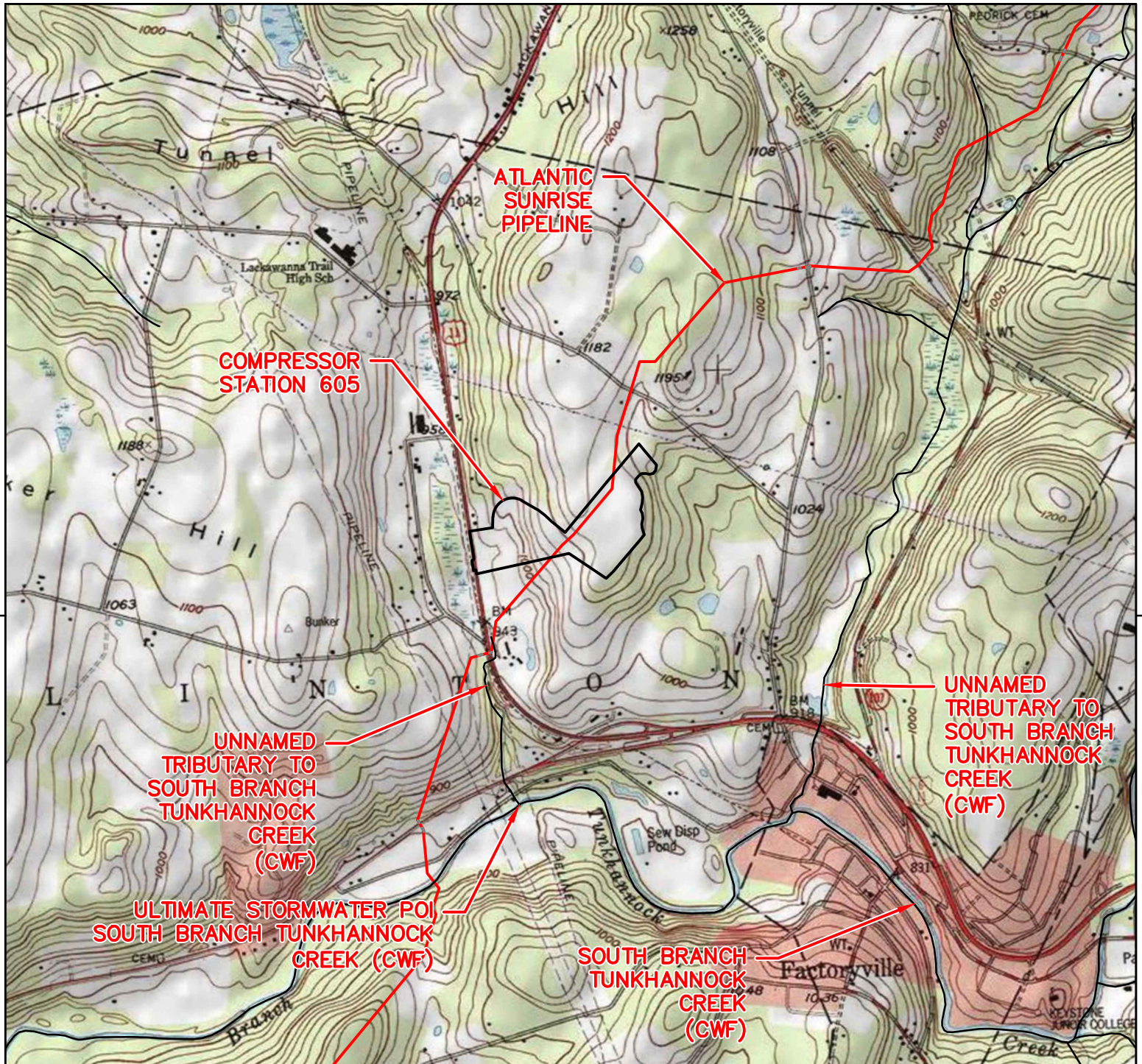
Facility Name	Facility Description	Facility Coordinates
Compressor Station 605	Compressor Station	N41°34'40.56", W75°47'48.39"

The Compressor Station 605 will be approximately 50.68 acres in area including a 3,100 linear foot new access road, 265,400 square feet (6.09 acres) of new gravel pad, and 172,510 square feet (3.96 acres) of impervious area. The Site will utilize existing public and private roads for access to the Site during and after construction. Best Management Practices (BMPs), in accordance with the standards and specifications in the Pennsylvania Department of Environmental Protection's (PADEP's) "Erosion and Sediment Pollution Control (E&S) Program Manual," Technical Guidance No. 363-2134-008, as amended and updated (E&S Manual) will be implemented to minimize and/or avoid potential adverse environmental impacts due to the construction, operation and maintenance activities associated with the Site. The proposed practices are designed to maximize volume reduction technologies, eliminate or minimize point source discharges to surface waters, preserve the integrity of stream channels, and protect the physical, biological, and chemical qualities of the receiving surface water. The intent is to keep the post construction runoff volume and flow rate no greater than the pre-construction conditions while maintaining water quality. Impervious areas, land clearing and soil compaction are minimized and natural drainage features and vegetation are protected wherever possible. Heavy equipment will be restricted from infiltration areas. E&SC and PCSM BMP measures will be installed and maintained as needed to control stormwater movement in the Site area.

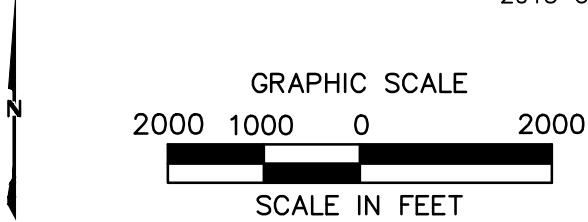
Refer to the ECP (**Section 4 of the ESCGP-2 NOI**) for overall Project information.

There are no impacts to regulated wetlands associated with this proposed Site. Refer to the Wetland Delineation Report provided in **Section 5 of the ESCGP-2 NOI** for information supporting wetland mapping as shown on the Erosion and Sediment Control (E&SC) Plans (**Section 2 of the ESCGP-2 NOI**).


1.1 Topographic Features



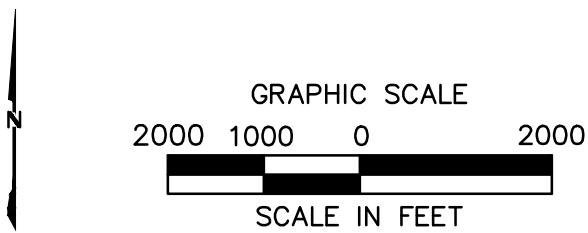
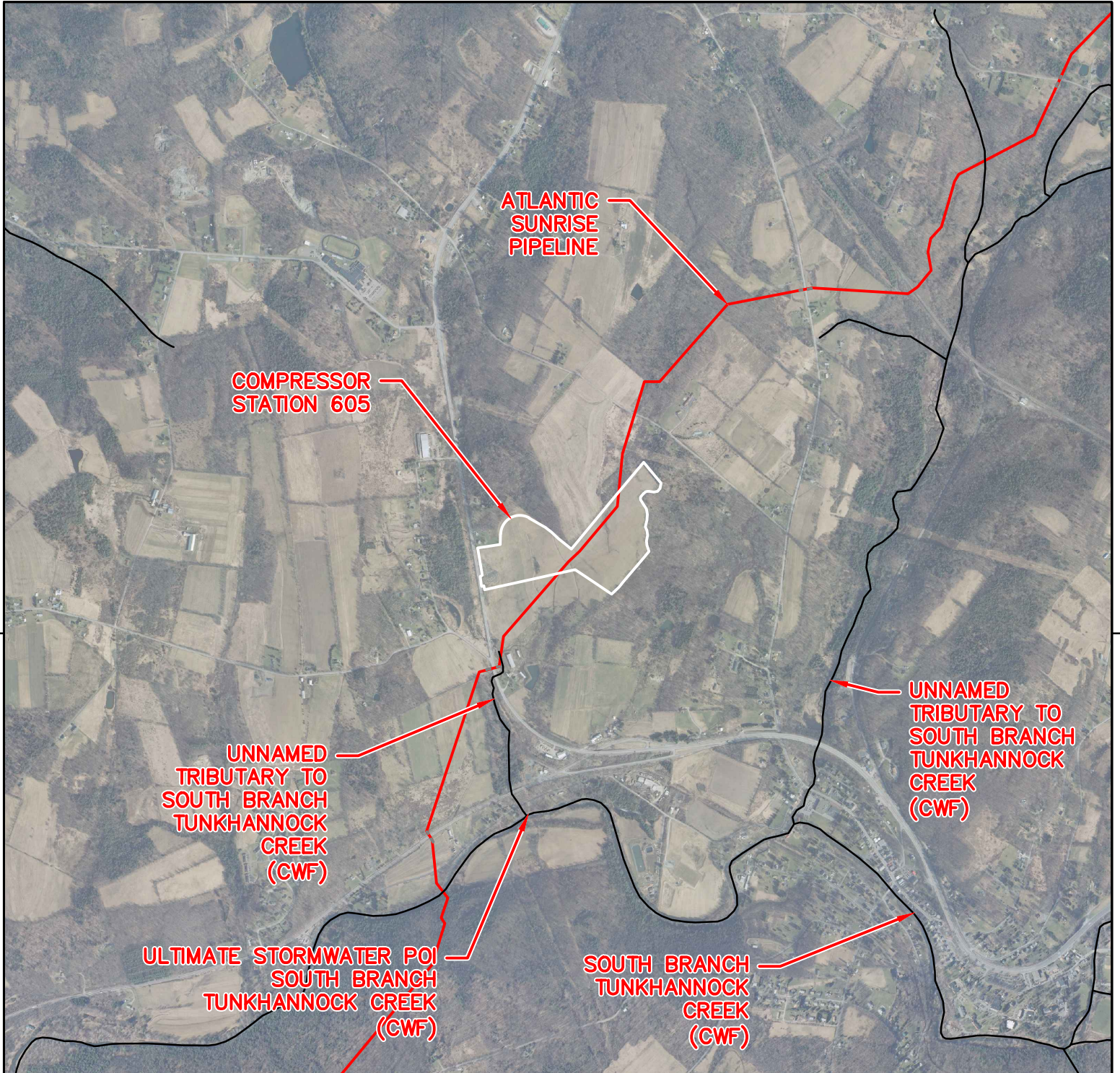
2013 USGS FACTORYVILLE QUADRANGLE




ATLANTIC SUNRISE PROJECT  
COMPRESSOR STATION 605  
USGS LOCATION MAP  
CLINTON TOWNSHIP  
WYOMING COUNTY, PENNSYLVANIA



NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	DATE:	ISSUED FOR BID:	SCALE:
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161497	SMK		JEC	04/03/15		1"=2,000'
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	1161497	AJB			04/03/15		
2	09-01-16	BL	MOD 1 ISSUED FOR PADEP SUBMITTAL	1161481	AJB			04/03/15		
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	1161481	AJB					
							WO:	1161497	DRAWING NUMBER:	CS 605 LOCATION
										SHEET 1 OF 1



**ATLANTIC SUNRISE PROJECT**  
**COMPRESSOR STATION 605**  
**AERIAL LOCATION MAP**  
**CLINTON TOWNSHIP**  
**WYOMING COUNTY, PENNSYLVANIA**



NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	JEC	DATE:	04/03/15	ISSUED FOR BID:	SCALE:	1"=2,000'
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161497	SMK		CHECKED BY:	AOE	DATE:	04/03/15	ISSUED FOR CONSTRUCTION:		
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	1161497	AJB		APPROVED BY:	AJB	DATE:	04/03/15	DRAWING NUMBER:	CS 605 LOCATION	SHEET
2	09-01-16	BL	MOD 1 ISSUED FOR PADEP SUBMITTAL	1161481	AJB		WO:	1161497					1
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	1161481	AJB								OF 1

## 1.2 Soil Characteristics

In addition to the below use limitations and resolutions, refer to Appendix C for the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report for the Site.

**Soil Type and Use Limitations**

Map Symbol	Soil Name	Slope	Cut Banks Cave	Corrosive to Concrete or Steel	Droughty	Easily Erodible	Flooding	High Water Table	Hydric/Hydric Inclusions	Low Strength	Slow Percolation	Piping	Poor Source of Topsoil	Frost Action	Shrink-Swell	Potential Sinkhole	Ponding	Wetness
MsB	Morris very stony silt loam	0-8%	X	C/S	X	X		X	X	X	X		X	X				X
MsC	Morris channery silt loam	3-8%	X	C/S	X	X		X	X	X	X	X		X				X
MrB	Morris channery silt loam	3-8%	X	C/S	X	X		X	X	X	X	X		X				X
MrC	Morris flaggy silt loam	8-15%	X	C/S	X	X		X	X	X	X	X	X	X				X
NcB	Norwich and Chippewa soils	3-8%	X	C/S	X	X		X	X	X	X		X	X			X	X
OcC	Oquaga channery loam	8-15%	X	C	X	X			X		X			X				
OcD	Oquaga channery loam	15-25%	X	C/S	X	X			X		X			X			X	X
OfB	Oquaga flaggy loam	3-8%	X	C/S	X	X			X		X			X			X	X
WcB	Wellsboro channery loam	8-15%	X	C/S	X	X		X	X	X	X	X		X				X
WcD	Wellsboro channery loam	15-25%	X	C/S	X	X		X	X	X	X	X		X				X

Source: Appendix E, Table E-1, PADEP, *Erosion and Sediment Pollution Control (E&S) Program Manual* Technical Guidance Number 363-2134-008.

### Soil Use Limitations Resolutions

Limitation	Resolution
Cut Banks Cave	Excavations will be properly supported by sheeting and shoring to prevent caves.
Corrosive to Concrete or Steel	No concrete or steel piping is proposed without appropriate coatings and protection.
Droughty	Existing suitable topsoil and soil amendments will be used during construction.
Easily Erodible	Temporary and permanent erosion control BMPs will be employed throughout the Site.
Flooding	Ensure that the Site has proper drainage.
High Water Table	A geotechnical investigation was conducted to minimize conflicts with saturated zones.
Hydric/Hydric Inclusions	A wetland investigation was completed to determine no wetlands are present in the development area.
Low Strength	A maximum of 3:1 slopes are proposed.
Slow Percolation	A field investigation of percolation rates at the infiltration areas was performed to verify the soils percolation capacity.
Piping	Watertight pipe, antiseep collars, clay cores through basin berms, and concrete endwalls will be used to minimize the danger of piping.
Poor Source of Topsoil	Existing topsoil, which has proven to be suitable, will be reused on the Site.
Frost Action	Pavement subbase will be provided to minimize frost effects.
Shrink-Swell	Stone base will be provided to prevent shrink-swell from effecting pavement.
Potential Sinkhole	Geotechnical engineer of record recommendations will be followed for any potential occurrences.
Ponding	Surface grading and drainage facilities will be provided to minimize ponding affects.
Wetness	Wet weather construction recommendations, per the geotechnical engineer's recommendations, will be employed to minimize the effects of wetness during construction, surface grading. Surface grading and drainage will be provided to minimize wetness affects after construction.

### 1.3 Earth Disturbance Activity Characterization

#### Proposed Improvements and Land Use

The proposed Compressor Station 605 will be constructed in Clinton Township, Wyoming County, Pennsylvania. Compressor Station 605 will involve the construction of a natural gas compressor station. The earthmoving activity will involve the stripping and stockpiling of top soil, Site grading, Site excavation, placement of fill, trenching and backfill, construction of buildings and equipment with gravel pad/parking lot, construction of a macadam access drive, construction of a stormwater management system, finish grading, and stabilization of disturbed surfaces. Approximately 172,510 square feet (3.96 acres) of additional impervious area and 265,400 square feet (6.09 acres) of additional gravel surface will result on-site. Areas outside the Site limit of disturbance (LOD) may be used for staging of equipment and materials, but no earth disturbance will occur in these areas.

#### Present/Past Land Use

This section identifies the land requirements for construction and operation of the proposed CPL North, CPL South, and Associated Facilities. Table 1.3.1 summarizes the land requirements for the proposed Compressor Station 605 associated with the CPL North and CPL South mainlines.

The characterization of land use within the proposed CPL North, CPL South, and Associated Facilities project areas is based on interpretation of aerial photographs taken in the spring of 2014 and information gathered from field surveys conducted during 2014 and 2015. Transco classified land uses within the proposed CPL North, CPL South, and Associated Facilities project areas into the following eight broad types:

- Agricultural Land – land associated with active cultivation of row and field crops; areas of grasses planted for livestock grazing or for the production of hay crops; orchards; and specialty crops, including vineyards, Christmas trees, and fruits and vegetables.
- Upland Forest/Woodland – includes upland deciduous forest, evergreen forest, and mixed (deciduous and evergreen) forest, but does not include forested wetlands.
- Industrial/Commercial Land – land used for mines or quarries and associated processing plants; manufacturing or other industrial facilities; and land developed for commercial or retail uses, including malls, strip plazas, business parks, and medical facilities.

- Transportation Land – land used for transportation purposes, including interstate highways; state, county, and local highways and roads; and railroad lines.
- Residential Land – residential areas, including yards of individual residences.
- Open Land – non-forested and undeveloped land not classified for another use, including land maintained as utility ROWs for overhead and underground electric transmission, natural gas transmission, and oil transmission facilities.
- Wetlands – includes wetlands covered with emergent, scrub-shrub, and forested vegetation.
- Open Water – include rivers, streams, creeks, canals, and other linear waterbodies, as well as lakes, ponds, and other non-flowing waterbodies.

New MLVs will be wholly located within the permanent ROWs for the proposed CPL North and CPL South mainlines. Construction will primarily occur within the proposed CPL North and CPL South construction ROWs.

**Table 1.3.1  
Land Requirements for the New Aboveground Facilities<sup>a</sup>**

Facility	Milepost	County	Agricultural Land (acres)		Upland Forest / Woodland (acres)		Open Land (acres)		Total (acres)	
			Cons	Op	Cons	Op	Cons	Op	Cons	Op
New Compressor Station 605	CPL North 44.9	Wyoming	45.0	36.0	5.1	3.2	0.0	0.0	50.1	39.2
<b>Compressor Station 605 Subtotal</b>			<b>45.0</b>	<b>36.0</b>	<b>5.1</b>	<b>3.2</b>	<b>0.0</b>	<b>0.0</b>	<b>50.1</b>	<b>39.2</b>

Notes:

<sup>a</sup> Land use acreages for construction and operation are provided for reference only. Acreages provided were calculated by using kmz files and prepared as part of the June 8, 2015 FERC Supplement. Refer to plans and ESCGP-2 NOI for actual site conditions.

Key:

Cons = Construction  
L = Leidy Line system milepost  
Op = Operation

Please refer to the PCSM/SR Plans and Detail Sheets, as provided in **Section 3 of the ESCGP-2 NOI**, and Section 1.2 and Appendix C of this PCSM/SR Narrative for information on the Site soils.

#### **1.4 Stormwater Management Calculation Methodology & Net Change in Volume and Rate of Runoff**

Runoff volume and rate calculations have been performed for the Site and are included in Appendix A.

Pre-development and Post Development runoff hydrographs were developed for the 1-, 2-, 10-, 25-, 50-, and 100-year 24 hour storm events using the Soil Conservation Service's TR-55 Method. The PCSM/SR BMPs will meet the volume reduction and water quality requirements of Control Guideline 1 (CG 1). PCSM Standard Worksheet #4 was used to complete the CG 1 volume analysis for the 2-year storm event. Stormwater models were created using the HydroCAD Version 7.10 computer program produced by HydroCAD Software Solutions, LLC. Stormwater conveyance calculations were performed using Worksheet #11 of the Pennsylvania Erosion and Sediment Pollution Control (E&S) Program Manual. Analysis of rates and flows at each point of interest (POI) were completed to meet CG 1 Requirements. National Oceanic Atmospheric Administration (NOAA) Atlas 14 rainfall intensities were used in the calculations. See Appendix A for calculations and results.

##### Drainage Area Summary:

The proposed Compressor Station 605 will be located at a highpoint that drains into two primary drainage areas that are sub-drainage areas of the South Branch of Tunkhannock Creek watershed. Drainage Area A and Drainage Area B comprise a single larger drainage with a combined POI located at POI B. However, they were analyzed separately to demonstrate that there will be no increase in discharge from the site into the existing roadside swale. The Ultimate Point of Interest is located to the south of the site and is shown on the Aerial Location Map and USGS Location Map in this narrative. The peak rate discharges for the sub-drainage areas have been analyzed to demonstrate that there will be no increase in runoff from the site for the 1, 2, 5, 10, 25, 50 and 100 24 hour year storm events. A list of the POIs is given below:

POI A: POI A will drain to an existing roadside swale west of the Site that will convey runoff south to a point of convergence with POI B.

POI B: POI B will drain to an existing roadside swale west of the Site where it will combine with the discharge from POI A. The flow will then be conveyed in the roadside swale to an unnamed tributary to South Branch Tunkhannock Creek and then to South Branch Tunkhannock Creek.

POI C: POI C drains to a convergence point east of the Site. Stormwater runoff will be conveyed from the convergence point, via existing waterways to an unnamed tributary to South Branch Tunkhannock Creek. The runoff will then travel along South Branch Tunkhannock Creek to the ultimate POI.

Overall POI: South Branch of Tunkhannock Creek (see Aerial Location Map and USGS Location Map)

Overall Site: Susquehanna River Watershed

### Volume Summary Table

WATERSHED	2- YR PRE (FT <sup>3</sup> )	2- YR POST (FT <sup>3</sup> )	2- YR VOLUME INCREASE (FT <sup>3</sup> )	2- YR STRUCTURAL AND NONSTRUCTURAL CREDITS (FT <sup>3</sup> )	REDUCTION (FT <sup>3</sup> )
<b>POI A&amp;B</b>	<b>92,842</b>	<b>150,921</b>	<b>58,079</b>	<b>65,090</b>	<b>7,011</b>
<b>POI C</b>	<b>56,541</b>	<b>35,395</b>	<b>-20,146</b>	<b>-</b>	<b>-20,146</b>

\*See Appendix A for calculations.

### Runoff Rate Summary Table

STORM EVENT	DRAINAGE AREA A			DRAINAGE AREA B			DRAINAGE AREA C		
	PRE (CFS)	POST (CFS)	REDUCTION (CFS)	PRE (CFS)	POST (CFS)	REDUCTION (CFS)	PRE (CFS)	POST (CFS)	REDUCTION (CFS)
1-yr	22.95	20.73	2.22	25.77	25.57	0.20	79.40	77.71	1.69
2-yr	35.73	32.75	2.98	40.04	39.67	0.37	123.66	121.03	2.63
5-yr	55.79	51.43	4.36	62.23	61.54	0.69	192.98	188.88	4.10
10-yr	72.72	67.87	4.85	80.90	79.85	1.05	252.17	246.80	5.37
25-yr	98.04	93.83	4.21	108.36	106.38	1.98	340.76	333.51	7.25
50-yr	119.71	114.92	4.79	131.35	128.12	3.23	417.04	408.16	8.88
100-yr	143.36	139.06	4.30	156.60	152.21	4.39	500.28	489.64	10.64

\*See Appendix A.1 for Pre-Development Calculations with Mapping and Appendix A.2 for Post Development Calculations with Mapping.

## Act 167 Summary

The Site is not located within a current, PADEP approved Act 167 Stormwater Management Watershed Plan. Therefore, the Site has been designed to be consistent with CG 1 requirements.

### **1.5 Surface Water Classification**

The PCSM/SR drawings in **Section 3 of the ESCGP-2 NOI** depict the locations of the streams and wetlands in and near the LOD for the Site. The Site area surface water runoff drains to South Branch Tunkhannock Creek, which is not a High Quality (HQ) or Exceptional Value (EV) stream. The receiving waters are designated as Cold Water Fishery (CWF) under PA Code 25 Chapter 93. The Site watershed is not listed as impaired in the PADEP Integrated List.

### **1.6 BMP Description Narrative**

The structural PCSM BMPs listed below are to be used for this Site. The calculations used to design the PCSM BMPs are included in Appendix A. The locations of the PCSM BMPs are shown on the PCSM/SR Plans and Detail Sheets (**Section 3 of the ESCGP-2 NOI**).

Infiltration Basin: Two infiltration basins with a total volume of approximately 39,622 cubic feet will be utilized to infiltrate post construction stormwater runoff and provide runoff rate control.

Infiltration Berm: An infiltration berm will be constructed with Infiltration Basin #1. This will serve to increase the surface area available for infiltration as well as increasing the volume infiltrated without additional excavation.

Stormwater Management Basins: The infiltration basins will also be utilized to provide runoff rate control.

Protect Sensitive and Special Value Features: An area of approximately 6.61 acres of sensitive and special value features will be protected to reduce stormwater impacts. Construction activities will be conducted in a manner that avoids affecting and encroaching upon areas with important stormwater functions or stormwater impact sensitivities wherever practical so that the valuable functions are preserved. This BMP is proposed to account for a portion of the required volume reduction credits.

Minimize Total Disturbed Areas – Grading: The extent of proposed earthwork on the Site will be minimized in order to avoid special value/sensitive areas and reduce disturbed areas. Orange construction fence will be used to protect special value/sensitive areas during construction. This BMP is not proposed to account for any pollutant removal or volume reduction requirements over and above those of the infiltration basin.

Minimize Soil Compaction in Disturbed Areas: Soil compaction within the LOD will be minimized to the extent practicable in order to protect soil quality, preserve permeability and protect the soil from damage where possible. Approximately 2.14 acres of minimum compaction areas will be surrounded by orange construction fence for the duration of construction activities to ensure minimum compaction. This BMP is not proposed to account for any pollutant removal or volume reduction requirements over and above those of the infiltration basin.

Soil Amendment and Restoration: Soil amendments shall be added to infiltration areas after construction in order to restore soil porosity and enhance long term infiltration. Approximately 2.14 acres of infiltration area will receive soil amendments. This BMP is not proposed to account for any pollutant removal or volume reduction requirements over and above those of the infiltration basin.

Reduce Parking Impervious Area: Impervious parking areas will be minimized to the maximum extent practicable. Overflow parking will be on gravel areas. This BMP is not proposed to account for any pollutant removal or volume reduction requirements over and above those of the infiltration basin.

## **1.7 BMP Installation Sequence Narrative**

1. At least 7 days prior to starting any earth disturbance activities, including clearing and grubbing, the owner and/or operator shall invite all contractors, Environmental Inspectors, the landowner, appropriate municipal officials, the E&S plan preparer, the PCSM plan preparer, the licensed professional responsible for oversight of critical stages of implementation of the PCSM plan, and a representative from the local conservation district to an on-site preconstruction meeting.
2. At least 3 days prior to starting any earth disturbance activities, or expanding into an area previously unmarked, the Pennsylvania One Call System Inc. shall be notified at 1-800-242-1776 for the location of existing underground utilities.
3. Hold pre-construction conference with the Environmental Inspectors, local County Conservation District (CCD), PADEP, and Design Engineer.

4. Install orange construction fence around areas to be protected.
5. Locate staging areas and access points including construction entrances. Field locate limits of disturbance.
6. Install rock construction entrances (RCEs).
7. Remove brush to effectively install perimeter controls, level side cuts to grant access for vehicles and workers to safely perform the installation of sediment barriers on the Site as shown on the construction drawings.
8. The Compliance Manager shall provide PADEP and CCD at least three days' notice prior to bulk earth disturbance and upon completed installation of perimeter erosion controls.
9. **\* Install sediment basin, including clay core, antiseep collars, slope liners, cleanout stake, and associated improvements.**
10. Install vegetated roadside swales, culverts and riprap outlet protection. Rough grade access roads.
11. Upon grading Infiltration Basin 2, install orange construction fence to prevent damage. Do not install OS 2. Install compost filter socks at interior toe of slope to minimize siltation of basin bottom.
12. **\* Install drainage channel aprons as soon as swale grading is complete.**
13. Begin construction staking for grading.
14. Begin grading and strip and stockpile topsoil within the area of improvements and install sediment barriers around stockpiles.
15. Upon temporary cessation of an earth disturbance activity or any stage of an activity where the cessation of earth disturbance activities will exceed four days, 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 any stage 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, or an acceptable BMP which

temporarily minimizes accelerated erosion and sedimentation. Temporary stabilization will not occur on active vehicular travel ways within the ROW. The on-Site environmental inspector will log daily activity within the LOD and notify the Contractor of areas requiring temporary stabilization (i.e., areas where work has ceased for at least four days).

16. Grade the compressor station pads, including stormwater runoff conveyance features as shown on the E&SC and PCSM/SR Plans (**Sections 2 and 3 of the ESCGP-2 NOI**).
17. Immediately stabilize side slopes with erosion control matting when slopes are 3:1 or greater. See PCSM/SR Plans and Detail Sheets, as provided in **Section 3 of the ESCGP-2 NOI**, (patterns differ by slope category). Install rip rap slope stabilization where shown on the PCSM/SR Plans.
18. Establish final grade.
19. Surface Stabilization, apply permanent stabilization measures immediately to any disturbed areas where work has reached final grade.
20. Upon completion of all earthwork activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for an inspection prior to the removal/conversion of the E&SC BMPs.
21. **\* After all upslope disturbed areas are stabilized, convert sediment basin to proposed stormwater management basin 1 including infiltration berms and amended soils.**
22. **\* Install OS-2. Install amended soils. Reinstall compost filter sock in interior toe of slope to protect amended soil from siltation.**
23. After finish grading and topsoil placement is completed, disturbed areas shall be fertilized, seeded, and mulched. Seed mixtures, fertilizer and mulch applications rates and dates shall conform to the tables provided on the PCSM/SR Plans and Detail Sheets (**Section 3 of the ESCGP-2 NOI**), land owner agreements and/or the **ECP (Section 4 of the ESCGP-2 NOI)**.
24. After seeding, fertilizing and mulching is complete, install ECBS as required or ordered or on slopes of than 3:1 or greater.

25. After the Site is permanently stabilized and upon PADEP or local CCD and Owner approval of stabilization and re-vegetation, remove temporary erosion and sediment control measures and stabilize areas disturbed by removal.
26. **\* Complete Site stabilization, including soil amendment, seed application, ECB blanket installing in basin, and mulching.**
27. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for a final inspection.
28. Maintain E&SC BMPs until Site work is complete and uniform 70% perennial vegetative cover is established.
29. Remove and properly dispose/recycle E&SC BMPs. Remove orange construction fence. Repair and permanently stabilize areas disturbed during E&SC BMP removal upon establishment of uniform 70% vegetative cover.

**\* indicates a critical stage of PCSM installation to be observed by a licensed professional or designee. Contractor to provide three working days' notice to Design Engineer.**

## **1.8 Supporting Calculations**

Supporting calculations are included in Appendix A.

## **1.9 Plan Drawings**

PCSM/SR Plans, including sensitive resource mapping, are included in **Section 3 of the ESCGP-2 NOI**.

## **1.10 Long Term Operation and Maintenance Schedule**

### **Monitoring**

Transco's personnel (Operations) will perform visual inspections on an annual basis after permit closure, by qualified personnel, trained and experienced in PCSM/SR, to ascertain that the BMPs are functioning and operating effectively to ensure Compressor Station 605 are causing no undue burden on the property owner or adjacent owners. Repairs of deficiencies will be initiated within ten business days of discovery.

## **Maintenance**

The Contractor will be responsible for the maintenance of the system during construction. After construction, the stormwater management facilities will be owned and maintained by Transco.

Where maintenance of the storm system after acceptance by the Owner will primarily consist of routine cleaning of accumulated sediment and debris by facility staff or private contractors, the specific maintenance steps and schedule are listed below:

### 1. Detention/Infiltration Facility

Inspect detention/infiltration facility annually and inspect soil, repair eroded areas and remove litter and debris as needed. Inspect twice a year for sediment buildup, erosion and vegetative conditions. Remove and replace dead and diseased vegetation. Any litter, debris, sediment, vegetation, or other items removed during maintenance activities will be disposed of in a manner consistent with the ESCGP-2 requirements. **Compaction of the basin bottom shall be prevented.**

### 2. Vegetated Swales with **Earthen** Check Dams

**Vegetated swales with Earthen Check Dams are to be inspected annually for sediment, build-up, erosion debris, and damage due to traffic. Ditches should be maintained to ensure that the specified design dimensions and vegetative lining are available at all times. No more than one-third of the shoot (grass leaf) shall be removed in any mowing. Grass height shall be maintained between 3 and 6 inches unless otherwise specified. Excess vegetation shall be removed from permanent channels to ensure sufficient channel capacity. Any litter, debris, sediment, vegetation, or other items removed during maintenance activities will be disposed of in a manner consistent with the ESCGP-2 requirements.**

### 3. Infiltration Berms/Retentive Grading

**All berms must be kept free of obstructions such as fill, fallen leaves & woody debris, accumulated sediment, and construction material/wastes. Any disturbance to the berms shall be immediately repaired and stabilized. Compaction of the berm bottoms shall be prevented.**

### 4. Protect Sensitive/Special Value Features

***Protected areas shall remain undisturbed after construction activities cease. Orange construction fence will be used to protect special value/sensitive areas during construction.***

5. Minimize Soil Compaction

- ***Protected areas – restrict vehicle access, do not clear vegetation. Avoid earth disturbance.***
- ***Minimum disturbance areas – Restrict vehicle access.***

6. Soil Amendment and Restoration

Restrict vehicle access. Monitor water drawdown time in infiltration areas and replace amended soils if dewatering time increases to more than three days. Maintain Infiltration areas and vegetated swales as indicated on the PCSM/SR Plans.

7. Reduce Parking Area Imperviousness

Gravel areas will be maintained in good condition and will not be paved without obtaining prior approval from the PADEP or the County Conservation District.

8. Annual Records of Maintenance Procedures

The facility shall maintain a checklist whenever the storm system is inspected and cleaned. An annual list of inspections and major cleaning operations and repairs (pumping, sweeping parking lots, cleaning catch basin, etc.) shall be maintained. The local CCD or enforcement officials shall have access to those records.

9. ESCGP-2

The facility Owner and Operator shall ensure compliance with ESCGP-2 requirements by meeting all ongoing record, keeping maintenance, and other applicable ESCGP-2 and PADEP permit conditions.

### **1.11 Material Recycling and Disposal**

Transco has prepared a Spill Plan for Oil and Hazardous Materials to assist in prevention of any spills that may occur at the Site and to respond to any spills that do occur. The Contractor will be required to become familiar with the Spill Plan for Oil and

Hazardous Materials and its contents prior to commencing any construction-related activities. The Spill Plan for Oil and Hazardous Materials is included as **Attachment 9 to the ECP** provided as **Section 4 of the ESCGP-2 NOI**.

Contractors are required to inventory and manage their construction site materials. The goal is to be aware of the materials on-site; ensure they are properly maintained, used, and disposed of; and to make sure the materials are not exposed to stormwater.

### ***Materials Covered***

The following materials or substances are expected to be present on-site during construction (**Note: this list is not an all-inclusive list and the Materials Management Practices can be modified to address additional materials used on-site**):

- Acids
- Detergents
- Fertilizers (nitrogen/phosphorus)
- Hydroseeding mixtures
- Petroleum based products
- Sanitary wastes
- Soil stabilization additives
- Solder
- Solvents
- Other

These materials must be stored as appropriate and shall not contact storm or non-stormwater discharges. Contractor shall provide a weather proof container to store chemicals or erodible substances that must be kept on the Site. Contractor is responsible for reading, maintaining, and making employees and subcontractors aware of safety data sheets (SDSs).

### ***Material Management Practices***

The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

1. Good Housekeeping Practices

The following good housekeeping practices will be followed on Site during construction:

- Store only enough material required to do the job.
- Store materials in a neat, orderly manner.
- Store chemicals in watertight containers or in a storage shed, under a roof, completely enclosed, with appropriate secondary containment to prevent spill or leakage. Drip pans shall be provided under dispensers.
- Substances will not be mixed with one another unless recommended by the Manufacturer.
- Manufacturer's recommendations for proper use and disposal will be followed.
- Inspections will be performed to ensure proper use and disposal of materials.
- Cover and berm loose stockpiled construction materials that are not actively being used (i.e. Soil, spoils, aggregate, etc.).
- Minimize exposure of construction materials to precipitation.
- Minimize the potential for off-site tracking of loose construction and landscape materials.

## 2. Hazardous Products

These practices will be used to reduce the risks associated with hazardous materials. SDSs for each substance with hazardous properties that is used on the job site(s) will be obtained and used for the proper management of potential wastes that may result from these products. A SDS will be posted in the immediate area where such product is stored and/or used and another copy of each SDS will be maintained in a file at the job site construction trailer office. Each employee, who must handle a substance with hazardous properties, will be instructed on the use of SDS and the specific information in the applicable SDS for the product he/she is using, particularly regarding spill control techniques.

- Products will be kept in original containers with the original labels in legible condition.

- Original labels and SDSs will be produced and used for each material.
- If surplus product must be disposed of, manufacturers or local/state/federal recommended methods for proper disposal will be followed.

### 3. Hazardous Wastes

All hazardous waste materials will be disposed of by the Contractor in the manner specified by local, state, and/or federal regulations and by the manufacturer of such products. Site personnel will be instructed.

### 4. Concrete and Other Wash Waters

Prevent disposal of rinse, wash waters, or materials on impervious or pervious surfaces, into streams, wetlands or other water bodies.

Concrete trucks will be allowed to wash out or discharge surplus concrete or drum wash water on the Site, but only in either (1) specifically designated diked areas which have been prepared to prevent contact between the concrete and/or washout and soil and stormwater having the potential to be discharged from the Site; or (2) in locations where waste concrete can be poured into forms to make riprap or other useful concrete products.

The hardened residue from the concrete washout diked areas will be disposed of in the same manner as other non-hazardous construction waste materials or may be broken up and used on the Site as deemed appropriate by the Contractor and Owner or Owner's representative. The Contractor will be responsible for seeing that these procedures are followed.

All concrete washout areas will be located in an area where the likelihood of the area contributing to stormwater discharge is negligible. If required, additional E&SC BMPs must be implemented to prevent concrete wastes from contributing to stormwater discharges. The location of the concrete washout area(s) must be identified, by the Contractor/Job Site Superintendent, on the job site copy of the E&SC Plans (**Section 2 of the ESCGP-2 NOI**) and in the E&SC Narrative.

### 5. Sanitary Wastes

All sanitary waste units will be located in an area where the likelihood of the unit contributing to stormwater discharges is negligible. Additional E&SC BMPs must be implemented, such as containment trays (provided by the rental company) or

special containment created with 2" x 4" lumber, impervious plastic, and gravel. The location of the sanitary waste units must be identified on the job site copy of the E&SC Plans (**Section 2 of the ESCGP-2 NOI**), in the E&SC Narrative, by the Contractor/Job Site Superintendent.

## 6. Solid and Construction Wastes

All waste materials will be collected and stored in a securely lidded metal dumpster. The dumpster will comply with all local and state solid waste management regulations. The dumpster/container lids shall be closed at the end of every business day and during rain events. Appropriate measures shall be taken to prevent discharges from waste disposal containers to the receiving water.

## 7. Construction Access

A stabilized construction exit will be provided to help reduce vehicle tracking of sediments. The paved roads adjacent to the Site entrance will be inspected daily and swept as necessary to remove any excess mud, dirt, or rock tracked from the Site. Dump trucks hauling material from the construction site will be covered with a tarpaulin as necessary.

## 8. Petroleum Products

On-site vehicles will be monitored for leaks and receive regular preventative maintenance. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Petroleum storage tanks on-site will have a dike or berm containment structure constructed around it to contain spills which may occur (containment volume to be 110% of volume stored). The dike or bermed area shall be lined with an impervious material such as a heavy duty plastic sheet. Drip pans shall be provided for all dispensers. Any asphalt substances used on the Site will be applied according to the manufacturer's recommendations.

## 9. Fertilizers and Landscape Materials

Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to minimize the potential for exposure to stormwater. Storage will be under cover. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to minimize the potential for spills. The bin shall be labeled appropriately.

Contain stockpiled materials, such as but not limited to, mulches, top soil, rocks and gravel, and decomposed granite, when they are not actively being used.

Apply erodible landscape material at quantities and application rates according to the manufacturer's recommendations or based on written specifications by knowledgeable and experienced field personnel. Discontinue the application of any erodible landscape material within two days prior to a forecasted rain event or during periods of precipitation.

#### 10. Paints, Paint Solvents and Cleaning Solvents

Containers will be tightly sealed and stored when not in use. Excess paint and solvents will be properly disposed of according to the manufacturer's recommendations or local, state, and/or federal regulations.

#### 11. Contaminated Soils

Any contaminated soils (resulting from spills of materials with hazardous properties) which may result from construction activities will be contained and cleaned up immediately in accordance with applicable local, state and federal regulations.

### 1.12 Soil Conditions and Geologic Formations

There are no naturally occurring geologic formations or soils on-site are expected that may have the potential to cause pollution during earth disturbance activities. See E&SC Detail Sheets (**Section 2 of the ESCGP-2 NOI**) for Acid-Producing Soils and Bedrock Control Plan should any unexpected acid runoff producing soils be encountered.

### 1.13 Thermal Impacts

Thermal impacts associated with CPL North, CPL South, and Associated Facilities will be avoided to the maximum extent practicable. The following provisions related to thermal impacts are included in the **E&SC Plan** within **Section 2 of the ESCGP-2 NOI**:

- The minimum permanent changes in land cover, necessary to construct the required facilities are being proposed.
- Runoff from the permanent impervious areas will be collected as part of the Post Construction Stormwater Management/Site Restoration (PCSM/SR) Plan and

routed to PCSM/SR BMPs. In addition, impervious areas will be gravel instead of asphalt wherever practical.

- PCSM/SR BMPs incorporate the use of infiltration facilities such as basins and vegetated swales with Rock Filter Check Dams.
- The removal of vegetation, especially tree cover, will be limited to only that necessary for construction.
- The amount of impervious surfaces will be limited to only that necessary to support the construction of CPL North, CPL South, and Associated Facilities and/or operation of the pipeline.
- The impacts to existing riparian corridors will be limited to only that necessary for construction.

#### **1.14 Riparian Forest Buffer Management Plan**

There are no regulated riparian buffers within the Site area.

#### **1.15 Antidegradation Requirements**

The Site is not located in a special protection or siltation impaired watershed; therefore, no antidegradation analysis is necessary.

#### **1.16 Preparedness Prevention and Contingency Plan**

**See Attachment 9 of the ECP within Section 4 of the ESCGP-2 NOI** for the Preparedness Prevention and Contingency Plan provided.



## **APPENDICES**

- Appendix A            Compressor Station 605 Supporting Calculations
- A.1    Pre-Development Calculations
  - A.2    Post Development Calculations
  - A.3    Conveyance Calculations
  - A.4    PCSM BMP Calculations
  - A.5    Water Quality Worksheets
  - A.6    Site Characterization Assessment
  - A.7    Supporting Documentation
- Appendix B            Preparer Qualifications
- Appendix C            United States Department of Agriculture (USDA) Natural  
Resources Conservation Service (NRCS) Custom Soil  
Resource Report



## **APPENDIX A**

### **Compressor Station 605 Supporting Calculations**

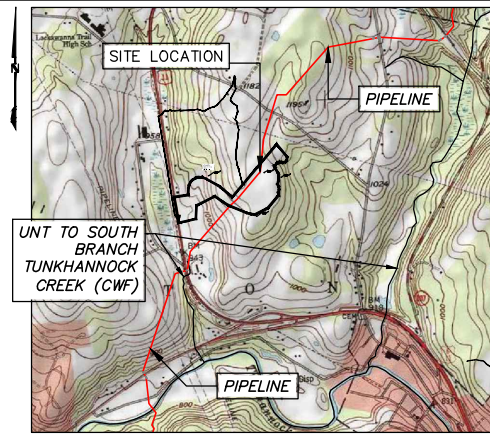
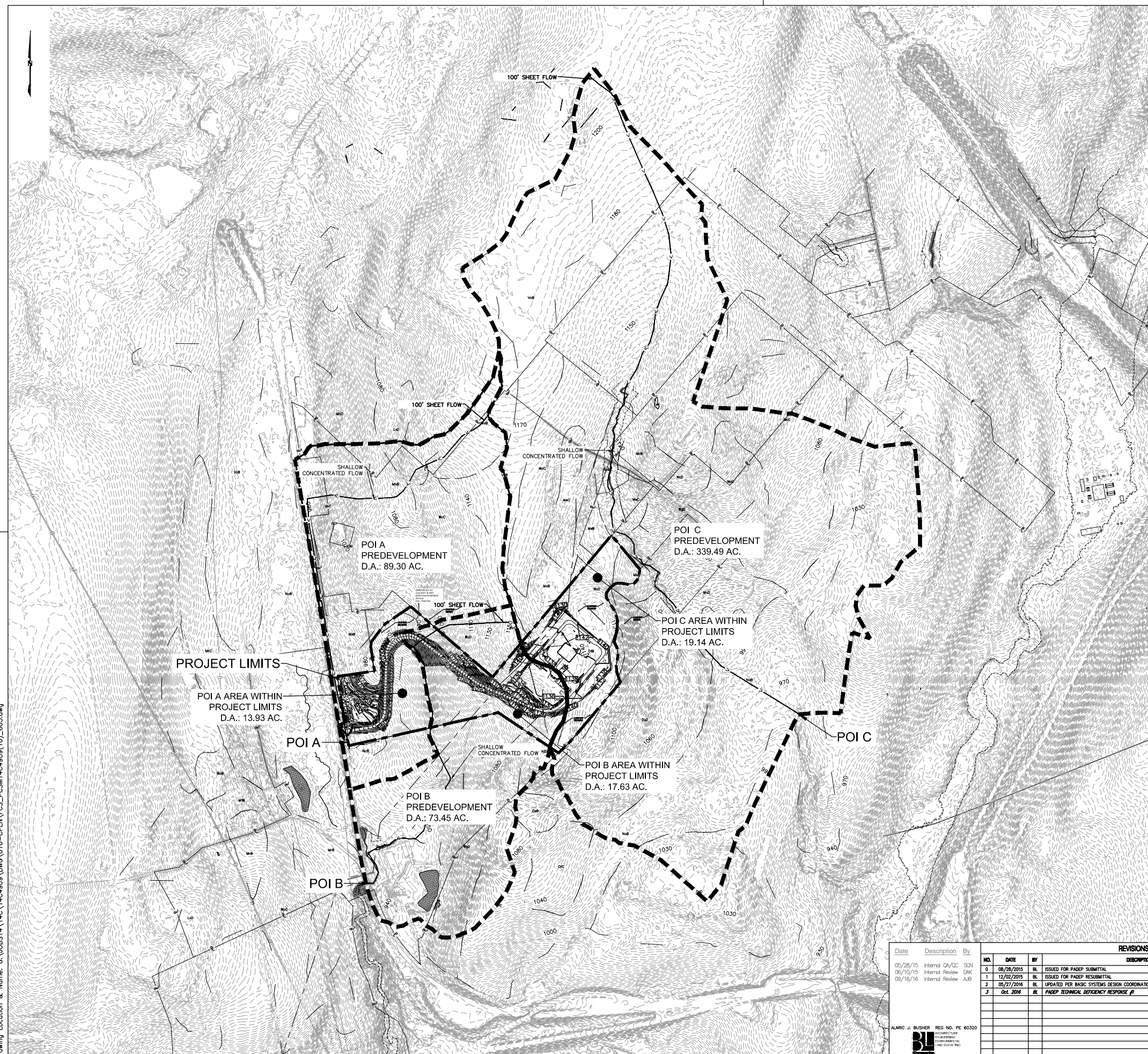
- A.1 Pre-Development Calculations
- A.2 Post Development Calculations
- A.3 Conveyance Calculations
- A.4 PCSM BMP Calculations
- A.5 Water Quality Worksheets
- A.6 Site Characterization Assessment
- A.7 Supporting Documentation



## A.1 Pre-Development Calculations

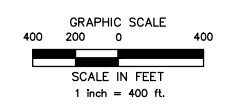


Drawing Location & Name: G:\OBSS14\14C\14C4909\DWG\010-CPLN\FCS\_PCSM14C4909\10\_605.dwg



**LEGEND**

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- MAJOR CONTOUR (10' INTERVAL)
- MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
- UTILITY BOX
- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- SOIL TYPE DESIGNATION
- ESCGP-2 PERMIT BOUNDARY (OVERALL PIPELINE PROJECT)
- LIMIT OF DISTURBANCE (COMPRESSOR STATION 605)
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- EXISTING ROAD
- ROW
- DRAINAGE AREA BOUNDARIES



REVISIONS			
NO.	DATE	BY	DESCRIPTION
0	08/28/2015	BL	ISSUED FOR PADEP SUBMITTAL
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL
2	05/27/2016	BL	UPDATED PER BASIC SYSTEMS DESIGN COORDINATION
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1

TRANSCONTINENTAL GAS PIPELINE COMPANY LLC			
ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE			
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS			
FOR COMPRESSOR STATION 605			
CLINTON TOWNSHIP, WYOMING COUNTY, PENNSYLVANIA			
PRE-DEVELOPMENT DRAINAGE AREA MAP			
DRAWN BY:	AGE	DATE: 04/03/15	ISSUED FOR BID: SCALE: AS NOTED
CHECKED BY:	AJB	DATE: 04/03/15	ISSUED FOR CONSTRUCTION: REVISION: J
APPROVED BY:	AJB	DATE: 07/17/15	DRAWING NUMBER: (66-0605)F-1A-9 SHEET 1 OF 1
NO.	1161497		

ALAN J. BUSHNER REG. NO. PE 60320





An Employee-Owned Company

## **Point of Interest A Pre-Development Calculations**



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 22.95 cfs @ 12.78 hrs, Volume= 4.116 af, Depth= 0.55"

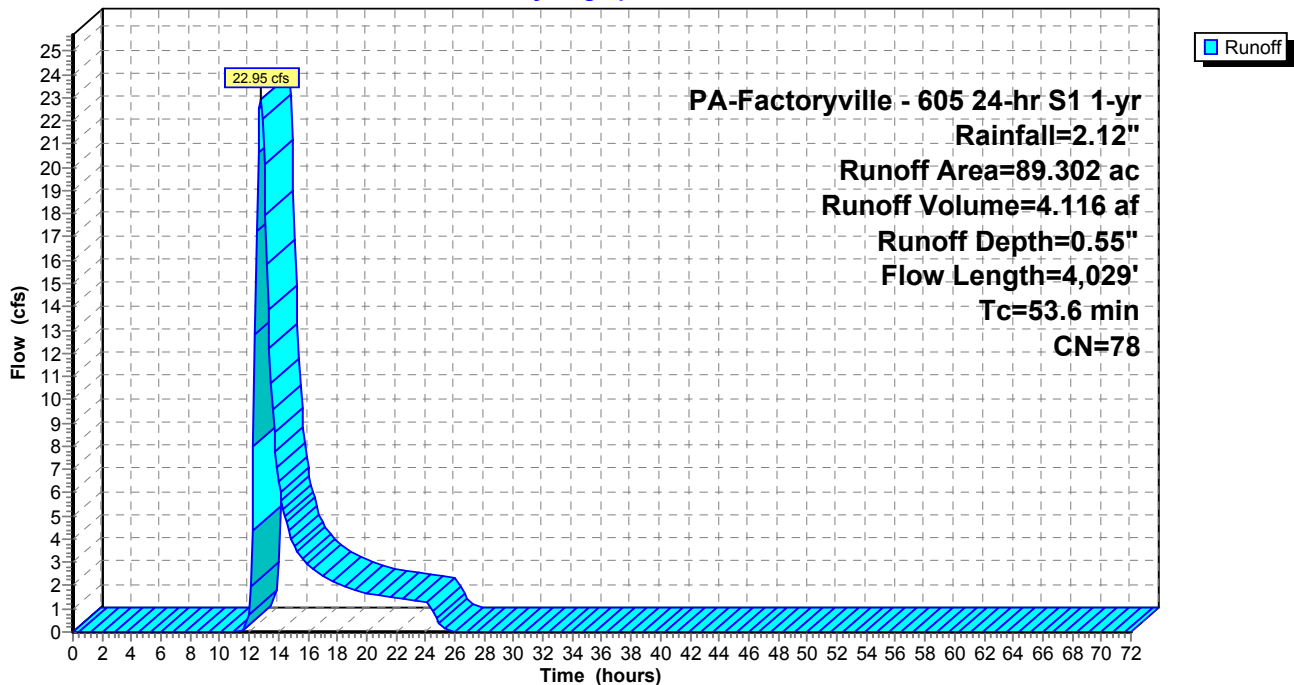
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 35.73 cfs @ 12.76 hrs, Volume= 6.057 af, Depth= 0.81"

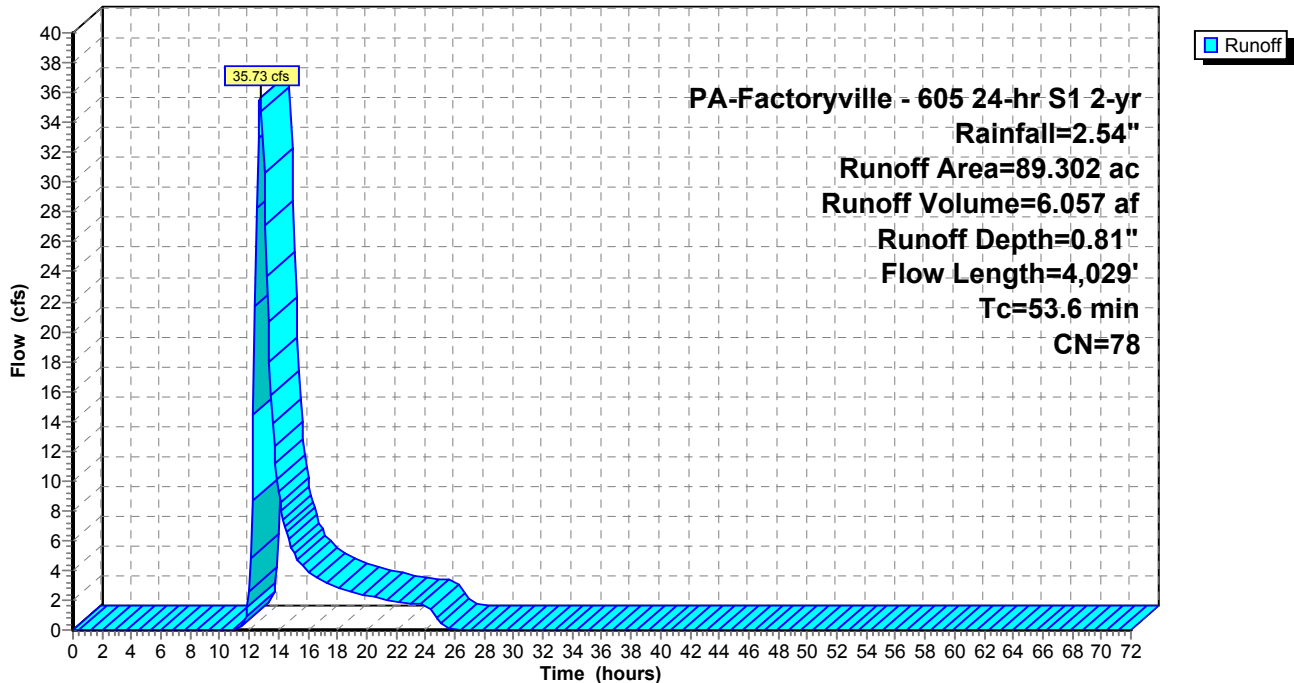
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b> Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 55.79 cfs @ 12.74 hrs, Volume= 9.150 af, Depth= 1.23"

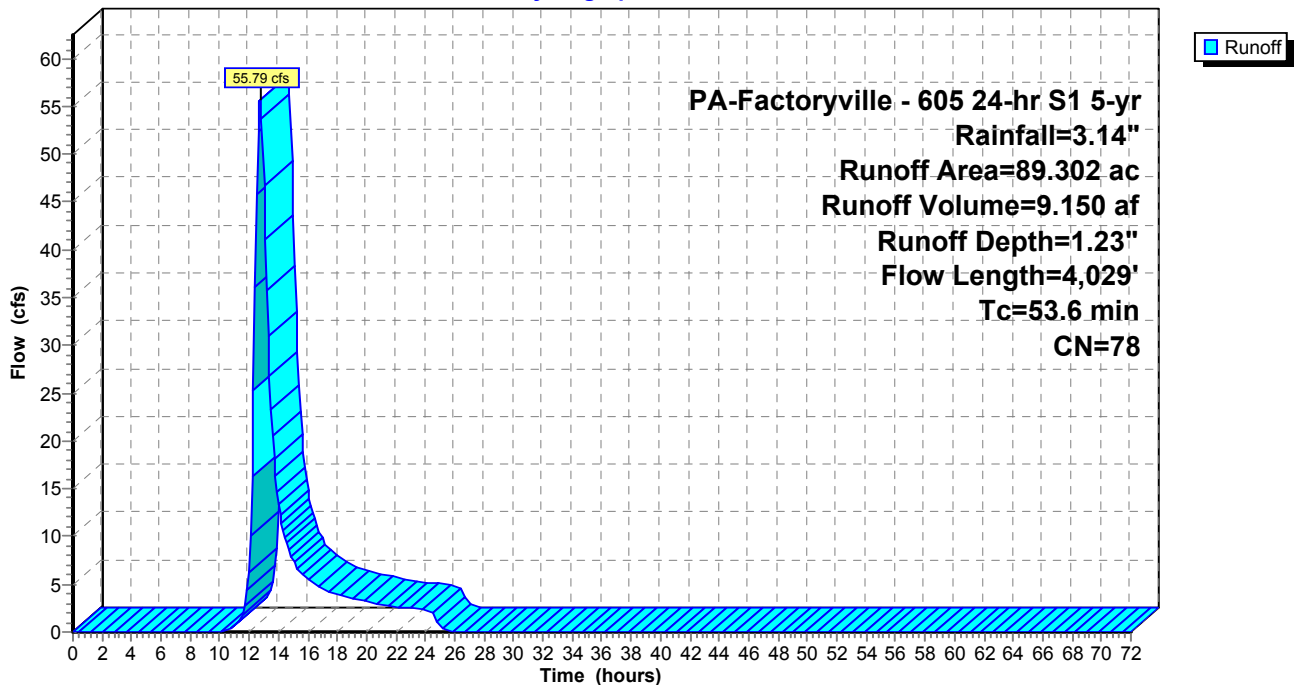
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b> Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 72.72 cfs @ 12.73 hrs, Volume= 11.998 af, Depth= 1.61"

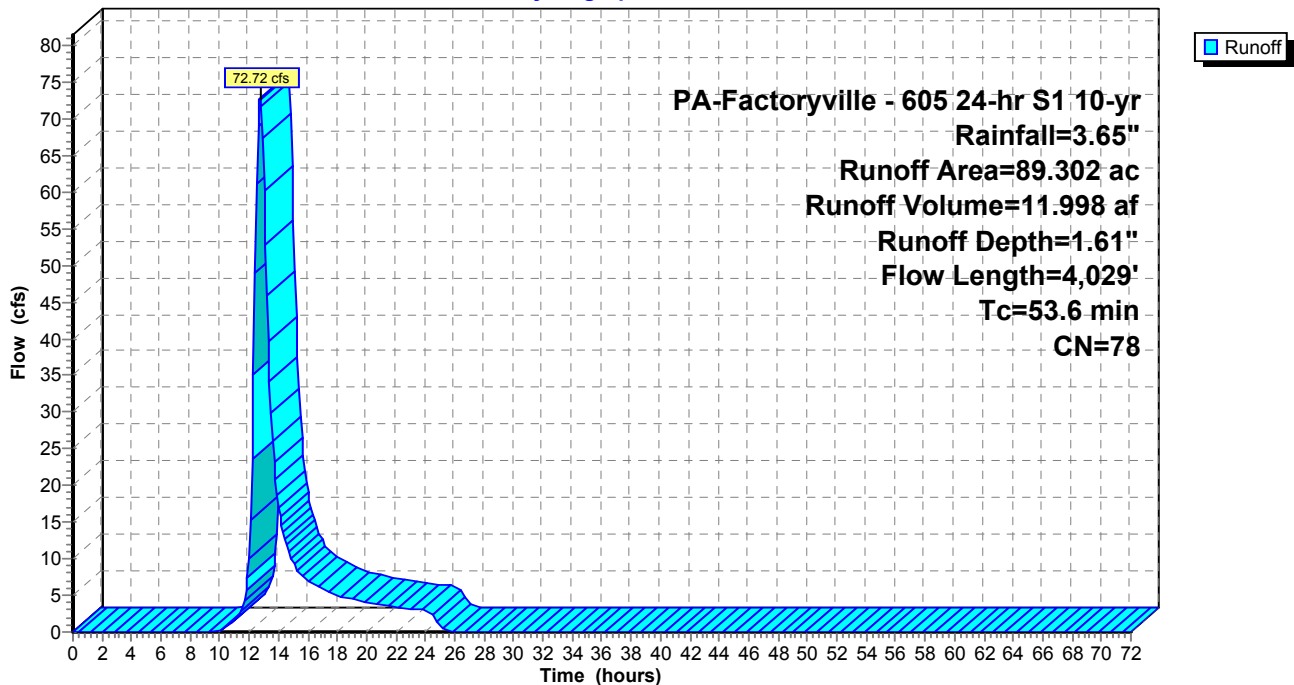
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 98.04 cfs @ 12.72 hrs, Volume= 16.695 af, Depth= 2.24"

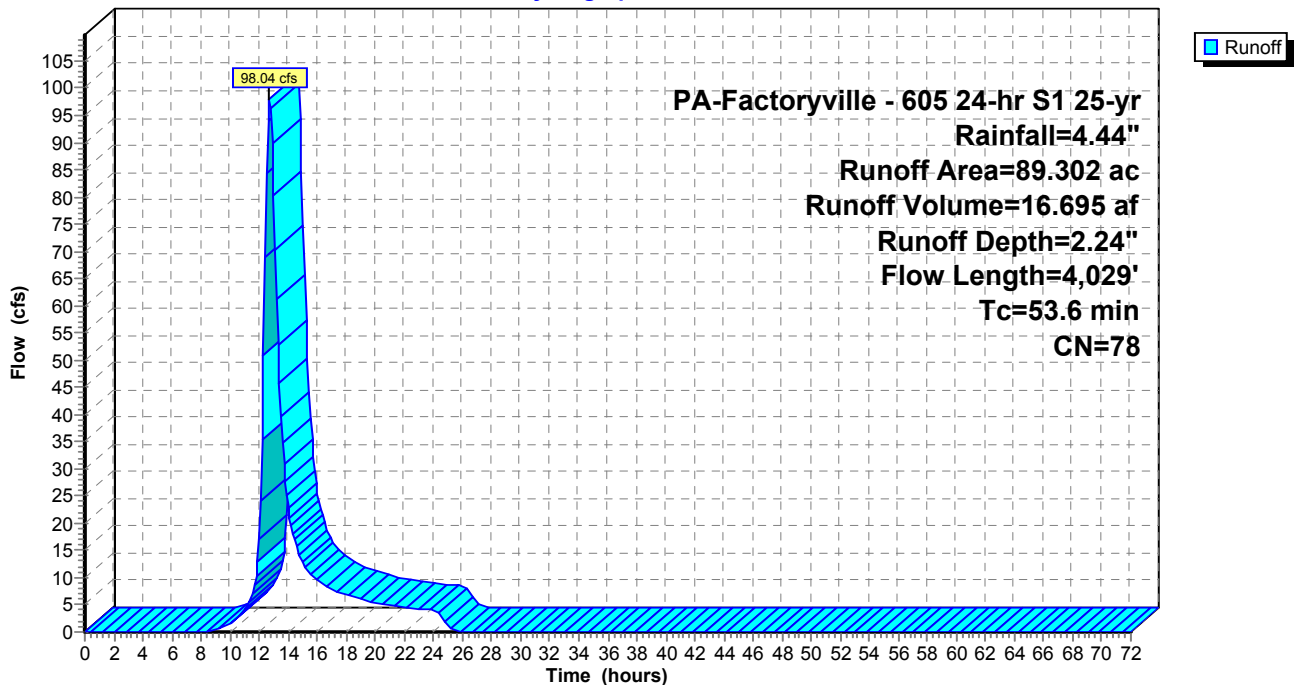
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 119.71 cfs @ 12.71 hrs, Volume= 21.195 af, Depth= 2.85"

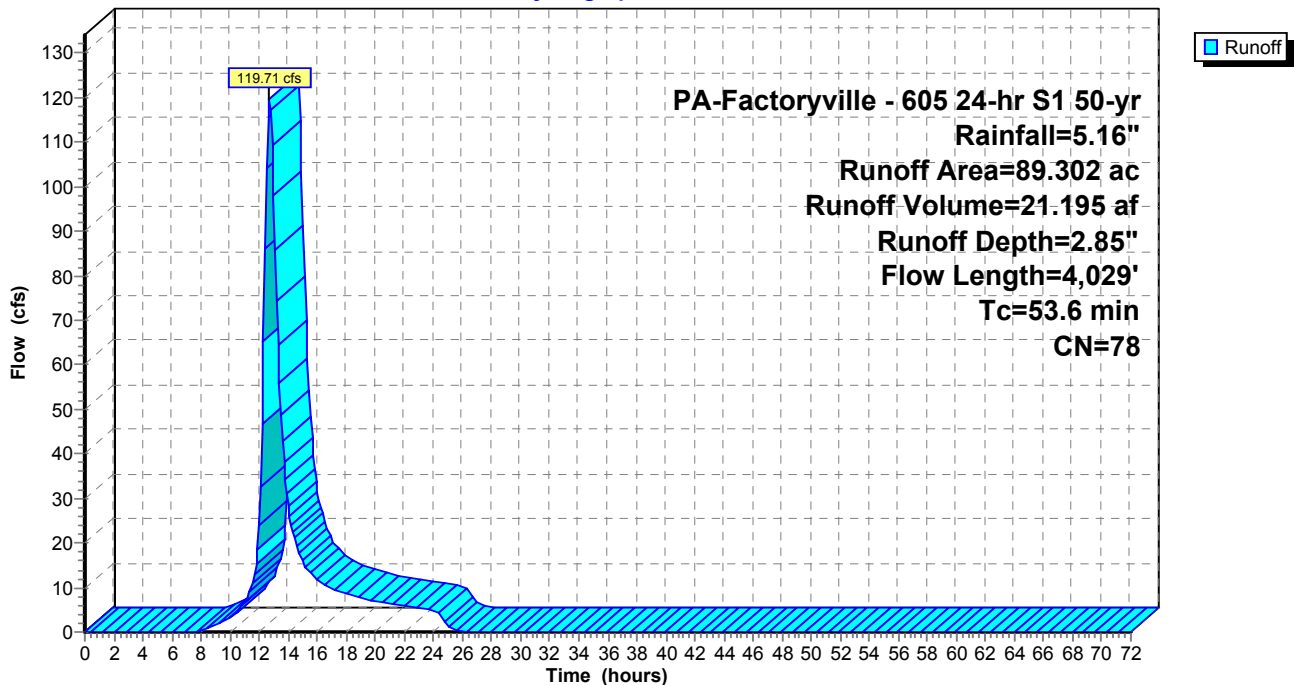
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph



**Summary for Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Runoff = 143.36 cfs @ 12.70 hrs, Volume= 26.502 af, Depth= 3.56"

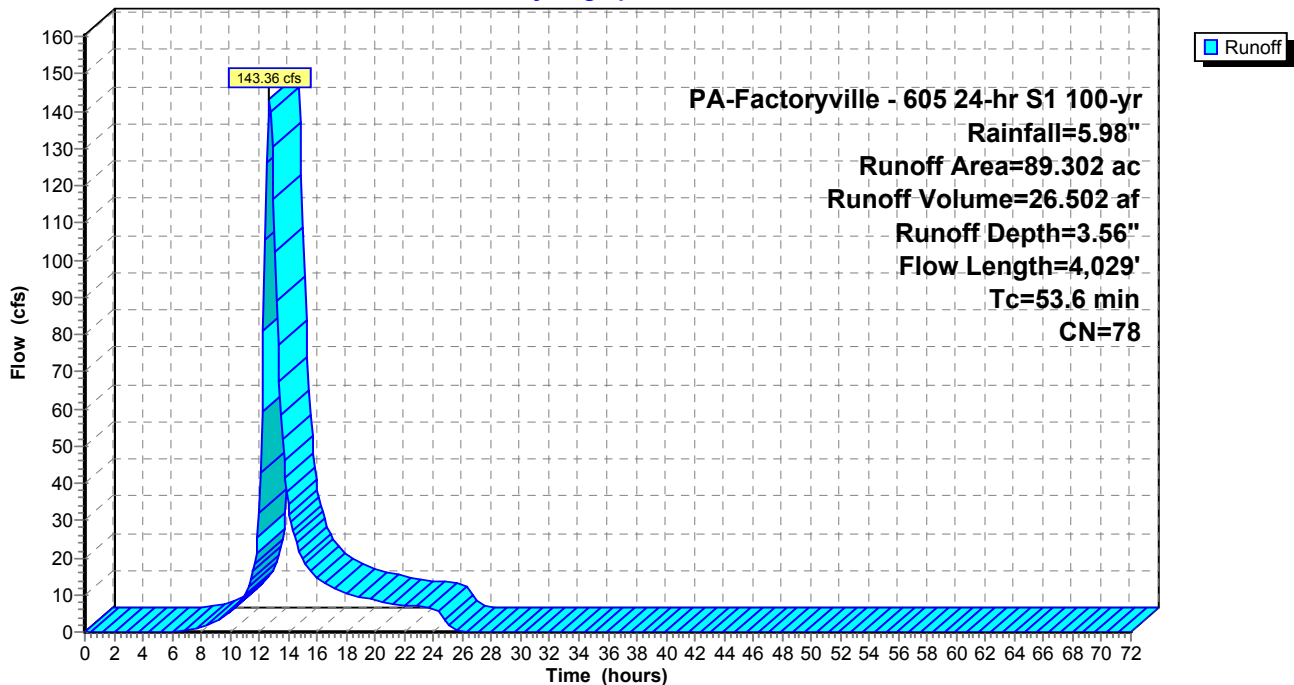
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
50.860	78	Meadow, non-grazed, HSG D
* 1.595	98	Impervious areas, HSG D
89.302	78	Weighted Average
87.707		98.21% Pervious Area
1.595		1.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 1: PREDEVELOPMENT DRAINAGE AREA TO POI A**

Hydrograph







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## **Point of Interest B Pre-Development Calculations**



**Summary for Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B**

Runoff = 25.77 cfs @ 12.43 hrs, Volume= 3.386 af, Depth= 0.55"

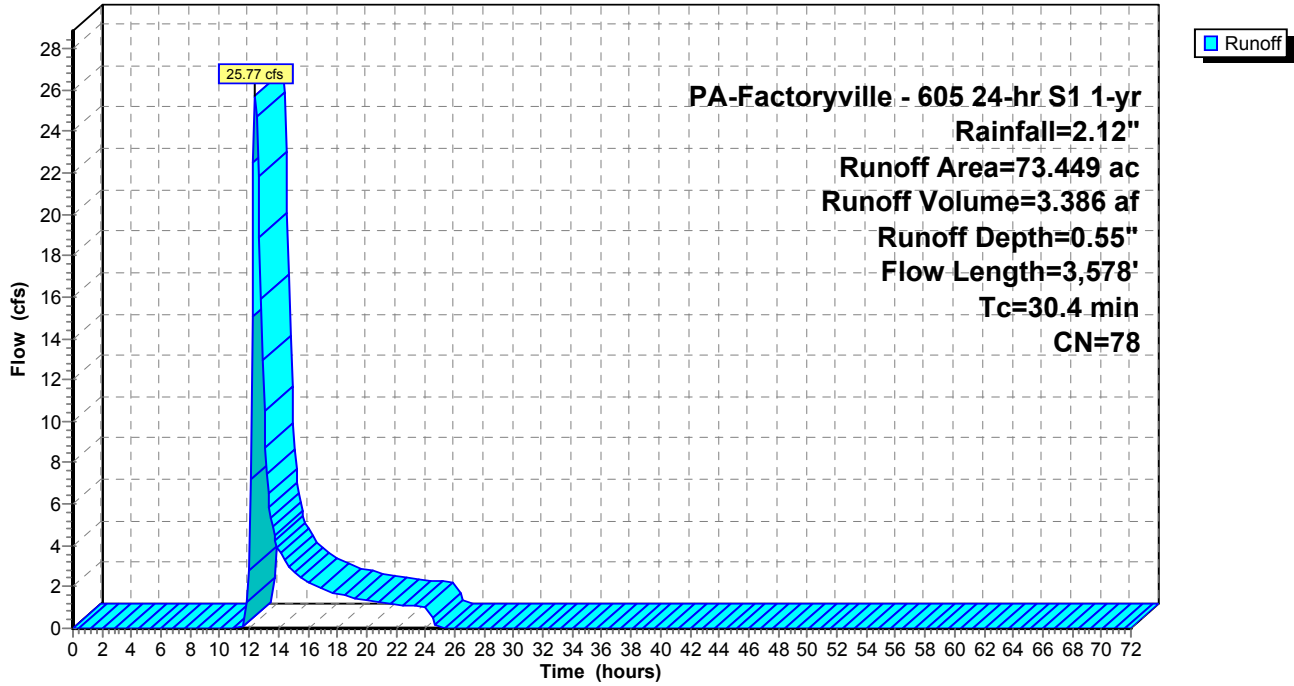
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
9.212	77	Woods, Good, HSG D
63.026	78	Meadow, non-grazed, HSG D
* 1.211	98	Impervious areas, HSG D
73.449	78	Weighted Average
72.238		98.35% Pervious Area
1.211		1.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0850	0.30		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
1.5	224	0.1290	2.51		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.6	325	0.1780	2.11		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
1.5	242	0.1490	2.70		<b>Shallow Concentrated Flow, SCF 3</b> Short Grass Pasture Kv= 7.0 fps
11.4	1,219	0.0140	1.77		<b>Shallow Concentrated Flow, SCF 4</b> Grassed Waterway Kv= 15.0 fps
0.2	110	0.2700	7.79		<b>Shallow Concentrated Flow, SCF 5</b> Grassed Waterway Kv= 15.0 fps
1.0	226	0.0620	3.73		<b>Shallow Concentrated Flow, SCF 6</b> Grassed Waterway Kv= 15.0 fps
4.3	798	0.0430	3.11		<b>Shallow Concentrated Flow, SCF 7</b> Grassed Waterway Kv= 15.0 fps
2.4	334	0.0240	2.32		<b>Shallow Concentrated Flow, SCF 8</b> Grassed Waterway Kv= 15.0 fps
30.4	3,578	Total			

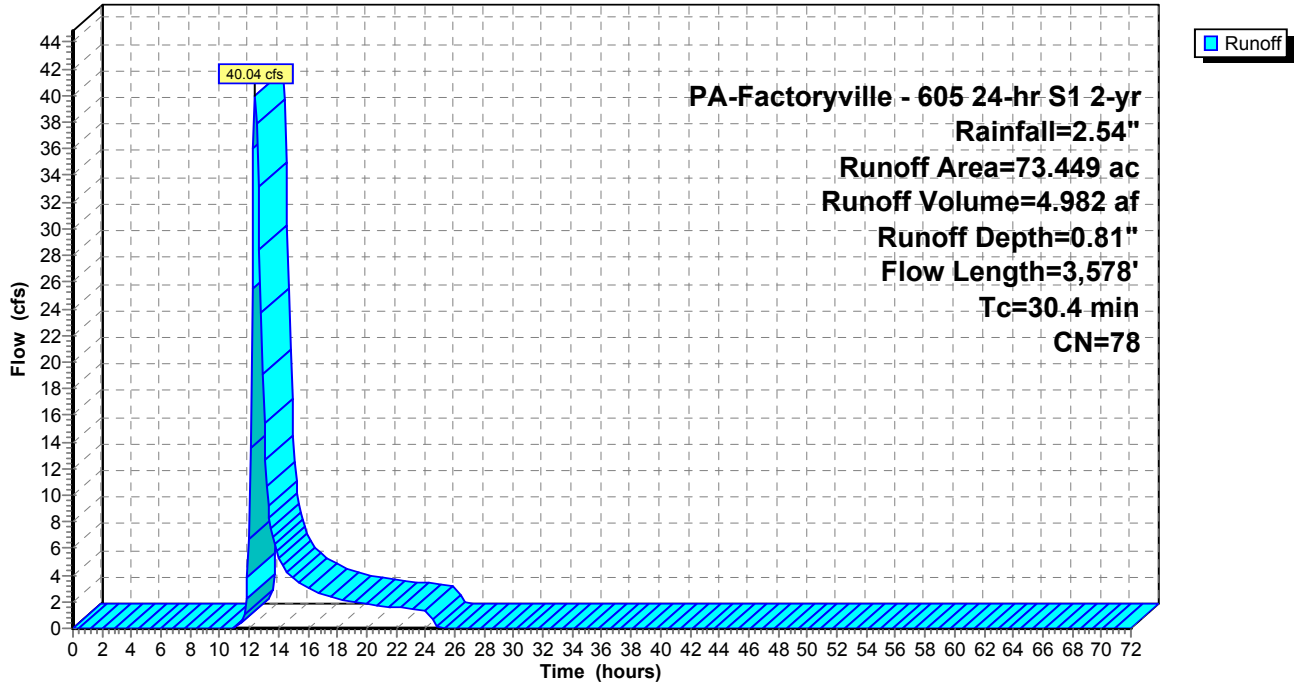
**Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



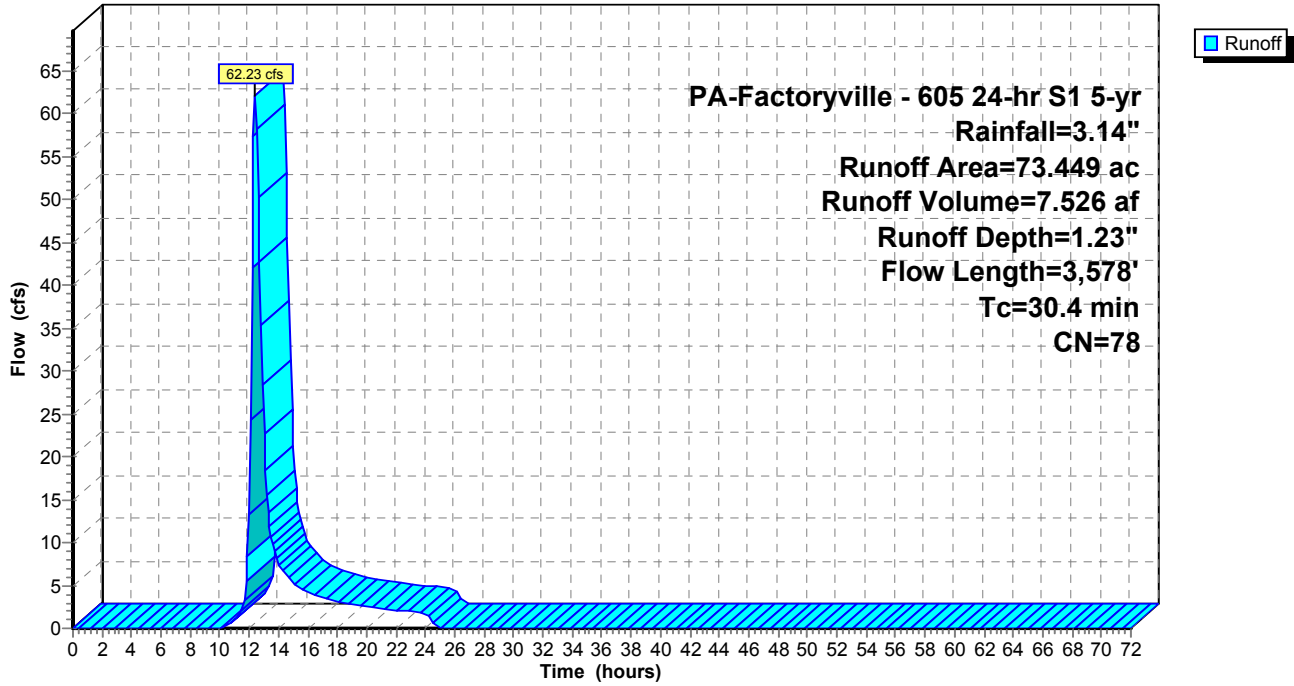
**Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



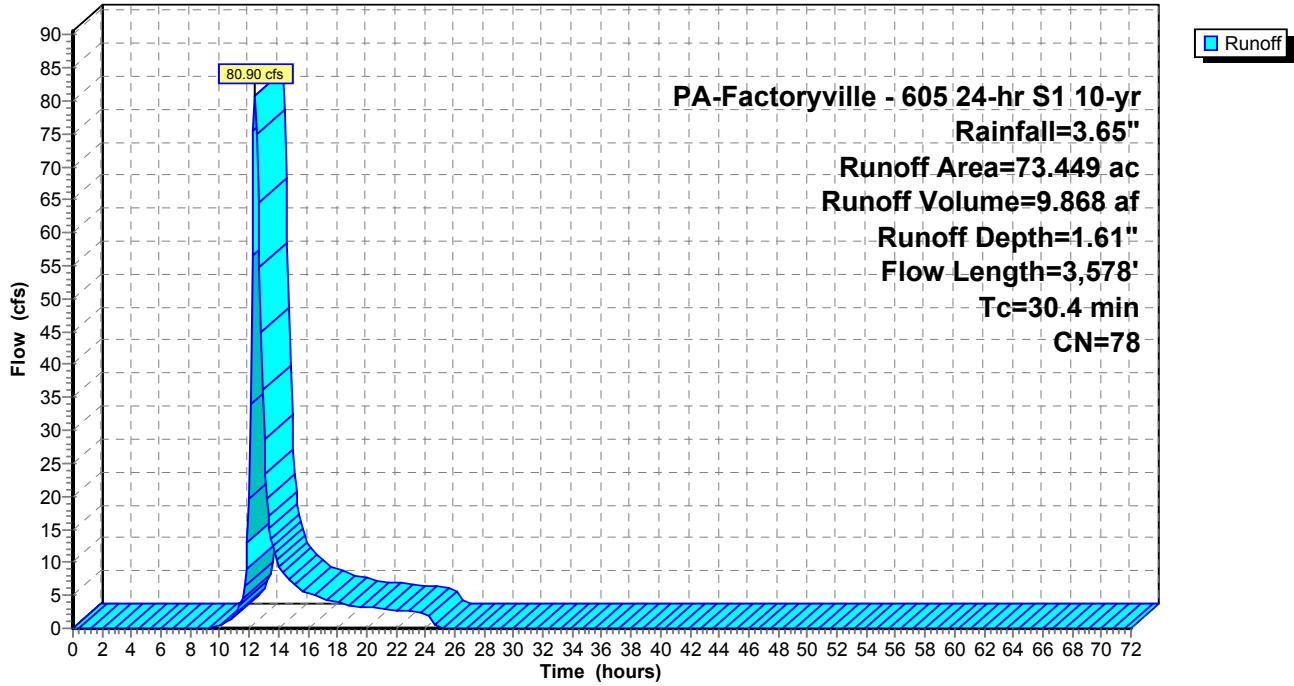
### Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B

Hydrograph



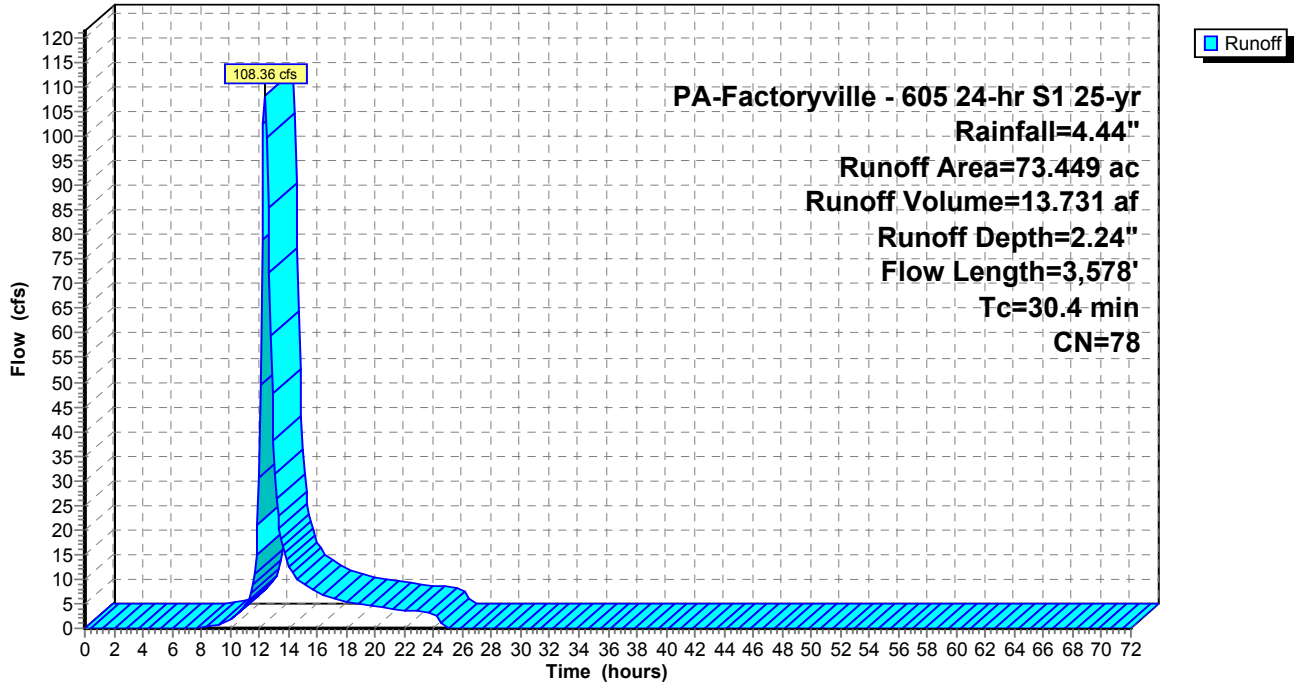
**Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



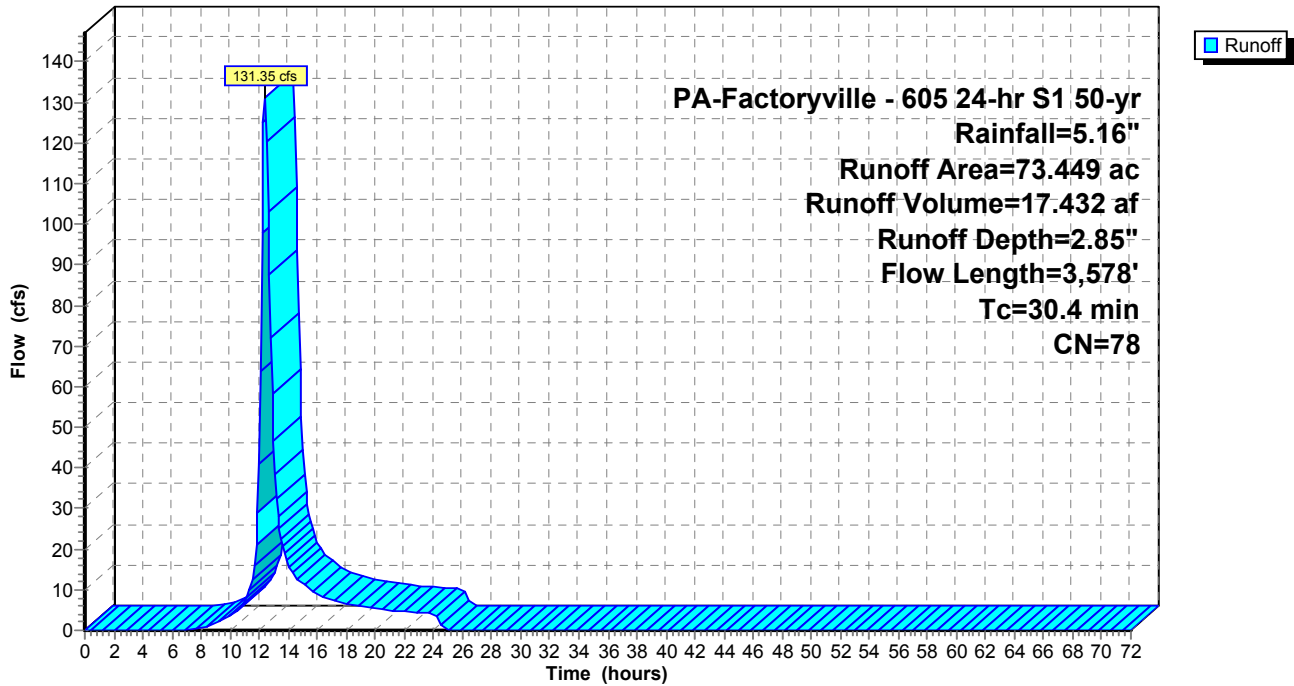
### Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B

Hydrograph



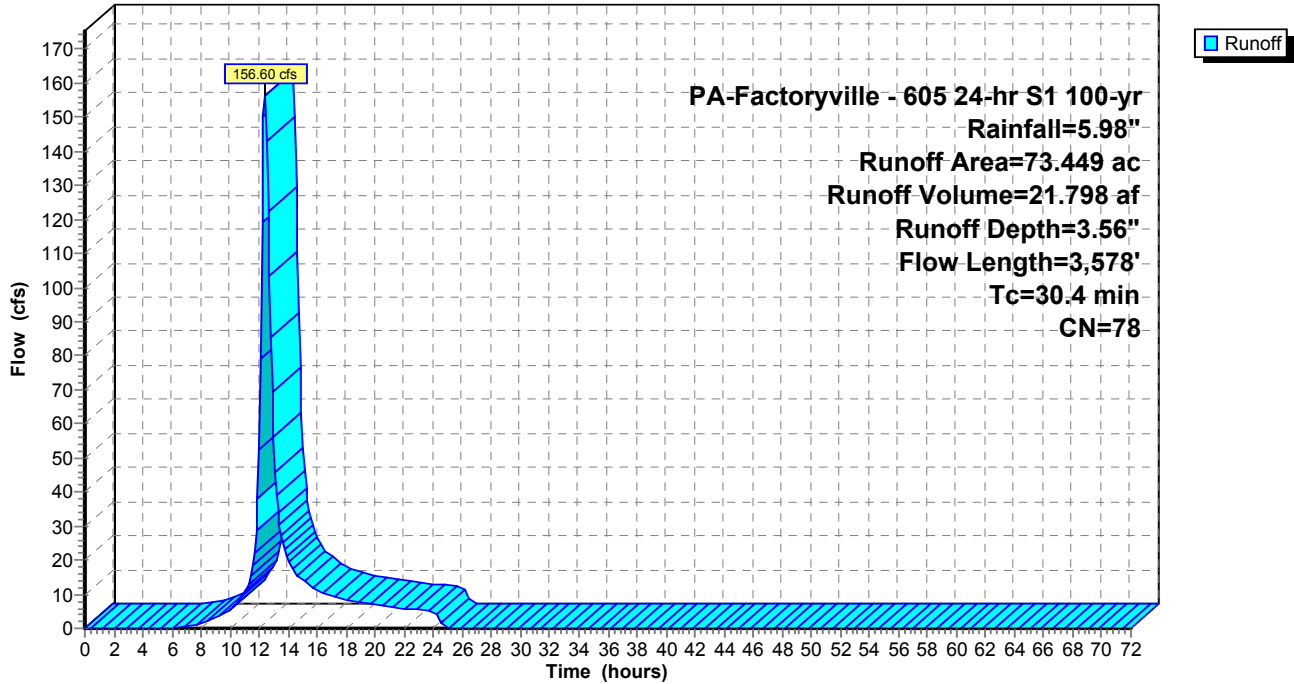
### Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B

Hydrograph



**Subcatchment 2: PREDEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph





An Employee-Owned Company

## **Point of Interest C Pre-Development Calculations**



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 79.40 cfs @ 12.91 hrs, Volume= 15.649 af, Depth= 0.55"

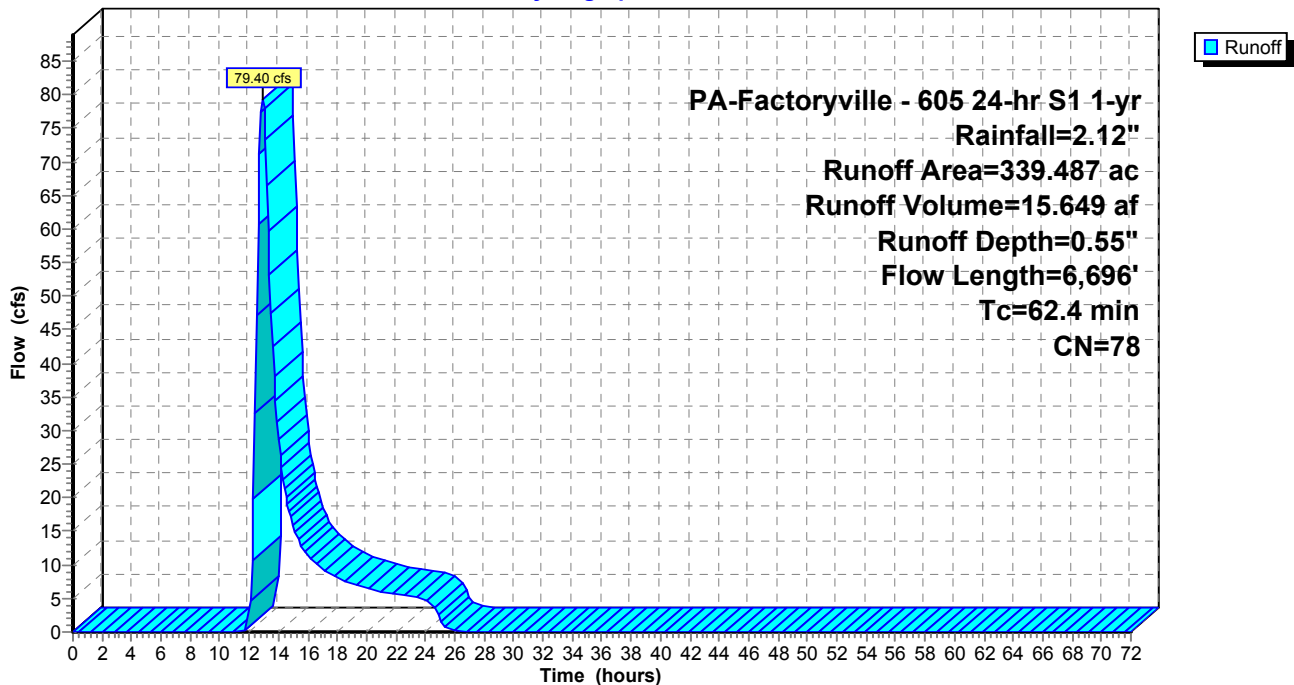
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 123.66 cfs @ 12.88 hrs, Volume= 23.028 af, Depth= 0.81"

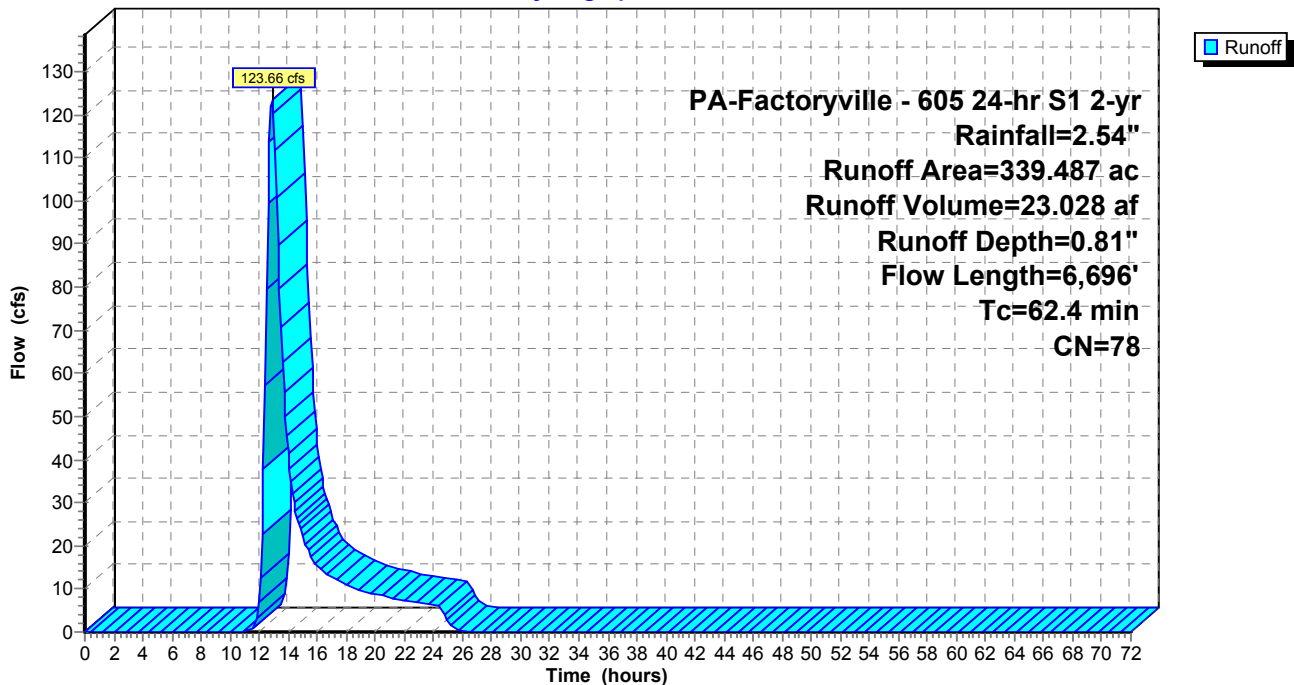
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 192.98 cfs @ 12.86 hrs, Volume= 34.785 af, Depth= 1.23"

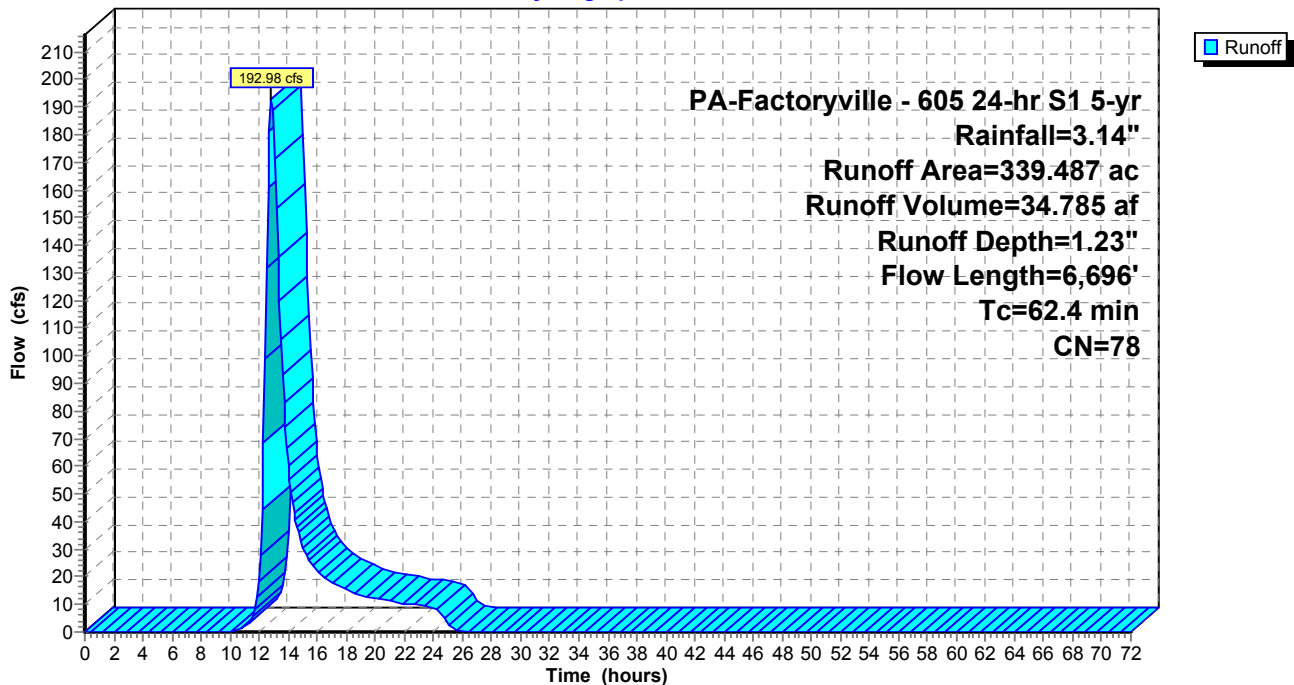
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 252.17 cfs @ 12.85 hrs, Volume= 45.612 af, Depth= 1.61"

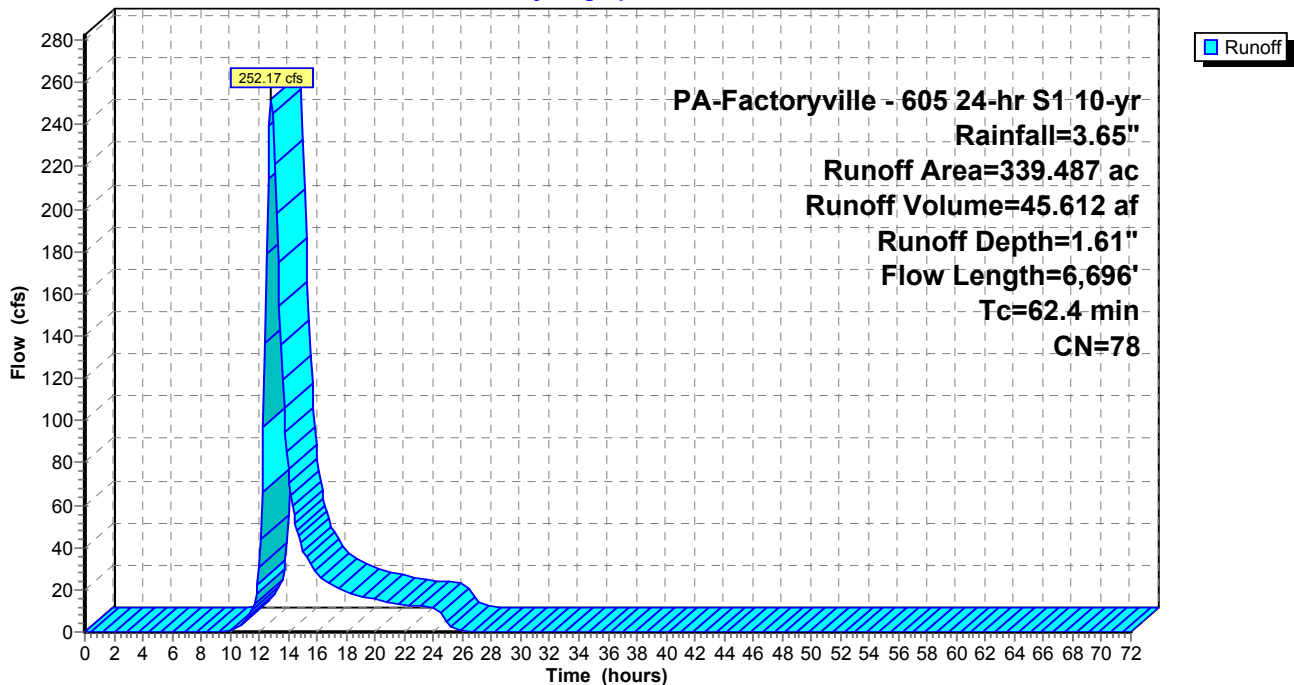
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 340.76 cfs @ 12.83 hrs, Volume= 63.466 af, Depth= 2.24"

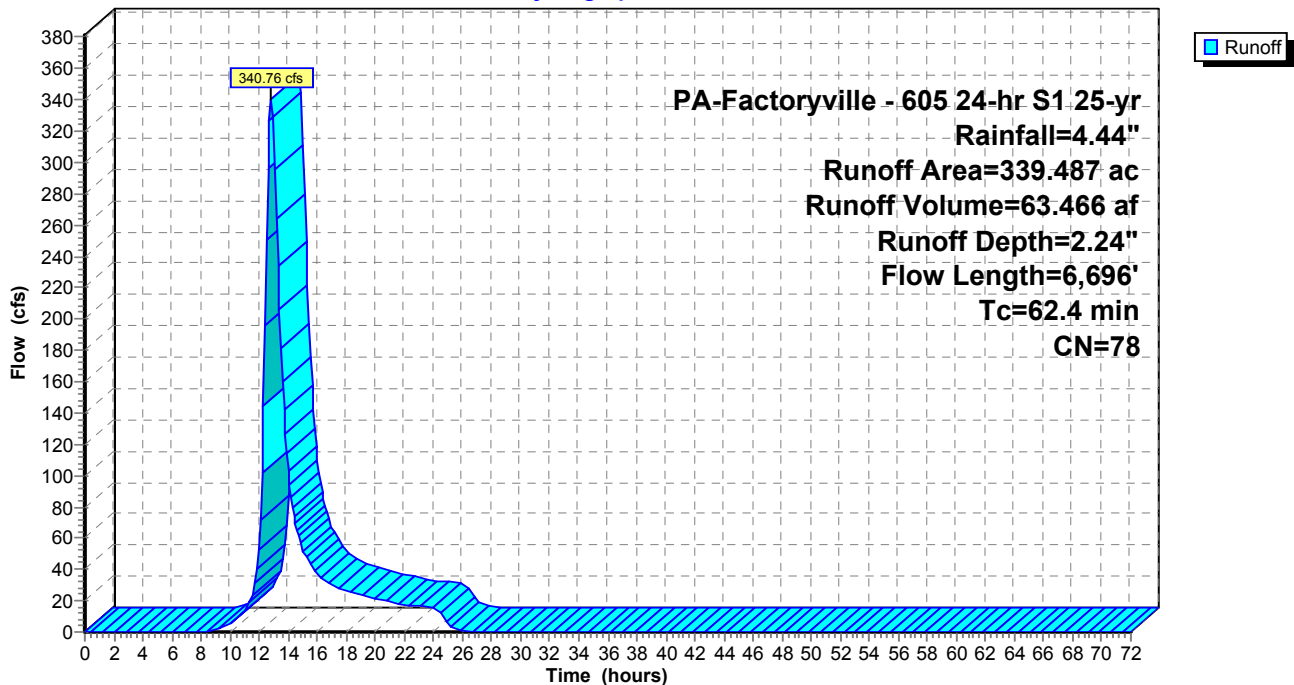
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 417.04 cfs @ 12.83 hrs, Volume= 80.573 af, Depth= 2.85"

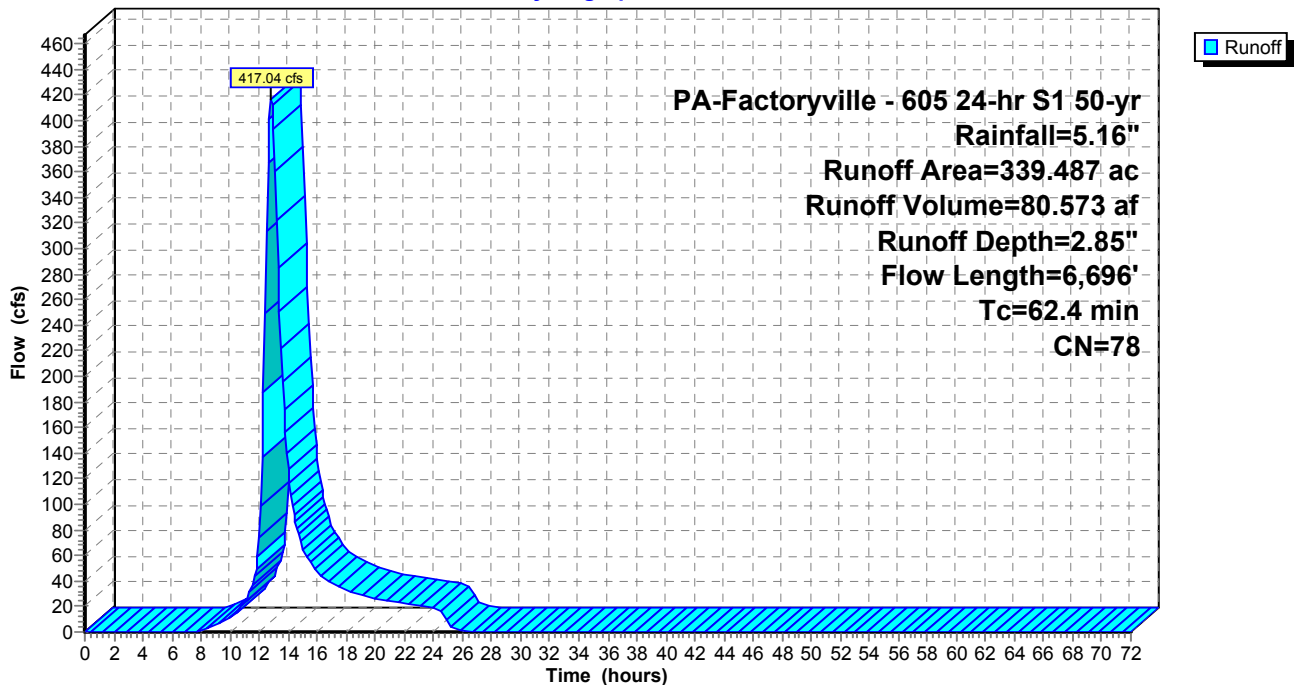
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 500.28 cfs @ 12.82 hrs, Volume= 100.750 af, Depth= 3.56"

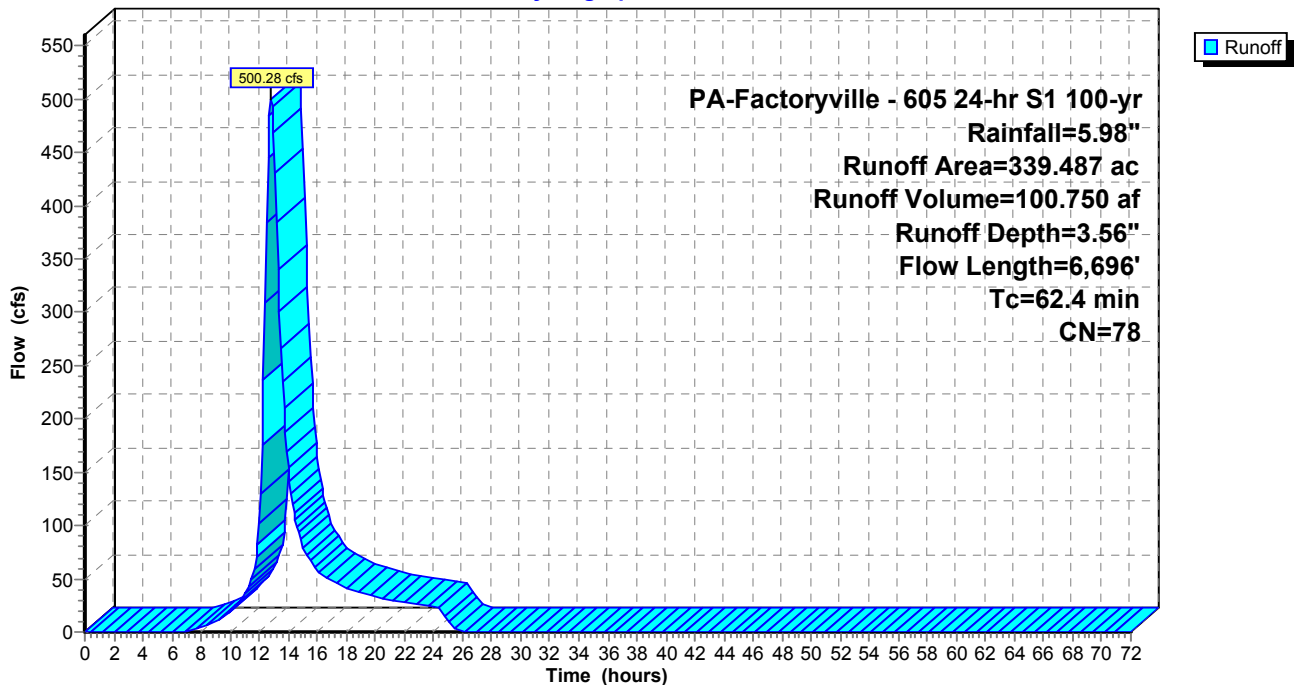
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
181.339	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
339.487	78	Weighted Average
335.234		98.75% Pervious Area
4.253		1.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 3: PREDEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph

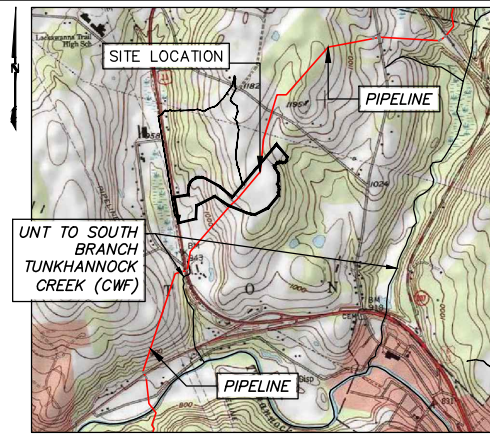
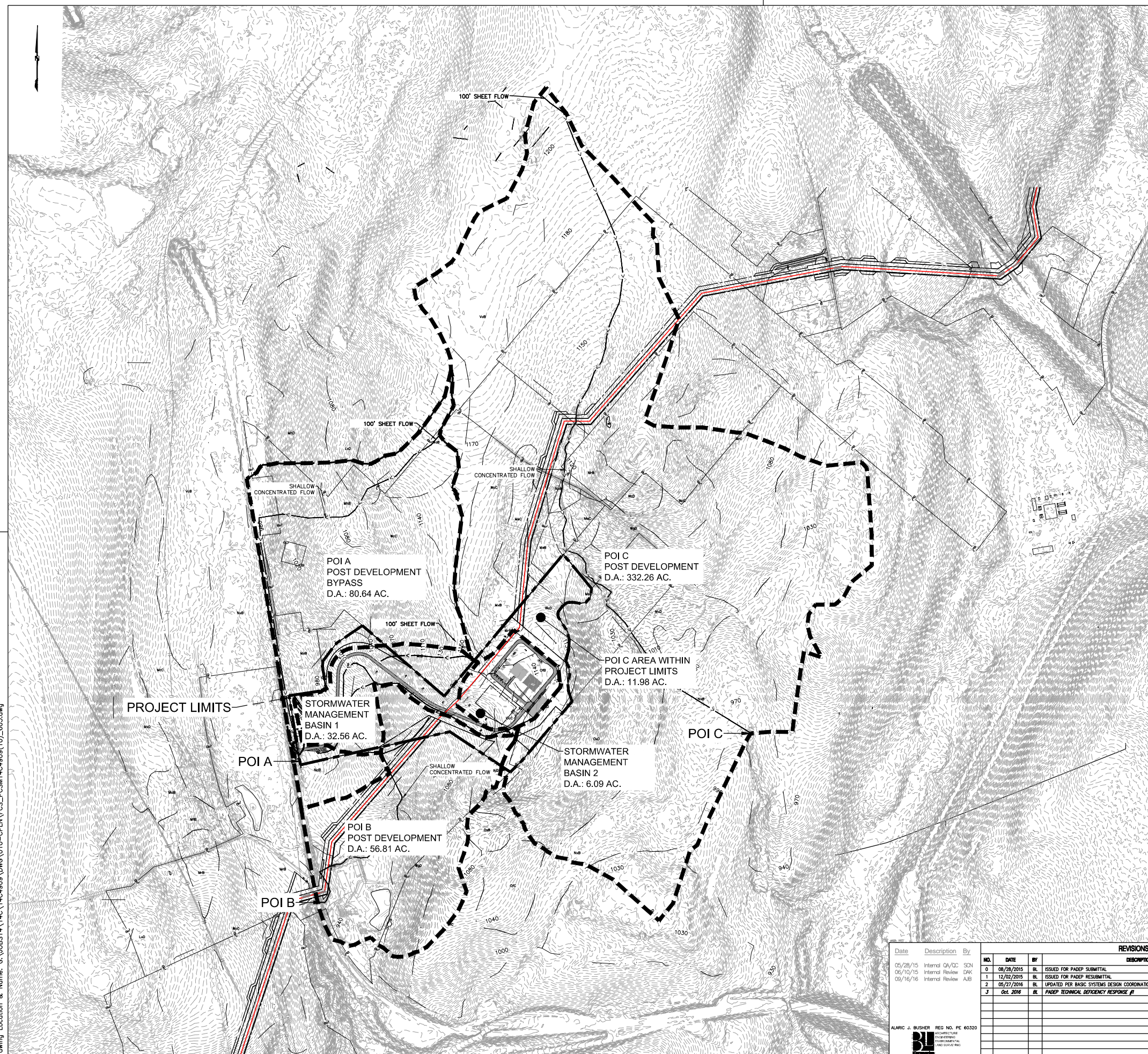




## **A.2 Post Development Calculations**

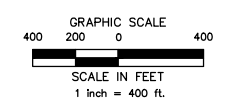


Drawing Location & Name: G:\OBS14\14C\14C4909\DWG\010-CPLN\FCS\_PCSM14C4909\10\_605.dwg



**LEGEND**

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- MAJOR CONTOUR (10' INTERVAL)
- MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
- UTILITY BOX
- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- MAJOR CONTOUR (10' INTERVAL)
- MINOR CONTOUR (2' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- LOD
- ESCOP-2 PERMIT BOUNDARY (OVERALL PIPELINE PROJECT)
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES
- GRAVEL COVER
- ACCESS ROAD
- BUILDING
- FUTURE BUILDING



REVISIONS				TRANSCONTINENTAL GAS PIPELINE COMPANY LLC			
NO.	DATE	BY	DESCRIPTION	W.D. NO.	CHK.	APP.	DESCRIPTION
0	05/28/2015	BL	ISSUED FOR PADEP SUBMITTAL	W01161497	DAK	AJB	ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161497	DAK	AJB	POST CONSTRUCTION STORMWATER MANAGEMENT PLANS
2	05/27/2016	BL	UPDATED PER BASIC SYSTEMS DESIGN COORDINATION	W01161497	AJB	AJB	FOR COMPRESSOR STATION 605
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161497	AJB	AJB	CLINTON TOWNSHIP, WYOMING COUNTY, PENNSYLVANIA

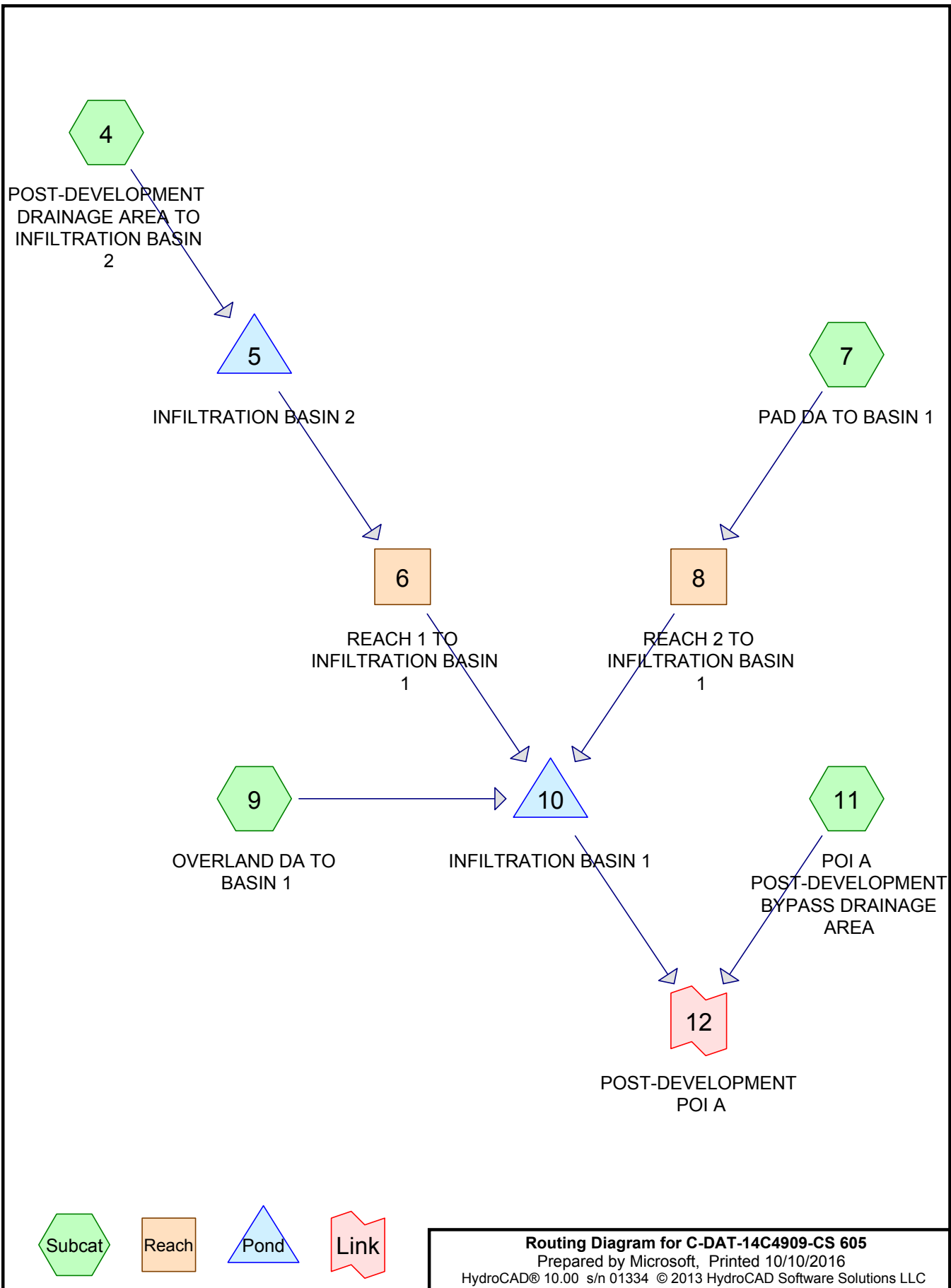
  

DRAWN BY: ADE		DATE: 04/03/15	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY: AJB		DATE: 04/03/15	ISSUED FOR CONSTRUCTION:	REVISION: J
APPROVED BY: AJB		DATE: 07/17/15	DRAWING NUMBER: (66-0605)F-1A-9	SHEET 1 OF 1

ALANIC J. BRUSHER REG. NO. PE 60320  
ARCHITECTURE  
PLANNING  
ENGINEERING











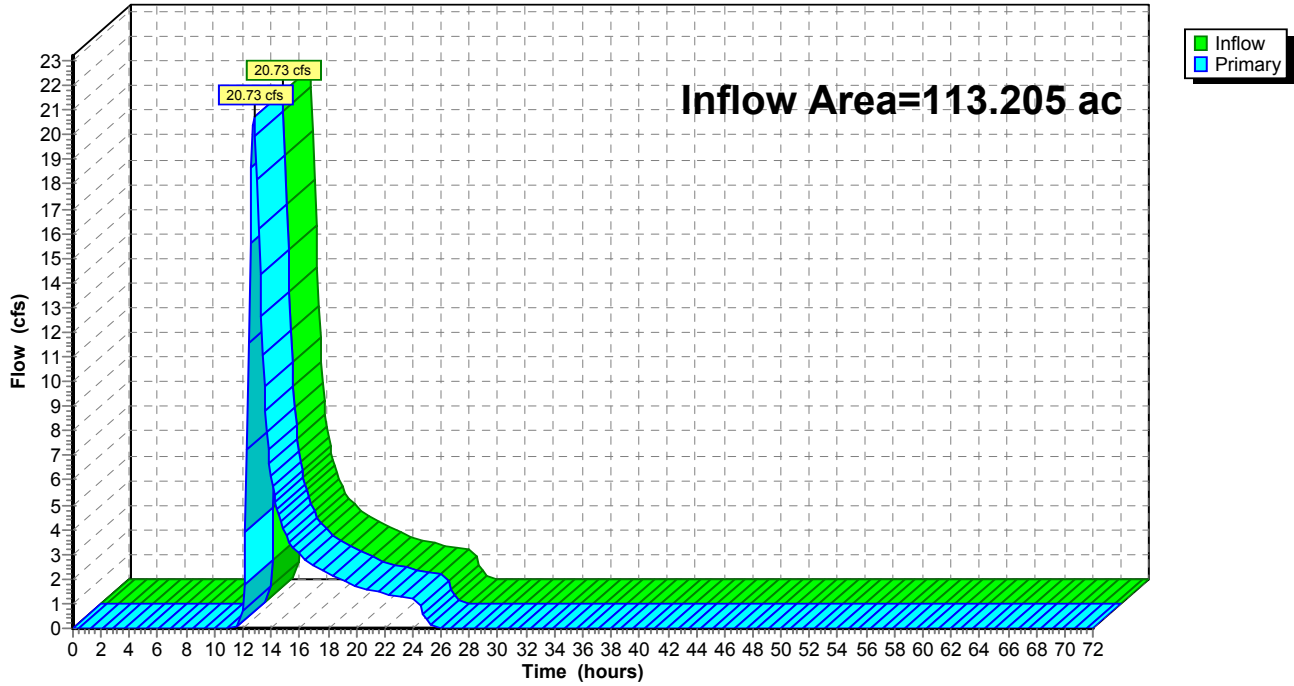
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## **Point of Interest A Post Development Total Drainage Area**



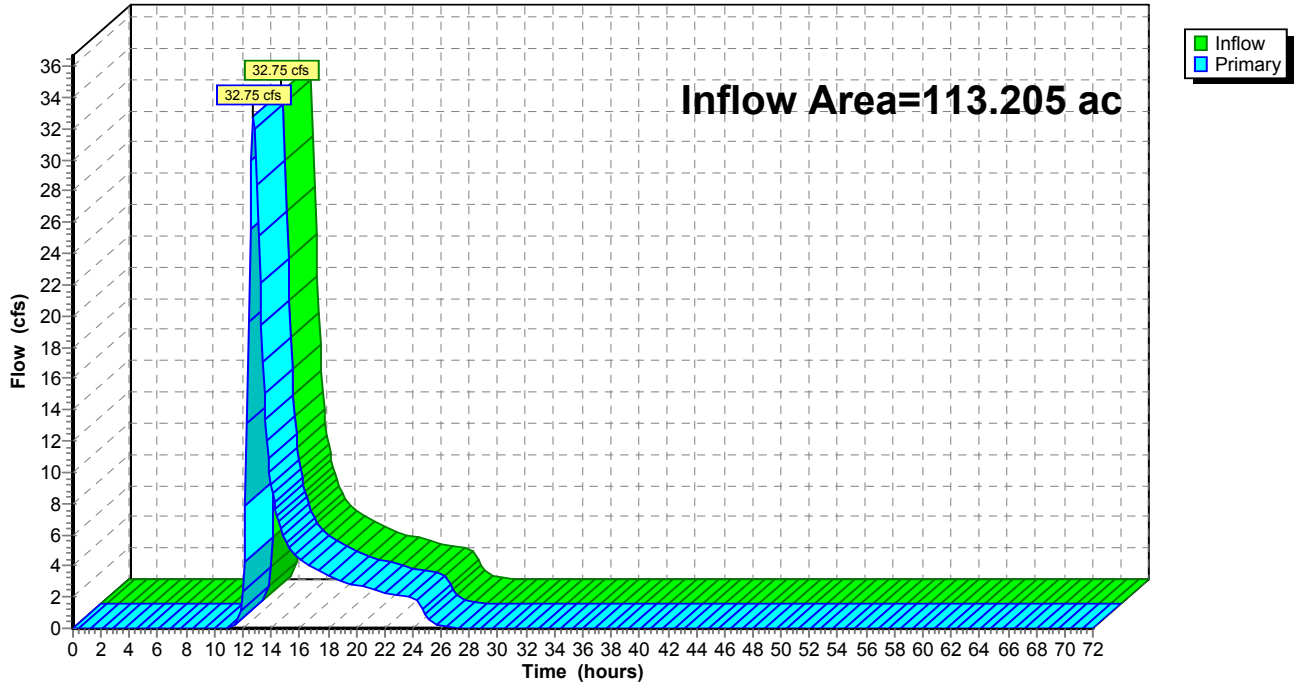
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



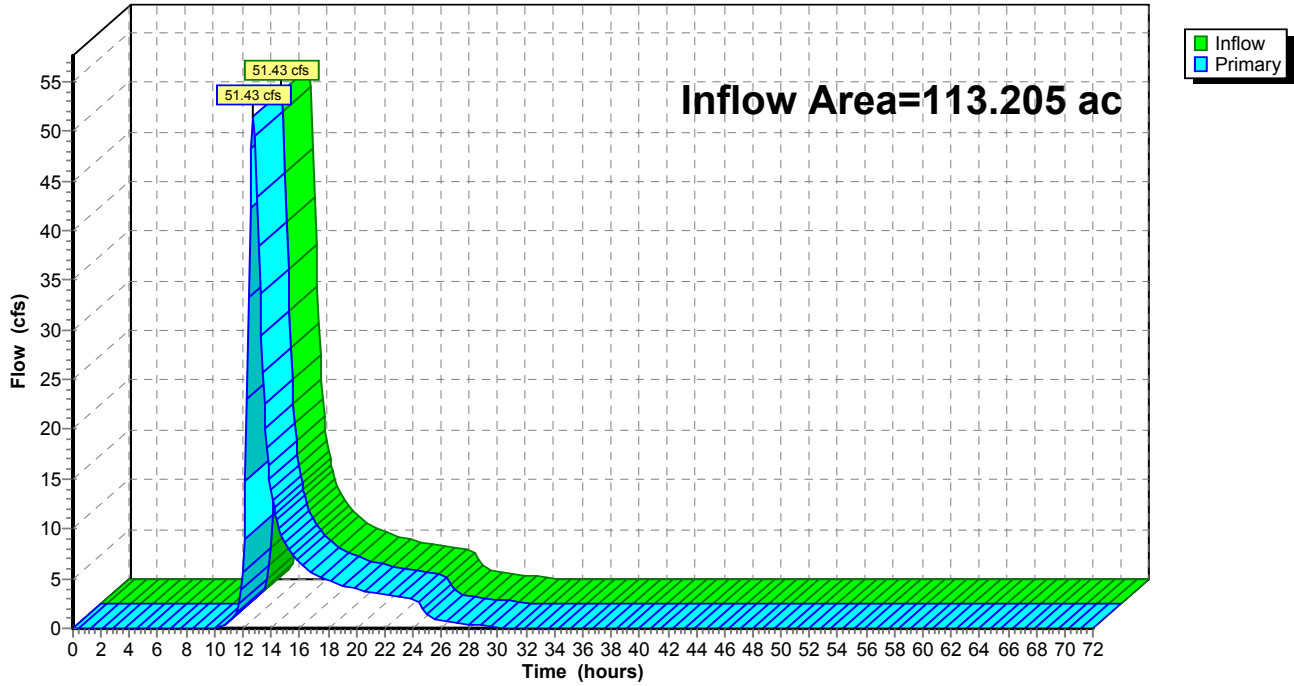
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



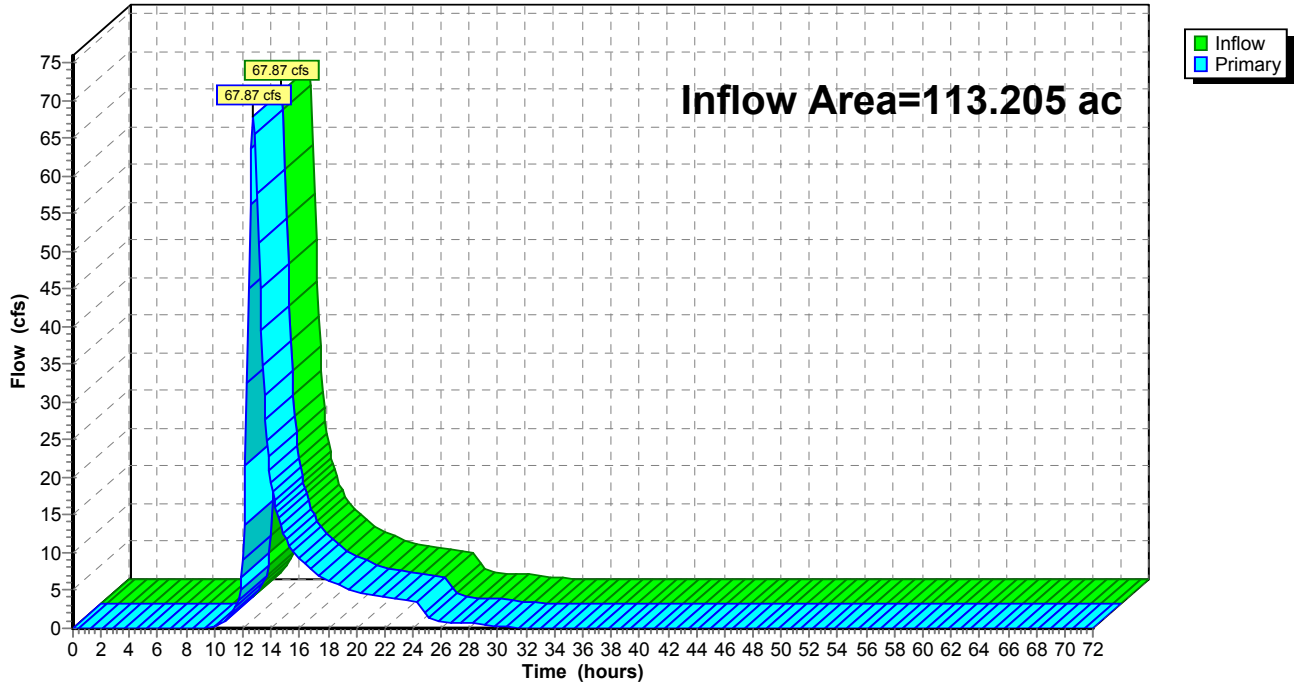
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



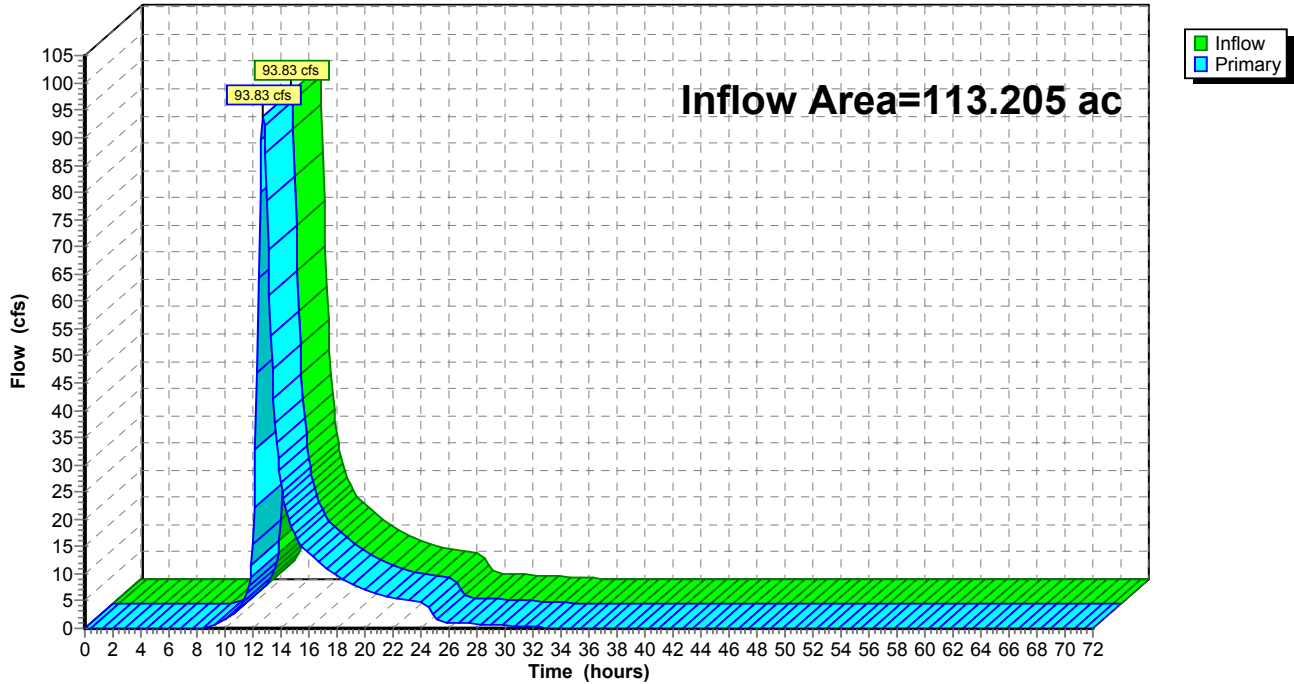
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



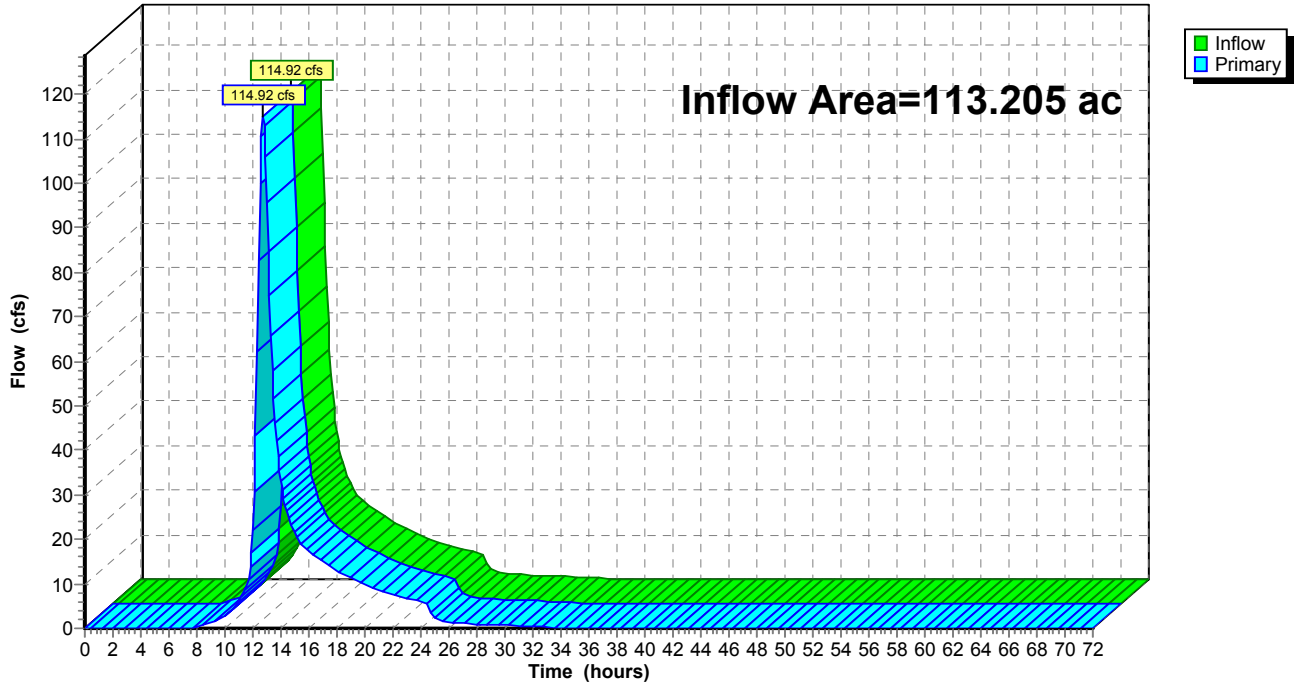
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



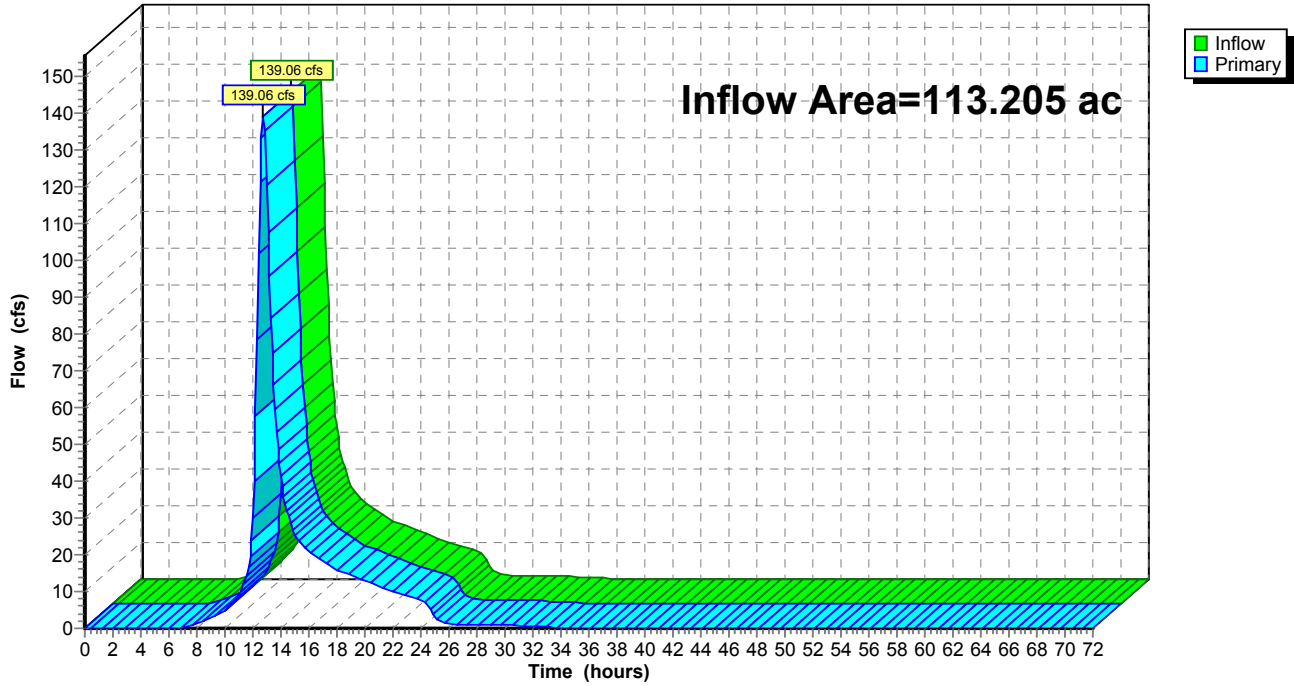
### Link 12: POST-DEVELOPMENT POI A

Hydrograph



### Link 12: POST-DEVELOPMENT POI A

Hydrograph







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## **Point of Interest A**

### **Post Development Drainage Area to Infiltration Basin 2**



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 7.84 cfs @ 12.03 hrs, Volume= 0.477 af, Depth= 0.94"

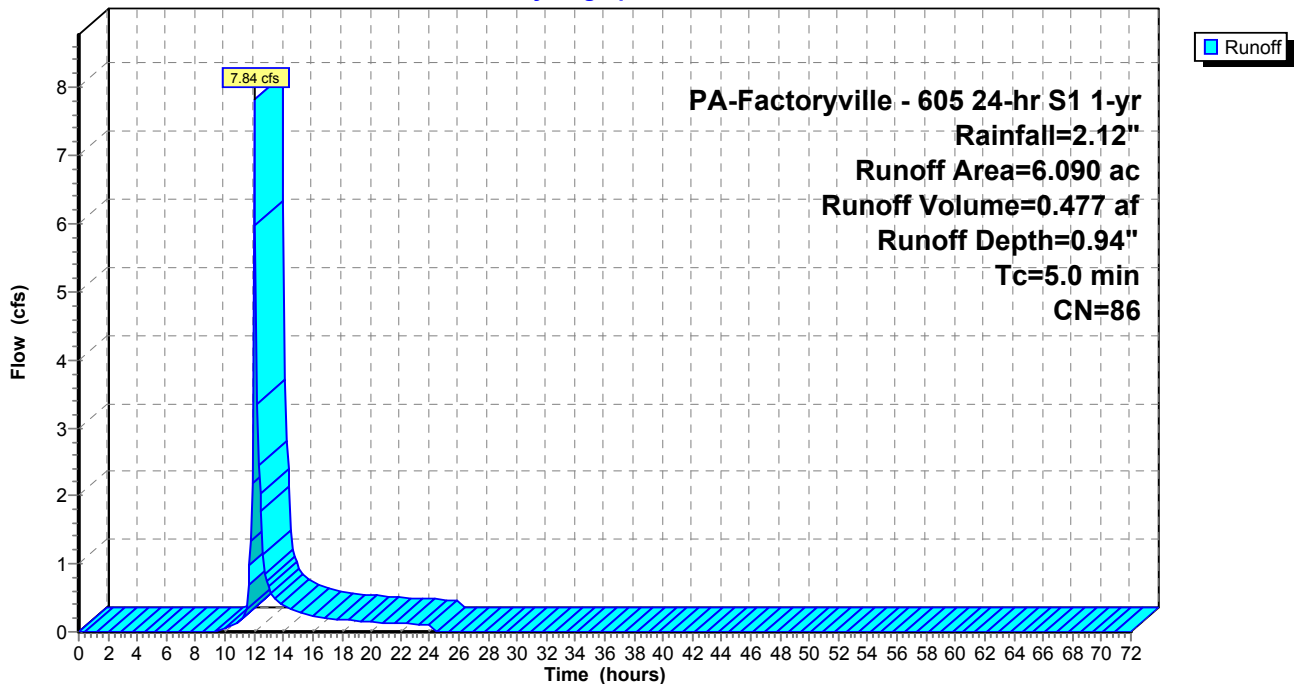
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 10.61 cfs @ 12.03 hrs, Volume= 0.648 af, Depth= 1.28"

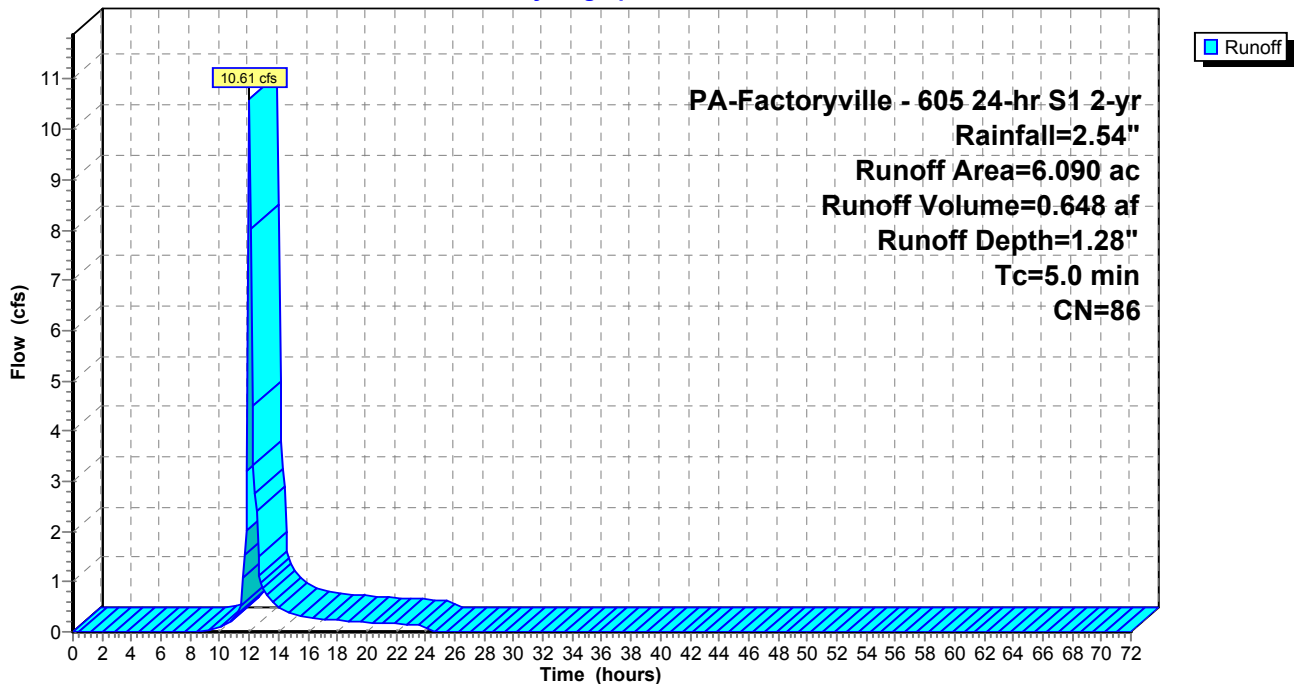
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 14.64 cfs @ 12.02 hrs, Volume= 0.905 af, Depth= 1.78"

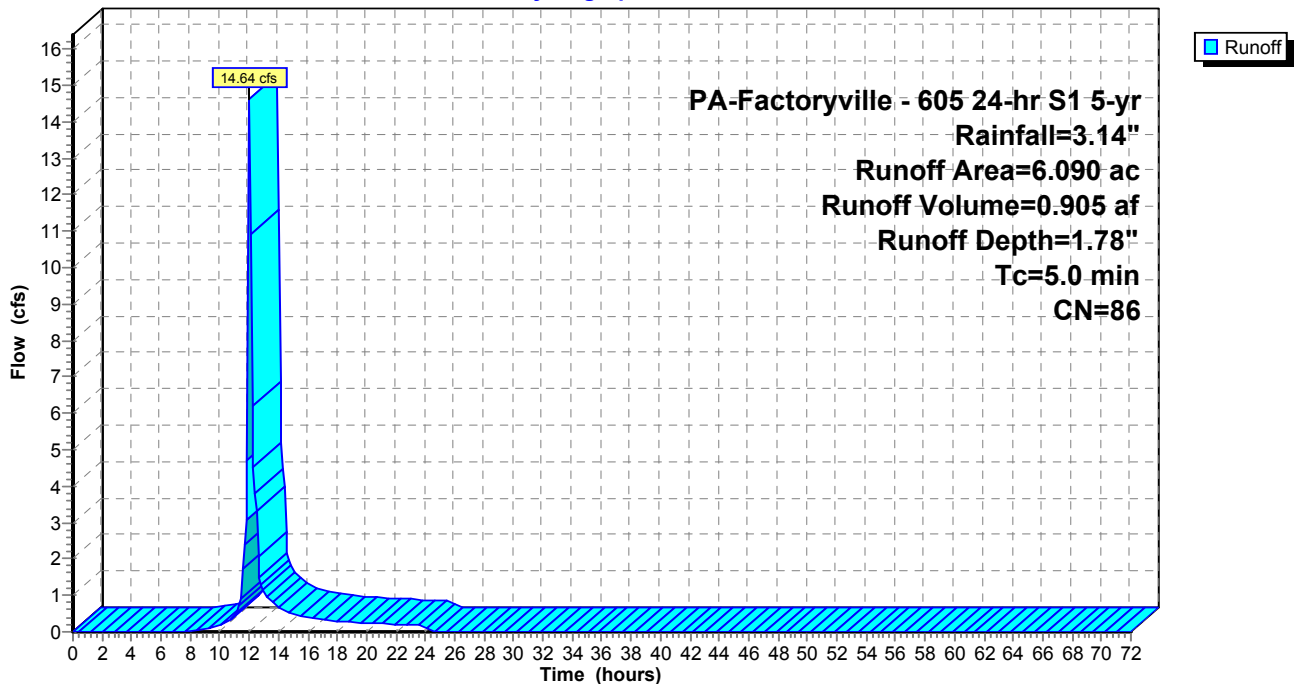
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 17.76 cfs @ 12.02 hrs, Volume= 1.133 af, Depth= 2.23"

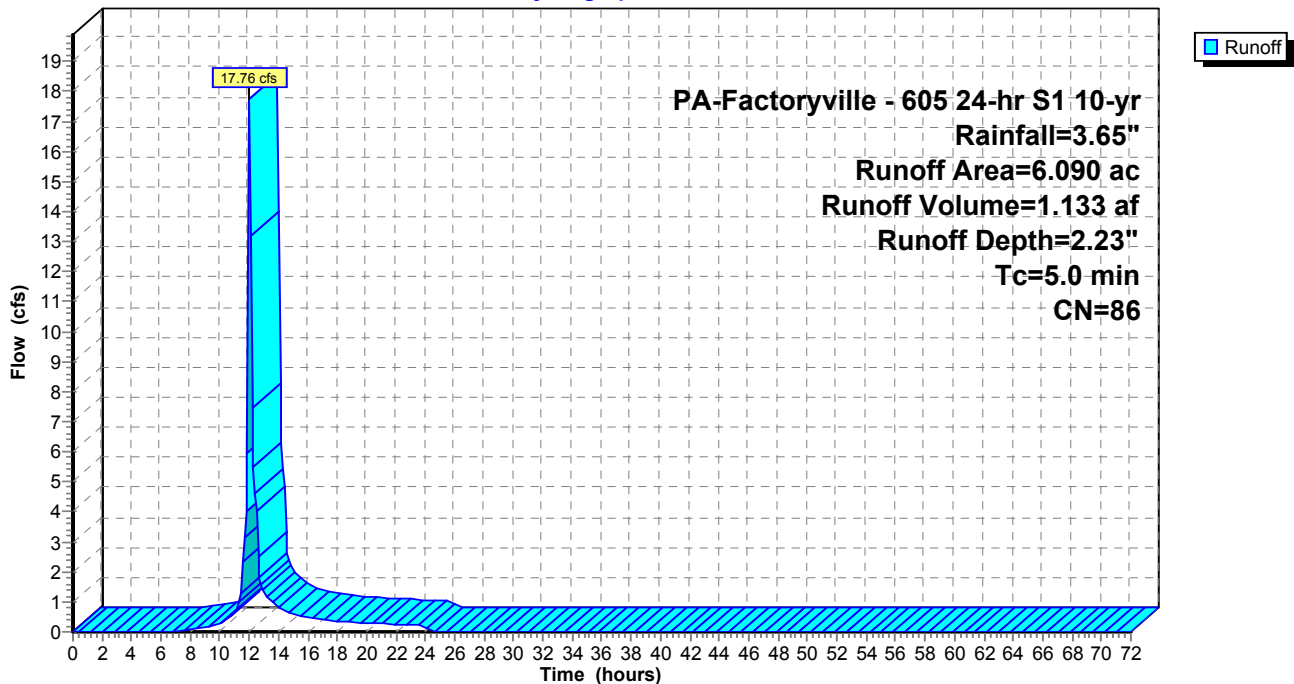
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 21.92 cfs @ 12.02 hrs, Volume= 1.496 af, Depth= 2.95"

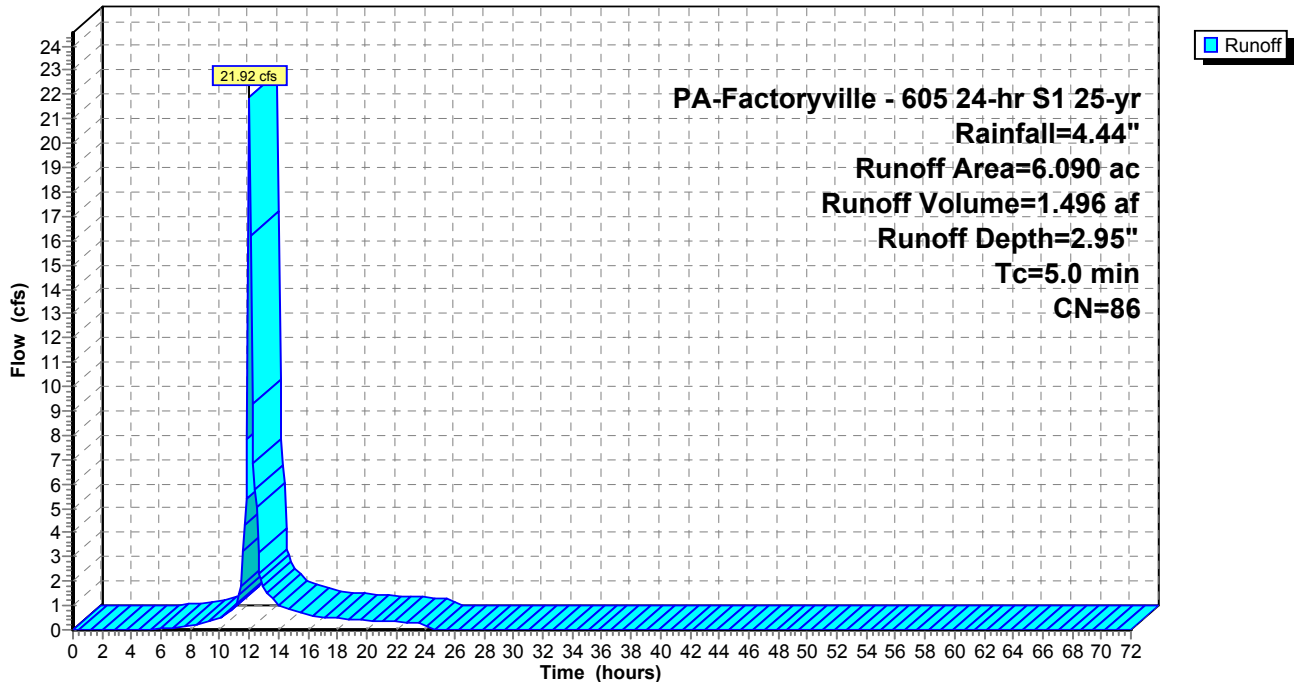
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.10$  hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 25.02 cfs @ 12.02 hrs, Volume= 1.835 af, Depth= 3.62"

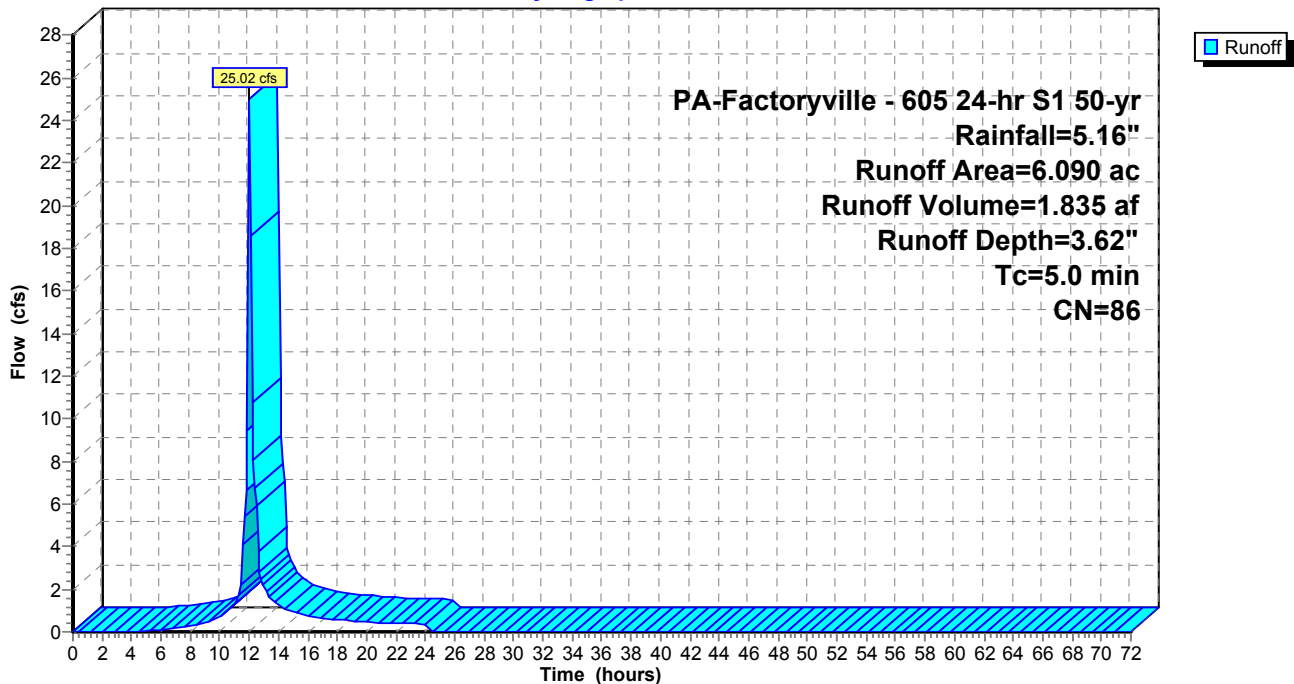
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 28.49 cfs @ 12.02 hrs, Volume= 2.228 af, Depth= 4.39"

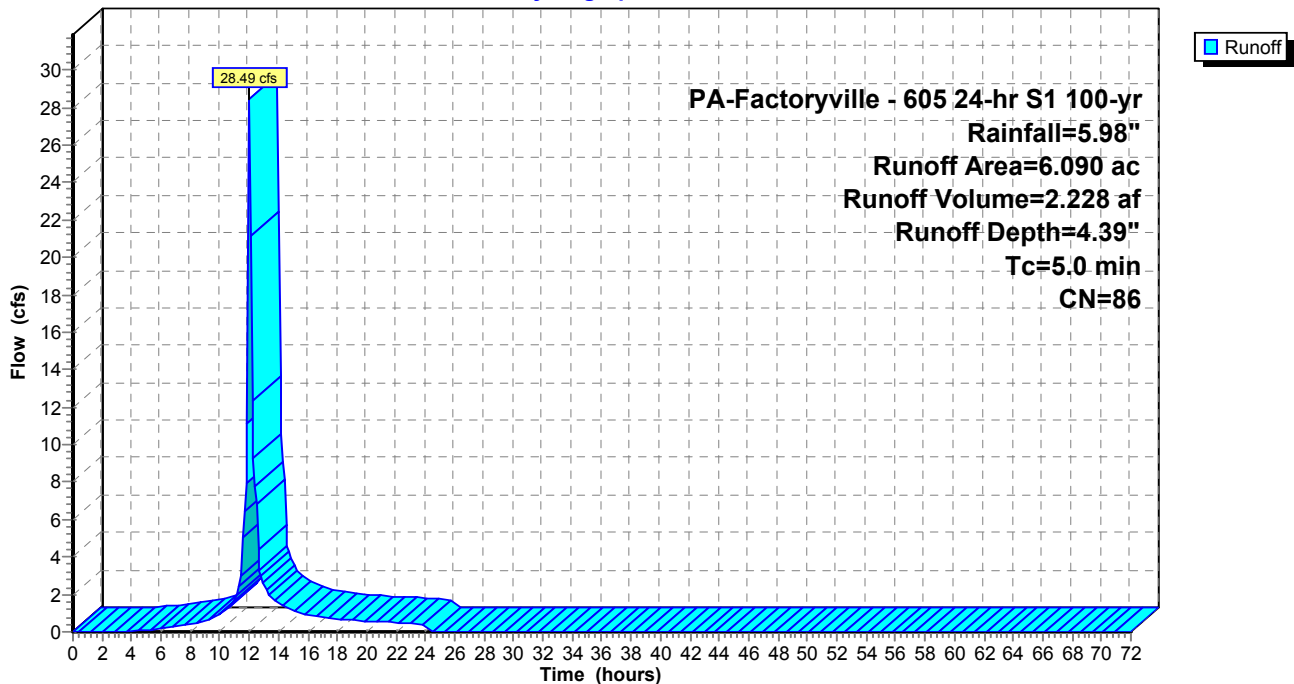
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 4: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph







An Employee-Owned Company

## **Point of Interest A Post Development Infiltration Basin 2**



**Summary for Pond 5: INFILTRATION BASIN 2**

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 0.94" for 1-yr event  
 Inflow = 7.84 cfs @ 12.03 hrs, Volume= 0.477 af  
 Outflow = 2.68 cfs @ 12.32 hrs, Volume= 0.477 af, Atten= 66%, Lag= 17.3 min  
 Discarded = 0.42 cfs @ 12.32 hrs, Volume= 0.375 af  
 Primary = 2.26 cfs @ 12.32 hrs, Volume= 0.102 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 1,120.15' @ 12.32 hrs Surf.Area= 6,763 sf Storage= 7,208 cf

Plug-Flow detention time= 167.0 min calculated for 0.477 af (100% of inflow)  
 Center-of-Mass det. time= 167.1 min ( 1,013.0 - 845.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,118.00'	56,769 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,118.00	0	0	0
1,120.00	6,243	6,243	6,243
1,122.00	13,256	19,499	25,742
1,124.00	17,771	31,027	56,769

Device	Routing	Invert	Outlet Devices
#1	Primary	1,117.00'	<b>18.0" Round Culvert</b> L= 126.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,117.00' / 1,106.00' S= 0.0873 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	1,118.00'	<b>2.660 in/hr Exfiltration over Surface area</b>
#3	Device 1	1,120.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Primary	1,120.50'	<b>20.0' long x 17.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.42 cfs @ 12.32 hrs HW=1,120.15' (Free Discharge)  
 ↑**2=Exfiltration** (Exfiltration Controls 0.42 cfs)

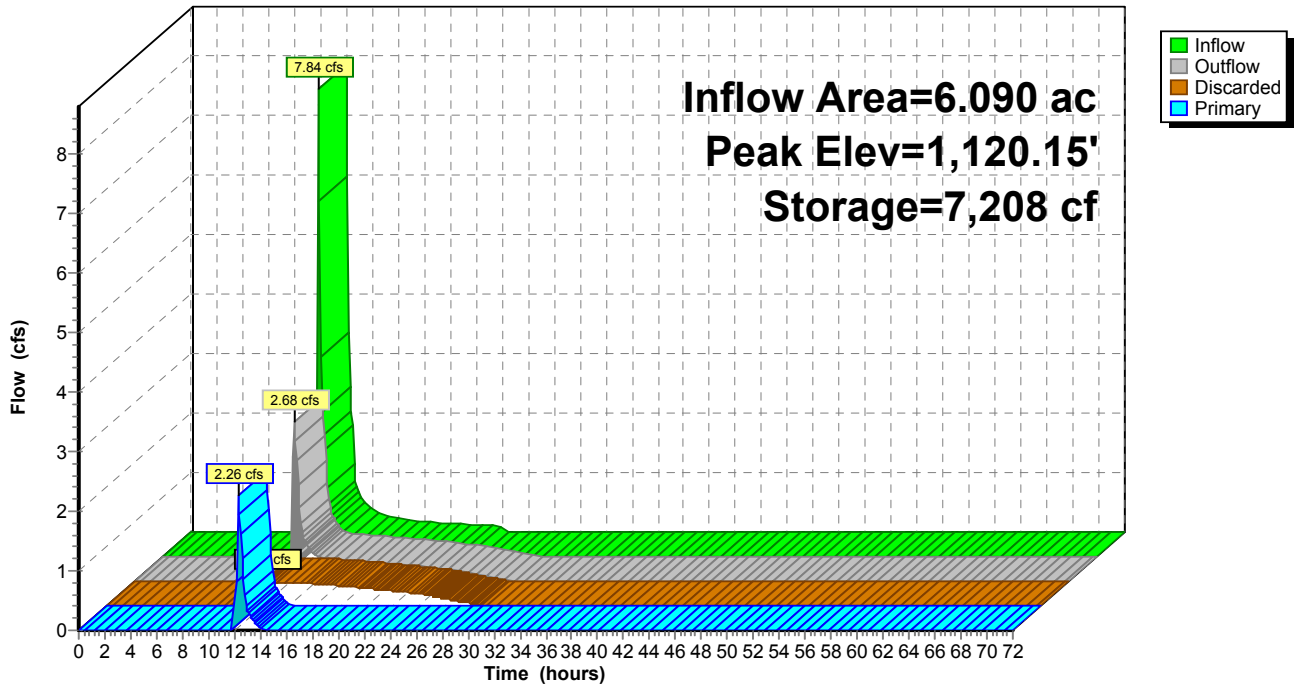
**Primary OutFlow** Max=2.18 cfs @ 12.32 hrs HW=1,120.15' (Free Discharge)  
 ↑**1=Culvert** (Passes 2.18 cfs of 13.17 cfs potential flow)  
 ↑**3=Orifice/Grate** (Weir Controls 2.18 cfs @ 1.25 fps)  
 ↑**4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Stage-Area-Storage for Pond 5: INFILTRATION BASIN 2**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,118.00	0	0	1,123.20	15,965	43,275
1,118.10	312	16	1,123.30	16,191	44,882
1,118.20	624	62	1,123.40	16,417	46,513
1,118.30	936	140	1,123.50	16,642	48,166
1,118.40	1,249	250	1,123.60	16,868	49,841
1,118.50	1,561	390	1,123.70	17,094	51,539
1,118.60	1,873	562	1,123.80	17,319	53,260
1,118.70	2,185	765	1,123.90	17,545	55,003
1,118.80	2,497	999	1,124.00	<b>17,771</b>	<b>56,769</b>
1,118.90	2,809	1,264			
1,119.00	3,122	1,561			
1,119.10	3,434	1,889			
1,119.20	3,746	2,247			
1,119.30	4,058	2,638			
1,119.40	4,370	3,059			
1,119.50	4,682	3,512			
1,119.60	4,994	3,996			
1,119.70	5,307	4,511			
1,119.80	5,619	5,057			
1,119.90	5,931	5,634			
1,120.00	6,243	6,243			
1,120.10	6,594	6,885			
1,120.20	6,944	7,562			
1,120.30	7,295	8,274			
1,120.40	7,646	9,021			
1,120.50	7,996	9,803			
1,120.60	8,347	10,620			
1,120.70	8,698	11,472			
1,120.80	9,048	12,359			
1,120.90	9,399	13,282			
1,121.00	9,750	14,239			
1,121.10	10,100	15,232			
1,121.20	10,451	16,259			
1,121.30	10,801	17,322			
1,121.40	11,152	18,420			
1,121.50	11,503	19,552			
1,121.60	11,853	20,720			
1,121.70	12,204	21,923			
1,121.80	12,555	23,161			
1,121.90	12,905	24,434			
1,122.00	13,256	25,742			
1,122.10	13,482	27,079			
1,122.20	13,708	28,438			
1,122.30	13,933	29,820			
1,122.40	14,159	31,225			
1,122.50	14,385	32,652			
1,122.60	14,610	34,102			
1,122.70	14,836	35,574			
1,122.80	15,062	37,069			
1,122.90	15,288	38,587			
1,123.00	15,514	40,127			
1,123.10	15,739	41,689			

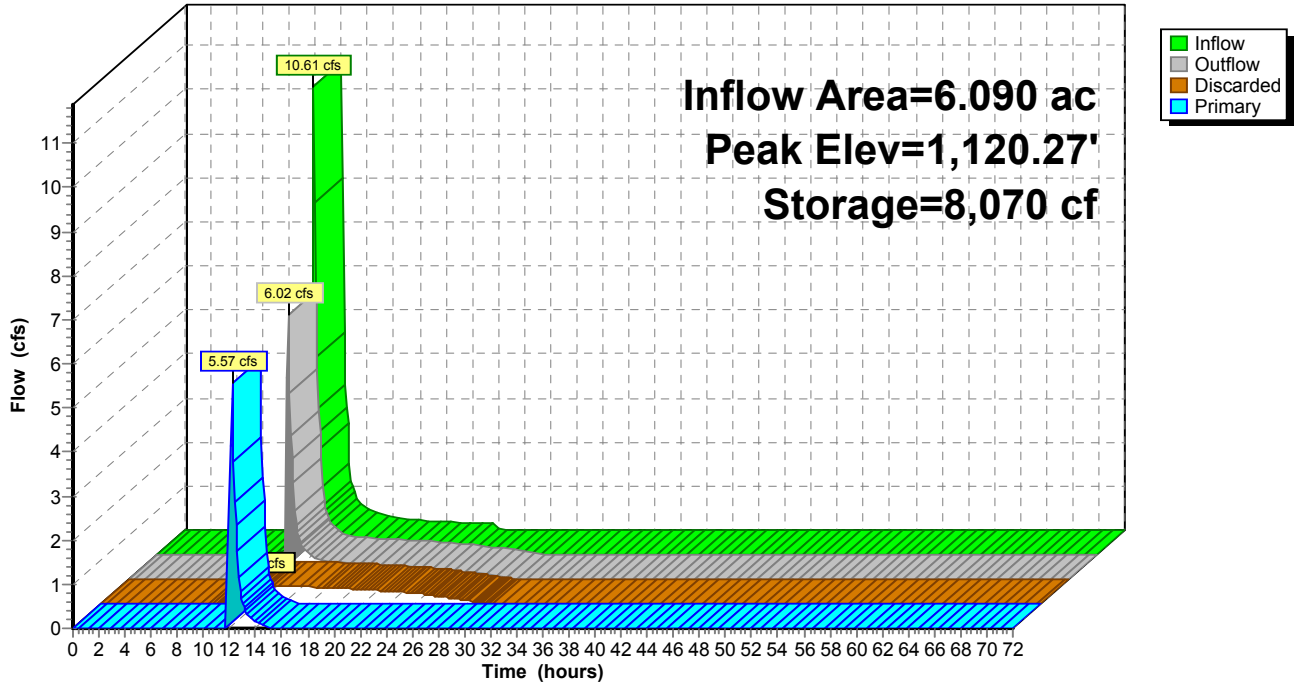
### Pond 5: INFILTRATION BASIN 2

Hydrograph



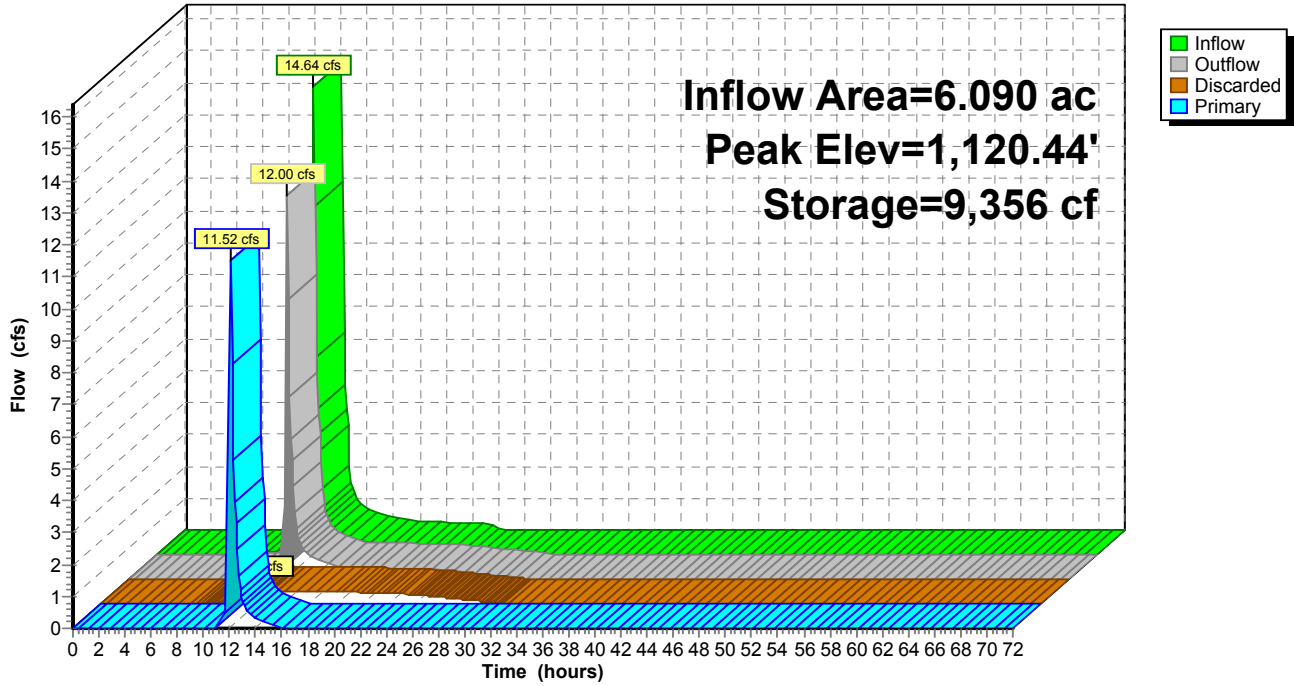
### Pond 5: INFILTRATION BASIN 2

Hydrograph



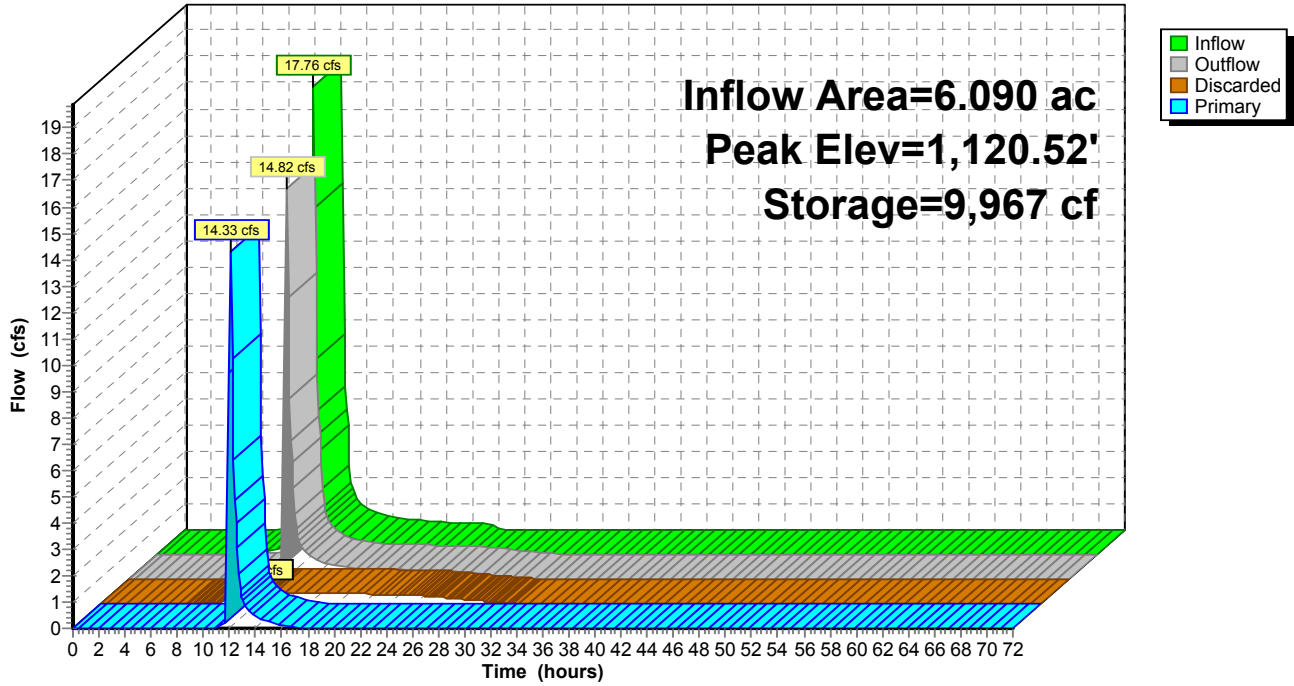
### Pond 5: INFILTRATION BASIN 2

Hydrograph



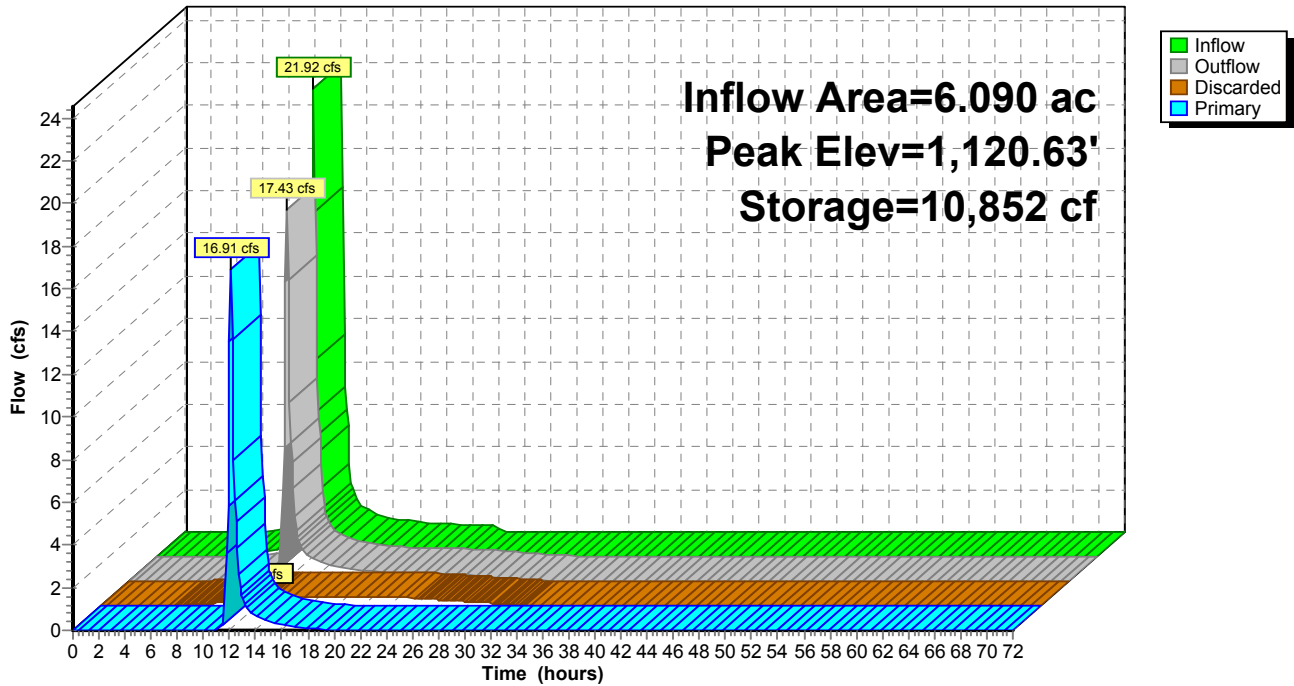
### Pond 5: INFILTRATION BASIN 2

Hydrograph



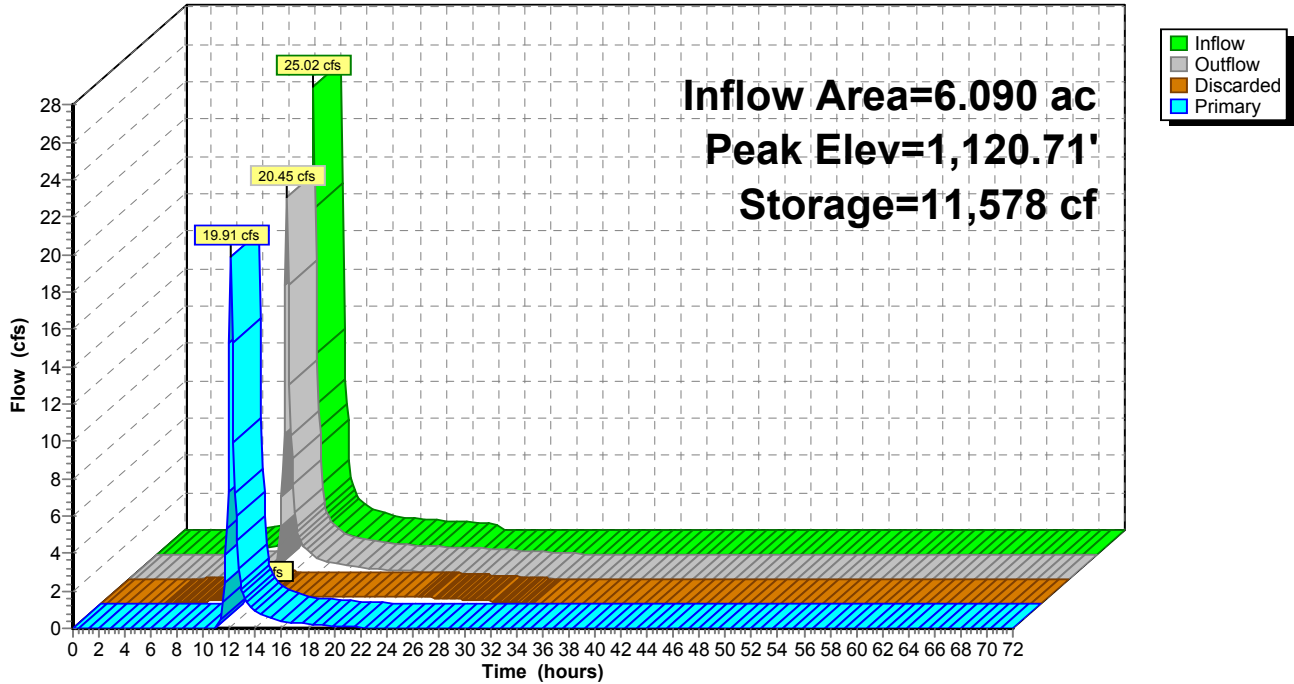
### Pond 5: INFILTRATION BASIN 2

Hydrograph



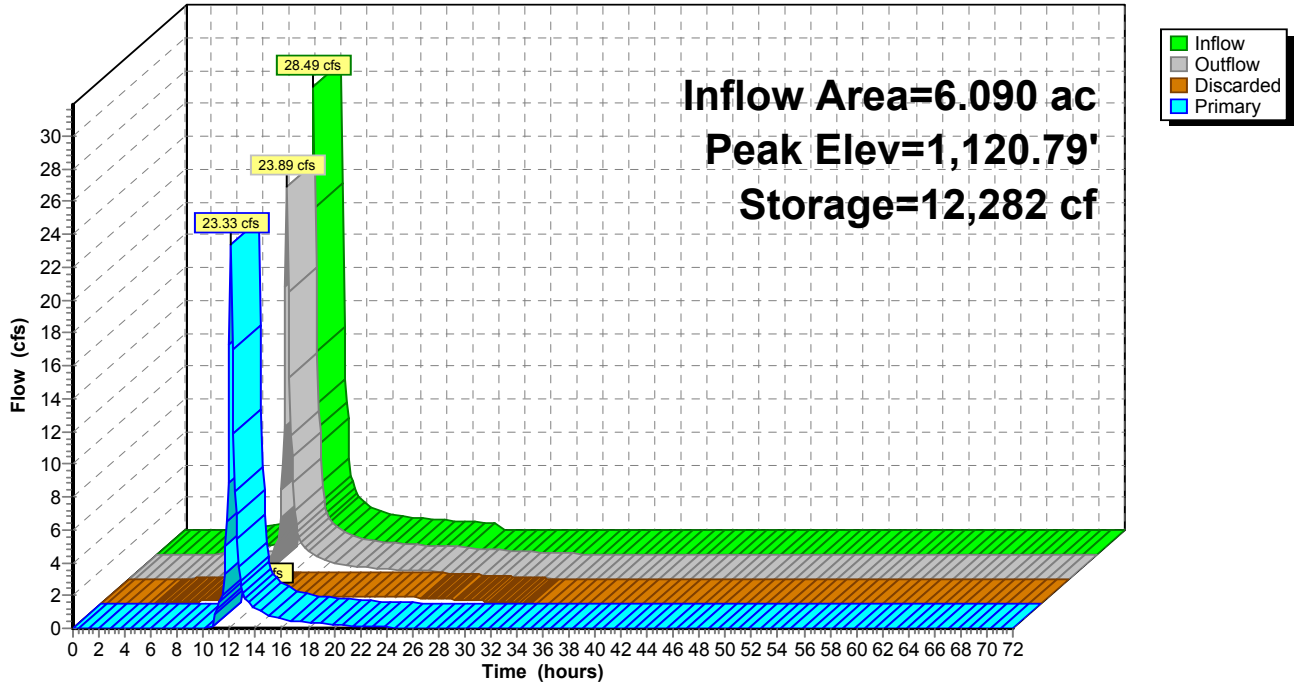
### Pond 5: INFILTRATION BASIN 2

Hydrograph



### Pond 5: INFILTRATION BASIN 2

Hydrograph







An Employee-Owned Company

## **Point of Interest A Reach 1 to Infiltration Basin 1**



### Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.20'

Inflow Area =	6.090 ac,	6.08% Impervious,	Inflow Depth = 0.20"	for 1-yr event
Inflow =	2.26 cfs @	12.32 hrs,	Volume=	0.102 af
Outflow =	1.13 cfs @	13.10 hrs,	Volume=	0.102 af, Atten= 50%, Lag= 47.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 1.24 fps, Min. Travel Time= 27.9 min  
 Avg. Velocity = 0.37 fps, Avg. Travel Time= 92.4 min

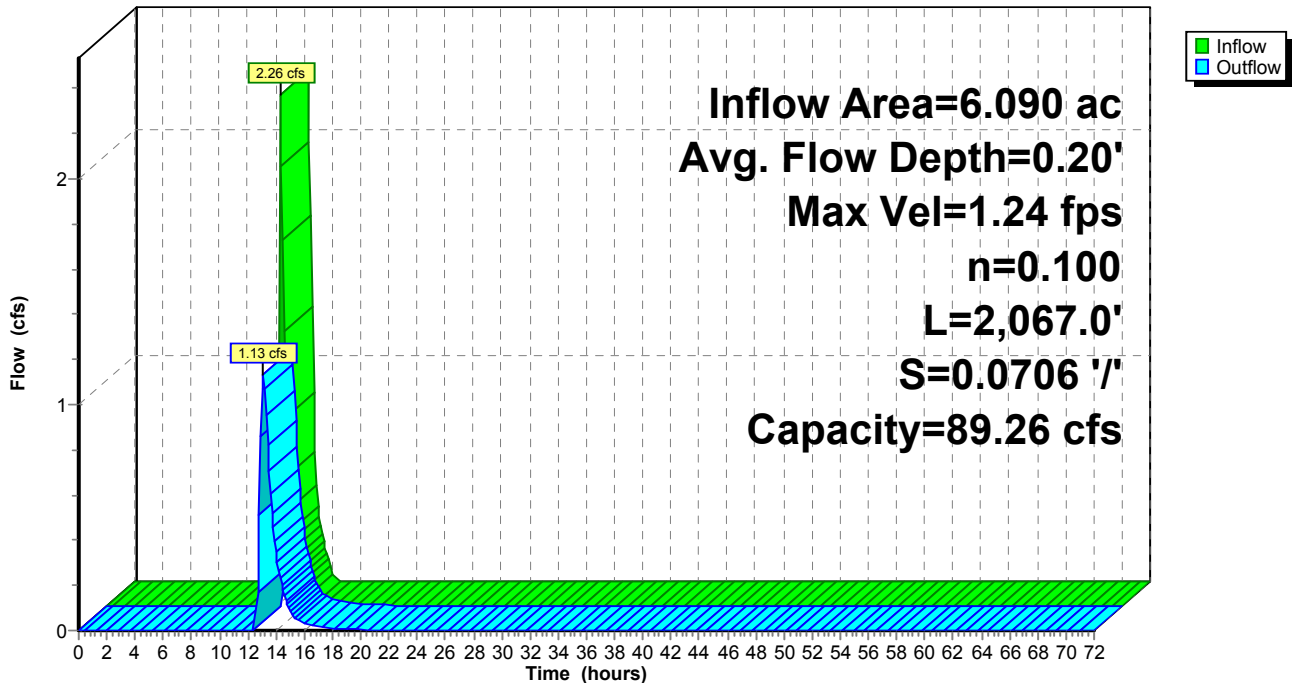
Peak Storage= 1,912 cf @ 12.63 hrs  
 Average Depth at Peak Storage= 0.20'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 6: REACH 1 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.33'

Inflow Area =	6.090 ac,	6.08% Impervious,	Inflow Depth = 0.44"	for 2-yr event
Inflow =	5.57 cfs @	12.19 hrs,	Volume=	0.224 af
Outflow =	2.71 cfs @	12.79 hrs,	Volume=	0.224 af, Atten= 51%, Lag= 36.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 1.66 fps, Min. Travel Time= 20.8 min  
 Avg. Velocity = 0.42 fps, Avg. Travel Time= 82.9 min

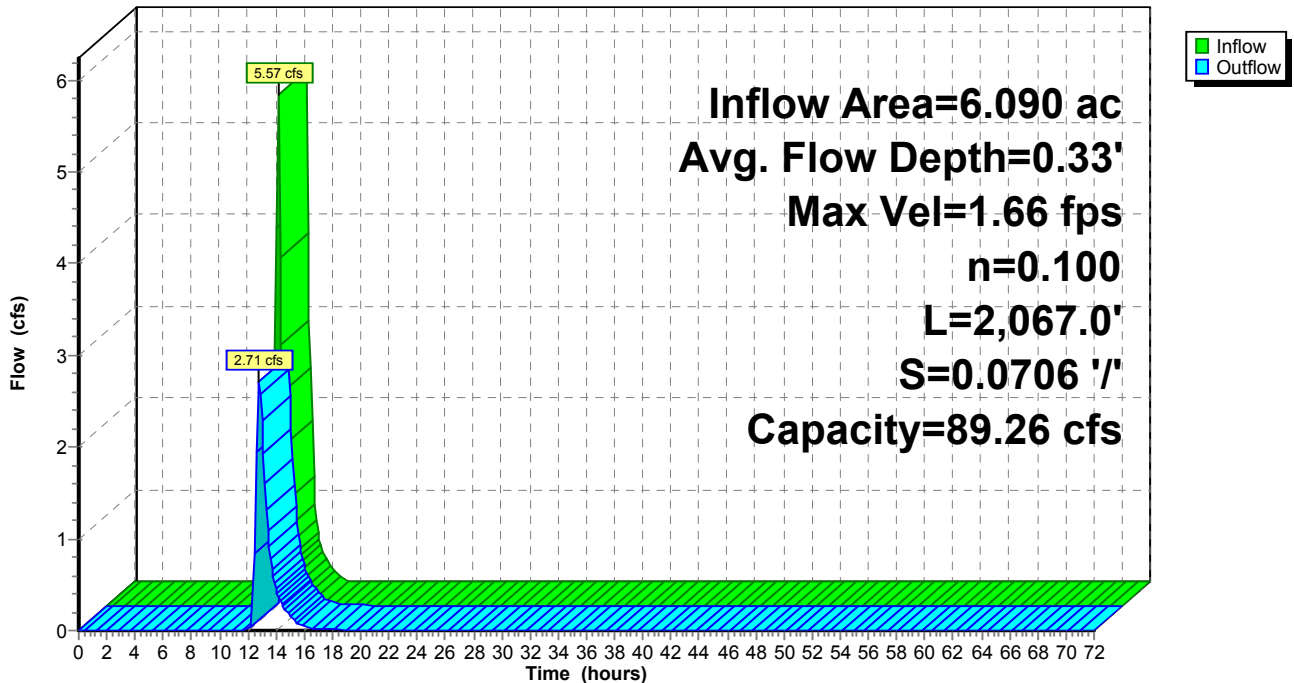
Peak Storage= 3,439 cf @ 12.44 hrs  
 Average Depth at Peak Storage= 0.33'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 6: REACH 1 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.50'

Inflow Area =	6.090 ac,	6.08% Impervious,	Inflow Depth = 0.83"	for 5-yr event
Inflow =	11.52 cfs @	12.12 hrs,	Volume=	0.419 af
Outflow =	5.62 cfs @	12.60 hrs,	Volume=	0.419 af, Atten= 51%, Lag= 28.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.09 fps, Min. Travel Time= 16.5 min  
 Avg. Velocity = 0.46 fps, Avg. Travel Time= 74.7 min

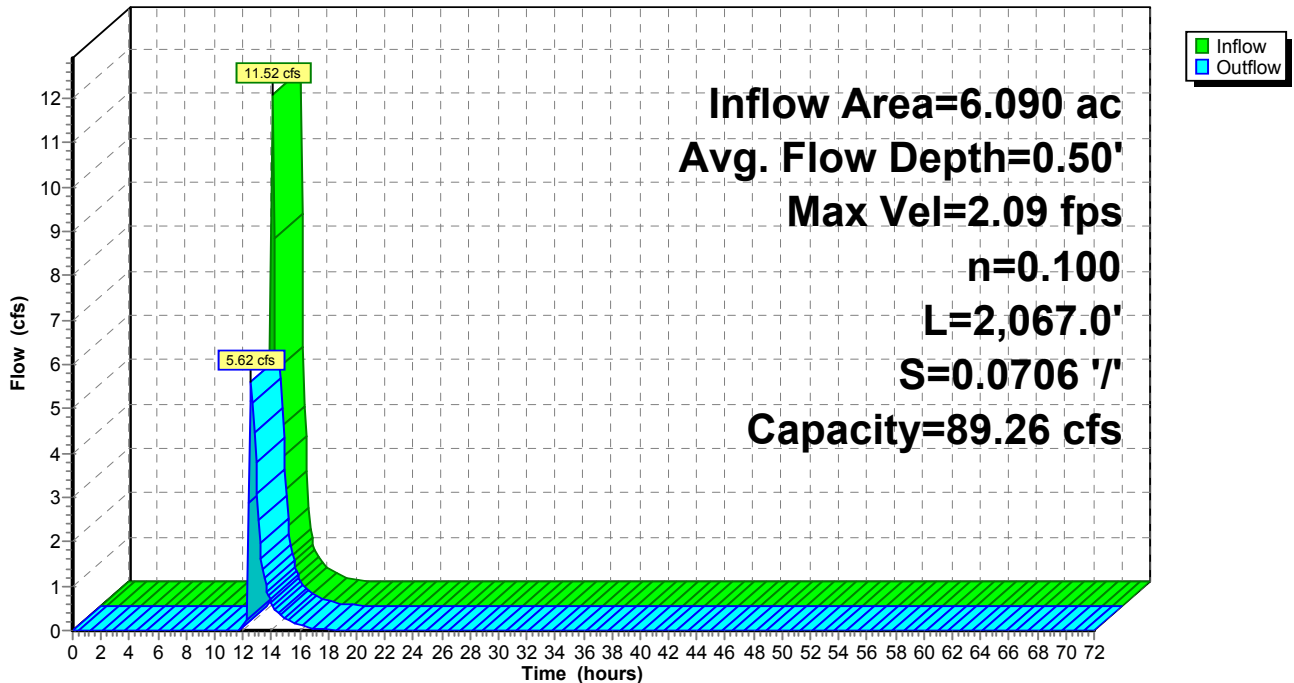
Peak Storage= 5,688 cf @ 12.31 hrs  
 Average Depth at Peak Storage= 0.50'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 6: REACH 1 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.61'

Inflow Area =	6.090 ac,	6.08% Impervious,	Inflow Depth = 1.18"	for 10-yr event
Inflow =	14.33 cfs @	12.10 hrs,	Volume=	0.597 af
Outflow =	8.21 cfs @	12.52 hrs,	Volume=	0.597 af, Atten= 43%, Lag= 25.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.32 fps, Min. Travel Time= 14.8 min  
 Avg. Velocity = 0.49 fps, Avg. Travel Time= 69.6 min

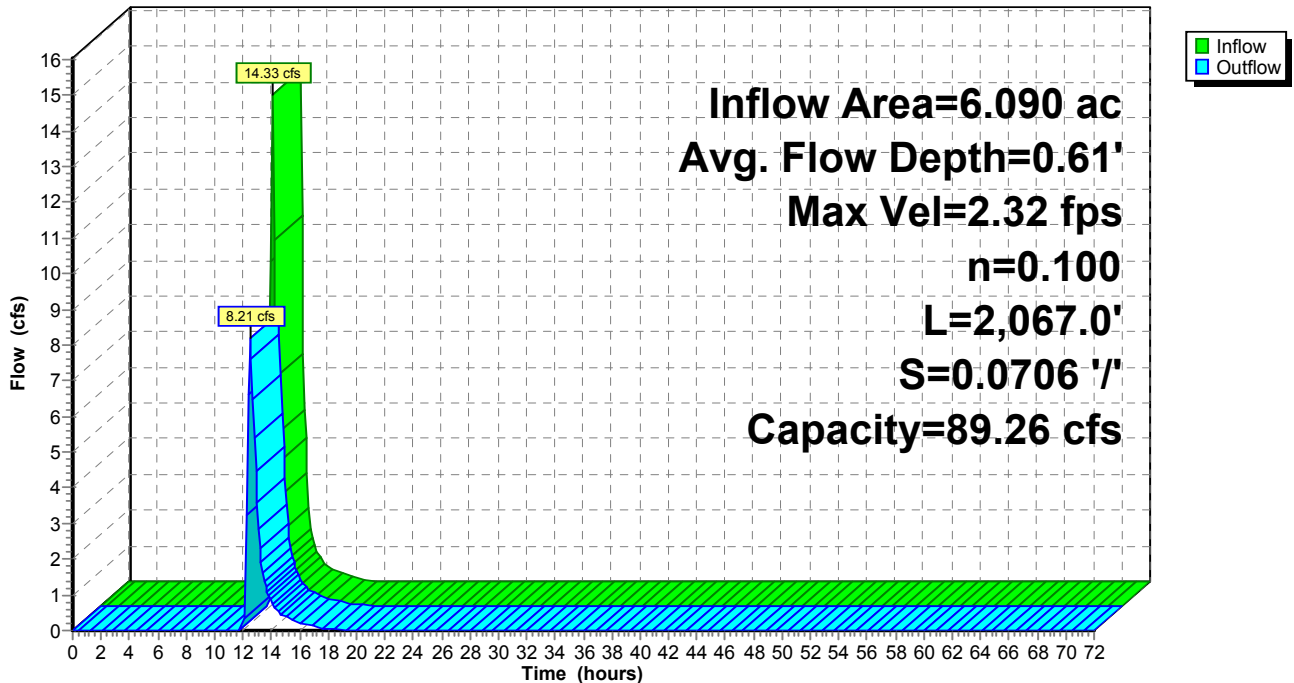
Peak Storage= 7,369 cf @ 12.26 hrs  
 Average Depth at Peak Storage= 0.61'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 6: REACH 1 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.74'

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 1.76" for 25-yr event  
 Inflow = 16.91 cfs @ 12.10 hrs, Volume= 0.894 af  
 Outflow = 11.67 cfs @ 12.46 hrs, Volume= 0.894 af, Atten= 31%, Lag= 21.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.59 fps, Min. Travel Time= 13.3 min  
 Avg. Velocity = 0.54 fps, Avg. Travel Time= 63.4 min

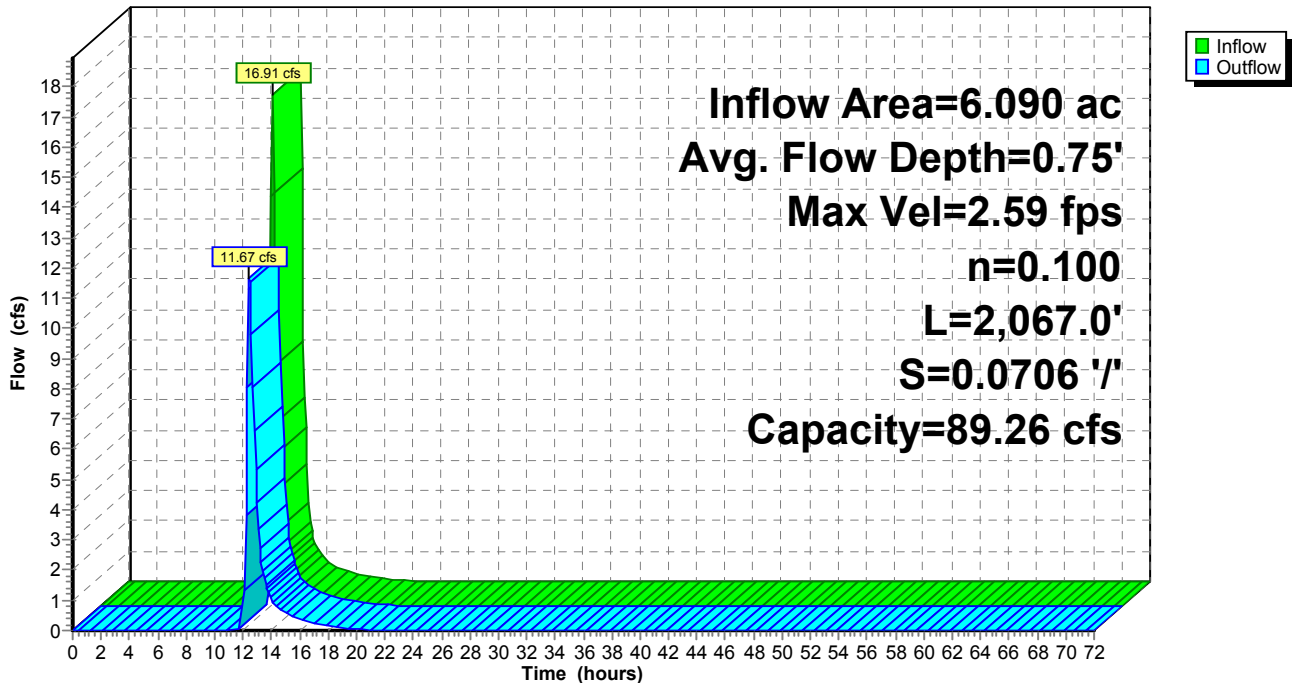
Peak Storage= 9,658 cf @ 12.23 hrs  
 Average Depth at Peak Storage= 0.75'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 6: REACH 1 TO INFILTRATION BASIN 1

Hydrograph



**Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1**

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.82'

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 2.34" for 50-yr event  
 Inflow = 19.91 cfs @ 12.10 hrs, Volume= 1.189 af  
 Outflow = 14.51 cfs @ 12.43 hrs, Volume= 1.189 af, Atten= 27%, Lag= 20.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.74 fps, Min. Travel Time= 12.6 min  
 Avg. Velocity = 0.58 fps, Avg. Travel Time= 59.1 min

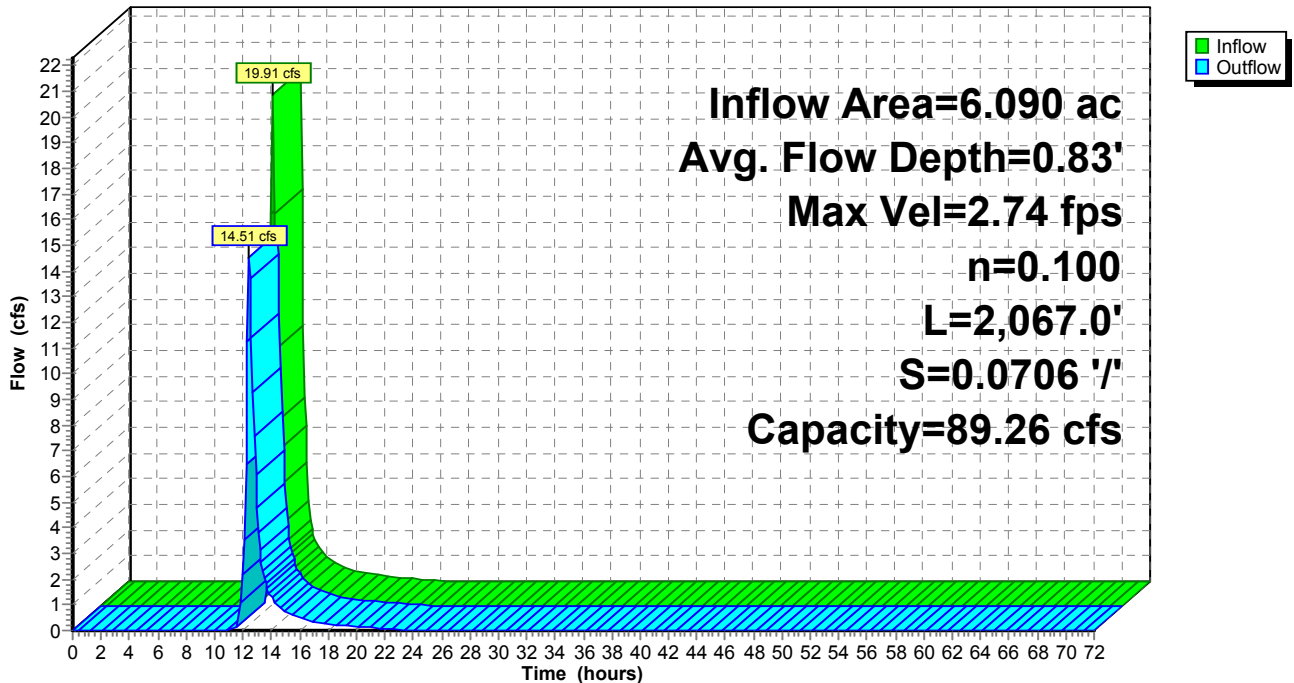
Peak Storage= 11,059 cf @ 12.22 hrs  
 Average Depth at Peak Storage= 0.83'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



**Reach 6: REACH 1 TO INFILTRATION BASIN 1**

Hydrograph



**Summary for Reach 6: REACH 1 TO INFILTRATION BASIN 1**

[79] Warning: Submerged Pond 5 Primary device # 1 OUTLET by 0.90'

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 3.05" for 100-yr event  
 Inflow = 23.33 cfs @ 12.10 hrs, Volume= 1.547 af  
 Outflow = 17.25 cfs @ 12.42 hrs, Volume= 1.547 af, Atten= 26%, Lag= 19.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.87 fps, Min. Travel Time= 12.0 min  
 Avg. Velocity = 0.64 fps, Avg. Travel Time= 53.9 min

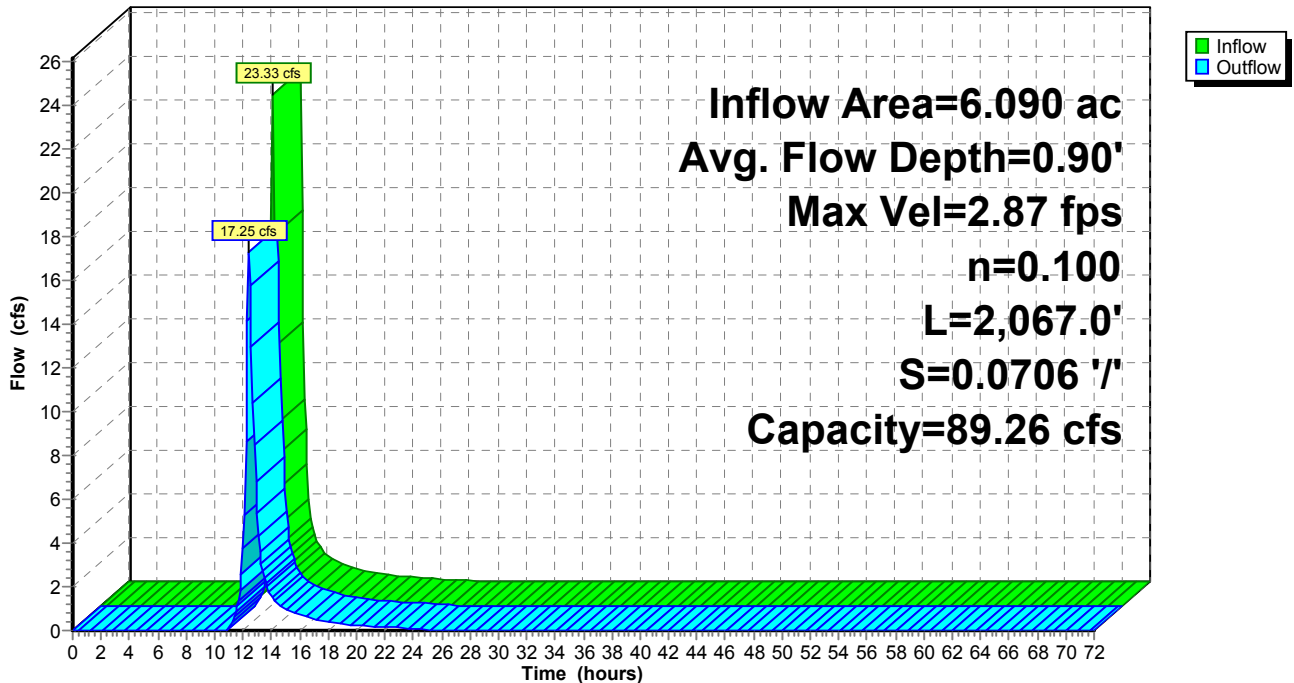
Peak Storage= 12,413 cf @ 12.22 hrs  
 Average Depth at Peak Storage= 0.90'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 89.26 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,067.0' Slope= 0.0706 '/'  
 Inlet Invert= 1,106.00', Outlet Invert= 960.00'



**Reach 6: REACH 1 TO INFILTRATION BASIN 1**

Hydrograph







An Employee-Owned Company

## **Point of Interest A Pad Drainage Area to Infiltration Basin 1**



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint: Tc<2dt may require smaller dt

Runoff = 9.96 cfs @ 12.02 hrs, Volume= 0.589 af, Depth= 1.27"

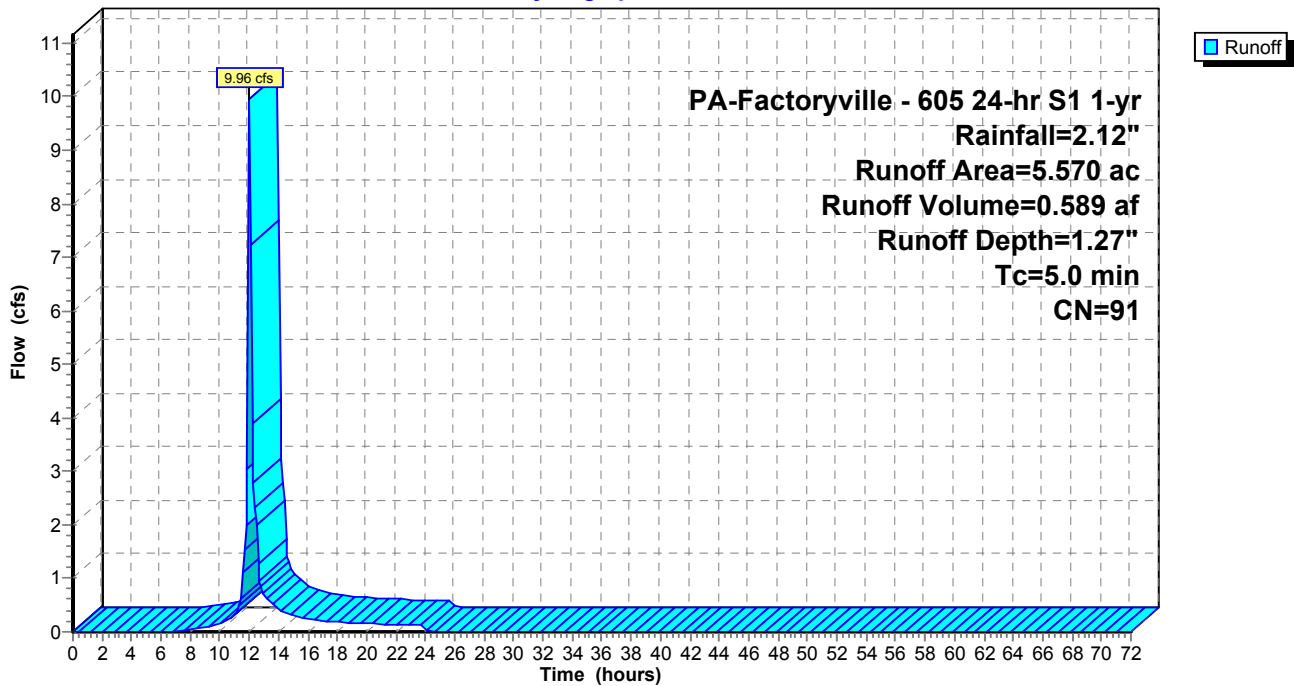
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 12.68 cfs @ 12.02 hrs, Volume= 0.764 af, Depth= 1.65"

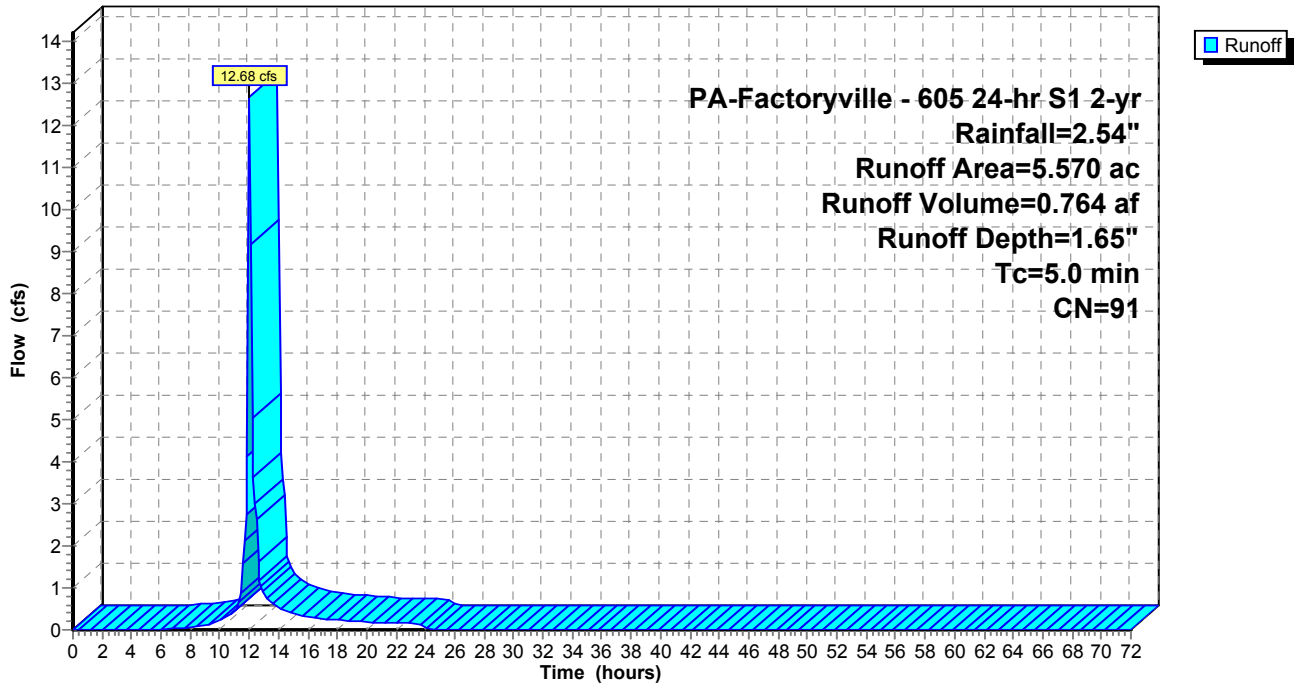
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 16.50 cfs @ 12.02 hrs, Volume= 1.022 af, Depth= 2.20"

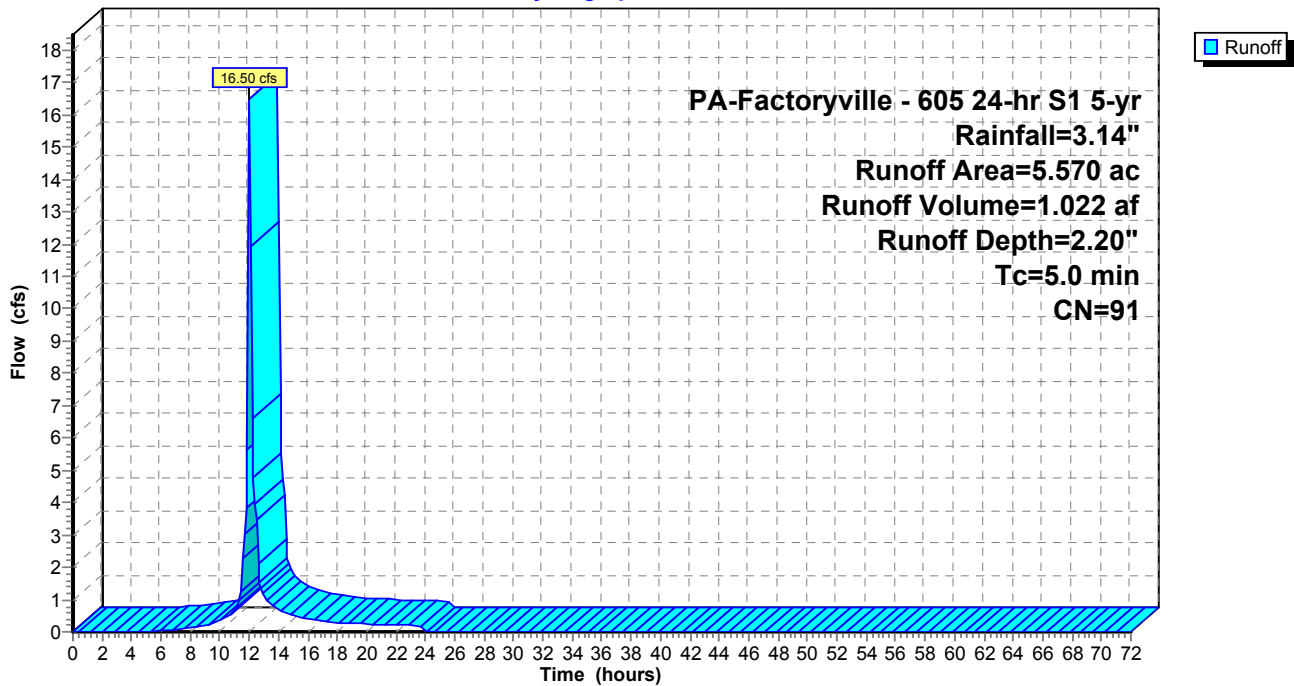
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 19.33 cfs @ 12.02 hrs, Volume= 1.246 af, Depth= 2.68"

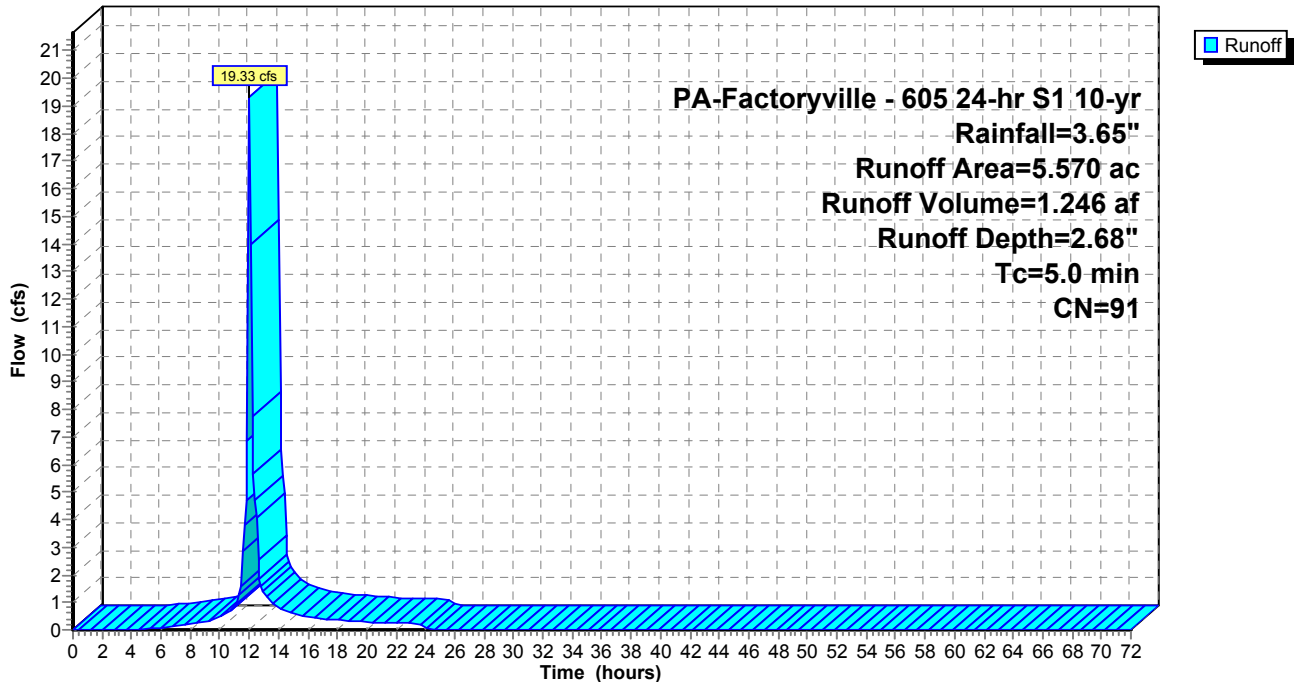
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 22.96 cfs @ 12.02 hrs, Volume= 1.597 af, Depth= 3.44"

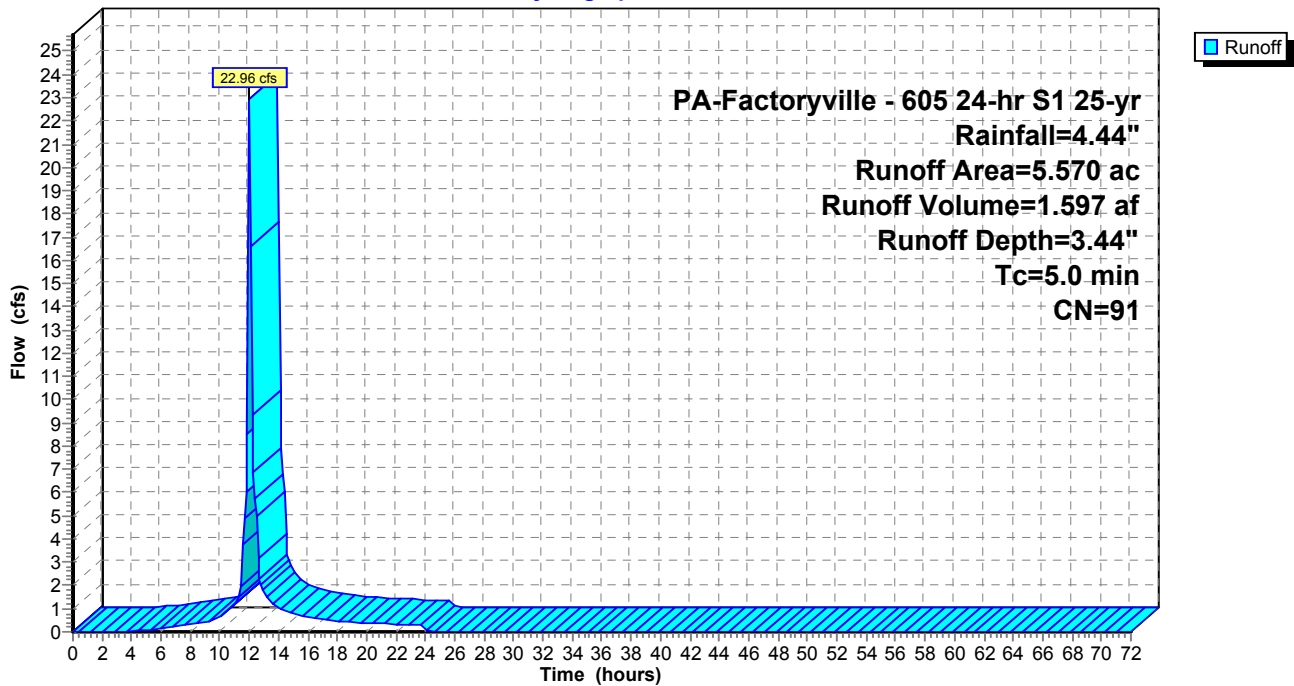
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 25.57 cfs @ 12.02 hrs, Volume= 1.921 af, Depth= 4.14"

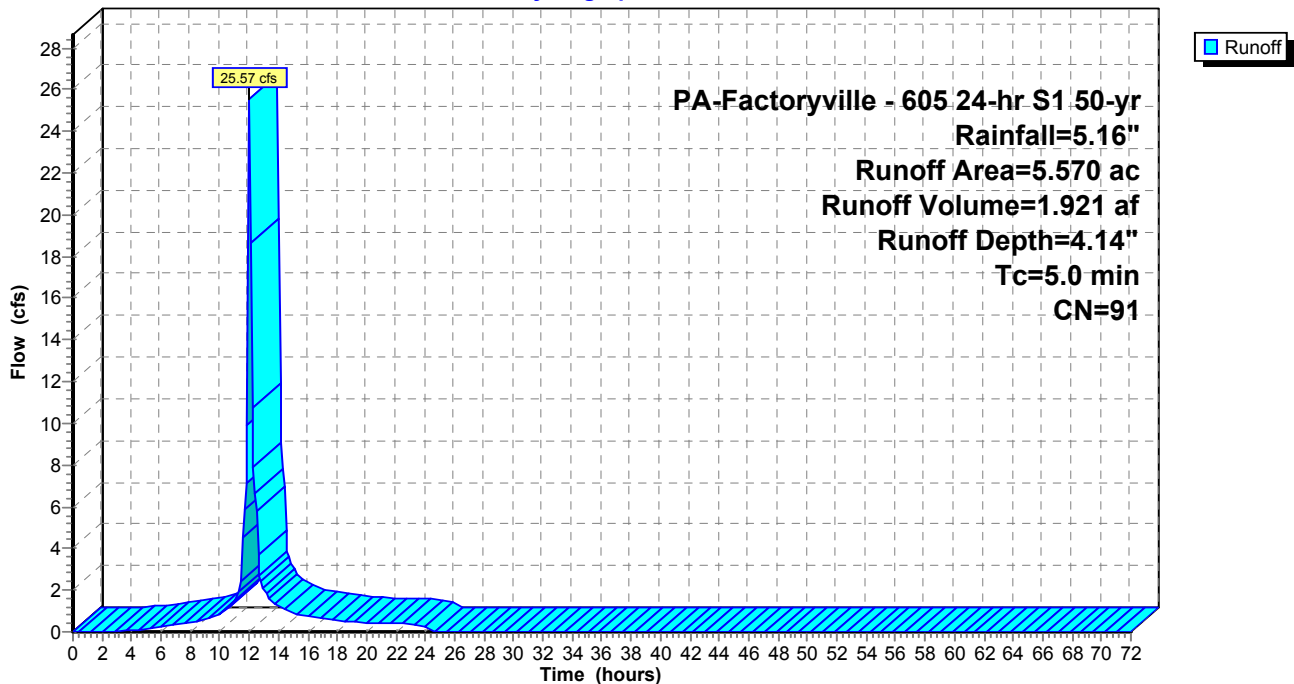
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 7: PAD DA TO BASIN 1**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 28.53 cfs @ 12.02 hrs, Volume= 2.292 af, Depth= 4.94"

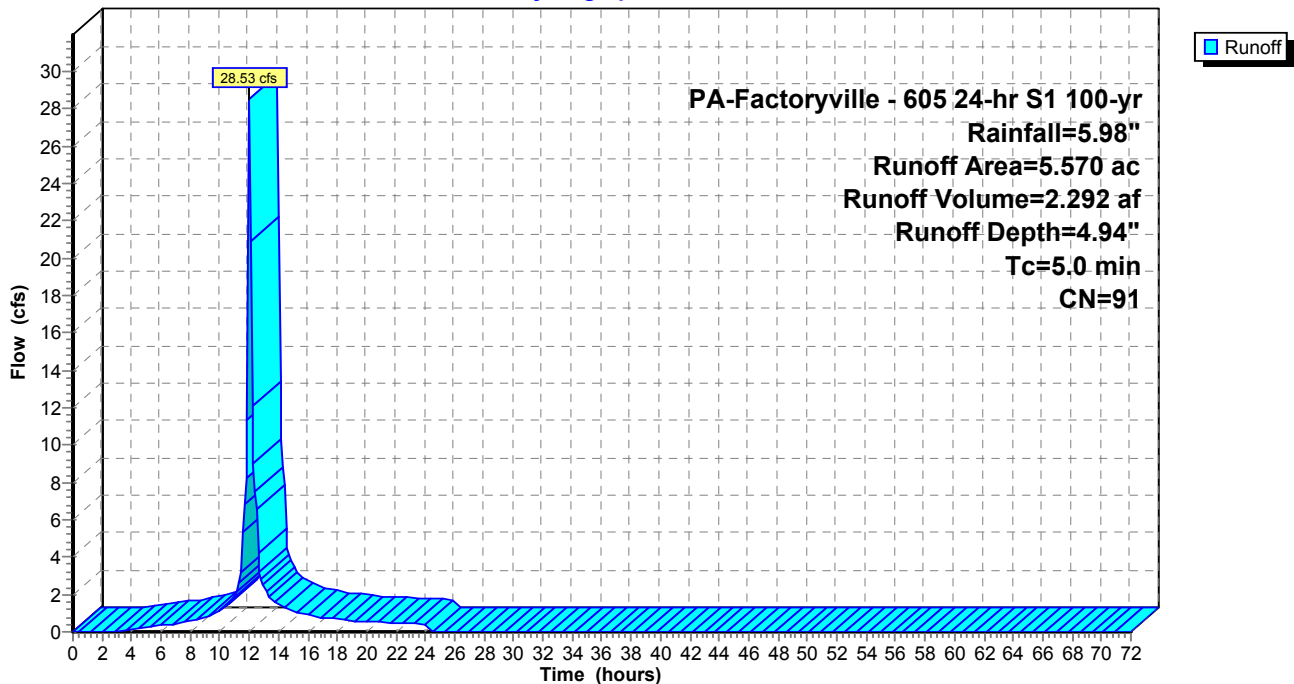
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 7: PAD DA TO BASIN 1**

Hydrograph







An Employee-Owned Company

## **Point of Interest A Reach 2 to Infiltration Basin 1**



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 1.27" for 1-yr event  
 Inflow = 9.96 cfs @ 12.02 hrs, Volume= 0.589 af  
 Outflow = 5.21 cfs @ 12.47 hrs, Volume= 0.589 af, Atten= 48%, Lag= 27.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.10 fps, Min. Travel Time= 17.9 min  
 Avg. Velocity = 0.53 fps, Avg. Travel Time= 71.1 min

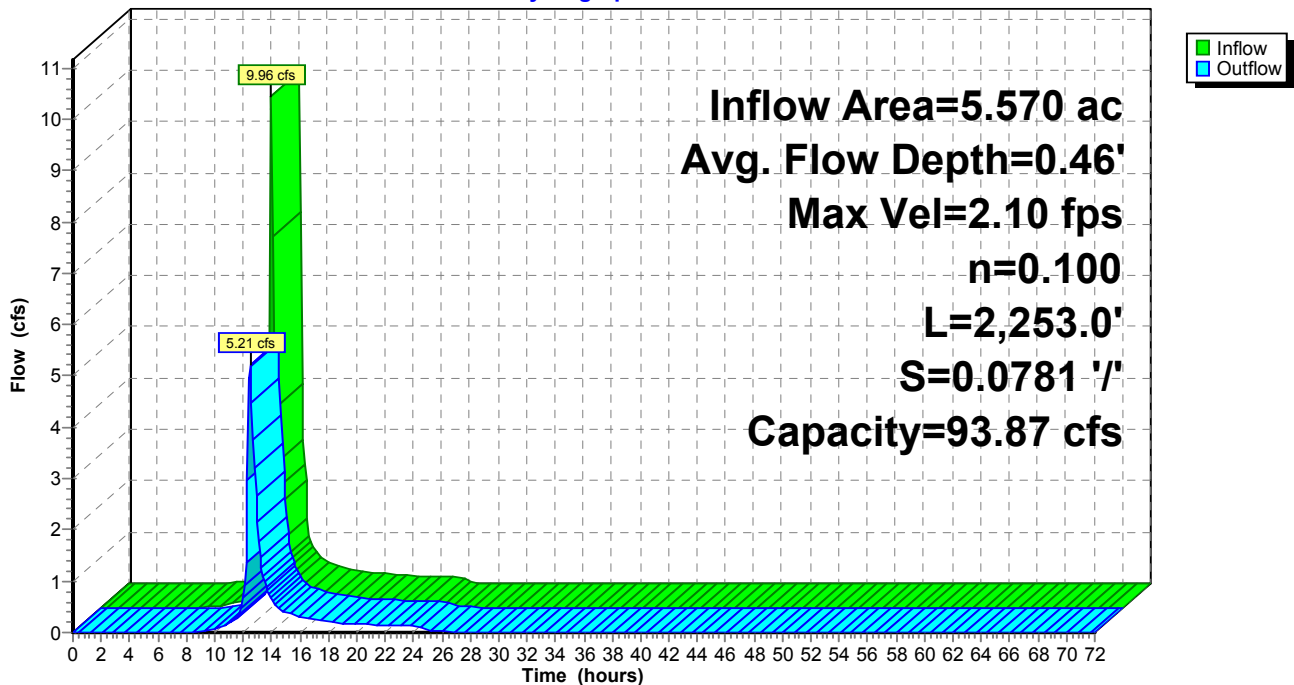
Peak Storage= 5,604 cf @ 12.17 hrs  
 Average Depth at Peak Storage= 0.46'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 1.65" for 2-yr event
Inflow = 12.68 cfs @ 12.02 hrs, Volume= 0.764 af
Outflow = 6.98 cfs @ 12.44 hrs, Volume= 0.764 af, Atten= 45%, Lag= 25.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Max. Velocity= 2.28 fps, Min. Travel Time= 16.4 min
Avg. Velocity = 0.56 fps, Avg. Travel Time= 67.0 min

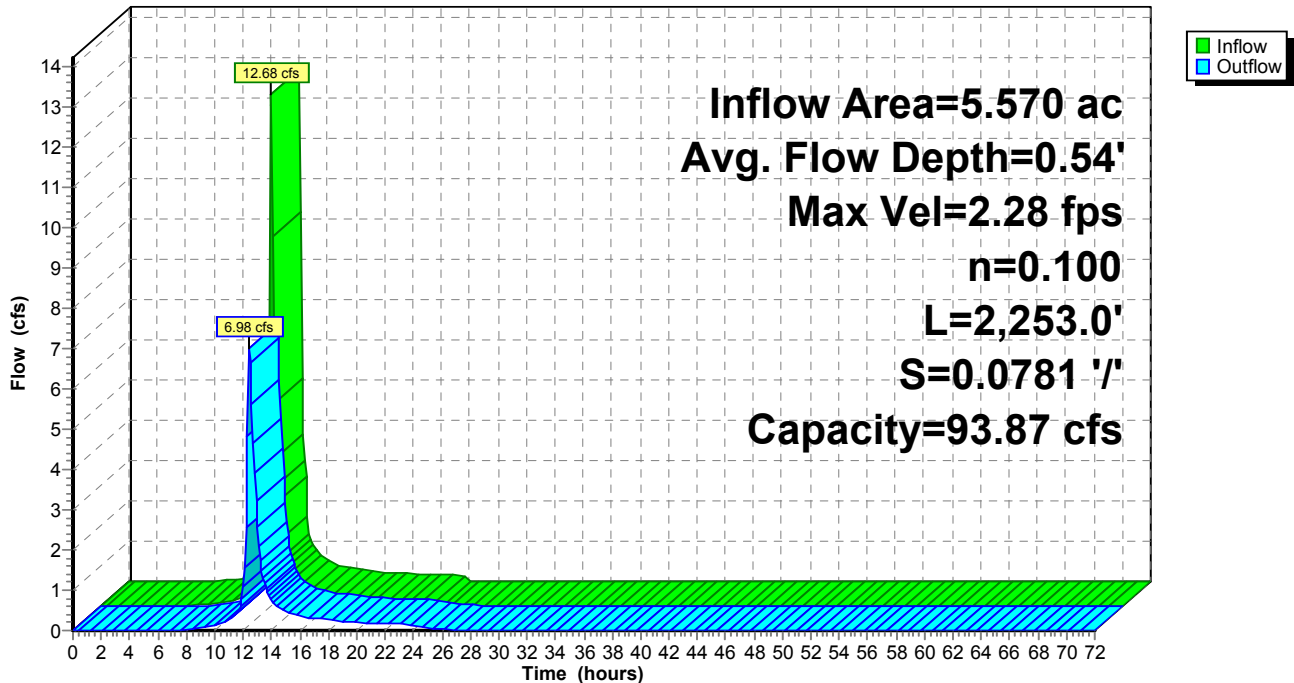
Peak Storage= 6,864 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 2,253.0' Slope= 0.0781 '/'
Inlet Invert= 1,130.00', Outlet Invert= 954.00'



Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 2.20" for 5-yr event  
 Inflow = 16.50 cfs @ 12.02 hrs, Volume= 1.022 af  
 Outflow = 9.37 cfs @ 12.42 hrs, Volume= 1.022 af, Atten= 43%, Lag= 23.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.50 fps, Min. Travel Time= 15.0 min  
 Avg. Velocity = 0.60 fps, Avg. Travel Time= 62.5 min

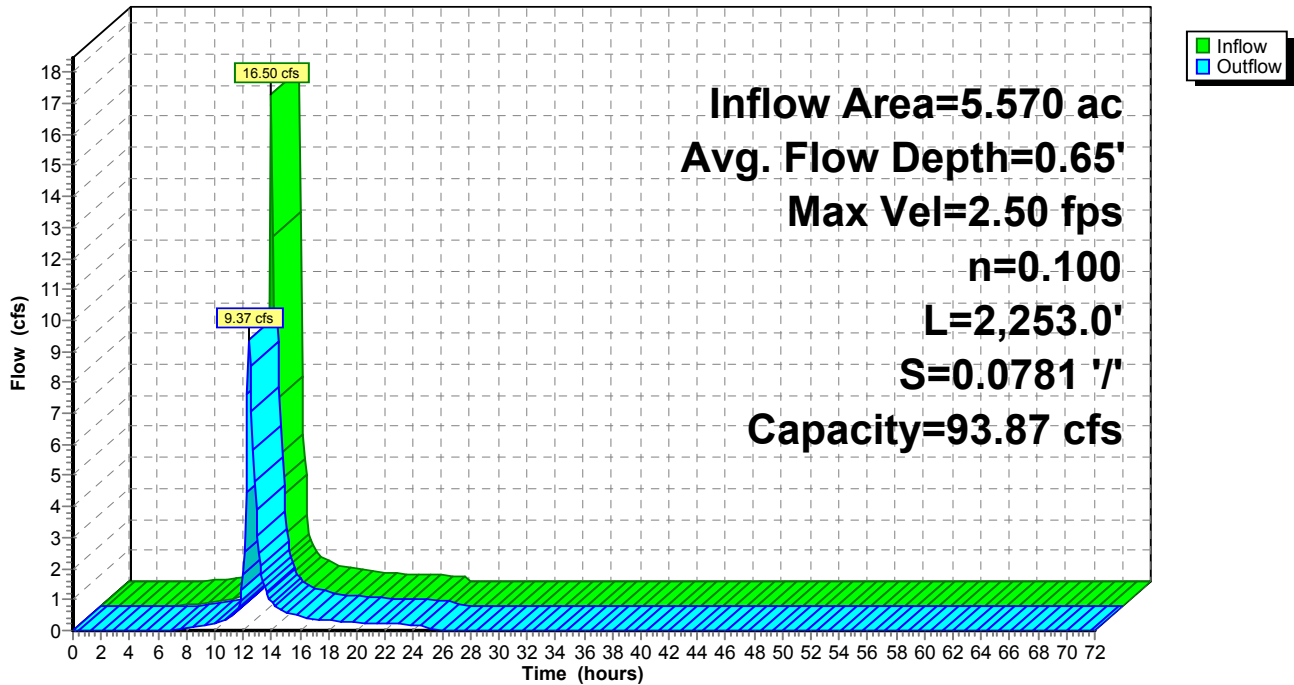
Peak Storage= 8,705 cf @ 12.15 hrs  
 Average Depth at Peak Storage= 0.65'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 2.68" for 10-yr event  
 Inflow = 19.33 cfs @ 12.02 hrs, Volume= 1.246 af  
 Outflow = 11.21 cfs @ 12.40 hrs, Volume= 1.246 af, Atten= 42%, Lag= 22.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.65 fps, Min. Travel Time= 14.2 min  
 Avg. Velocity = 0.63 fps, Avg. Travel Time= 59.2 min

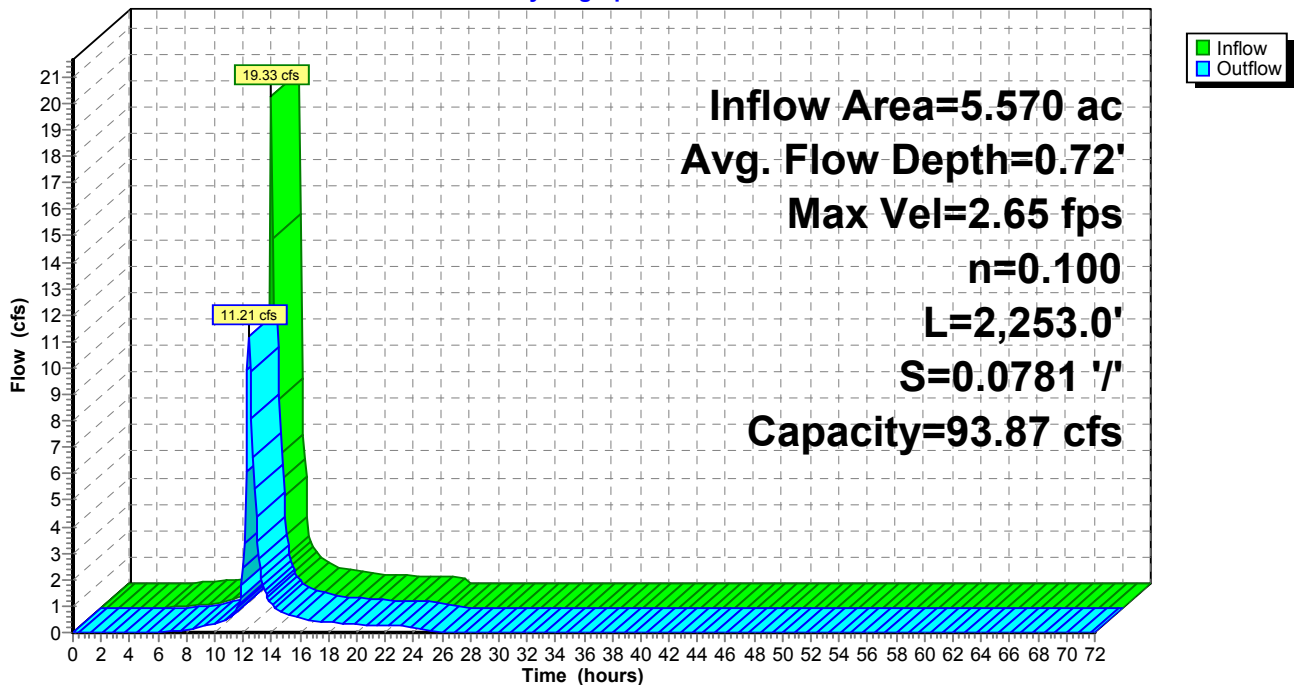
Peak Storage= 9,945 cf @ 12.14 hrs  
 Average Depth at Peak Storage= 0.72'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 3.44" for 25-yr event  
 Inflow = 22.96 cfs @ 12.02 hrs, Volume= 1.597 af  
 Outflow = 13.78 cfs @ 12.37 hrs, Volume= 1.597 af, Atten= 40%, Lag= 21.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.81 fps, Min. Travel Time= 13.3 min  
 Avg. Velocity = 0.68 fps, Avg. Travel Time= 54.9 min

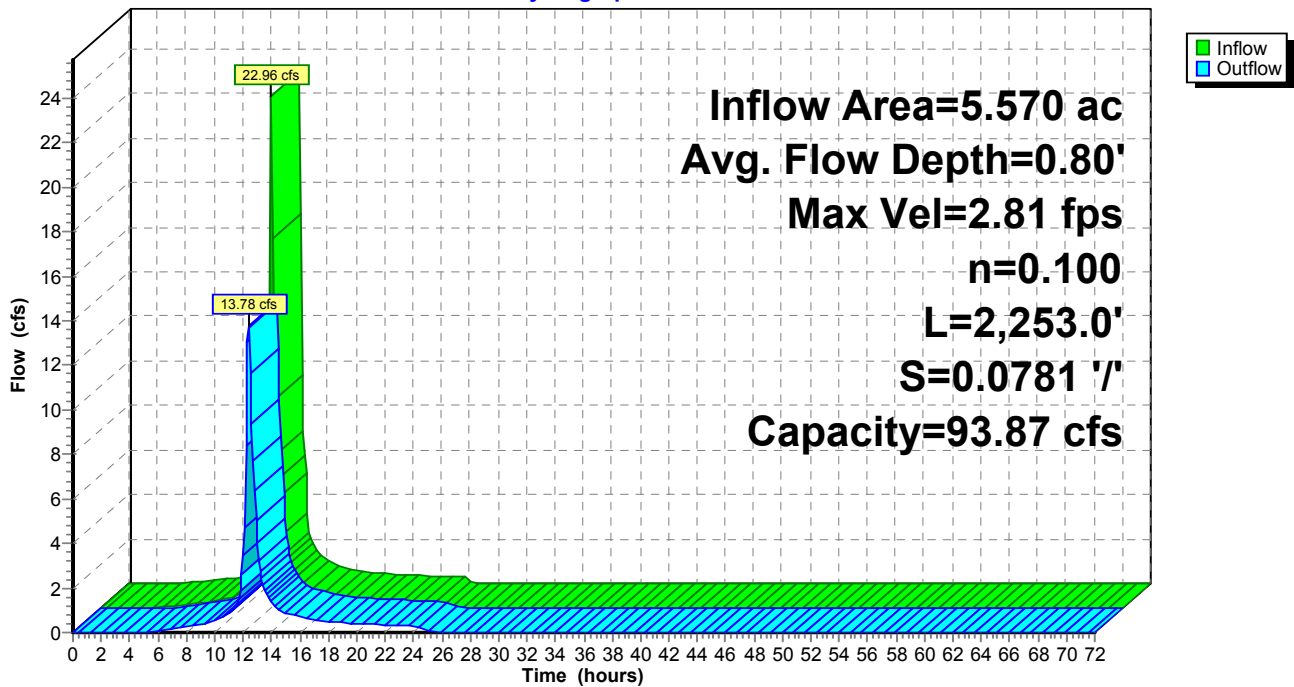
Peak Storage= 11,533 cf @ 12.14 hrs  
 Average Depth at Peak Storage= 0.80'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 4.14" for 50-yr event  
 Inflow = 25.57 cfs @ 12.02 hrs, Volume= 1.921 af  
 Outflow = 15.85 cfs @ 12.35 hrs, Volume= 1.921 af, Atten= 38%, Lag= 20.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 2.93 fps, Min. Travel Time= 12.8 min  
 Avg. Velocity = 0.73 fps, Avg. Travel Time= 51.6 min

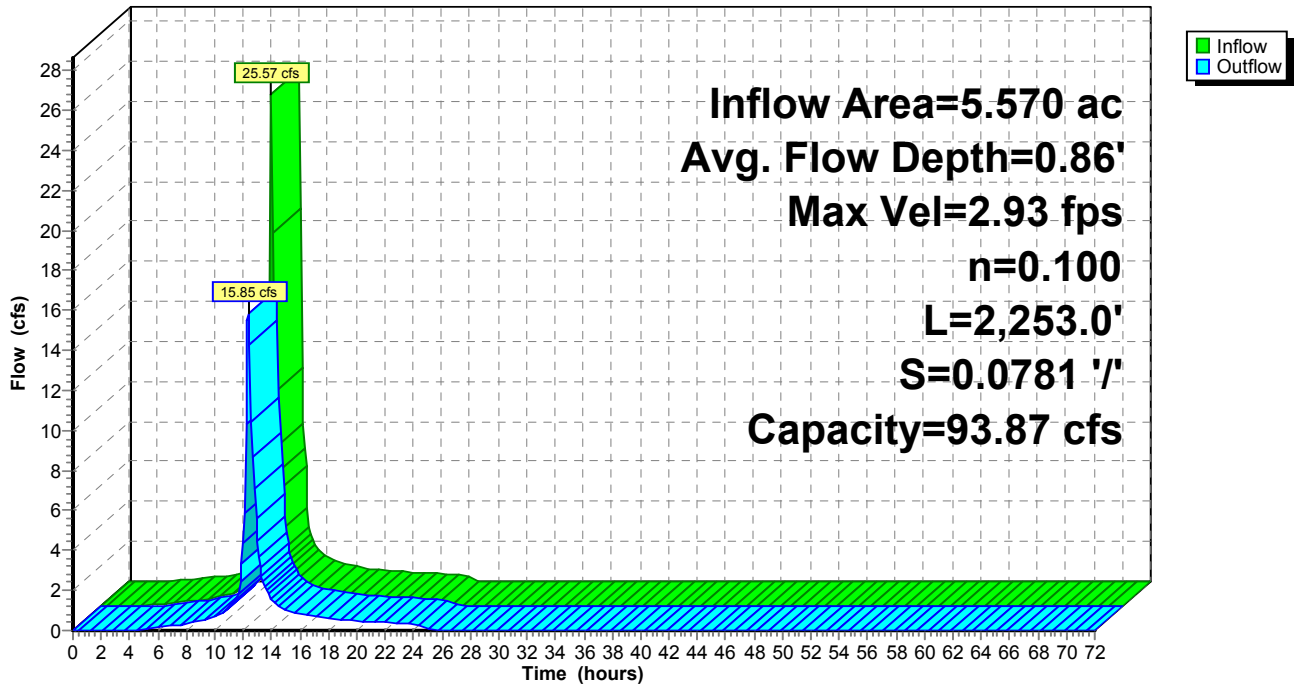
Peak Storage= 12,701 cf @ 12.14 hrs  
 Average Depth at Peak Storage= 0.86'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph



### Summary for Reach 8: REACH 2 TO INFILTRATION BASIN 1

Inflow Area = 5.570 ac, 29.26% Impervious, Inflow Depth = 4.94" for 100-yr event  
 Inflow = 28.53 cfs @ 12.02 hrs, Volume= 2.292 af  
 Outflow = 18.64 cfs @ 12.34 hrs, Volume= 2.292 af, Atten= 35%, Lag= 19.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Max. Velocity= 3.04 fps, Min. Travel Time= 12.4 min  
 Avg. Velocity = 0.77 fps, Avg. Travel Time= 48.7 min

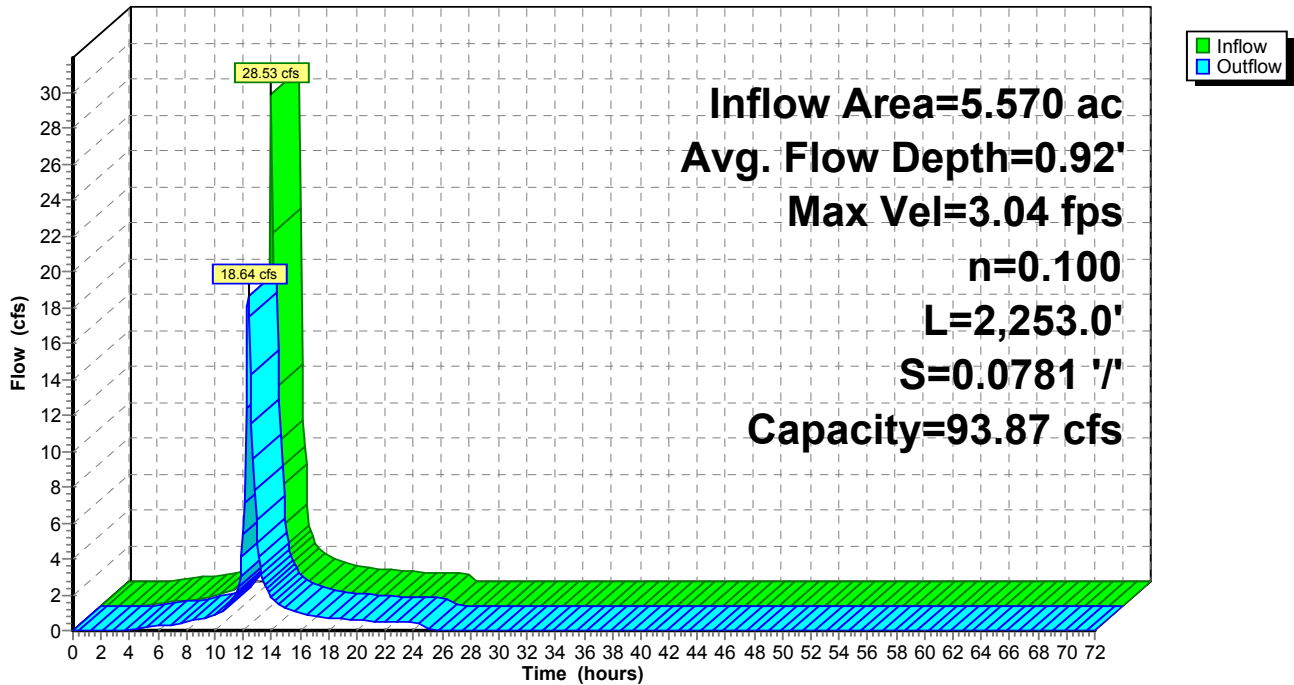
Peak Storage= 13,935 cf @ 12.14 hrs  
 Average Depth at Peak Storage= 0.92'  
 Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
 Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
 Length= 2,253.0' Slope= 0.0781 '/'  
 Inlet Invert= 1,130.00', Outlet Invert= 954.00'



### Reach 8: REACH 2 TO INFILTRATION BASIN 1

Hydrograph







An Employee-Owned Company

## **Point of Interest A**

### **Overland Drainage Area to Infiltration Basin 1**



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 11.36 cfs @ 12.19 hrs, Volume= 1.035 af, Depth= 0.59"

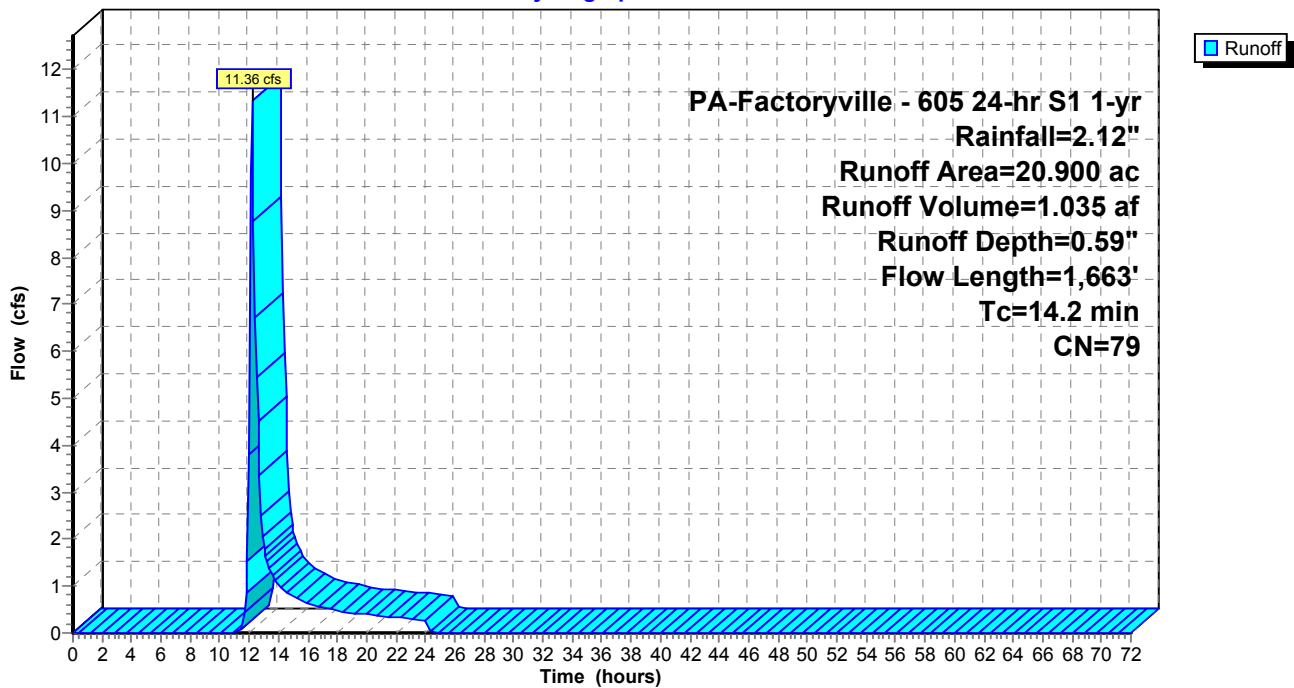
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 17.14 cfs @ 12.18 hrs, Volume= 1.505 af, Depth= 0.86"

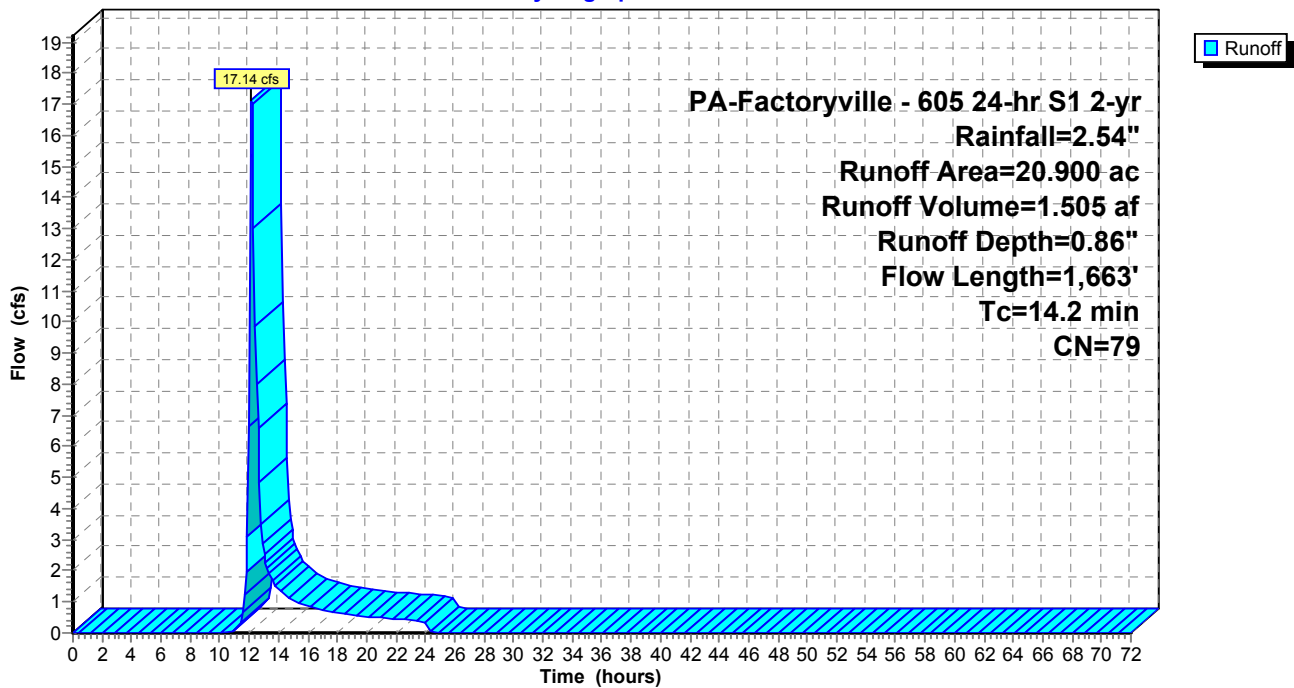
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 26.02 cfs @ 12.17 hrs, Volume= 2.250 af, Depth= 1.29"

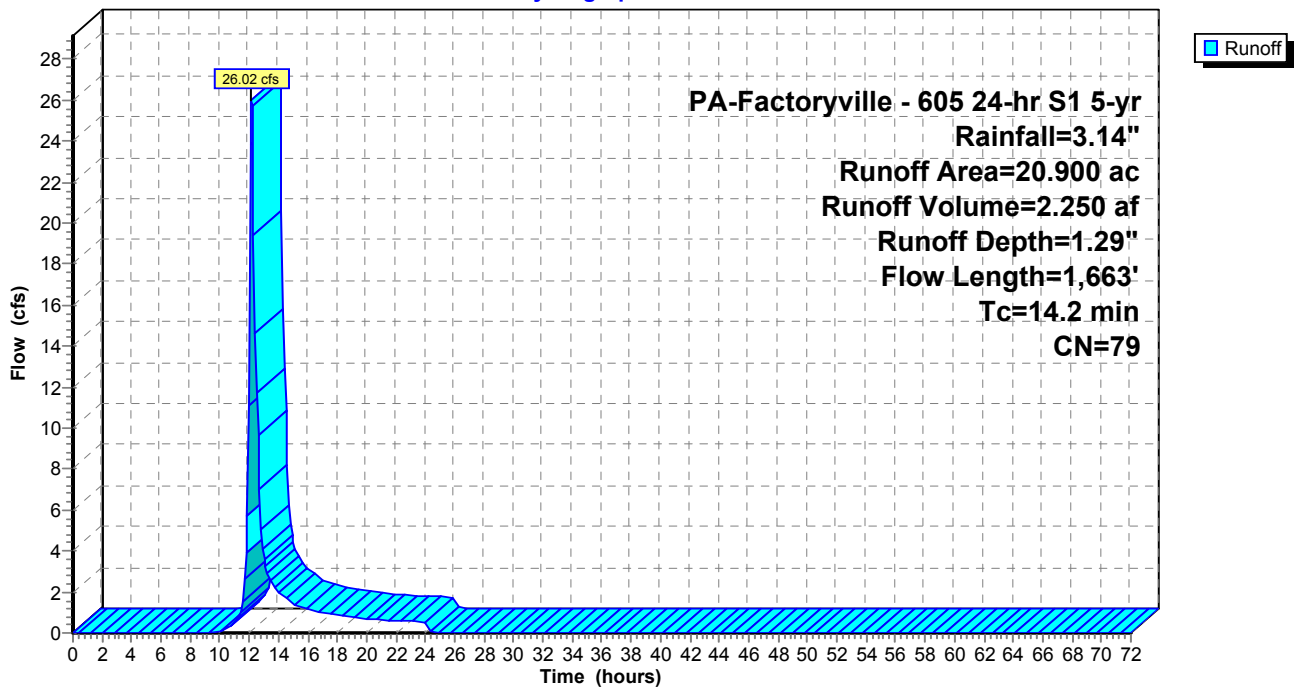
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 33.36 cfs @ 12.17 hrs, Volume= 2.932 af, Depth= 1.68"

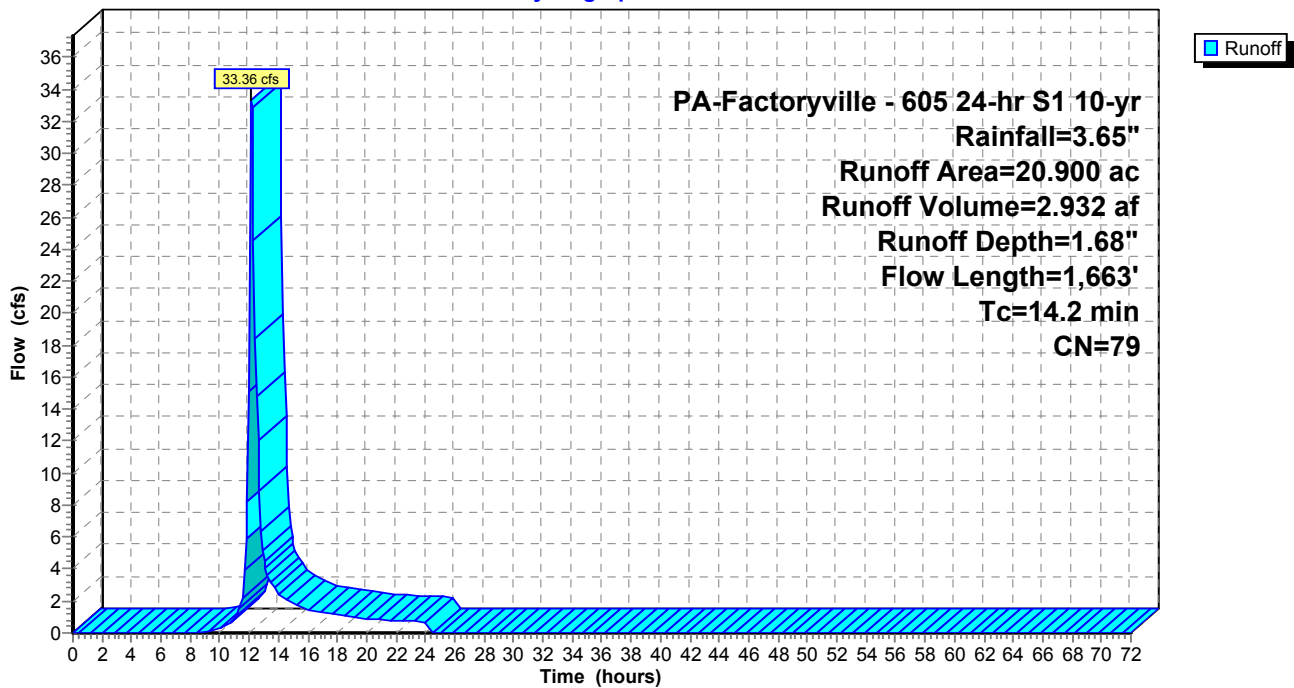
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 43.88 cfs @ 12.16 hrs, Volume= 4.051 af, Depth= 2.33"

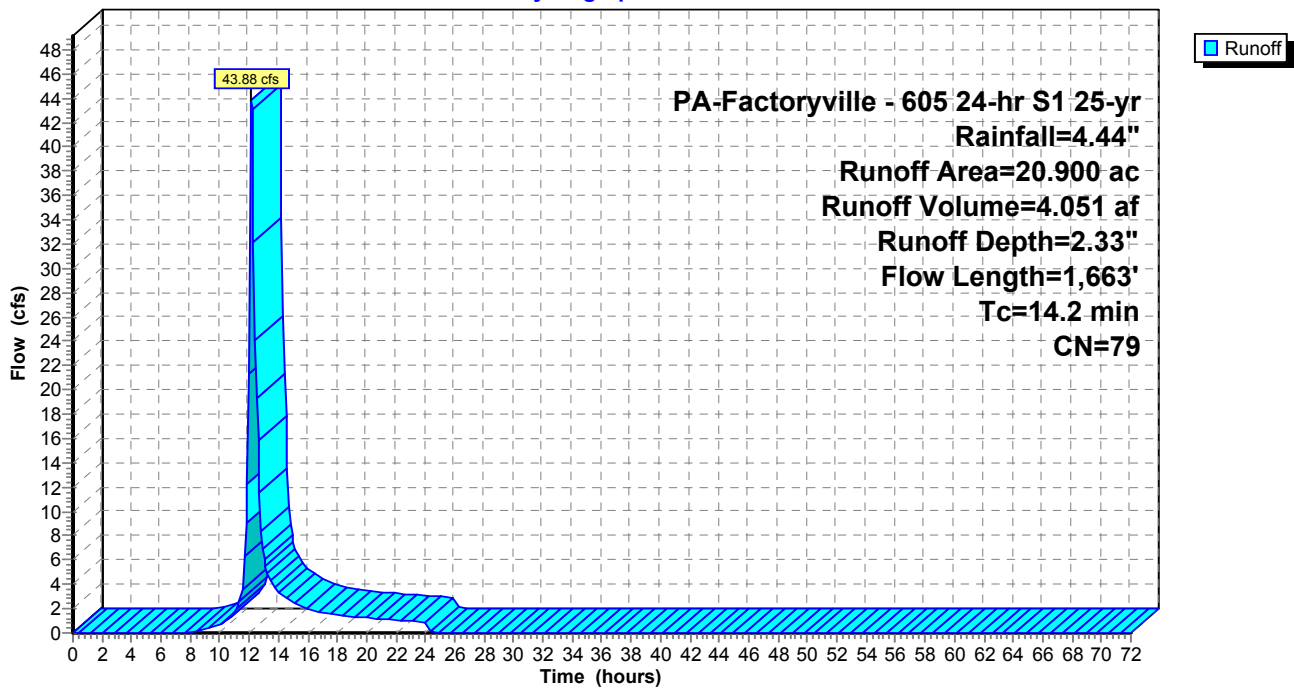
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 52.39 cfs @ 12.16 hrs, Volume= 5.120 af, Depth= 2.94"

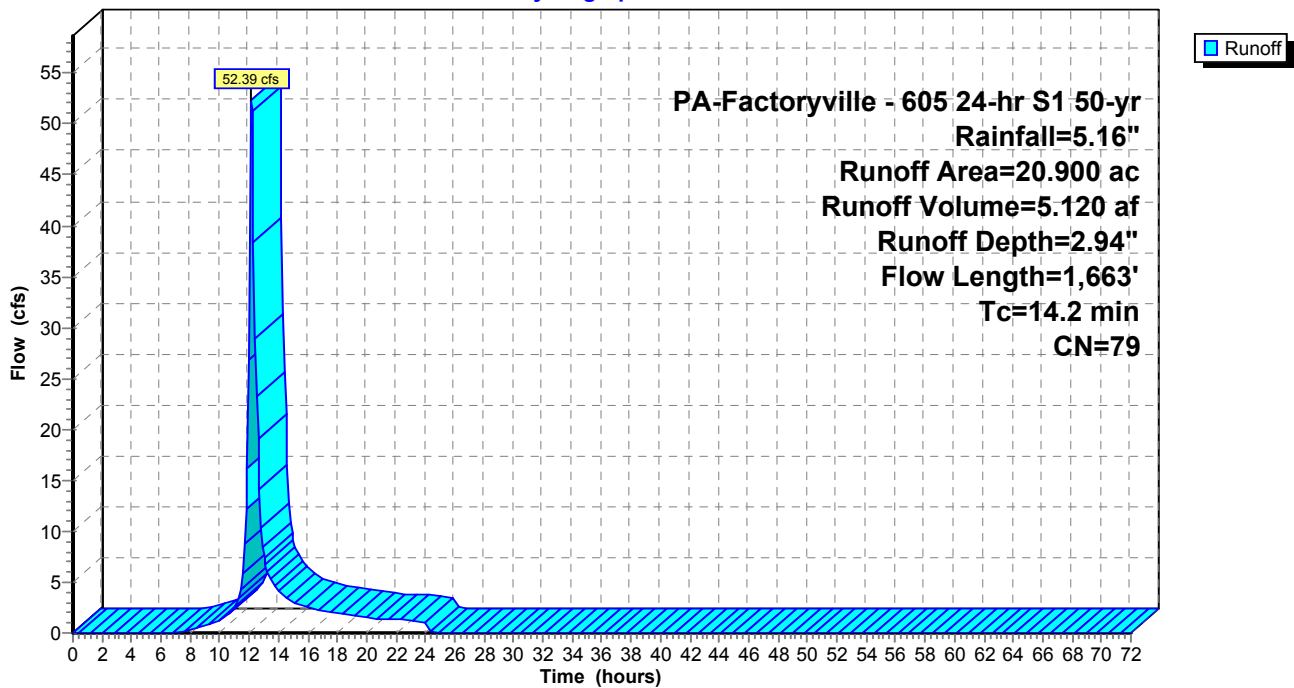
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph



**Summary for Subcatchment 9: OVERLAND DA TO BASIN 1**

Runoff = 61.82 cfs @ 12.16 hrs, Volume= 6.378 af, Depth= 3.66"

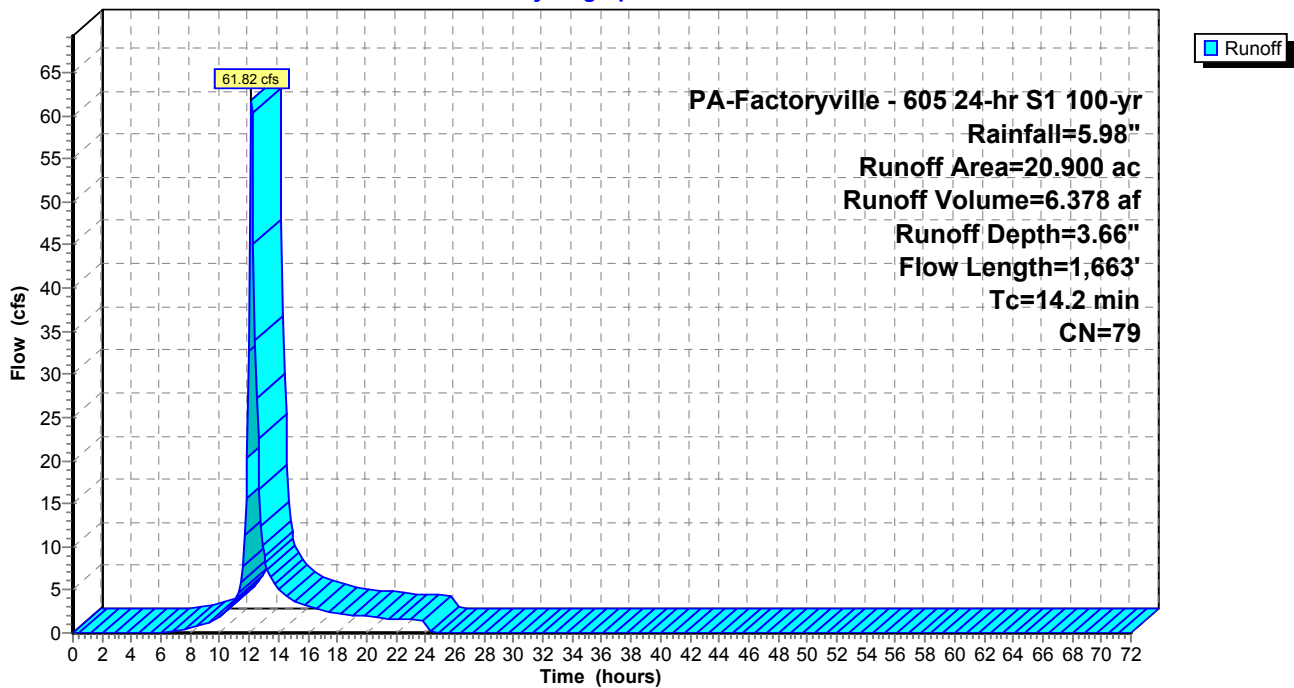
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
17.302	78	Meadow, non-grazed, HSG D
2.348	77	Woods, Good, HSG D
* 1.250	98	Impervious areas, HSG D
20.900	79	Weighted Average
19.650		94.02% Pervious Area
1.250		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
2.7	877	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
14.2	1,663	Total			

**Subcatchment 9: OVERLAND DA TO BASIN 1**

Hydrograph







An Employee-Owned Company

## **Point of Interest A Infiltration Basin 1**



**Summary for Pond 10: INFILTRATION BASIN 1**

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 0.64" for 1-yr event  
 Inflow = 12.75 cfs @ 12.22 hrs, Volume= 1.726 af  
 Outflow = 1.09 cfs @ 15.46 hrs, Volume= 1.726 af, Atten= 91%, Lag= 194.9 min  
 Discarded = 0.71 cfs @ 15.46 hrs, Volume= 1.527 af  
 Primary = 0.38 cfs @ 15.46 hrs, Volume= 0.199 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 951.67' @ 15.46 hrs Surf.Area= 25,526 sf Storage= 43,573 cf

Plug-Flow detention time= 624.5 min calculated for 1.724 af (100% of inflow)  
 Center-of-Mass det. time= 625.1 min ( 1,503.1 - 878.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.71 cfs @ 15.46 hrs HW=951.67' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 0.71 cfs)

**Primary OutFlow** Max=0.38 cfs @ 15.46 hrs HW=951.67' (Free Discharge)

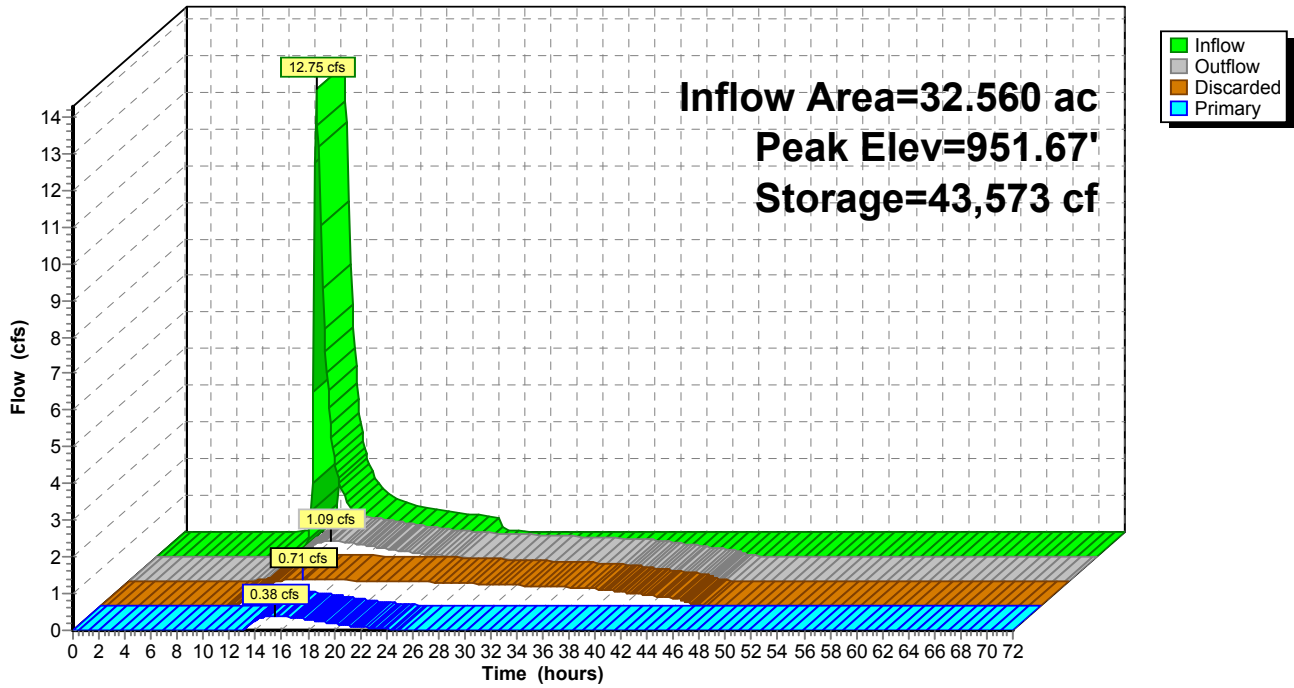
↑ **1=Culvert** (Passes 0.38 cfs of 14.53 cfs potential flow)  
 ↑ **3=Orifice/Grate** (Orifice Controls 0.38 cfs @ 2.20 fps)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Stage-Area-Storage for Pond 10: INFILTRATION BASIN 1**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
949.25	5,082	0	954.45	42,035	137,307
949.35	6,654	587	954.55	42,626	141,540
949.45	8,226	1,331	954.65	43,217	145,832
949.55	9,798	2,232	954.75	43,809	150,184
949.65	11,370	3,290	954.85	44,400	154,594
949.75	12,942	4,506	954.95	44,991	159,064
949.85	14,514	5,879	955.05	45,582	163,592
949.95	16,086	7,409	955.15	46,173	168,180
950.05	17,132	9,083	955.25	46,764	172,827
950.15	17,651	10,822	955.35	47,356	177,533
950.25	18,170	12,613	955.45	47,947	182,298
950.35	18,689	14,456	955.55	48,538	187,122
950.45	19,208	16,351	955.65	49,129	192,006
950.55	19,727	18,298	955.75	49,720	196,948
950.65	20,246	20,296	955.85	50,311	201,950
950.75	20,766	22,347	955.95	50,902	207,010
950.85	21,285	24,449	956.05	51,385	212,127
950.95	21,804	26,604	956.15	51,759	217,285
951.05	22,323	28,810	956.25	52,133	222,479
951.15	22,842	31,068	956.35	52,507	227,711
951.25	23,361	33,379	956.45	52,881	232,980
951.35	23,881	35,741	956.55	53,255	238,287
951.45	24,400	38,155	956.65	53,629	243,631
951.55	24,919	40,621	956.75	54,003	249,013
951.65	25,438	43,138	956.85	54,377	254,432
951.75	25,957	45,708	956.95	54,751	259,888
951.85	26,476	48,330	957.05	55,124	265,382
951.95	26,995	51,003	957.15	55,498	270,913
952.05	27,558	53,730	957.25	55,872	276,482
952.15	28,164	56,516	957.35	56,246	282,088
952.25	28,770	59,363	957.45	56,620	287,731
952.35	29,376	62,270	957.55	56,994	293,412
952.45	29,982	65,238	957.65	57,368	299,130
952.55	30,588	68,267	957.75	57,742	304,885
952.65	31,194	71,356	957.85	58,116	310,678
952.75	31,800	74,505	957.95	<b>58,490</b>	<b>316,509</b>
952.85	32,406	77,716			
952.95	33,012	80,987			
953.05	33,618	84,318			
953.15	34,224	87,710			
953.25	34,830	91,163			
953.35	35,436	94,676			
953.45	36,042	98,250			
953.55	36,648	101,885			
953.65	37,254	105,580			
953.75	37,860	109,335			
953.85	38,466	113,152			
953.95	39,072	117,029			
954.05	39,671	120,966			
954.15	40,262	124,963			
954.25	40,853	129,018			
954.35	41,444	133,133			

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 0.92" for 2-yr event  
 Inflow = 19.62 cfs @ 12.21 hrs, Volume= 2.494 af  
 Outflow = 1.71 cfs @ 14.95 hrs, Volume= 2.494 af, Atten= 91%, Lag= 164.1 min  
 Discarded = 0.82 cfs @ 14.95 hrs, Volume= 1.776 af  
 Primary = 0.89 cfs @ 14.95 hrs, Volume= 0.718 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 952.39' @ 14.95 hrs Surf.Area= 29,597 sf Storage= 63,344 cf

Plug-Flow detention time= 589.6 min calculated for 2.494 af (100% of inflow)  
 Center-of-Mass det. time= 590.4 min ( 1,453.2 - 862.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.82 cfs @ 14.95 hrs HW=952.39' (Free Discharge)

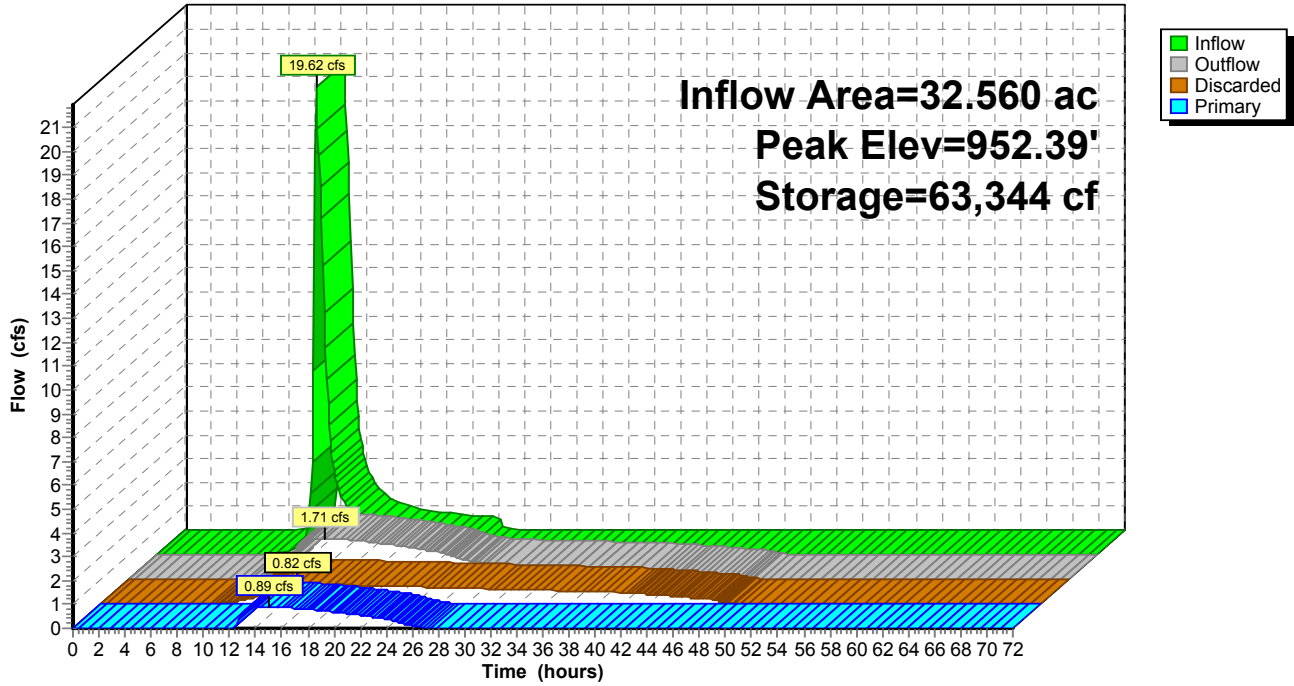
↑ **2=Exfiltration** (Exfiltration Controls 0.82 cfs)

**Primary OutFlow** Max=0.89 cfs @ 14.95 hrs HW=952.39' (Free Discharge)

↑ **1=Culvert** (Passes 0.89 cfs of 16.23 cfs potential flow)  
 ↑ **3=Orifice/Grate** (Orifice Controls 0.89 cfs @ 4.53 fps)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 1.36" for 5-yr event  
 Inflow = 30.26 cfs @ 12.21 hrs, Volume= 3.691 af  
 Outflow = 2.82 cfs @ 14.47 hrs, Volume= 3.691 af, Atten= 91%, Lag= 135.7 min  
 Discarded = 0.99 cfs @ 14.47 hrs, Volume= 2.191 af  
 Primary = 1.84 cfs @ 14.47 hrs, Volume= 1.500 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 953.37' @ 14.47 hrs Surf.Area= 35,547 sf Storage= 95,326 cf

Plug-Flow detention time= 596.8 min calculated for 3.691 af (100% of inflow)  
 Center-of-Mass det. time= 597.7 min ( 1,447.2 - 849.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.99 cfs @ 14.47 hrs HW=953.37' (Free Discharge)

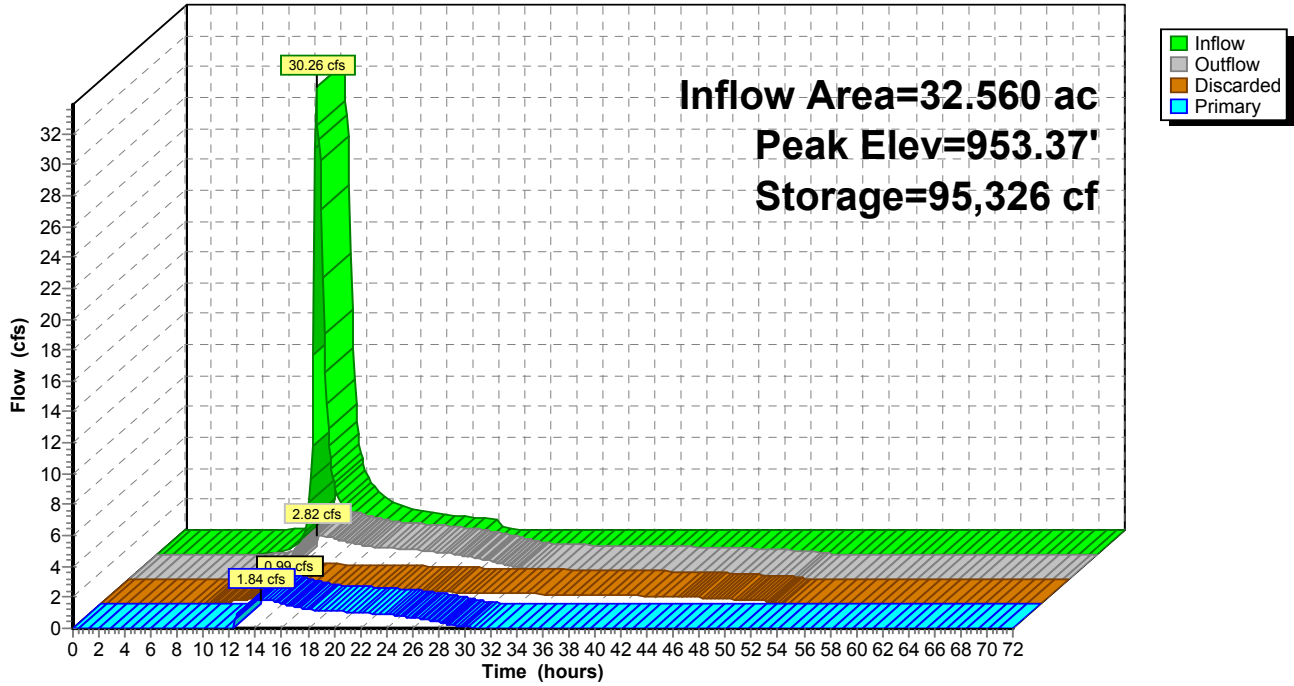
↑ **2=Exfiltration** (Exfiltration Controls 0.99 cfs)

**Primary OutFlow** Max=1.83 cfs @ 14.47 hrs HW=953.37' (Free Discharge)

↑ **1=Culvert** (Passes 1.83 cfs of 18.29 cfs potential flow)  
 ↑ **3=Orifice/Grate** (Orifice Controls 1.29 cfs @ 6.58 fps)  
 ↑ **4=Orifice/Grate** (Orifice Controls 0.54 cfs @ 2.07 fps)  
 ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 1.76" for 10-yr event  
 Inflow = 39.78 cfs @ 12.22 hrs, Volume= 4.774 af  
 Outflow = 5.08 cfs @ 13.75 hrs, Volume= 4.774 af, Atten= 87%, Lag= 91.5 min  
 Discarded = 1.08 cfs @ 13.75 hrs, Volume= 2.376 af  
 Primary = 3.99 cfs @ 13.75 hrs, Volume= 2.398 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 953.94' @ 13.75 hrs Surf.Area= 39,010 sf Storage= 116,629 cf

Plug-Flow detention time= 533.9 min calculated for 4.774 af (100% of inflow)  
 Center-of-Mass det. time= 535.0 min ( 1,378.3 - 843.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.08 cfs @ 13.75 hrs HW=953.94' (Free Discharge)

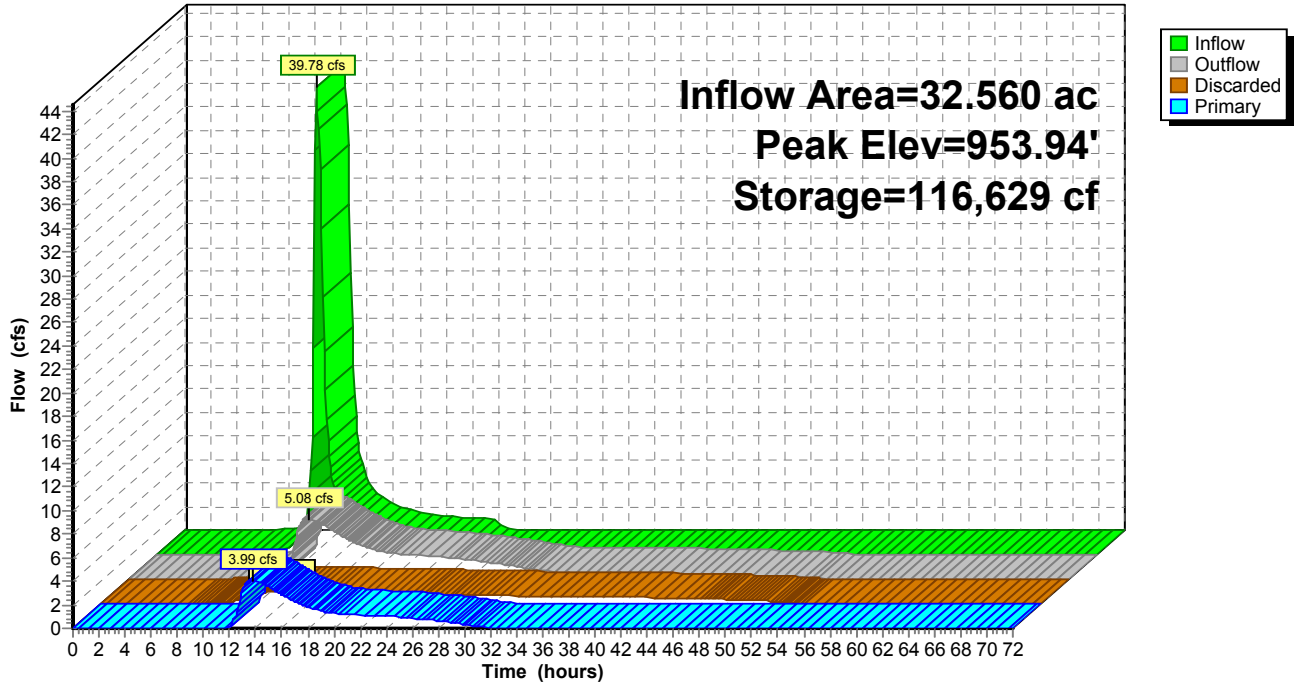
↑ **2=Exfiltration** (Exfiltration Controls 1.08 cfs)

**Primary OutFlow** Max=4.00 cfs @ 13.75 hrs HW=953.94' (Free Discharge)

↑ **1=Culvert** (Passes 4.00 cfs of 19.38 cfs potential flow)  
 ↑ **3=Orifice/Grate** (Orifice Controls 1.48 cfs @ 7.52 fps)  
 ↑ **4=Orifice/Grate** (Orifice Controls 2.53 cfs @ 3.30 fps)  
 ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

[62] Hint: Exceeded Reach 8 OUTLET depth by 0.64' @ 13.80 hrs

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 2.41" for 25-yr event  
 Inflow = 55.69 cfs @ 12.23 hrs, Volume= 6.543 af  
 Outflow = 7.37 cfs @ 13.58 hrs, Volume= 6.543 af, Atten= 87%, Lag= 81.1 min  
 Discarded = 1.23 cfs @ 13.58 hrs, Volume= 2.625 af  
 Primary = 6.14 cfs @ 13.58 hrs, Volume= 3.917 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 954.86' @ 13.58 hrs Surf.Area= 44,440 sf Storage= 154,897 cf

Plug-Flow detention time= 469.9 min calculated for 6.543 af (100% of inflow)  
 Center-of-Mass det. time= 471.0 min ( 1,308.8 - 837.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

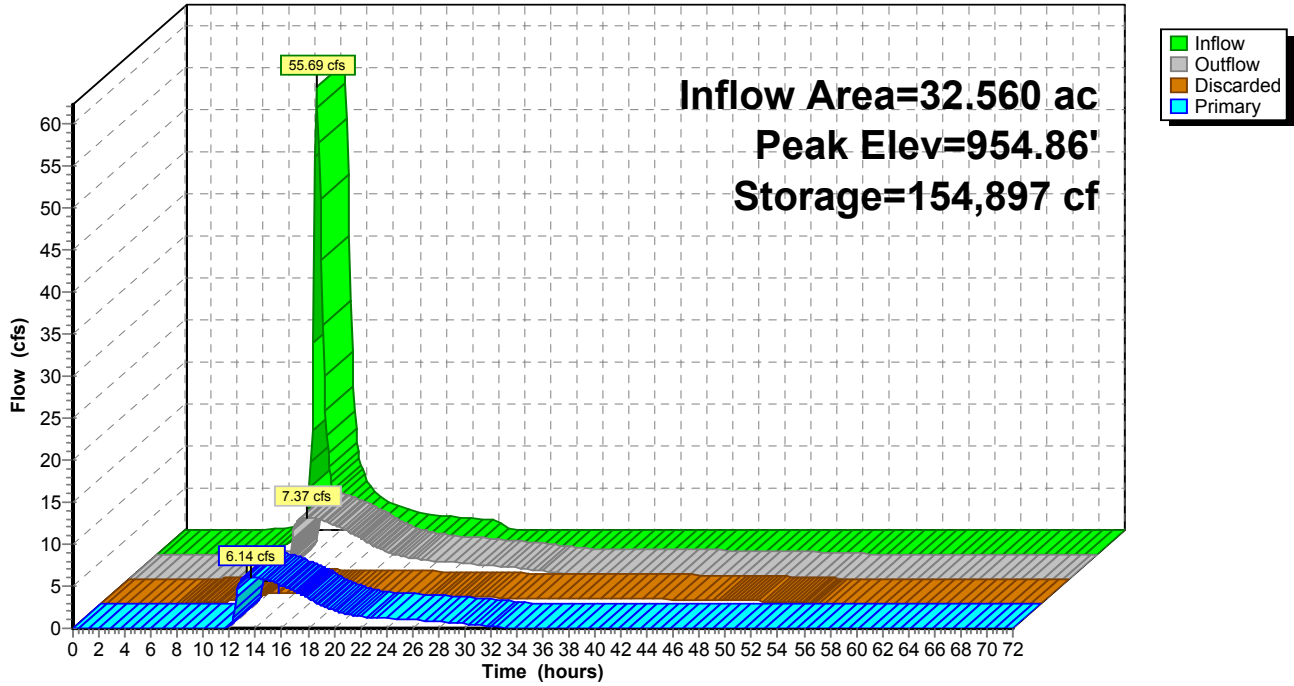
Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.23 cfs @ 13.58 hrs HW=954.86' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 1.23 cfs)

**Primary OutFlow** Max=6.14 cfs @ 13.58 hrs HW=954.86' (Free Discharge)  
 ↳ **1=Culvert** (Passes 6.14 cfs of 21.03 cfs potential flow)  
 ↳ **3=Orifice/Grate** (Orifice Controls 1.73 cfs @ 8.82 fps)  
 ↳ **4=Orifice/Grate** (Orifice Controls 4.40 cfs @ 5.61 fps)  
 ↳ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↳ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

[62] Hint: Exceeded Reach 8 OUTLET depth by 1.43' @ 13.80 hrs

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 3.03" for 50-yr event  
 Inflow = 68.49 cfs @ 12.22 hrs, Volume= 8.230 af  
 Outflow = 8.88 cfs @ 13.59 hrs, Volume= 8.230 af, Atten= 87%, Lag= 81.8 min  
 Discarded = 1.37 cfs @ 13.59 hrs, Volume= 2.844 af  
 Primary = 7.51 cfs @ 13.59 hrs, Volume= 5.386 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 955.67' @ 13.59 hrs Surf.Area= 49,269 sf Storage= 193,169 cf

Plug-Flow detention time= 440.0 min calculated for 8.230 af (100% of inflow)  
 Center-of-Mass det. time= 441.1 min ( 1,276.0 - 834.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

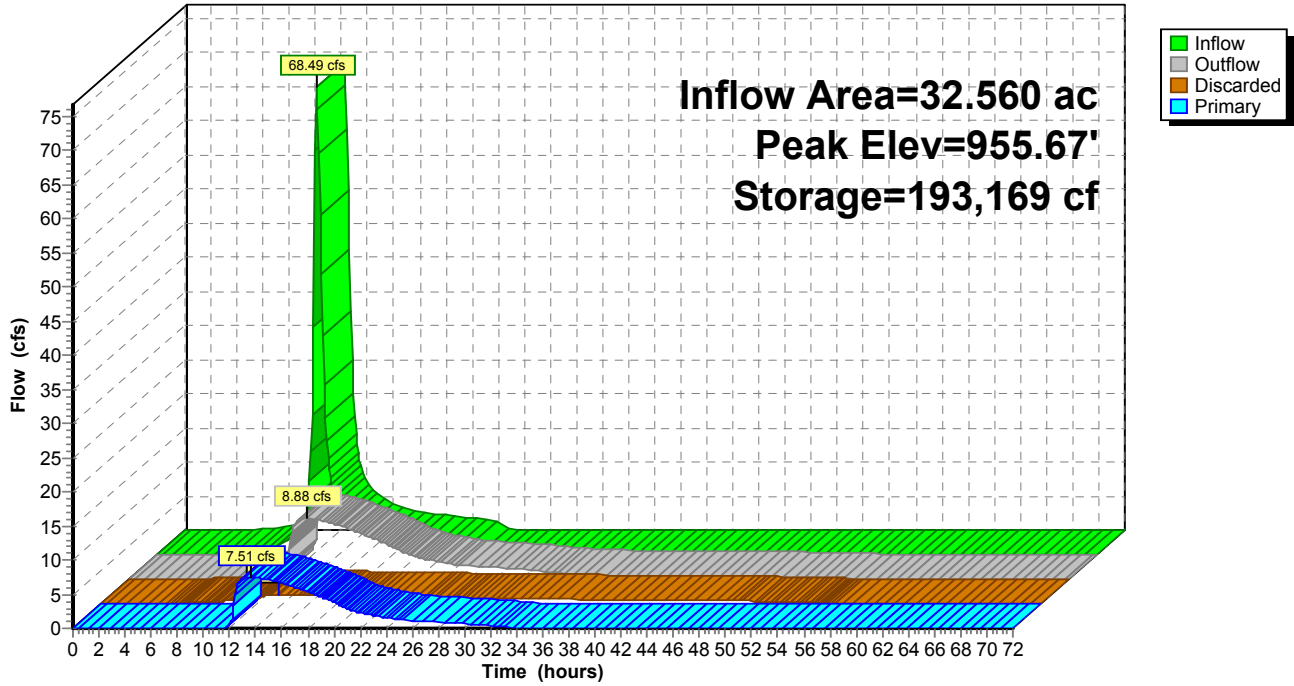
Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.37 cfs @ 13.59 hrs HW=955.67' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 1.37 cfs)

**Primary OutFlow** Max=7.51 cfs @ 13.59 hrs HW=955.67' (Free Discharge)  
 ↳ **1=Culvert** (Passes 7.51 cfs of 22.39 cfs potential flow)  
 ↳ **3=Orifice/Grate** (Orifice Controls 1.93 cfs @ 9.84 fps)  
 ↳ **4=Orifice/Grate** (Orifice Controls 5.58 cfs @ 7.10 fps)  
 ↳ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↳ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph



**Summary for Pond 10: INFILTRATION BASIN 1**

[62] Hint: Exceeded Reach 8 OUTLET depth by 1.99' @ 13.20 hrs

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 3.77" for 100-yr event  
 Inflow = 81.74 cfs @ 12.22 hrs, Volume= 10.217 af  
 Outflow = 17.16 cfs @ 13.09 hrs, Volume= 10.217 af, Atten= 79%, Lag= 52.0 min  
 Discarded = 1.46 cfs @ 13.09 hrs, Volume= 3.040 af  
 Primary = 15.70 cfs @ 13.09 hrs, Volume= 7.177 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 956.32' @ 13.09 hrs Surf.Area= 52,410 sf Storage= 226,358 cf

Plug-Flow detention time= 403.6 min calculated for 10.202 af (100% of inflow)  
 Center-of-Mass det. time= 405.5 min ( 1,238.1 - 832.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

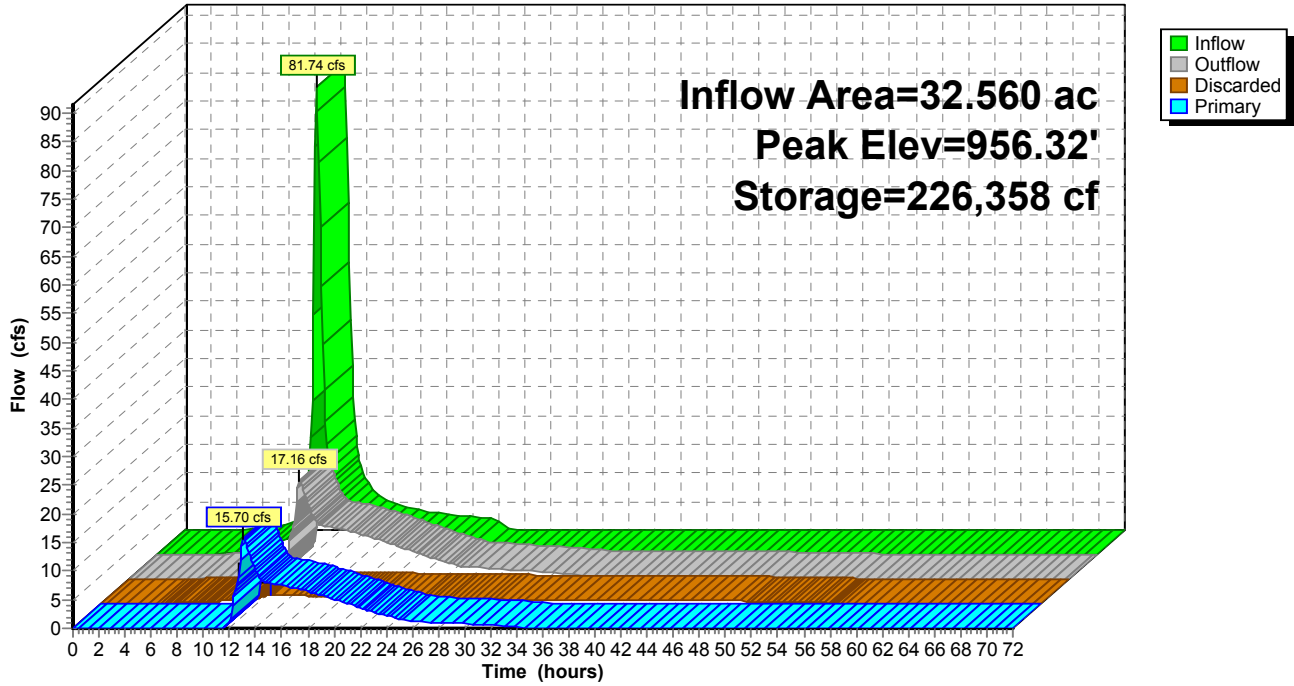
Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.46 cfs @ 13.09 hrs HW=956.32' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 1.46 cfs)

**Primary OutFlow** Max=15.65 cfs @ 13.09 hrs HW=956.32' (Free Discharge)  
 ↳ **1=Culvert** (Passes 15.65 cfs of 23.42 cfs potential flow)  
 ↳ **3=Orifice/Grate** (Orifice Controls 2.08 cfs @ 10.57 fps)  
 ↳ **4=Orifice/Grate** (Orifice Controls 6.35 cfs @ 8.09 fps)  
 ↳ **5=Orifice/Grate** (Weir Controls 7.22 cfs @ 1.86 fps)  
 ↳ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 10: INFILTRATION BASIN 1

Hydrograph







An Employee-Owned Company

## **Point of Interest A Post Development Bypass Drainage Area**



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 20.73 cfs @ 12.78 hrs, Volume= 3.717 af, Depth= 0.55"

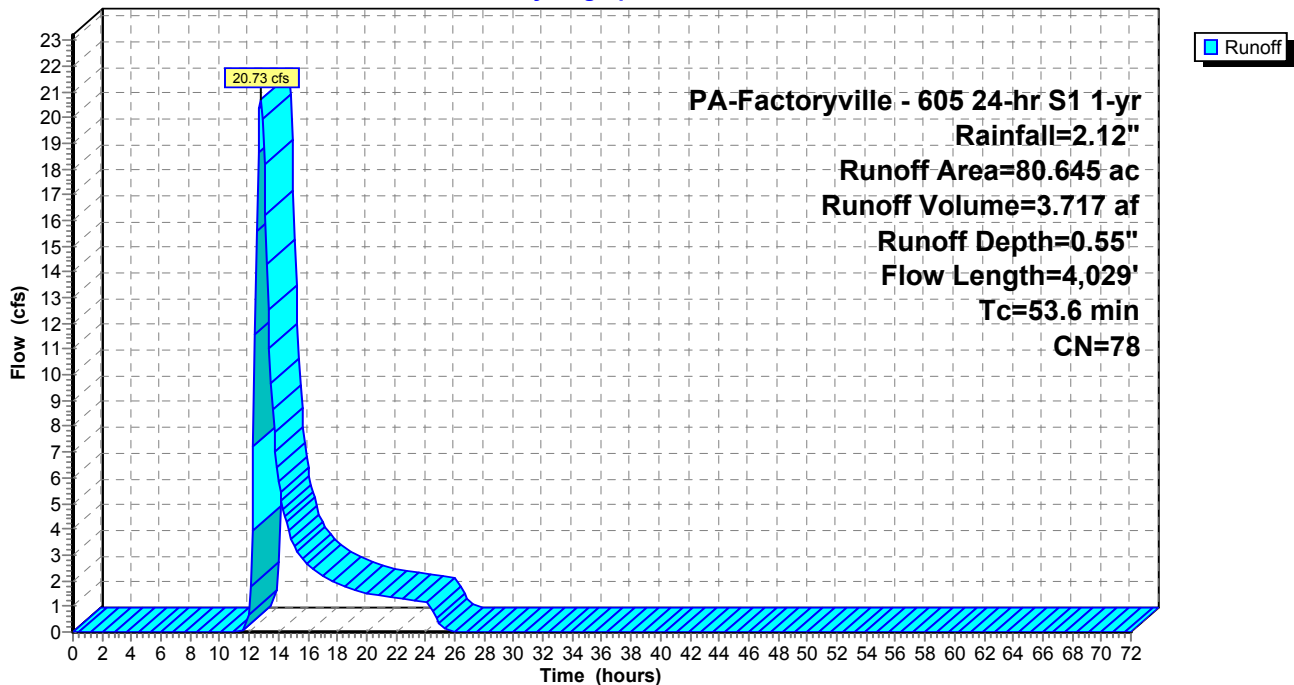
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 32.26 cfs @ 12.76 hrs, Volume= 5.470 af, Depth= 0.81"

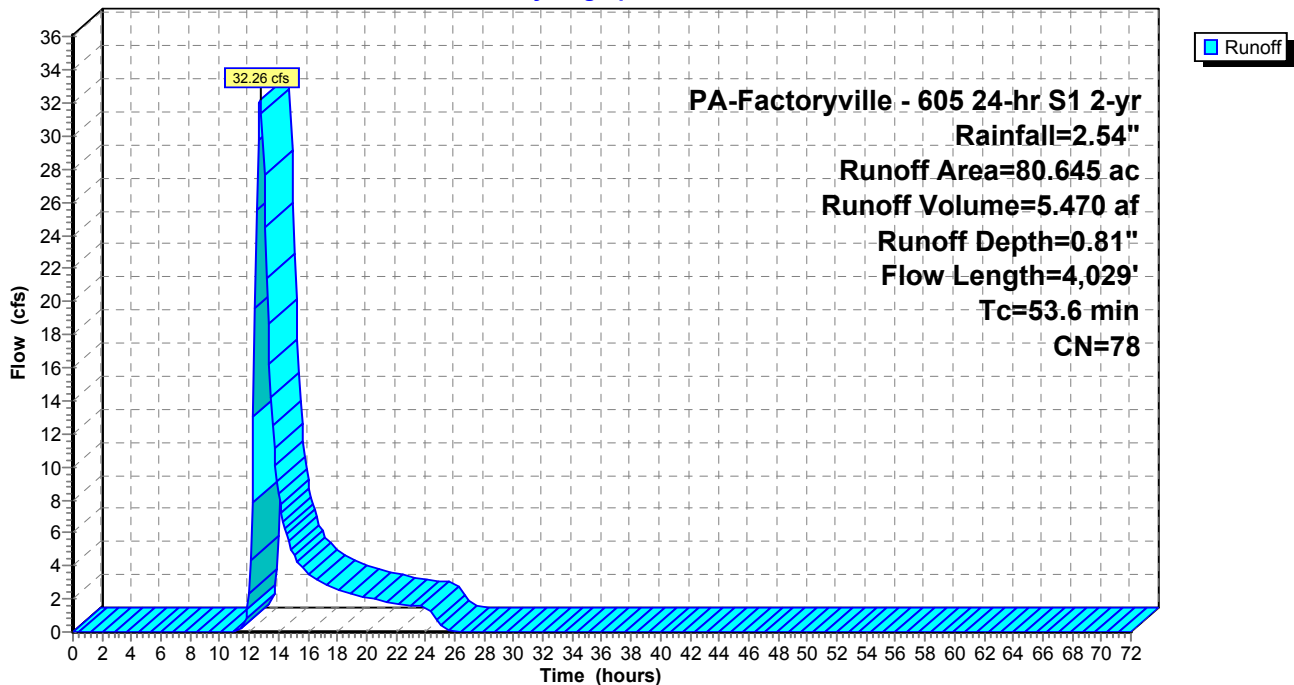
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b> Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 50.38 cfs @ 12.74 hrs, Volume= 8.263 af, Depth= 1.23"

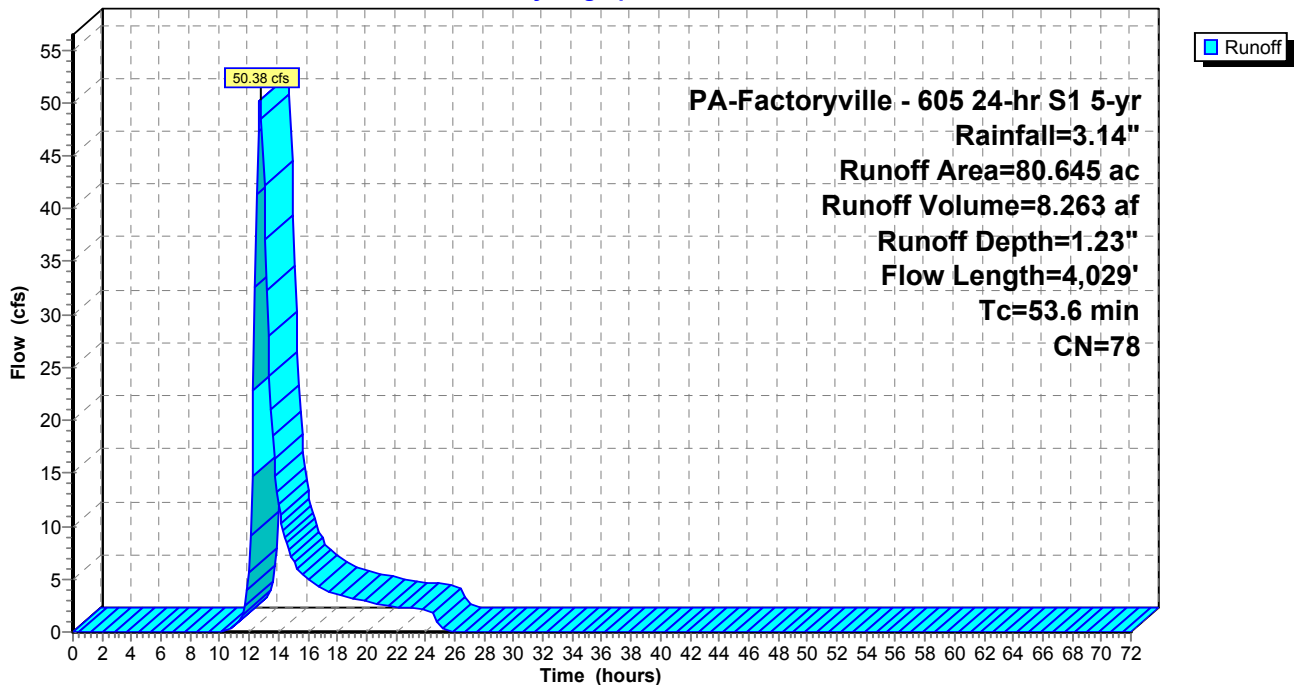
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 65.67 cfs @ 12.73 hrs, Volume= 10.835 af, Depth= 1.61"

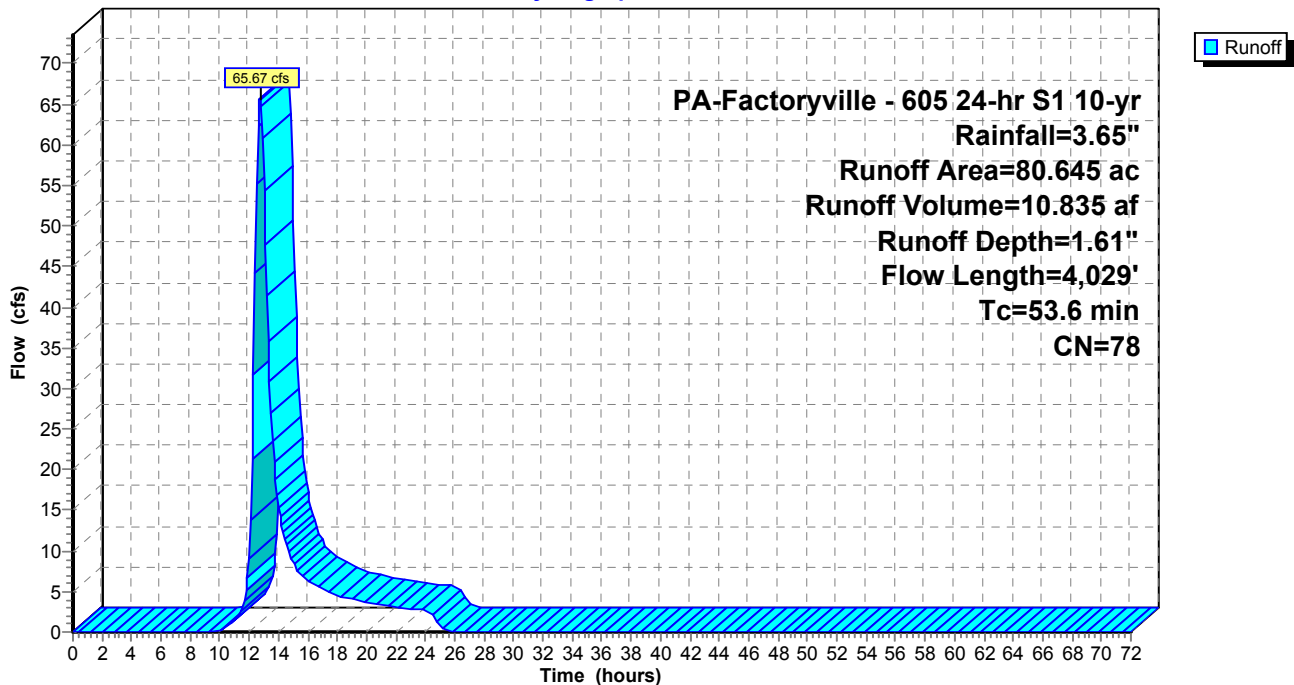
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 88.54 cfs @ 12.72 hrs, Volume= 15.076 af, Depth= 2.24"

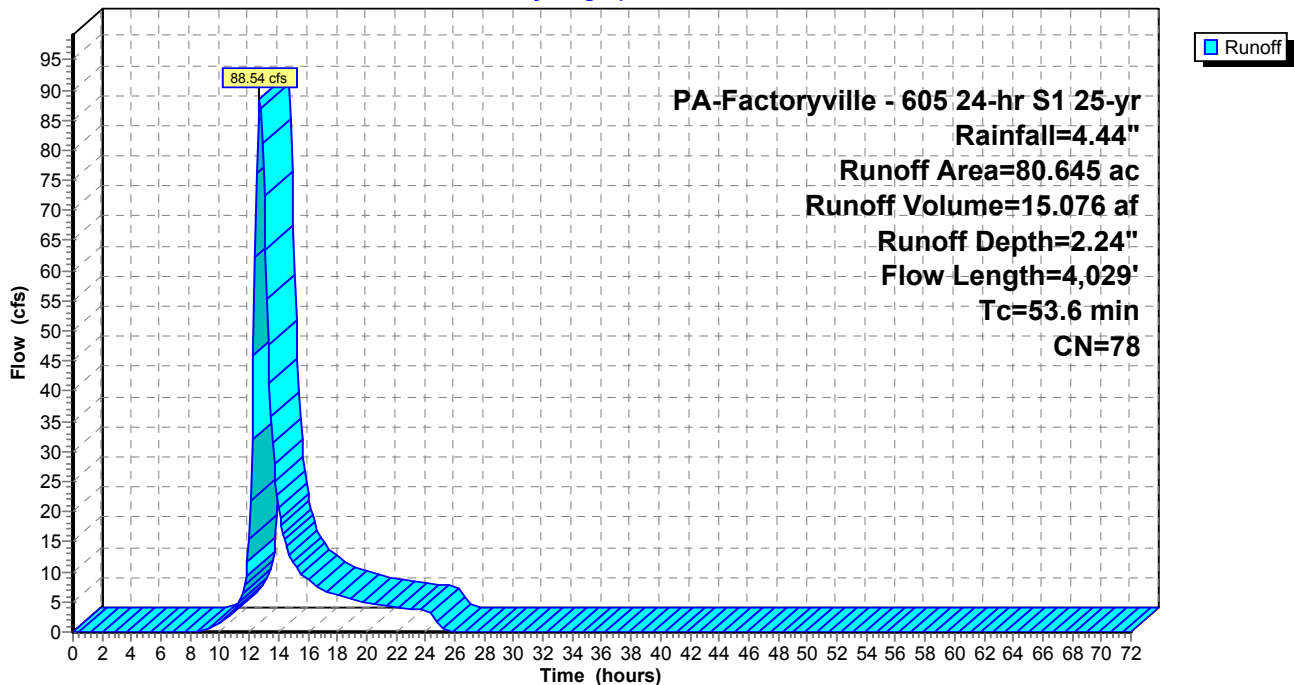
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 108.11 cfs @ 12.71 hrs, Volume= 19.140 af, Depth= 2.85"

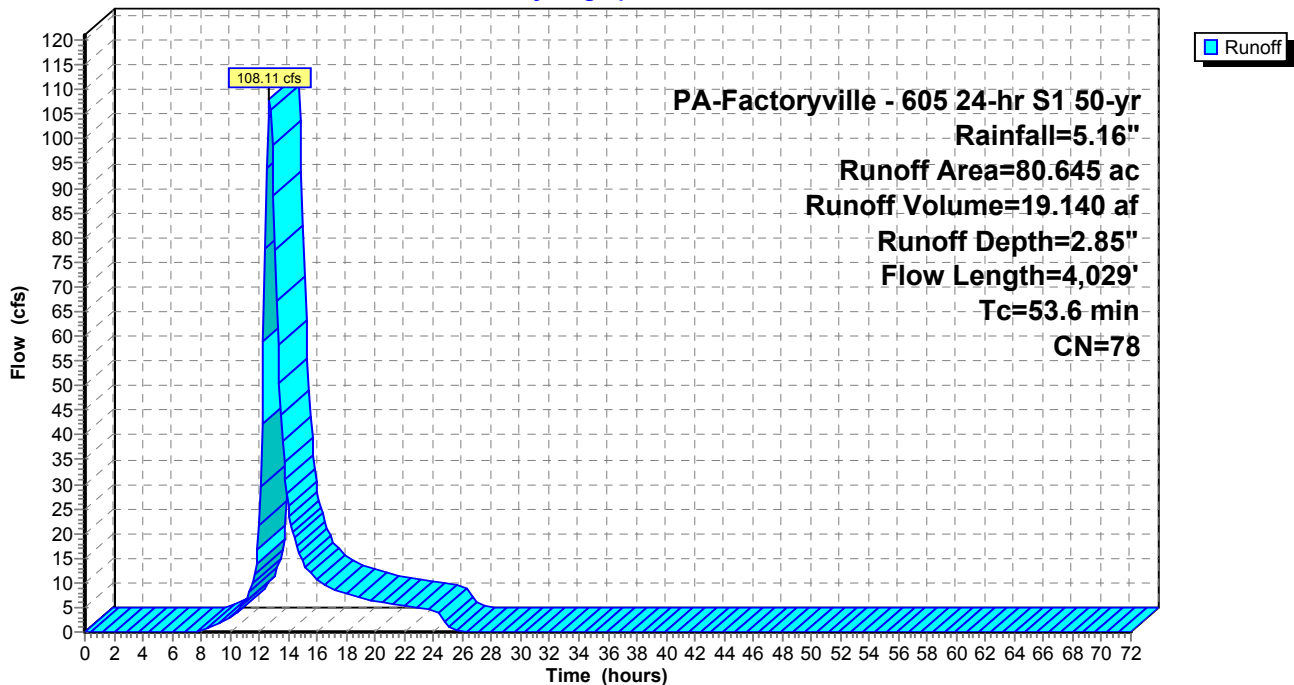
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b>
					Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b>
					Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b>
					Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b>
					Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph



**Summary for Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Runoff = 129.47 cfs @ 12.70 hrs, Volume= 23.933 af, Depth= 3.56"

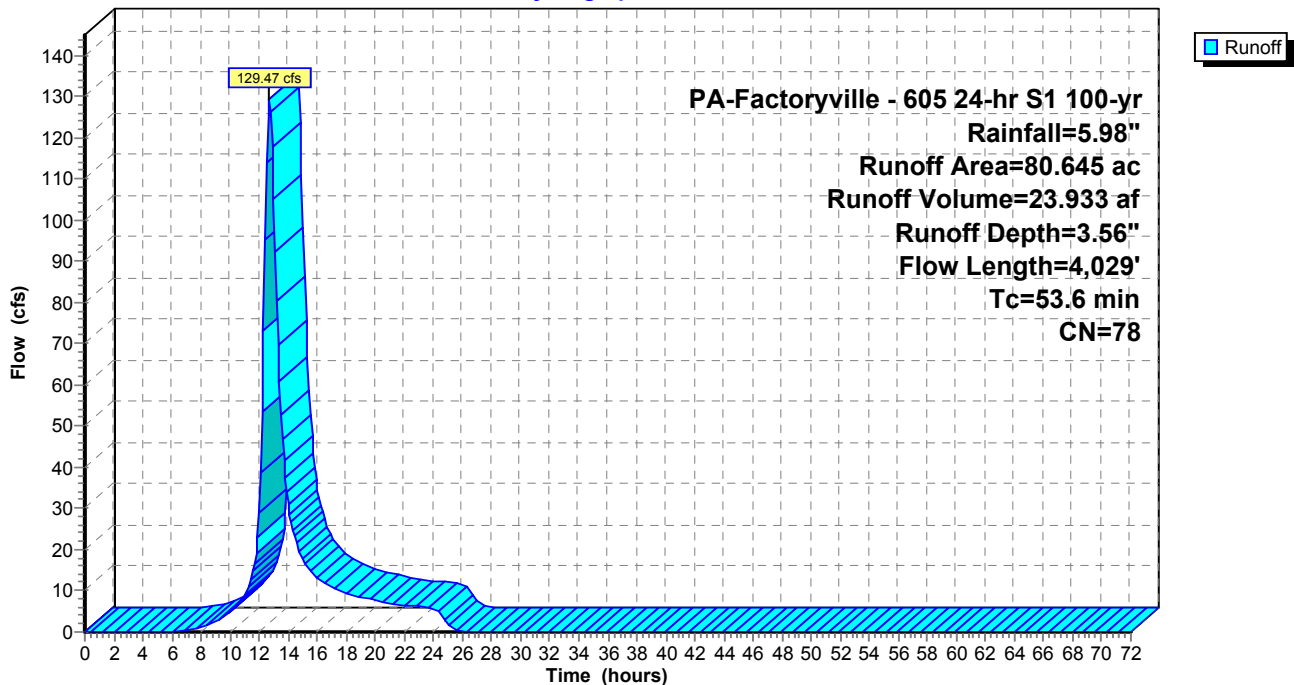
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
36.847	77	Woods, Good, HSG D
42.008	78	Meadow, non-grazed, HSG D
* 1.790	98	Impervious areas, HSG D
80.645	78	Weighted Average
78.855		97.78% Pervious Area
1.790		2.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b> Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
26.7	2,216	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
53.6	4,029	Total			

**Subcatchment 11: POI A POST-DEVELOPMENT BYPASS DRAINAGE AREA**

Hydrograph







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## **Point of Interest B Post Development Calculations**



**Summary for Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Runoff = 25.57 cfs @ 12.24 hrs, Volume= 2.619 af, Depth= 0.55"

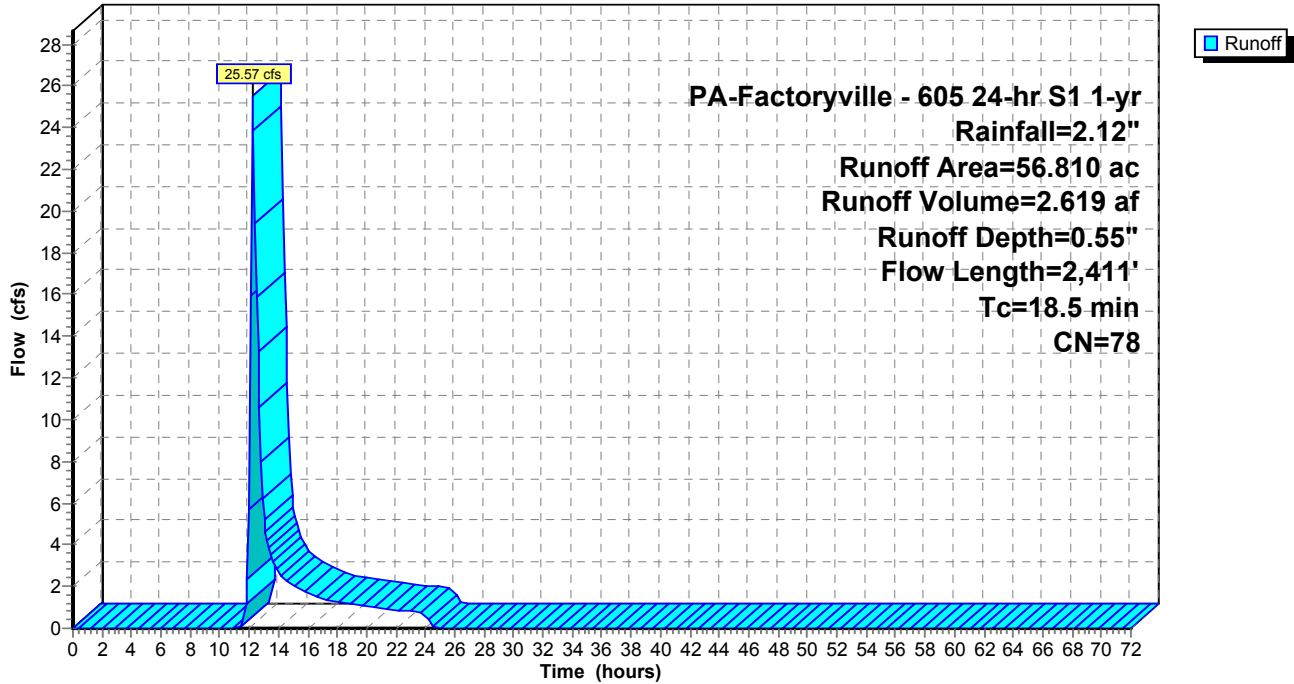
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
6.342	77	Woods, Good, HSG D
49.257	78	Meadow, non-grazed, HSG D
* 1.211	98	Impervious areas, HSG D
56.810	78	Weighted Average
55.599		97.87% Pervious Area
1.211		2.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.1500	0.38		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
2.2	429	0.2100	3.21		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
4.0	414	0.0130	1.71		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
0.2	110	0.2700	7.79		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
1.0	226	0.0620	3.73		<b>Shallow Concentrated Flow, SCF 4</b> Grassed Waterway Kv= 15.0 fps
4.3	798	0.0430	3.11		<b>Shallow Concentrated Flow, SCF 5</b> Grassed Waterway Kv= 15.0 fps
2.4	334	0.0240	2.32		<b>Shallow Concentrated Flow, SCF 6</b> Grassed Waterway Kv= 15.0 fps
18.5	2,411	Total			

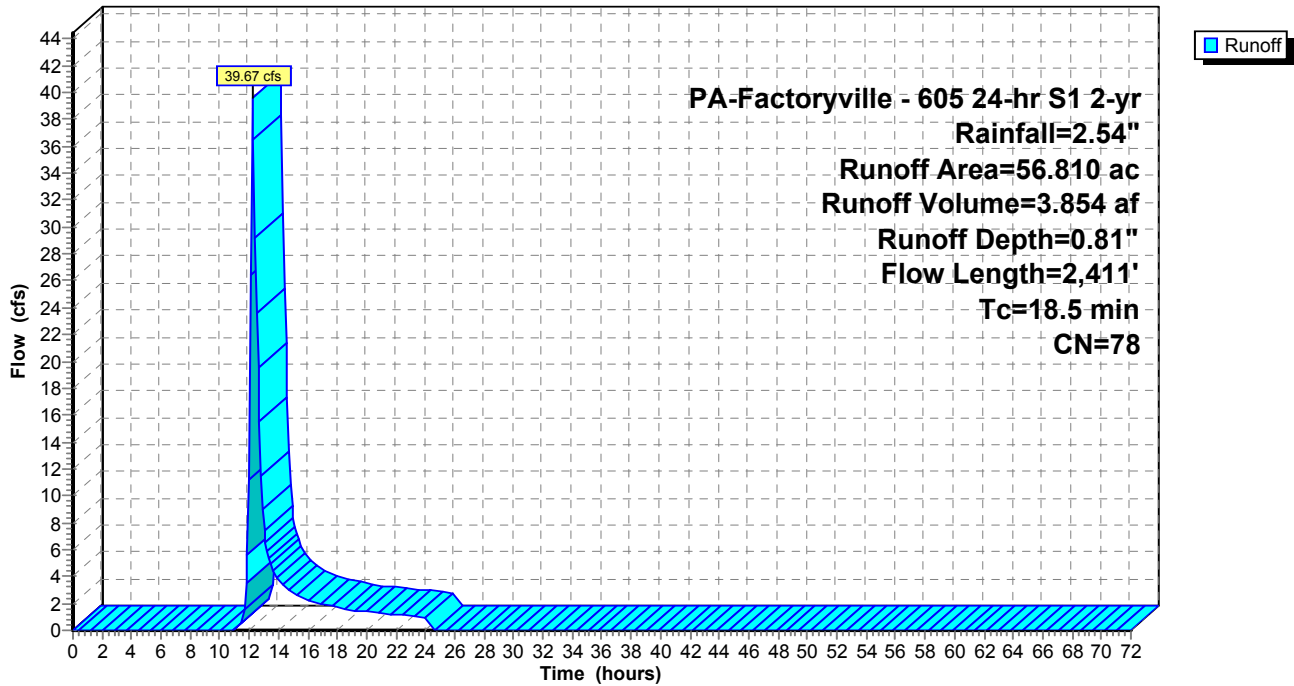
**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



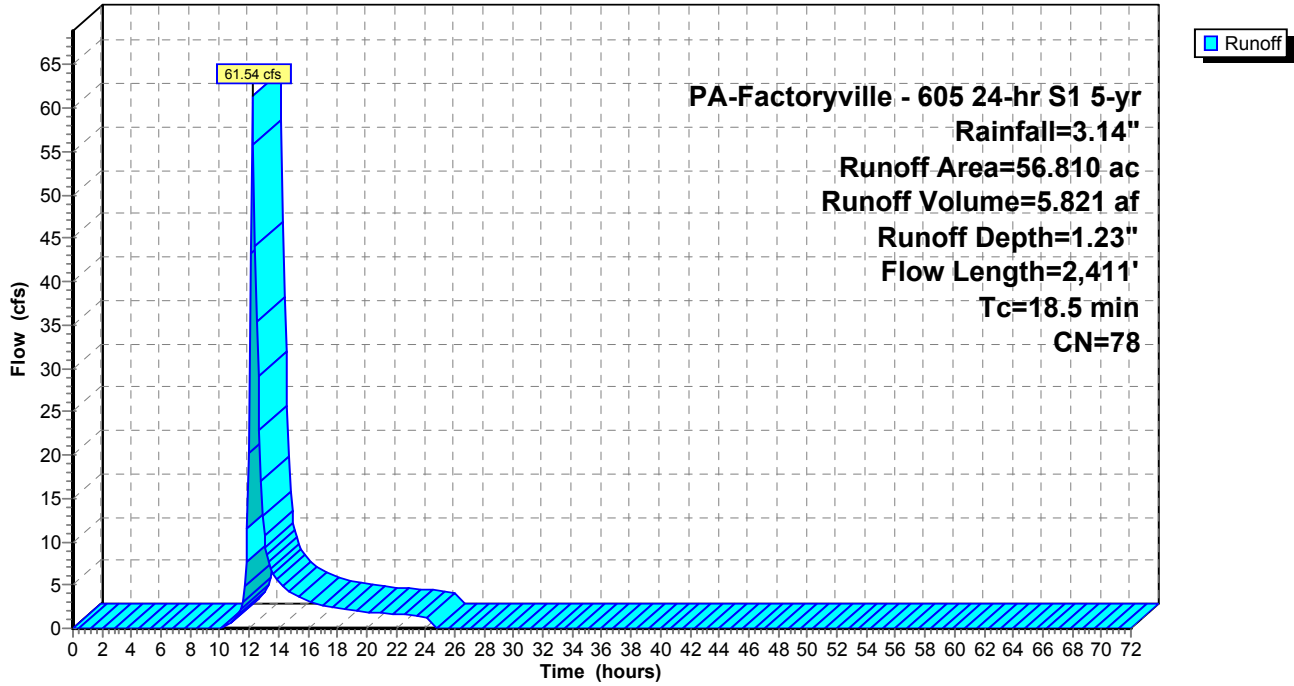
**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



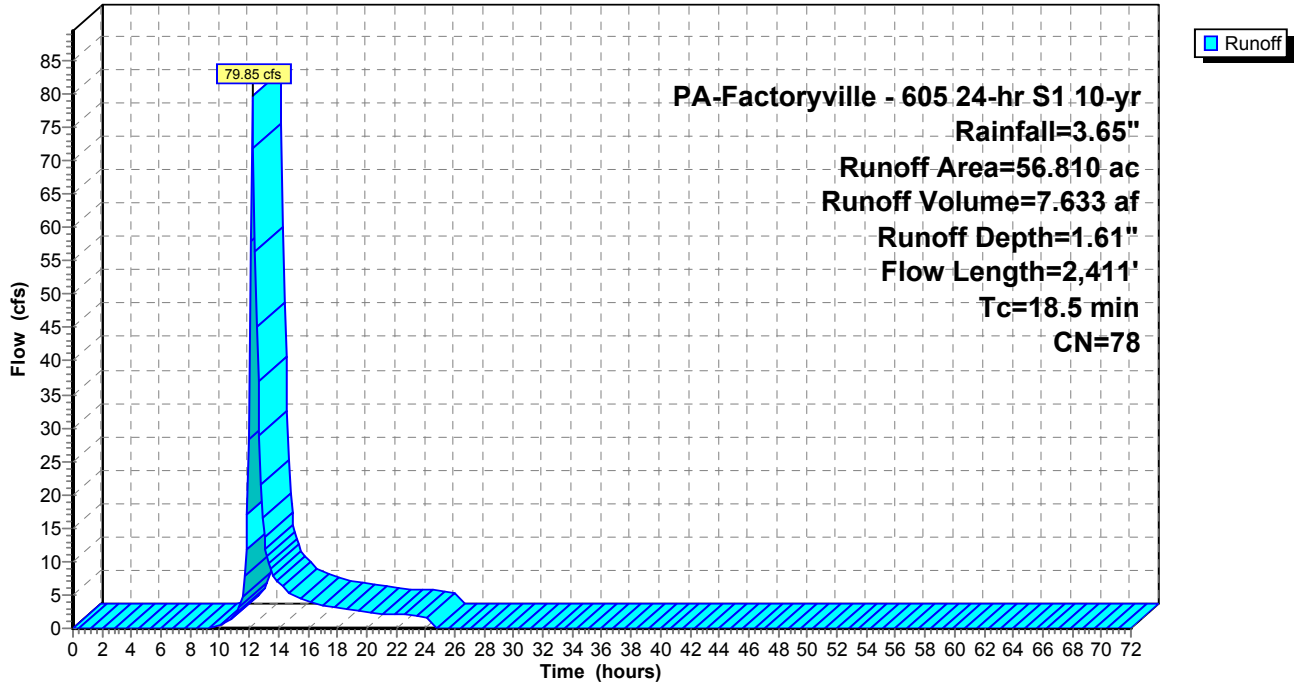
**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



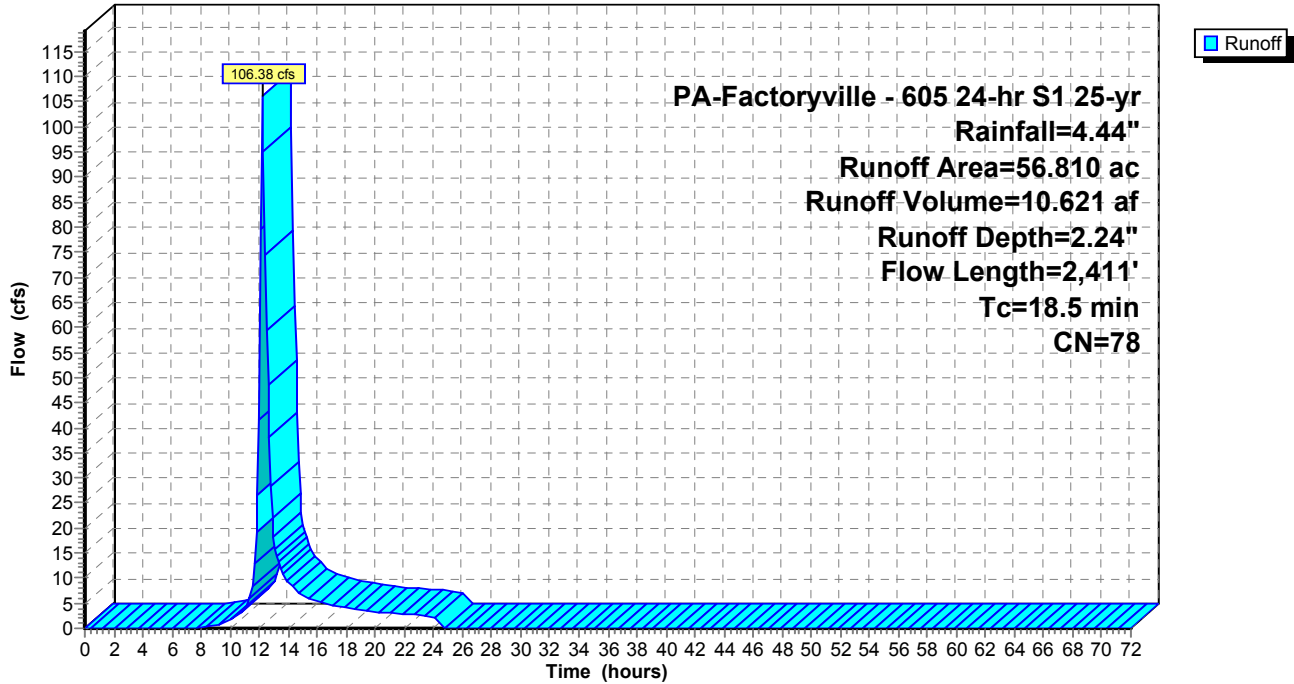
### Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B

Hydrograph



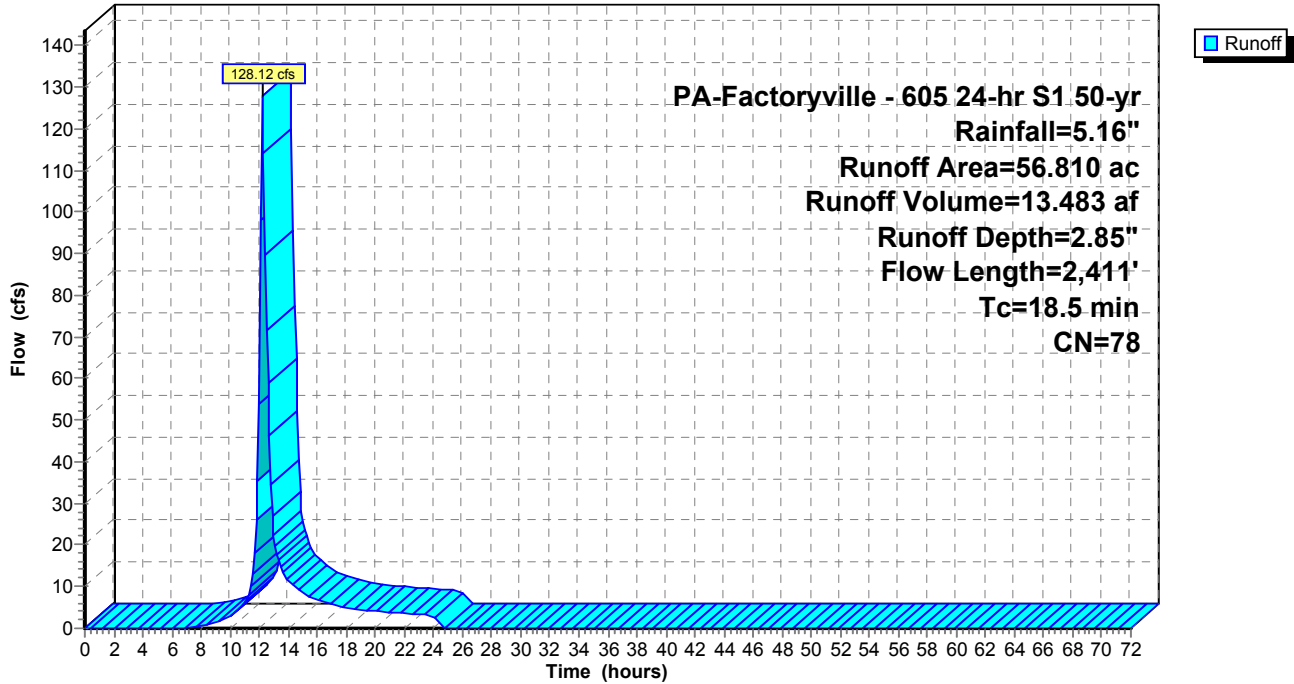
**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



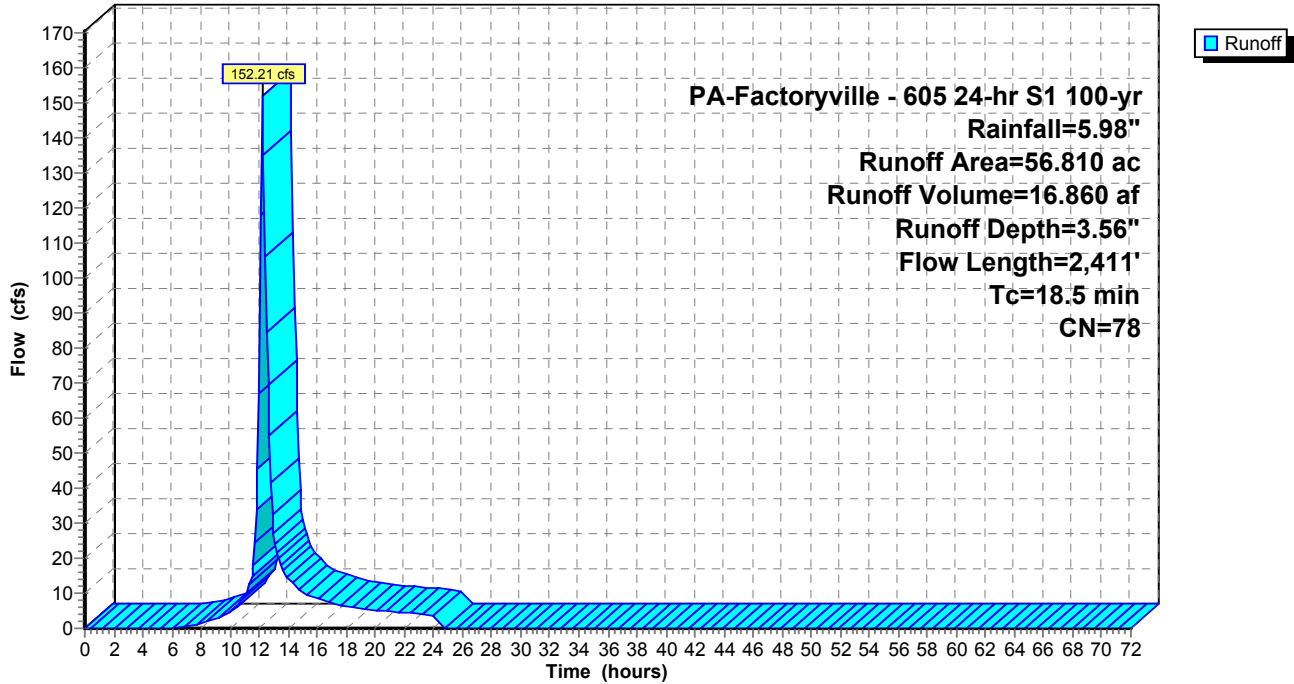
**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph



**Subcatchment 13: POST DEVELOPMENT DRAINAGE AREA TO POI B**

Hydrograph





An Employee-Owned Company

## **Point of Interest C Post Development Calculations**



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 77.71 cfs @ 12.91 hrs, Volume= 15.316 af, Depth= 0.55"

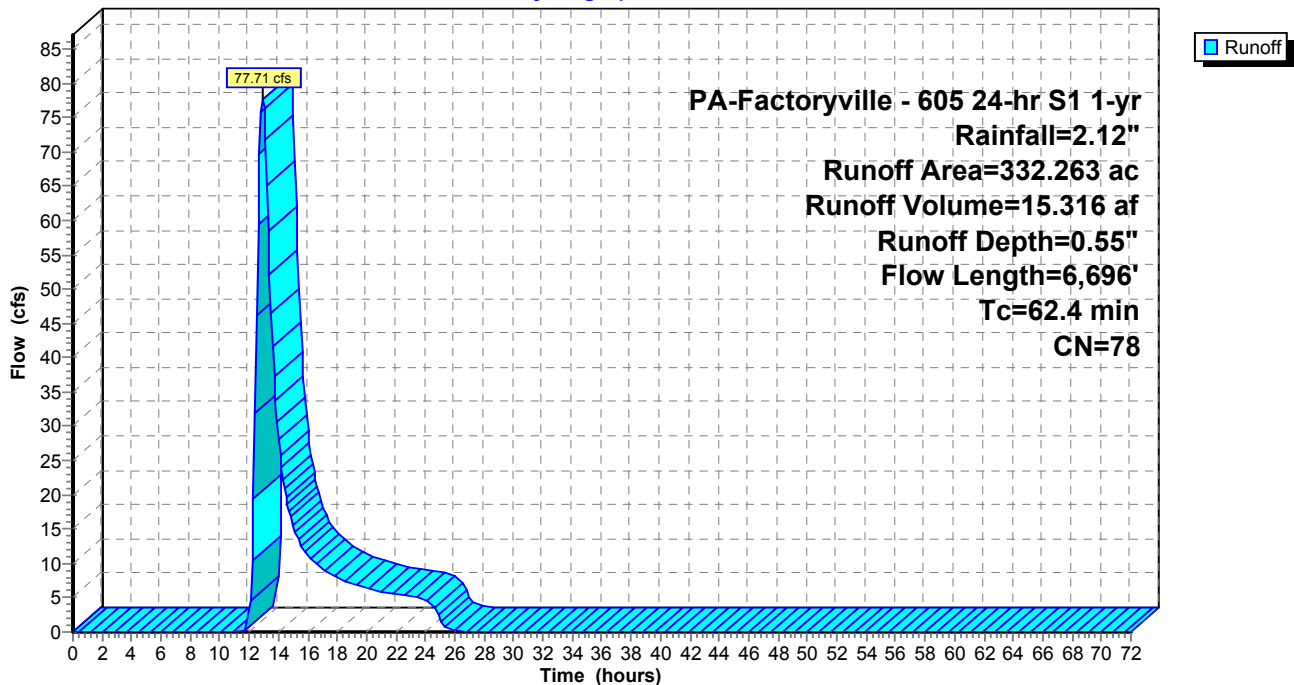
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 1-yr Rainfall=2.12"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 121.03 cfs @ 12.88 hrs, Volume= 22.538 af, Depth= 0.81"

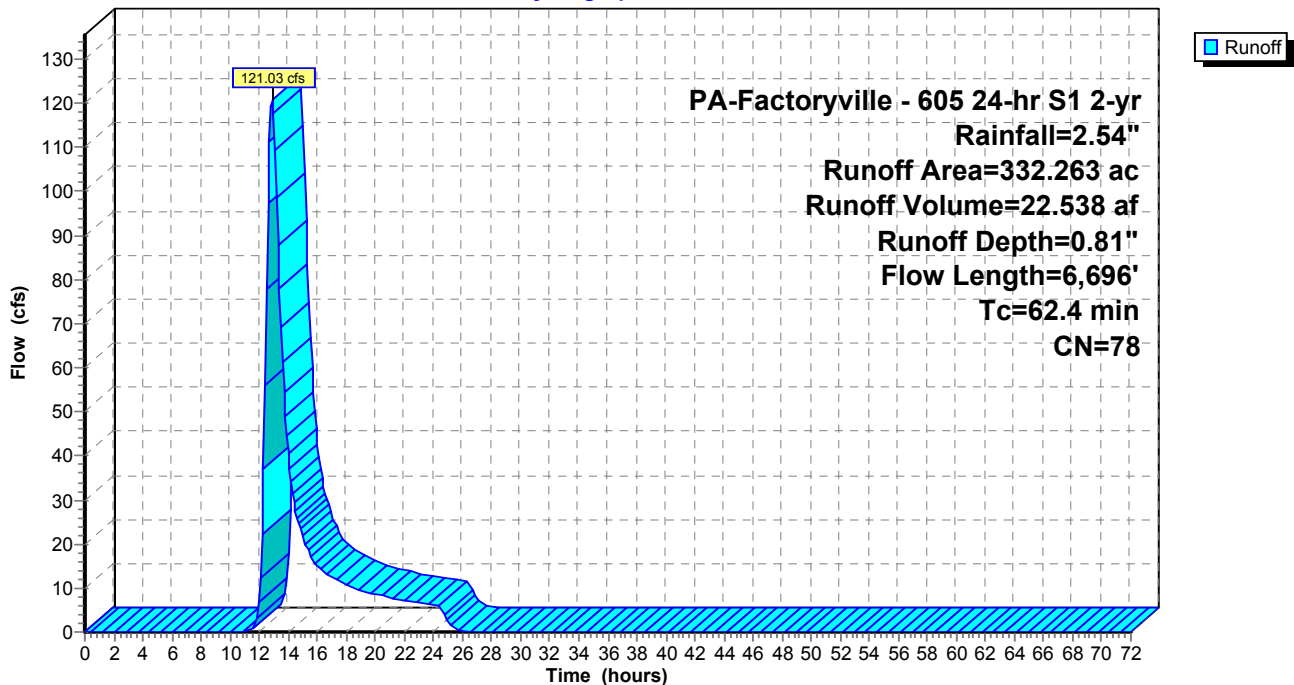
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 2-yr Rainfall=2.54"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 188.88 cfs @ 12.86 hrs, Volume= 34.045 af, Depth= 1.23"

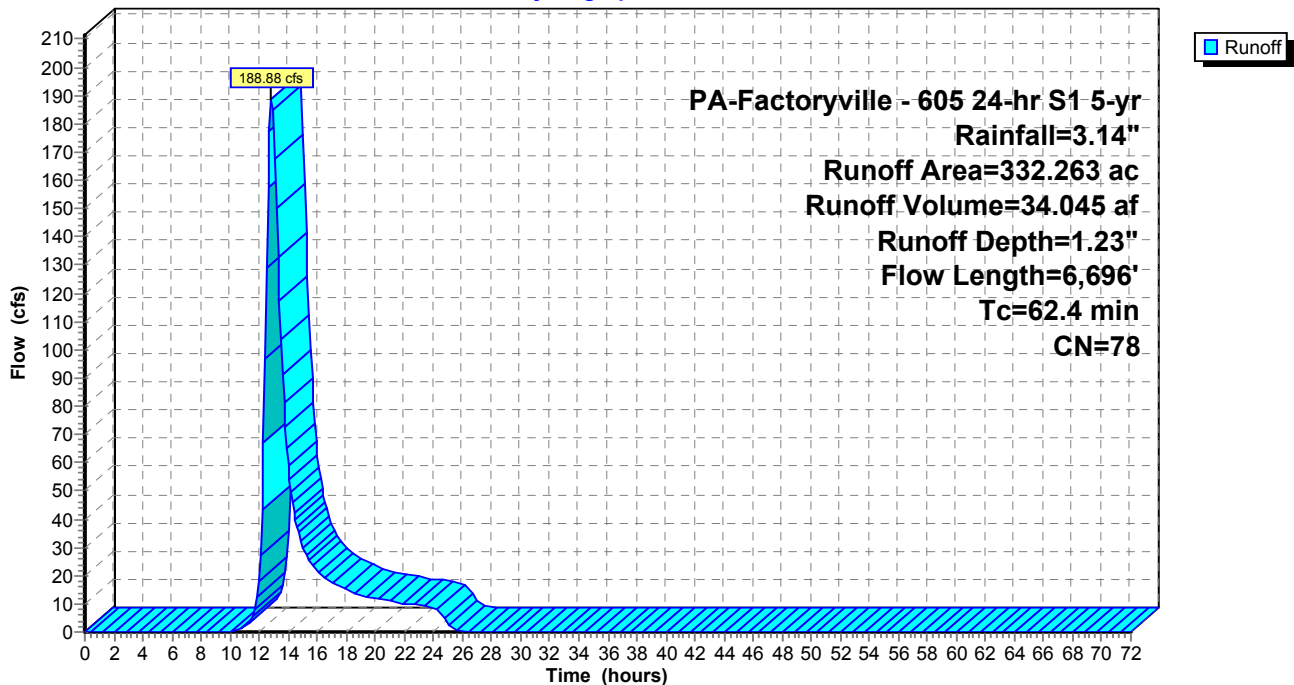
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 5-yr Rainfall=3.14"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 246.80 cfs @ 12.85 hrs, Volume= 44.642 af, Depth= 1.61"

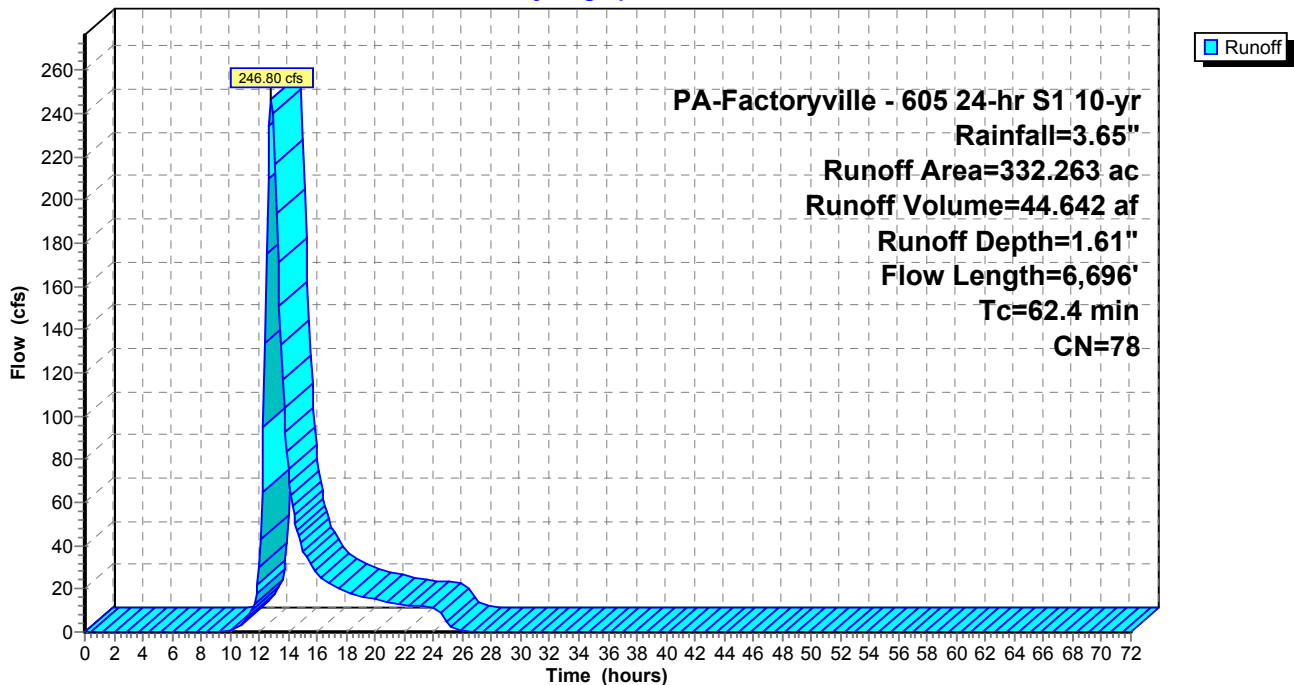
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 333.51 cfs @ 12.83 hrs, Volume= 62.116 af, Depth= 2.24"

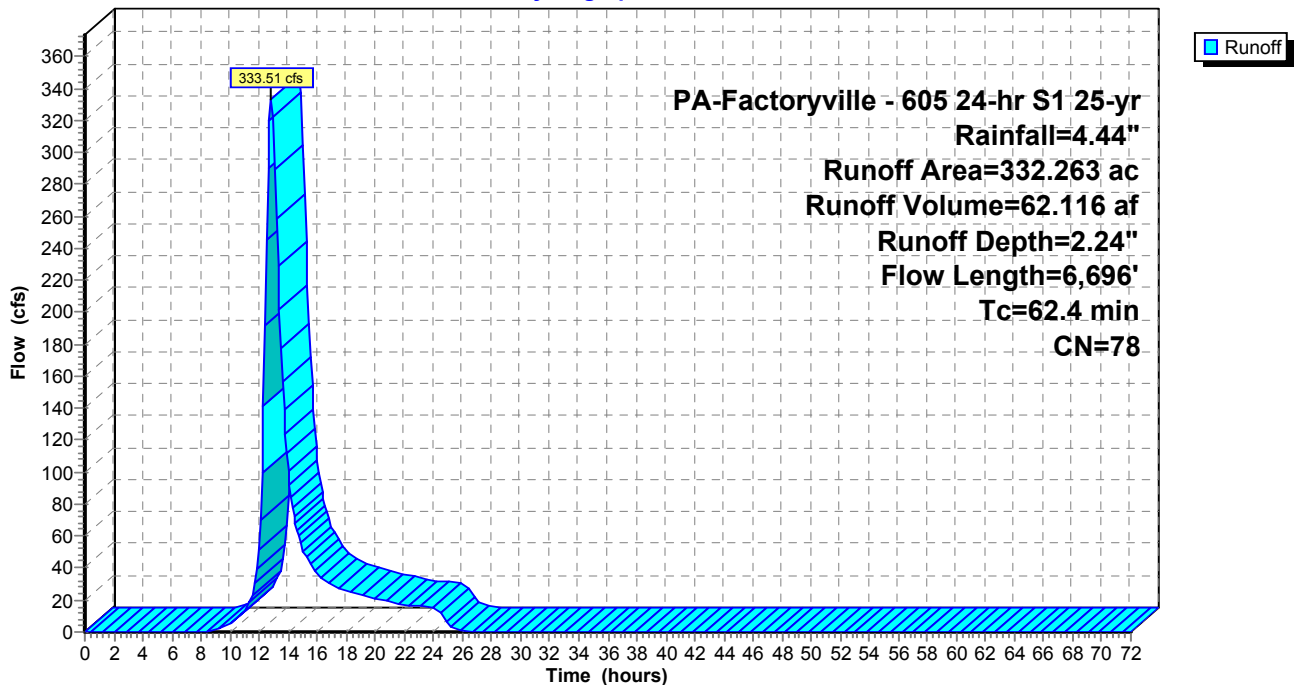
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 25-yr Rainfall=4.44"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 408.16 cfs @ 12.83 hrs, Volume= 78.858 af, Depth= 2.85"

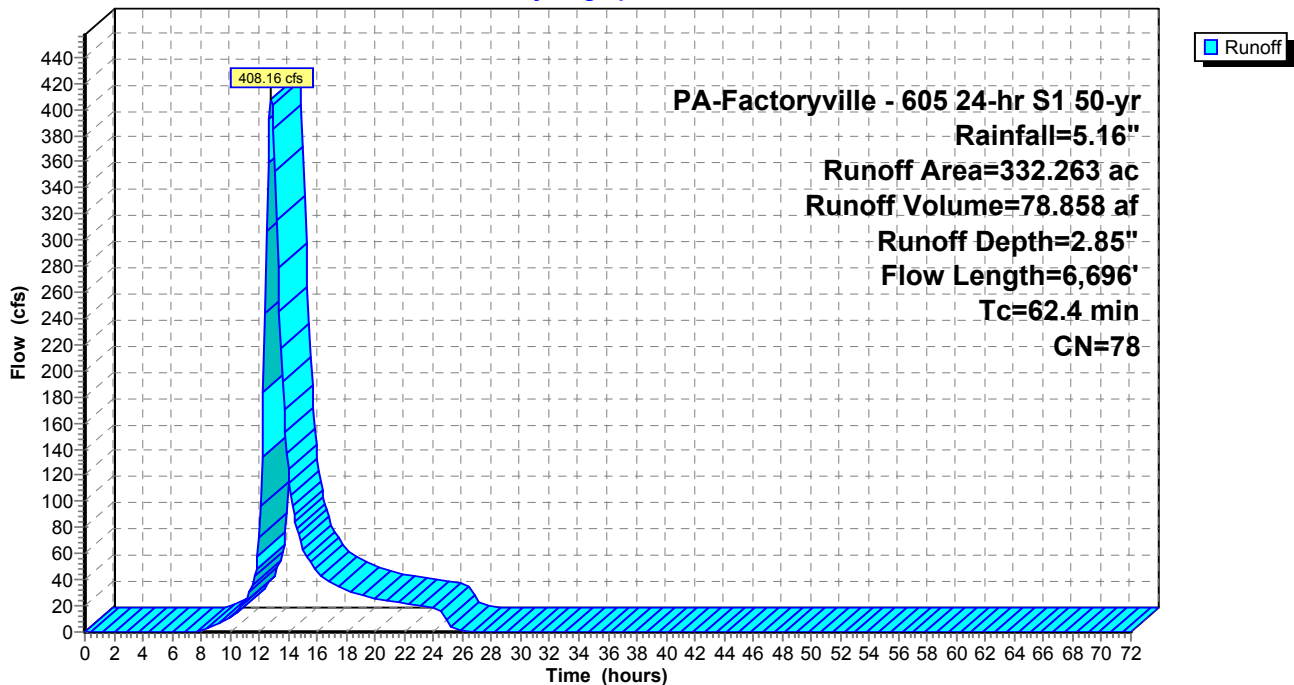
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 50-yr Rainfall=5.16"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph



**Summary for Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Runoff = 489.64 cfs @ 12.82 hrs, Volume= 98.606 af, Depth= 3.56"

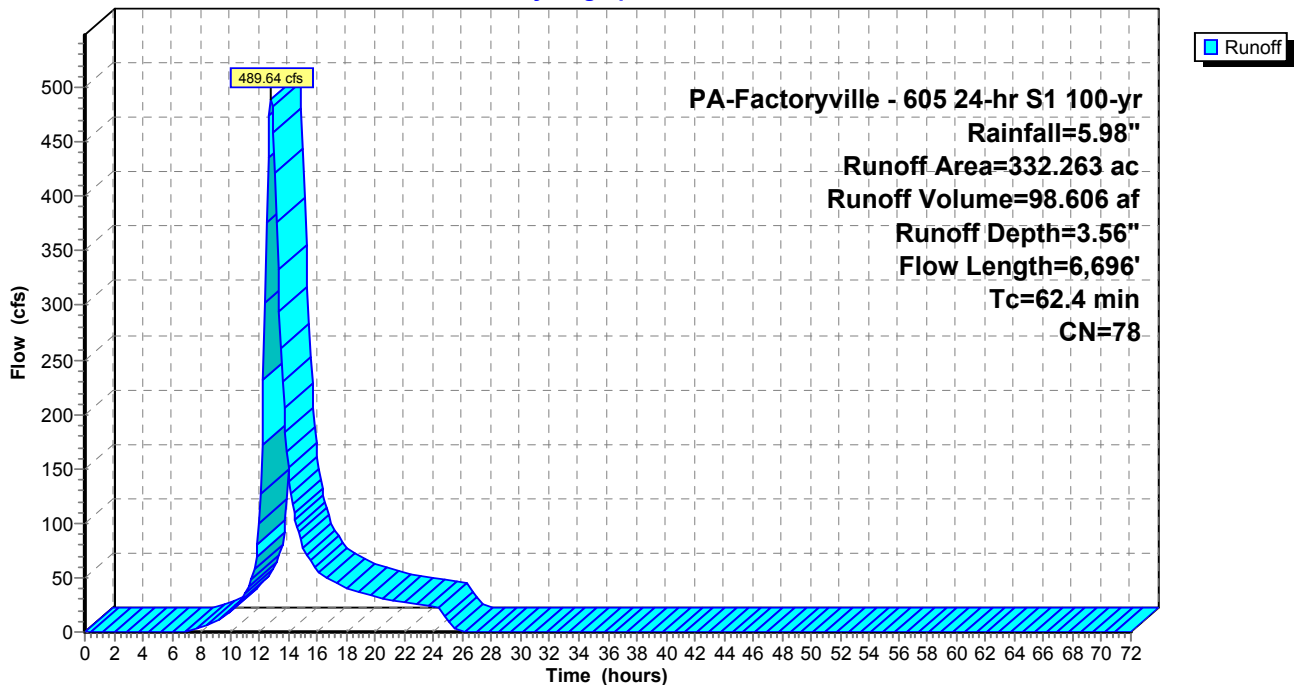
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
153.895	77	Woods, Good, HSG D
174.115	78	Meadow, non-grazed, HSG D
* 4.253	98	Impervious areas, HSG D
332.263	78	Weighted Average
328.010		98.72% Pervious Area
4.253		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0200	0.17		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
15.9	1,179	0.0310	1.23		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
12.0	702	0.0380	0.97		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.7	4,715	0.0450	3.18		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
62.4	6,696	Total			

**Subcatchment 14: POST DEVELOPMENT DRAINAGE AREA TO POI C**

Hydrograph

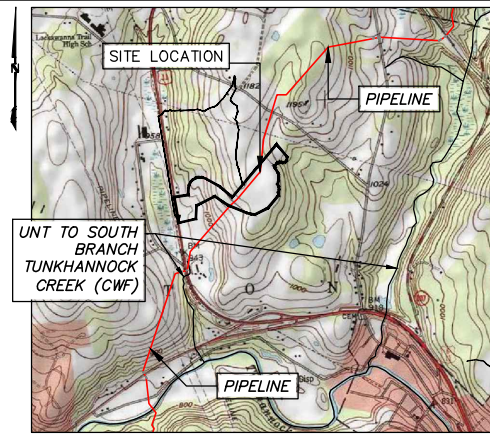
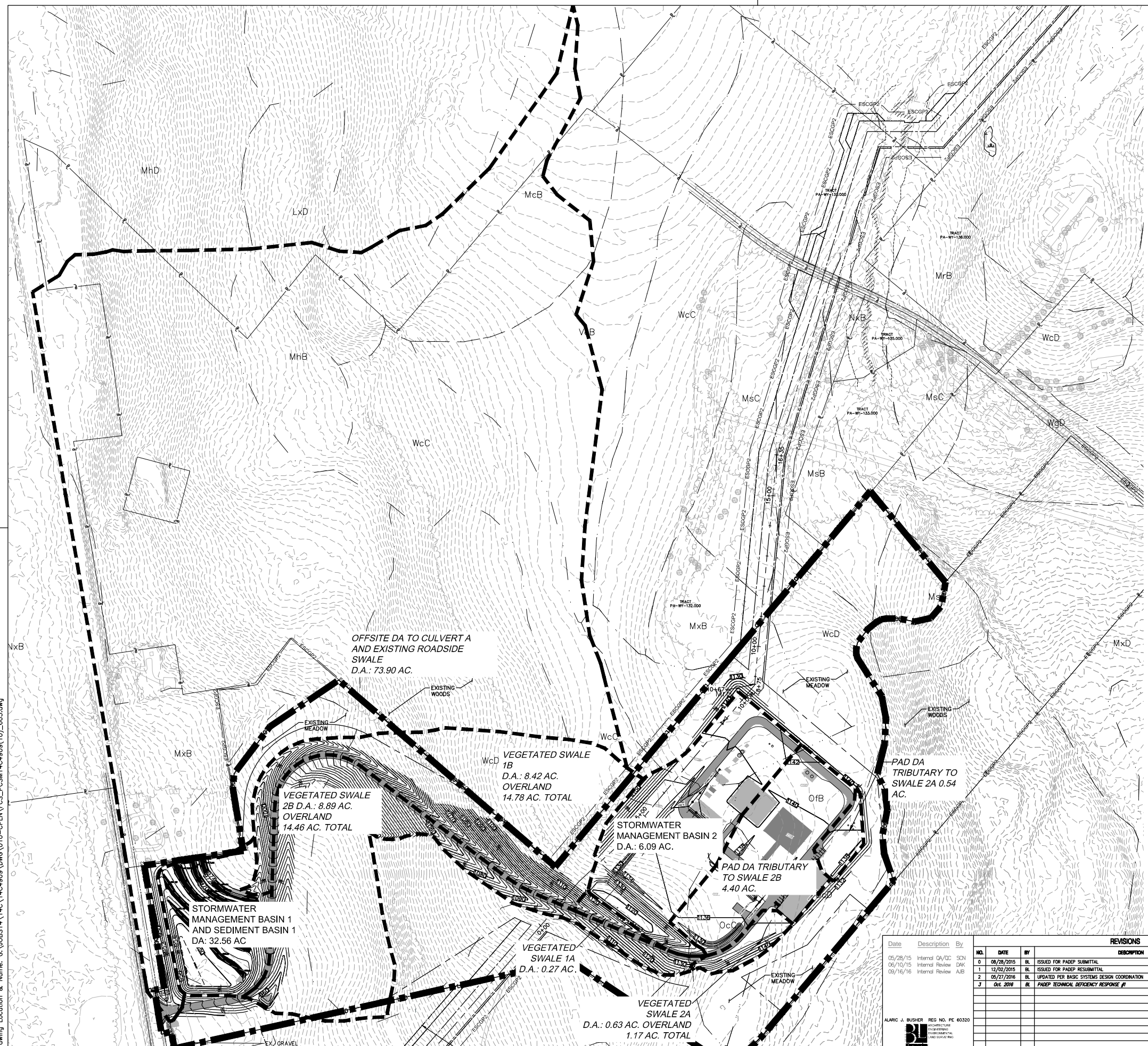




## **A.3 Conveyance Calculations**



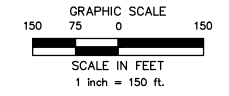
Drawing Location & Name: G:\OBIS14\14C\14C4909\DWG\010-CPLIN\_FCS\_PCSM14C4909\10\_605.dwg



**LOCATION MAP**  
USGS FACTORYVILLE QUADRANGLE  
SCALE: 1"=2,000'

**LEGEND**

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- MAJOR CONTOUR (10' INTERVAL)
- MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
- UTILITY BOX
- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- MAJOR CONTOUR (10' INTERVAL)
- MINOR CONTOUR (2' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- LOD
- ESCOP-2 PERMIT BOUNDARY (OVERALL PIPELINE PROJECT)
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES
- GRAVEL COVER
- ACCESS ROAD
- BUILDING
- FUTURE BUILDING



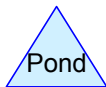
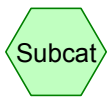
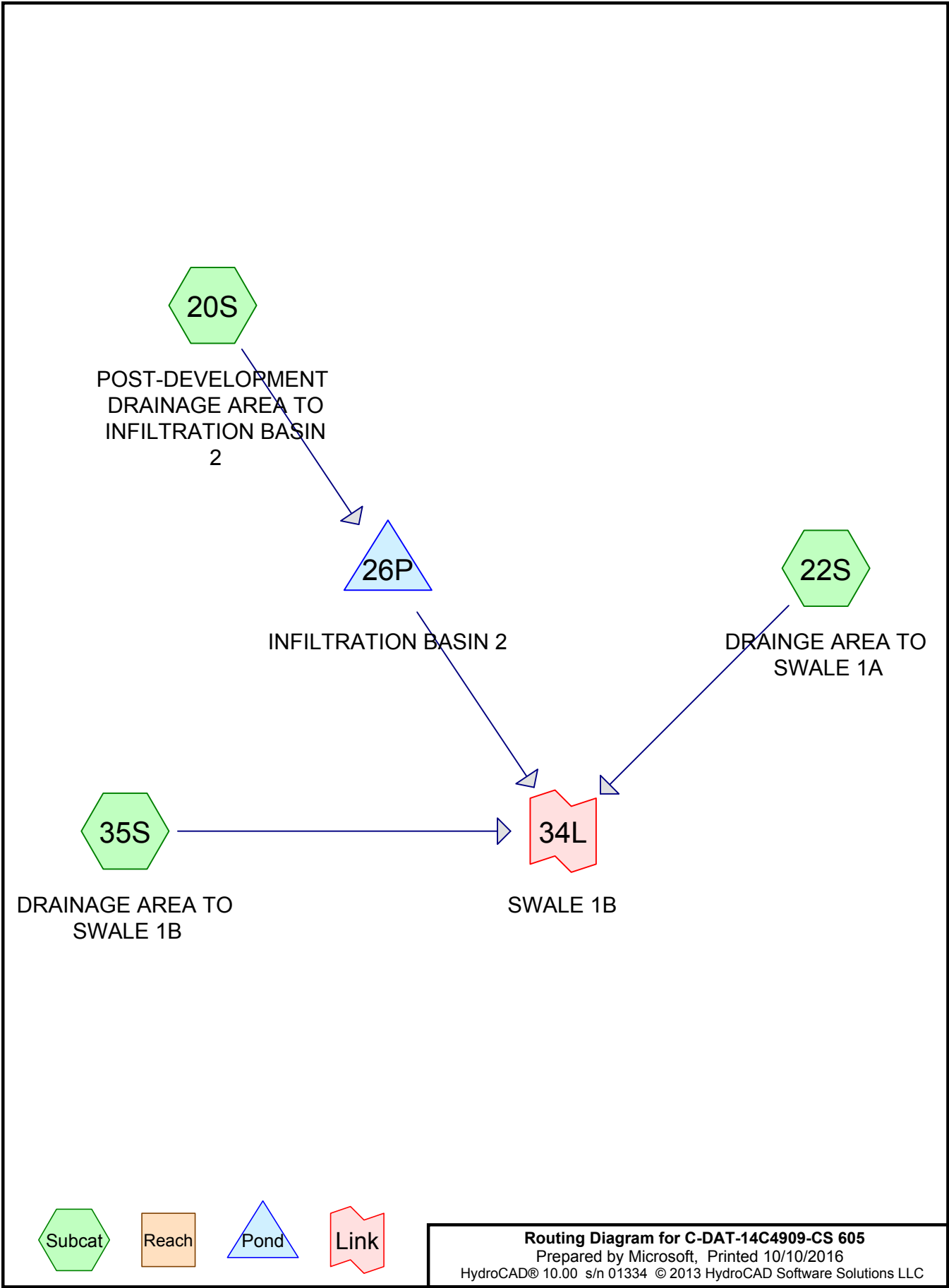
REVISIONS			
NO.	DATE	BY	DESCRIPTION
0	08/28/2015	BL	ISSUED FOR PADEP SUBMITTAL
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL
2	05/27/2016	BL	UPDATED PER BASIC SYSTEMS DESIGN COORDINATION
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1

TRANSCONTINENTAL GAS PIPELINE COMPANY LLC			
ATLANTIC SUNRISE PROJECT- PROPOSED 30" NATURAL GAS PIPELINE			
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS			
FOR COMPRESSOR STATION 605			
CLINTON TOWNSHIP, WYOMING COUNTY, PENNSYLVANIA			
POST DEVELOPMENT DRAINAGE AREA MAP - SWALES			
DRAWN BY:	AGE	DATE:	04/03/15
CHECKED BY:	AJB	DATE:	04/03/15
APPROVED BY:	AJB	DATE:	07/17/15
NO.	1161497	SCALE	AS NOTED
		REVISION	J
		DRAWING NUMBER	(66-0605)F-1A-9
		SHEET	1
		OF	1

ALAN J. BRUSHER REG. NO. PE 60320  
ARCHITECTURE  
PROFESSIONAL ENGINEER  
AND LANDSCAPE ARCHITECT







**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY

PREPARED BY: AOE

DATE: 11/18/15

CHECKED BY: AJB

DATE: 11/18/15

CHANNEL OR CHANNEL SECTION	SWALE 1A LINING (MIN/MAX)	SWALE 1A GRASS/LINING (MIN/MAX)			
TEMPORARY OR PERMANENT? (T OR P)	P	P			
DESIGN STORM (2, 5, OR 10 YR)	10	10			
ACRES (AC)	0.27	0.27			
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	N/A	N/A			
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	<b>1.21</b>	<b>1.21</b>			
Q (CALCULATED AT FLOW DEPTH d) (CFS)	<b>1.19</b>	<b>1.25</b>			
PROTECTIVE LINING <sup>2</sup>	SC250	GRASS/SC250			
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.04	0.159			
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A			
V (CALCULATED AT FLOW DEPTH d) (FPS)	<b>2.80</b>	<b>1.08</b>			
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	2.50	8.00			
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	<b>0.84</b>	<b>1.82</b>			
CHANNEL BOTTOM WIDTH (FT)	2	2			
CHANNEL SIDE SLOPES (H:V)	3	3			
D (TOTAL DEPTH) (FT)	1.0	1.0			
CHANNEL TOP WIDTH @ D (FT)	8	8			
d (CALCULATED FLOW DEPTH) (FT)	<b>0.17</b>	<b>0.37</b>			
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	<b>3.02</b>	<b>4.22</b>			
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	<b>11.76</b>	<b>5.41</b>			
d <sub>50</sub> STONE SIZE (IN)	N/A	N/A			
A (CROSS-SECTIONAL AREA) (SQ. FT.)	<b>0.43</b>	<b>1.15</b>			
R (HYDRAULIC RADIUS)	<b>0.14</b>	<b>0.27</b>			
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.079	0.079			
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	<b>0.046</b>	<b>0.589</b>			
.7S <sub>c</sub> (FT/FT)	<b>0.032</b>	<b>0.412</b>			
1.3S <sub>c</sub> (FT/FT)	<b>0.060</b>	<b>0.766</b>			
STABLE FLOW? (Y/N)	Y	Y			
FREEBOARD BASED ON UNSTABLE FLOW (FT)	<b>0.04</b>	<b>0.03</b>			
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.50			
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.50			
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (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.

**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE NATURAL GAS PIPELINE

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY

PREPARED BY: AOE

DATE: 11/16/15

CHECKED BY: AJB

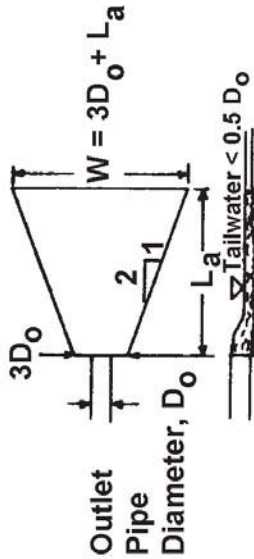
DATE: 11/16/15

CHANNEL OR CHANNEL SECTION	SWALE 1B GRASS/LINING (MIN)	SWALE 1B GRASS/LINING (MAX)	SWALE 1B GRASS/LINING (MIN)	SWALE 1B GRASS/LINING (MAX)	
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	
DESIGN STORM (2, 5, OR 10 YR)	10	10	100	100	
ACRES (AC)	14.78	14.78	14.78	14.78	
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	N/A	N/A	N/A	N/A	
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	<b>27.07</b>	<b>27.07</b>	<b>47.37</b>	<b>47.37</b>	
Q (CALCULATED AT FLOW DEPTH d) (CFS)	<b>28.18</b>	<b>29.16</b>	<b>49.09</b>	<b>48.35</b>	
PROTECTIVE LINING <sup>2</sup>	W3000/GRASS	W3000/GRASS	W3000/GRASS	W3000/GRASS	
n (MANNING'S COEFFICIENT) <sup>2</sup>	<b>0.054</b>	<b>0.052</b>	<b>0.047</b>	<b>0.045</b>	
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	
V (CALCULATED AT FLOW DEPTH d) (FPS)	<b>5.01</b>	<b>6.45</b>	<b>6.49</b>	<b>8.30</b>	
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	16.00	16.00	16.00	16.00	
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	<b>3.36</b>	<b>5.27</b>	<b>4.19</b>	<b>6.41</b>	
CHANNEL BOTTOM WIDTH (FT)	5	5	5	5	
CHANNEL SIDE SLOPES (H:V)	3	3	3	3	
D (TOTAL DEPTH) (FT)	2.0	2.0	2.0	2.0	
CHANNEL TOP WIDTH @ D (FT)	17	17	17	17	
d (CALCULATED FLOW DEPTH) (FT)	<b>0.77</b>	<b>0.65</b>	<b>0.96</b>	<b>0.79</b>	
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	<b>9.62</b>	<b>8.90</b>	<b>10.76</b>	<b>9.74</b>	
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	<b>6.49</b>	<b>7.69</b>	<b>5.21</b>	<b>6.33</b>	
d <sub>50</sub> STONE SIZE (IN)	N/A	N/A	N/A	N/A	
A (CROSS-SECTIONAL AREA) (SQ. FT.)	<b>5.63</b>	<b>4.52</b>	<b>7.56</b>	<b>5.82</b>	
R (HYDRAULIC RADIUS)	<b>0.57</b>	<b>0.50</b>	<b>0.68</b>	<b>0.58</b>	
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.07	0.13	0.07	0.13	
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	<b>0.053</b>	<b>0.178</b>	<b>0.243</b>	<b>0.172</b>	
.7S <sub>c</sub> (FT/FT)	<b>0.037</b>	<b>0.124</b>	<b>0.170</b>	<b>0.120</b>	
1.3S <sub>c</sub> (FT/FT)	<b>0.068</b>	<b>0.231</b>	<b>0.316</b>	<b>0.223</b>	
STABLE FLOW? (Y/N)	<b>Y</b>	<b>N</b>	<b>Y</b>	<b>N</b>	
FREEBOARD BASED ON UNSTABLE FLOW (FT)	<b>0.29</b>	<b>0.3</b>	<b>0.5</b>	<b>0.5</b>	
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.5	0.5	0.5	
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.50	0.50	0.51	
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> 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 1/4 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.

**VEGETATED SWALE 1 B - RIP RAP APRON DESIGN**

DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

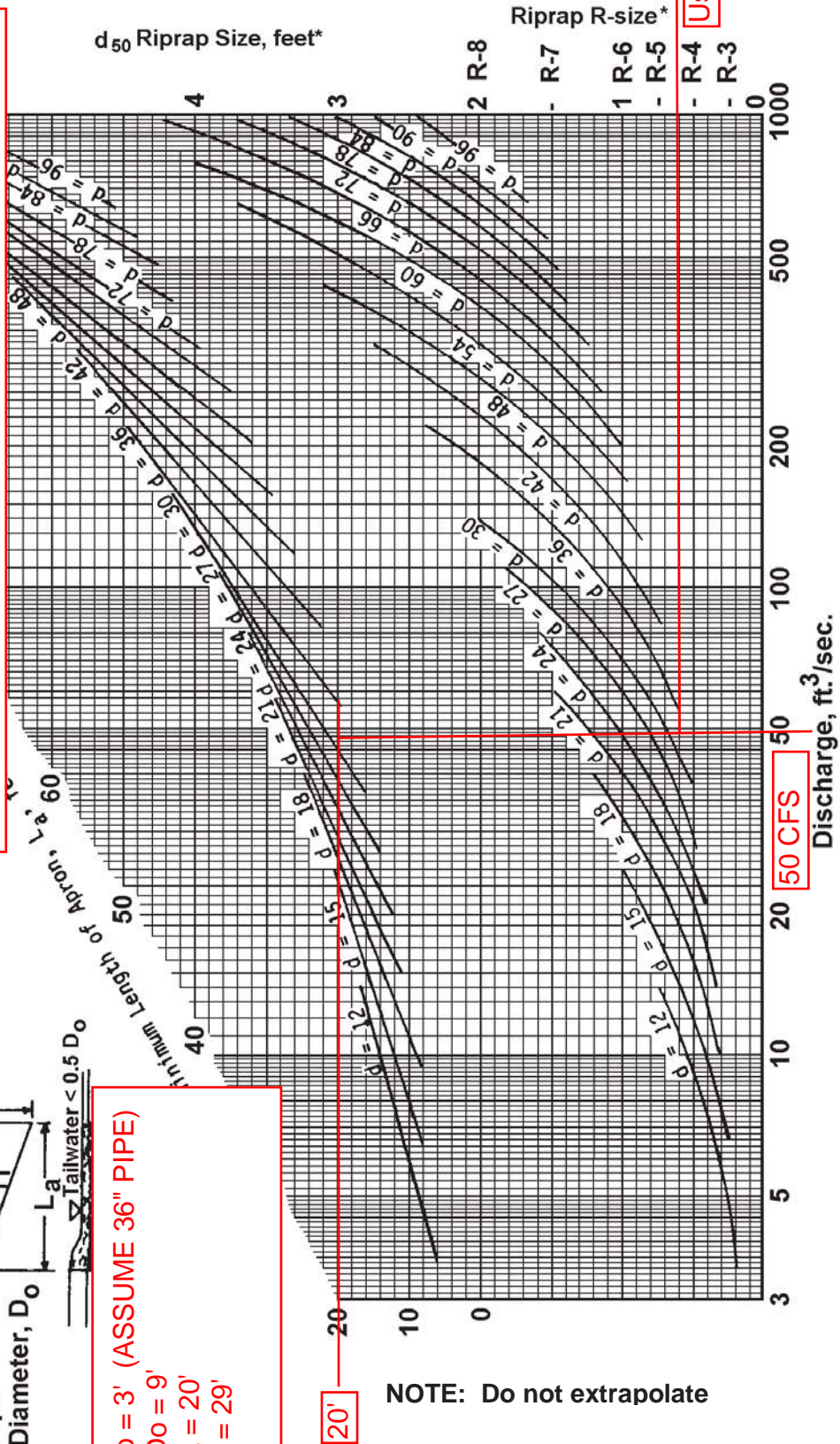


Adapted from USDA - NRCS

**Do = 3' (ASSUME 36" PIPE)**  
**3Do = 9'**  
**La = 20'**  
**W = 29'**

**MAX. ALLOWABLE VELOCITY FOR R-5 RIP RAP = 11.5 FPS**  
**(E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.5)**  
**CALCULATED VELOCITY = 8.30 FPS.**  
**(WORKSHEET 11)**

**FIGURE 9.3**  
**Riprap Apron Design, Minimum Tailwater Condition**



Not to be used for Box Culverts

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

**Summary for Subcatchment 20S: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 17.76 cfs @ 12.02 hrs, Volume= 1.133 af, Depth= 2.23"

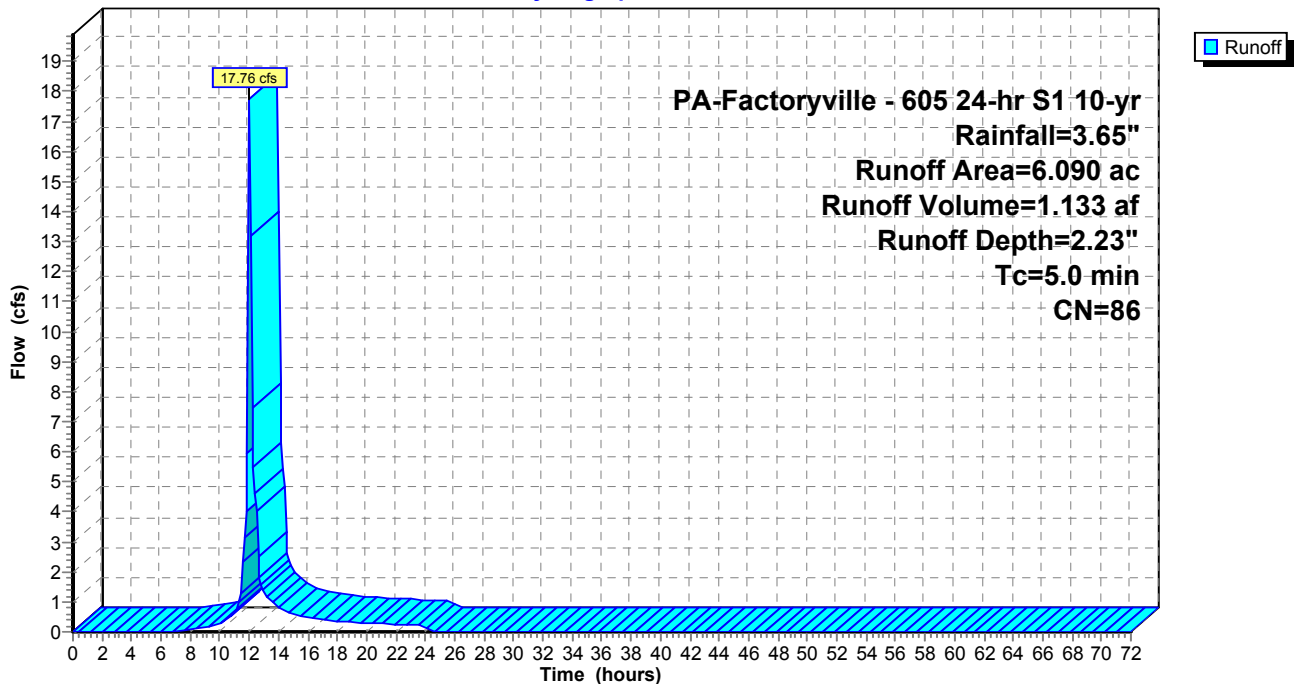
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.10$  hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 20S: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 22S: DRAINAGE AREA TO SWALE 1A**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 0.73 cfs @ 12.02 hrs, Volume= 0.046 af, Depth= 2.07"

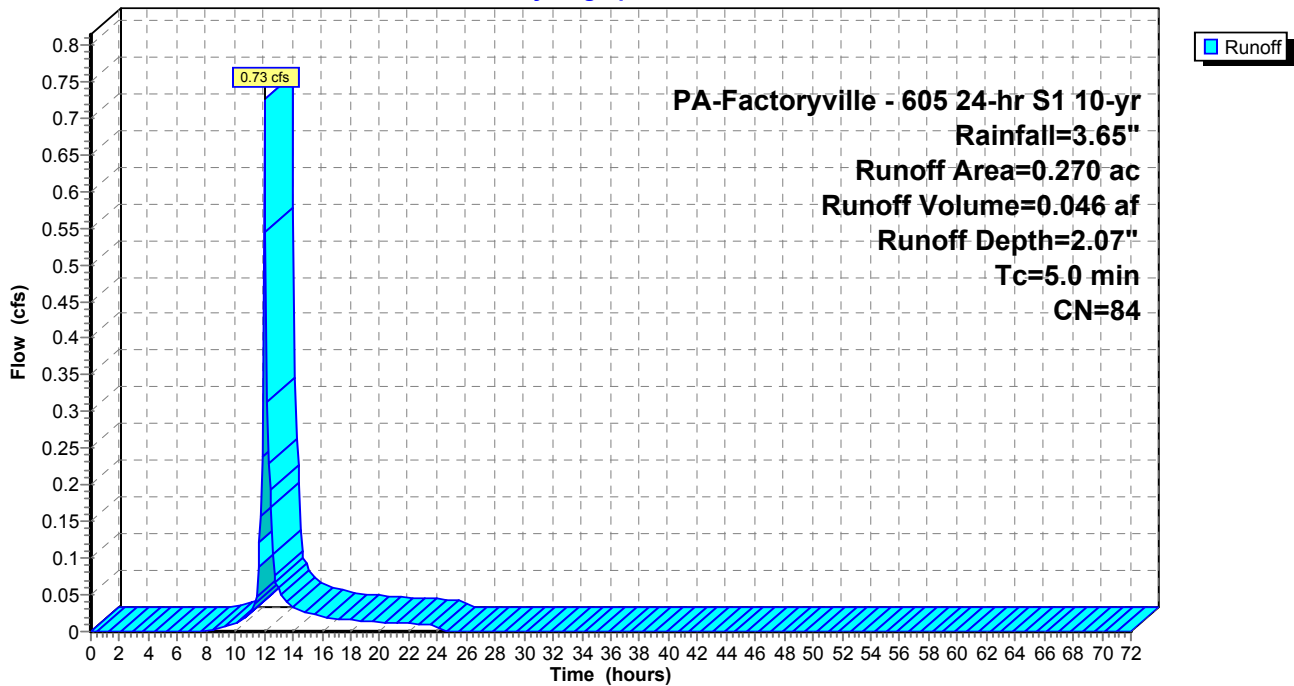
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
0.190	78	Meadow, non-grazed, HSG D
* 0.080	98	Impervious areas, HSG D
0.270	84	Weighted Average
0.190		70.37% Pervious Area
0.080		29.63% Impervious Area

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

**Subcatchment 22S: DRAINAGE AREA TO SWALE 1A**

Hydrograph



**Summary for Subcatchment 35S: DRAINAGE AREA TO SWALE 1B**

Runoff = 13.27 cfs @ 12.18 hrs, Volume= 1.181 af, Depth= 1.68"

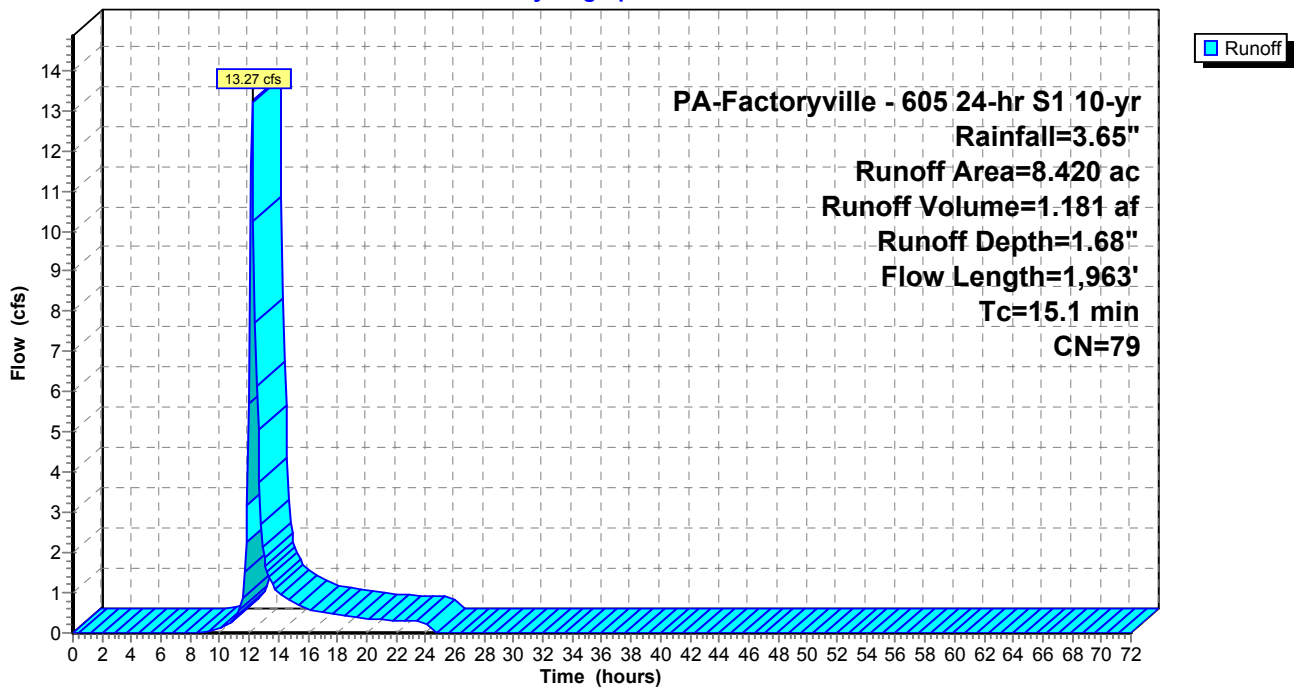
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
5.626	78	Meadow, non-grazed, HSG D
2.364	77	Woods, Good, HSG D
* 0.430	98	Impervious areas, HSG D
8.420	79	Weighted Average
7.990		94.89% Pervious Area
0.430		5.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
3.6	1,177	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
15.1	1,963	Total			

**Subcatchment 35S: DRAINAGE AREA TO SWALE 1B**

Hydrograph



**Summary for Pond 26P: INFILTRATION BASIN 2**

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 2.23" for 10-yr event  
 Inflow = 17.76 cfs @ 12.02 hrs, Volume= 1.133 af  
 Outflow = 14.82 cfs @ 12.10 hrs, Volume= 1.133 af, Atten= 17%, Lag= 4.8 min  
 Discarded = 0.50 cfs @ 12.10 hrs, Volume= 0.536 af  
 Primary = 14.33 cfs @ 12.10 hrs, Volume= 0.597 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 1,120.52' @ 12.10 hrs Surf.Area= 8,068 sf Storage= 9,967 cf

Plug-Flow detention time= 110.1 min calculated for 1.133 af (100% of inflow)  
 Center-of-Mass det. time= 110.0 min ( 931.2 - 821.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,118.00'	56,769 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,118.00	0	0	0
1,120.00	6,243	6,243	6,243
1,122.00	13,256	19,499	25,742
1,124.00	17,771	31,027	56,769

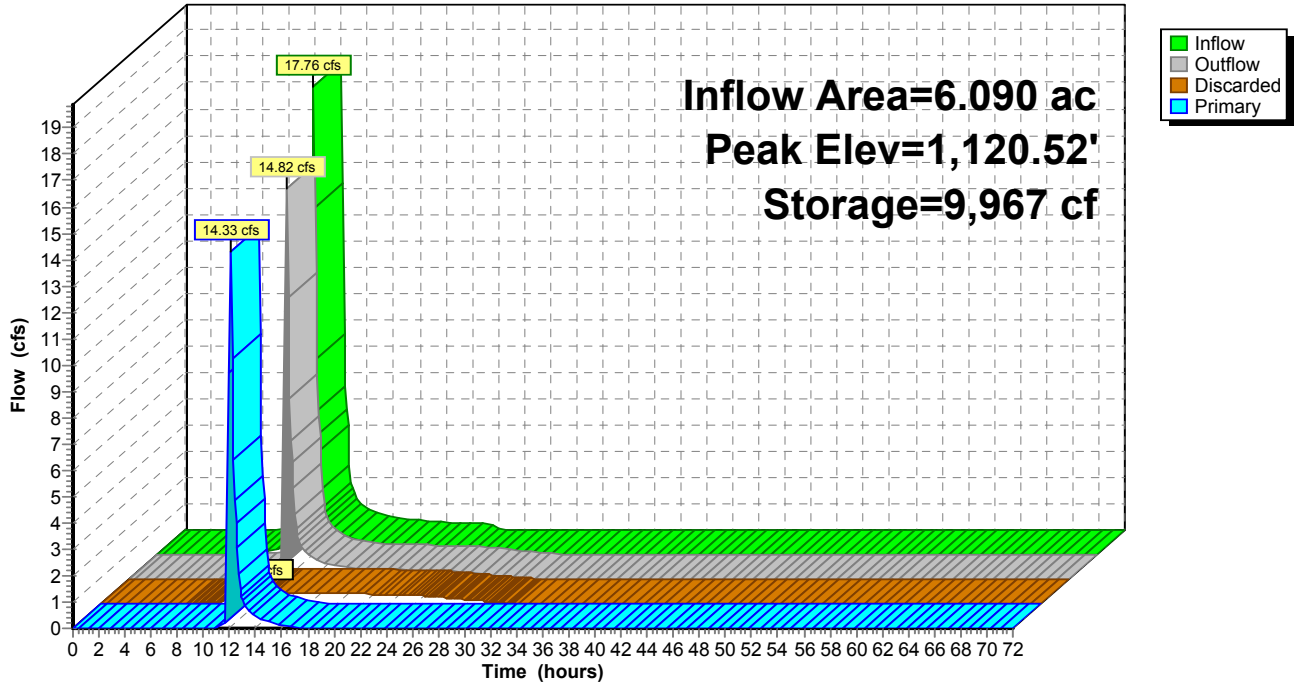
Device	Routing	Invert	Outlet Devices
#1	Primary	1,117.00'	<b>18.0" Round Culvert</b> L= 126.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,117.00' / 1,106.00' S= 0.0873 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	1,118.00'	<b>2.660 in/hr Exfiltration over Surface area</b>
#3	Device 1	1,120.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Primary	1,120.50'	<b>20.0' long x 17.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.50 cfs @ 12.10 hrs HW=1,120.52' (Free Discharge)  
 ↑**2=Exfiltration** (Exfiltration Controls 0.50 cfs)

**Primary OutFlow** Max=14.27 cfs @ 12.10 hrs HW=1,120.52' (Free Discharge)  
 ↑**1=Culvert** (Inlet Controls 14.15 cfs @ 8.01 fps)  
 ↑**3=Orifice/Grate** (Passes 14.15 cfs of 14.58 cfs potential flow)  
 ↑**4=Broad-Crested Rectangular Weir** (Weir Controls 0.12 cfs @ 0.35 fps)

### Pond 26P: INFILTRATION BASIN 2

Hydrograph



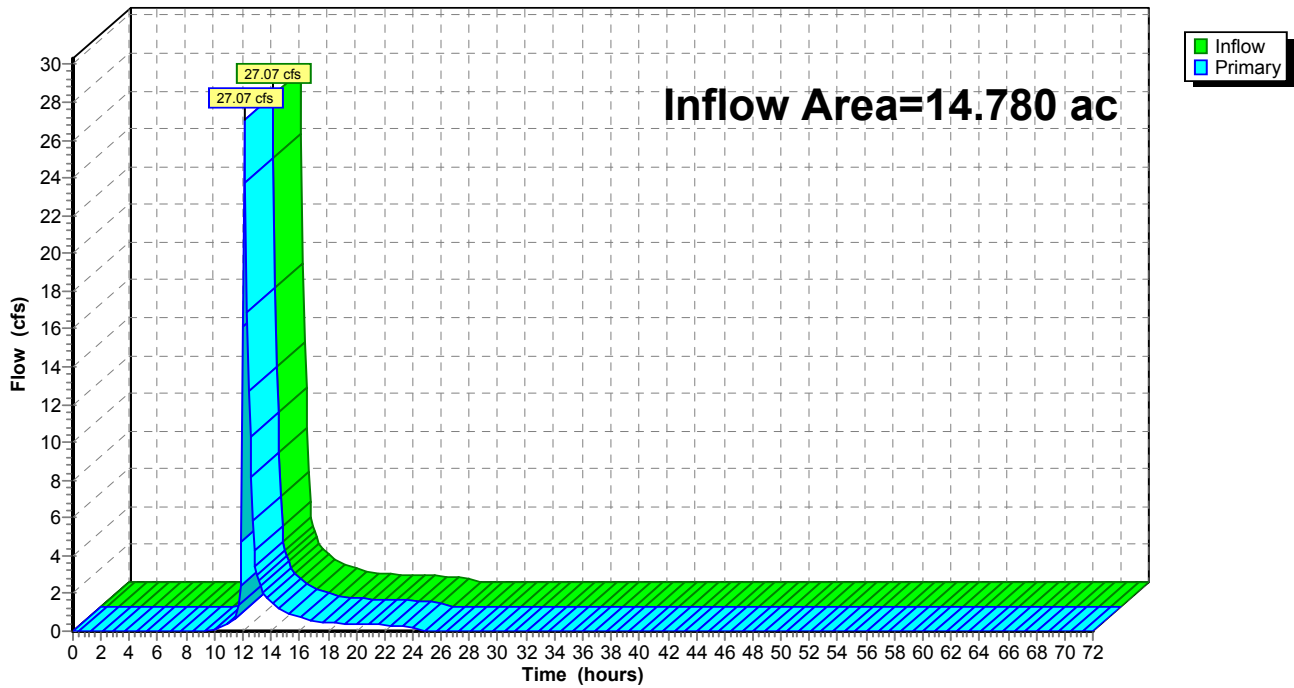
### Summary for Link 34L: SWALE 1B

Inflow Area = 14.780 ac, 5.95% Impervious, Inflow Depth = 1.48" for 10-yr event  
Inflow = 27.07 cfs @ 12.13 hrs, Volume= 1.825 af  
Primary = 27.07 cfs @ 12.13 hrs, Volume= 1.825 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs

### Link 34L: SWALE 1B

Hydrograph



**Summary for Subcatchment 20S: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 28.49 cfs @ 12.02 hrs, Volume= 2.228 af, Depth= 4.39"

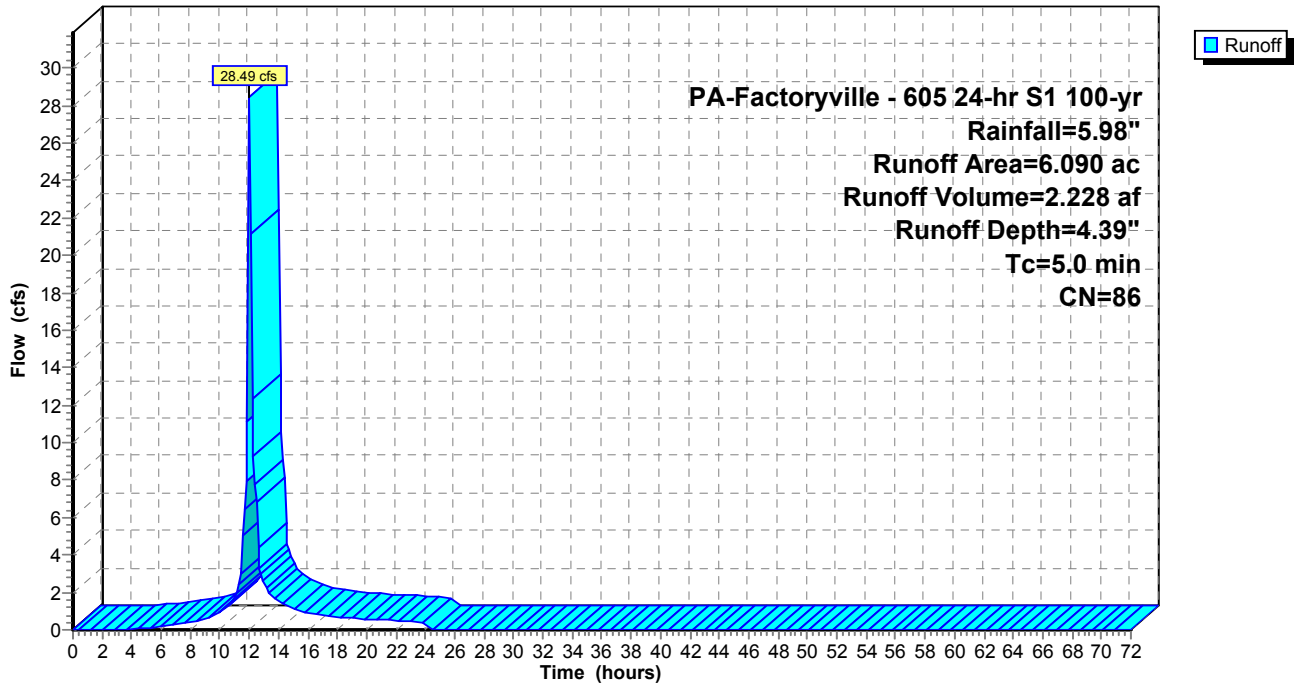
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.10$  hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

	Area (ac)	CN	Description
*	0.370	98	Impervious, HSG C
	2.360	78	Meadow, non-grazed, HSG D
*	3.360	91	Gravel Areas, HSG D
	6.090	86	Weighted Average
	5.720		93.92% Pervious Area
	0.370		6.08% Impervious Area

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

**Subcatchment 20S: POST-DEVELOPMENT DRAINAGE AREA TO INFILTRATION BASIN 2**

Hydrograph



**Summary for Subcatchment 22S: DRAINAGE AREA TO SWALE 1A**

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.21 cfs @ 12.02 hrs, Volume= 0.094 af, Depth= 4.18"

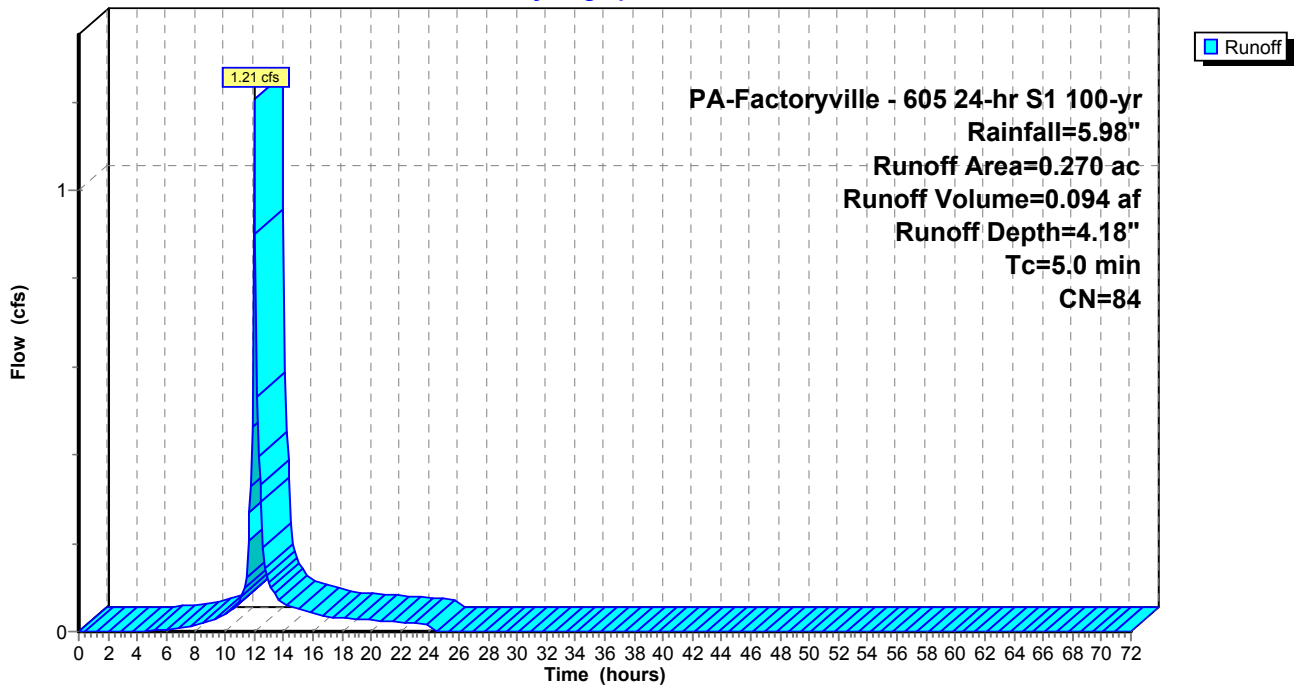
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
0.190	78	Meadow, non-grazed, HSG D
* 0.080	98	Impervious areas, HSG D
0.270	84	Weighted Average
0.190		70.37% Pervious Area
0.080		29.63% Impervious Area

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

**Subcatchment 22S: DRAINAGE AREA TO SWALE 1A**

Hydrograph



**Summary for Subcatchment 35S: DRAINAGE AREA TO SWALE 1B**

Runoff = 24.58 cfs @ 12.18 hrs, Volume= 2.569 af, Depth= 3.66"

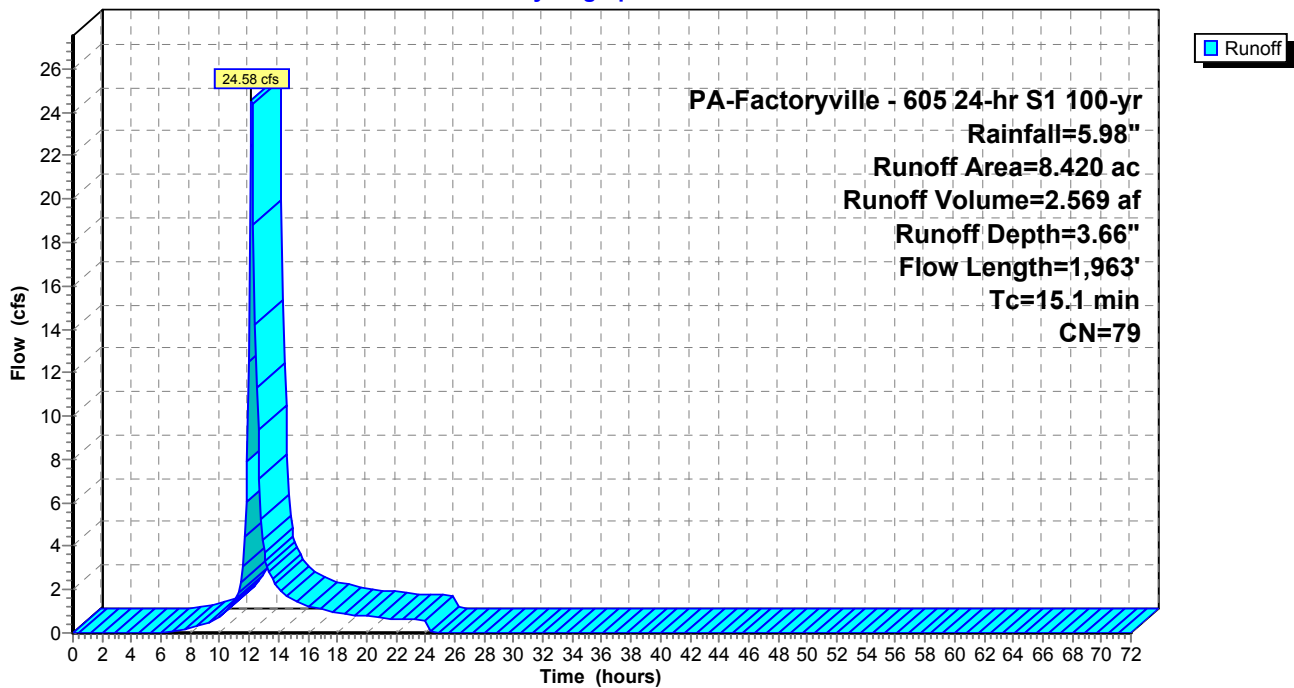
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
5.626	78	Meadow, non-grazed, HSG D
2.364	77	Woods, Good, HSG D
* 0.430	98	Impervious areas, HSG D
8.420	79	Weighted Average
7.990		94.89% Pervious Area
0.430		5.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		<b>Sheet Flow, SHT 1</b> Range n= 0.130 P2= 2.54"
4.1	686	0.1574	2.78		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
3.6	1,177	0.1290	5.39		<b>Shallow Concentrated Flow, SCF 2</b> Grassed Waterway Kv= 15.0 fps
15.1	1,963	Total			

**Subcatchment 35S: DRAINAGE AREA TO SWALE 1B**

Hydrograph



**Summary for Pond 26P: INFILTRATION BASIN 2**

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 4.39" for 100-yr event  
 Inflow = 28.49 cfs @ 12.02 hrs, Volume= 2.228 af  
 Outflow = 23.89 cfs @ 12.10 hrs, Volume= 2.228 af, Atten= 16%, Lag= 4.7 min  
 Discarded = 0.56 cfs @ 12.10 hrs, Volume= 0.681 af  
 Primary = 23.33 cfs @ 12.10 hrs, Volume= 1.547 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 1,120.79' @ 12.10 hrs Surf.Area= 9,018 sf Storage= 12,282 cf

Plug-Flow detention time= 74.1 min calculated for 2.225 af (100% of inflow)  
 Center-of-Mass det. time= 74.7 min ( 881.3 - 806.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,118.00'	56,769 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,118.00	0	0	0
1,120.00	6,243	6,243	6,243
1,122.00	13,256	19,499	25,742
1,124.00	17,771	31,027	56,769

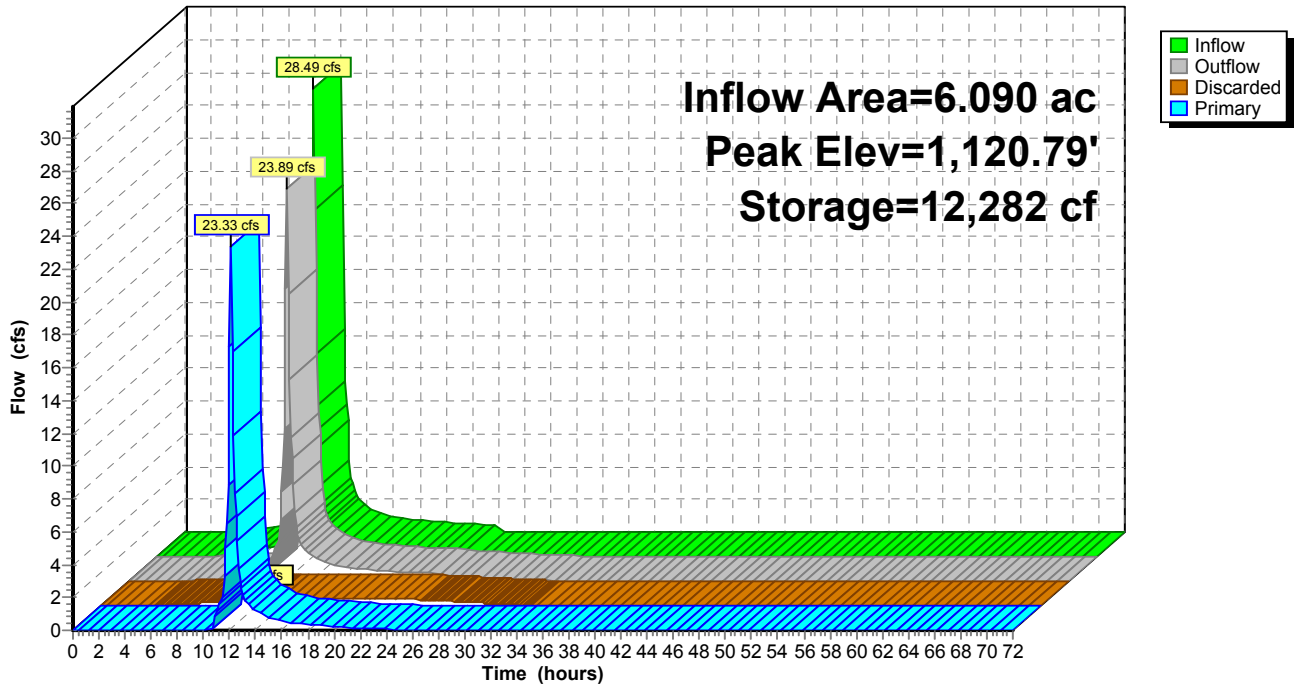
Device	Routing	Invert	Outlet Devices
#1	Primary	1,117.00'	<b>18.0" Round Culvert</b> L= 126.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,117.00' / 1,106.00' S= 0.0873 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	1,118.00'	<b>2.660 in/hr Exfiltration over Surface area</b>
#3	Device 1	1,120.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Primary	1,120.50'	<b>20.0' long x 17.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.55 cfs @ 12.10 hrs HW=1,120.79' (Free Discharge)  
 ↑**2=Exfiltration** (Exfiltration Controls 0.55 cfs)

**Primary OutFlow** Max=23.21 cfs @ 12.10 hrs HW=1,120.79' (Free Discharge)  
 ↑**1=Culvert** (Inlet Controls 14.83 cfs @ 8.39 fps)  
 ↑**3=Orifice/Grate** (Passes 14.83 cfs of 27.53 cfs potential flow)  
 ↑**4=Broad-Crested Rectangular Weir** (Weir Controls 8.38 cfs @ 1.45 fps)

### Pond 26P: INFILTRATION BASIN 2

Hydrograph



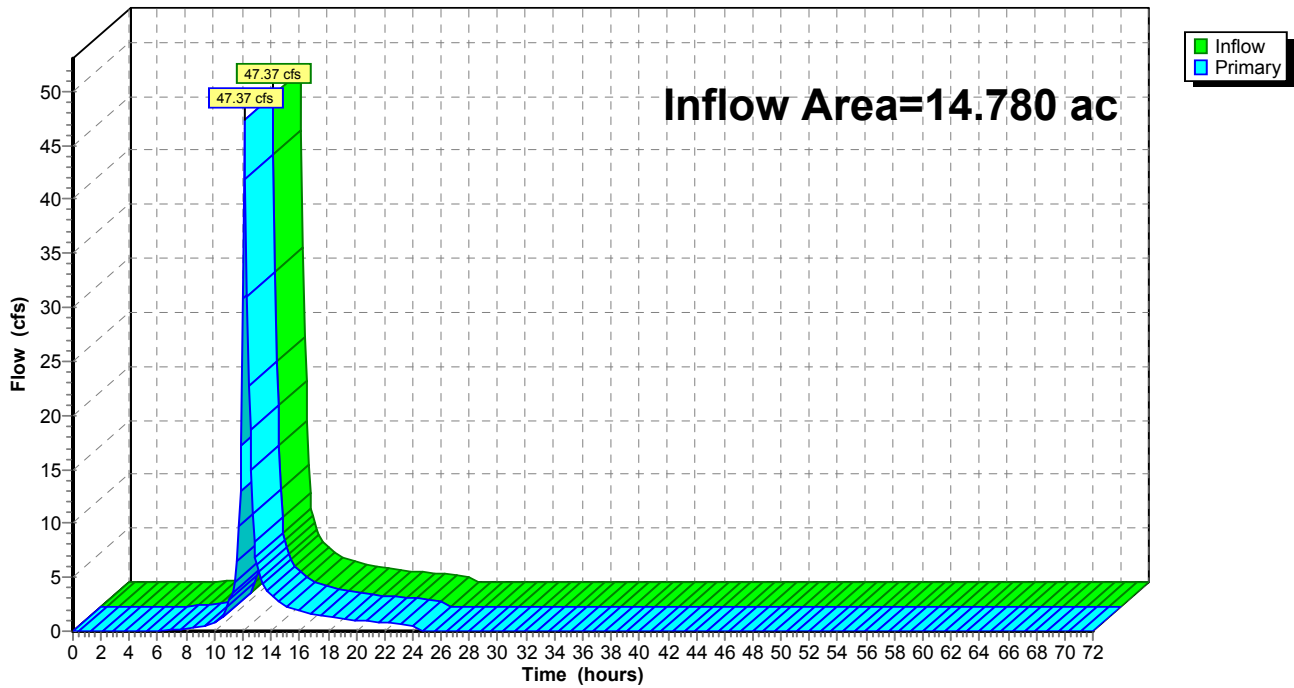
### Summary for Link 34L: SWALE 1B

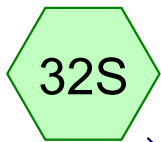
Inflow Area = 14.780 ac, 5.95% Impervious, Inflow Depth = 3.42" for 100-yr event  
Inflow = 47.37 cfs @ 12.13 hrs, Volume= 4.210 af  
Primary = 47.37 cfs @ 12.13 hrs, Volume= 4.210 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs

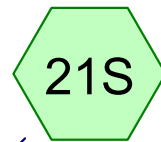
### Link 34L: SWALE 1B

Hydrograph

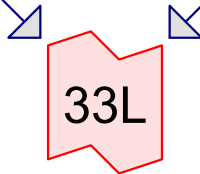




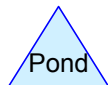
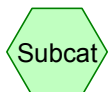
DRAINAGE AREA TO  
SWALE 2B



DRAINAGE AREA  
FROM PAD



SWALE 2B



**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE NATURAL GAS PIPELINE  
 PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605  
 PREPARED BY: AOE DATE: 08/12/15  
 CHECKED BY: AJB DATE: 08/12/15

CHANNEL OR CHANNEL SECTION	SWALE 2A LINING (MIN/MAX)	SWALE 2A GRASS (MIN/MAX)			
TEMPORARY OR PERMANENT? (T OR P)	P	P			
DESIGN STORM (2, 5, OR 10 YR)	10	10			
ACRES (AC)	1.17	1.17			
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	2.75	2.75			
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	3.22	3.22			
Q (CALCULATED AT FLOW DEPTH d) (CFS)	3.20	3.25			
PROTECTIVE LINING <sup>2</sup>	S75	GRASS			
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.055	0.13			
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A			
V (CALCULATED AT FLOW DEPTH d) (FPS)	1.44	0.77			
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	1.55	1.00			
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	0.37	0.56			
CHANNEL BOTTOM WIDTH (FT)	2	2			
CHANNEL SIDE SLOPES (H:V)	3	3			
D (TOTAL DEPTH) (FT)	1.5	1.5			
CHANNEL TOP WIDTH @ D (FT)	11	11			
d (CALCULATED FLOW DEPTH) (FT)	0.59	0.90			
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	5.54	7.40			
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	3.39	2.22			
d50 STONE SIZE (IN)	N/A	N/A			
A (CROSS-SECTIONAL AREA) (SQ. FT.)	2.22	4.23			
R (HYDRAULIC RADIUS)	0.39	0.55			
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.01	0.01			
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	0.062	1.041			
.7S <sub>c</sub> (FT/FT)	0.044	0.729			
1.3S <sub>c</sub> (FT/FT)	0.081	1.353			
STABLE FLOW? (Y/N)	Y	Y			
FREEBOARD BASED ON UNSTABLE FLOW (FT)	0.06	0.05			
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.50			
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.50			
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (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.

**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE NATURAL GAS PIPELINE

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605

PREPARED BY: AOE DATE: 08/12/15

CHECKED BY: AJB DATE: 08/12/15

CHANNEL OR CHANNEL SECTION	SWALE 2B GRASS/LINING (MIN)	SWALE 2B GRASS/LINING (MAX)	SWALE 2B GRASS/LINING (MIN)	SWALE 2B GRASS/LINING (MAX)	
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	
DESIGN STORM (2, 5, OR 10 YR)	10	10	100	100	
ACRES (AC)	14.46	14.46	14.46	14.46	
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	N/A	N/A	N/A	N/A	
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	31.68	31.68	53.00	53.00	
Q (CALCULATED AT FLOW DEPTH d) (CFS)	32.15	31.66	53.87	53.13	
PROTECTIVE LINING <sup>2</sup>	W3000	W3000/GRASS	W3000	W3000/GRASS	
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.06	0.049	0.052	0.043	
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	
V (CALCULATED AT FLOW DEPTH d) (FPS)	2.40	8.66	3.06	11.10	
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	16.00	16.00	16.00	16.00	
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	0.90	8.58	1.08	10.61	
CHANNEL BOTTOM WIDTH (FT)	5	5	5	5	
CHANNEL SIDE SLOPES (H:V)	3	3	3	3	
D (TOTAL DEPTH) (FT)	2.0	2.0	2.0	2.0	
CHANNEL TOP WIDTH @ D (FT)	17	17	17	17	
d (CALCULATED FLOW DEPTH) (FT)	1.44	0.55	1.73	0.68	
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	13.64	8.30	15.38	9.08	
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	3.47	9.09	2.89	7.35	
d50 STONE SIZE (IN)	N/A	N/A	N/A	N/A	
A (CROSS-SECTIONAL AREA) (SQ. FT.)	13.42	3.66	17.63	4.79	
R (HYDRAULIC RADIUS)	0.95	0.43	1.11	0.51	
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.01	0.25	0.01	0.25	
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	0.055	0.128	0.039	0.129	
.7S <sub>c</sub> (FT/FT)	0.039	0.090	0.028	0.090	
1.3S <sub>c</sub> (FT/FT)	0.072	0.166	0.051	0.168	
STABLE FLOW? (Y/N)	Y	Y	Y	Y	
FREEBOARD BASED ON UNSTABLE FLOW (FT)	0.26	0.36	0.40	0.57	
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.50	0.50	0.50	
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.50	0.50	0.57	
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> 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.

**Summary for Subcatchment 21S: DRAINAGE AREA FROM PAD**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 19.33 cfs @ 12.02 hrs, Volume= 1.246 af, Depth= 2.68"

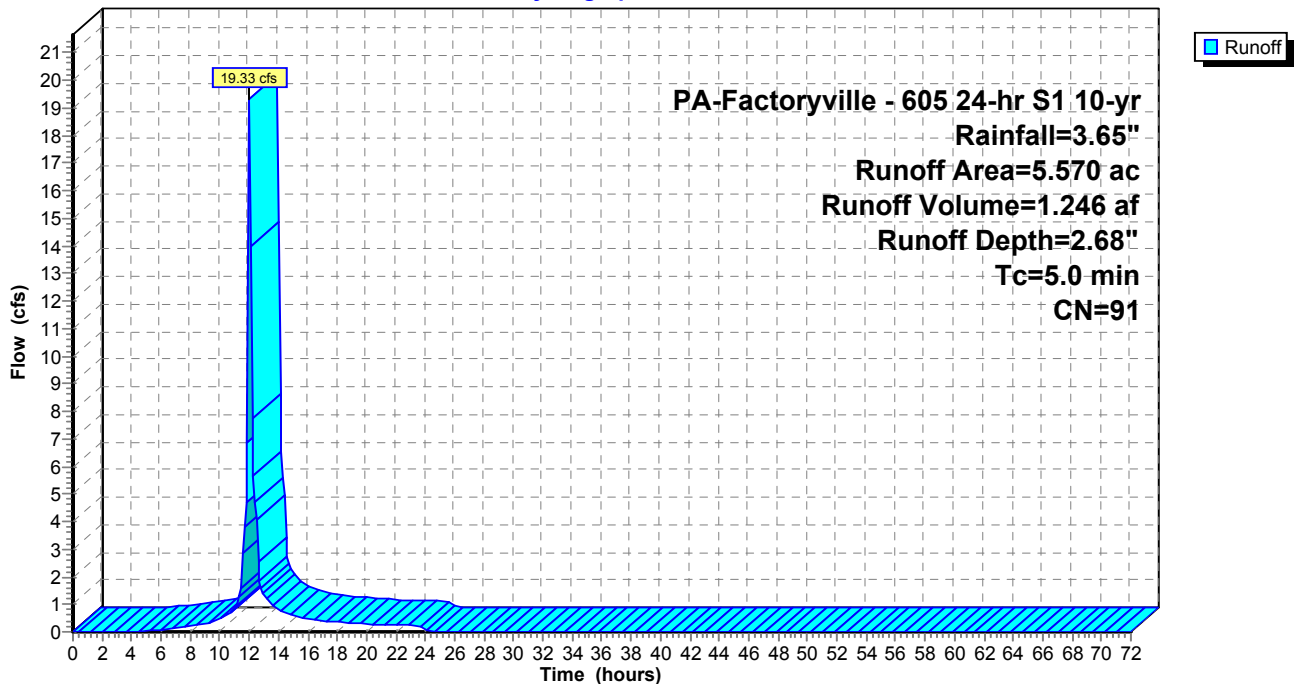
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 21S: DRAINAGE AREA FROM PAD**

Hydrograph



**Summary for Subcatchment 32S: DRAINAGE AREA TO SWALE 2B**

[49] Hint:  $T_c < 2dt$  may require smaller dt

Runoff = 16.95 cfs @ 12.11 hrs, Volume= 1.247 af, Depth= 1.68"

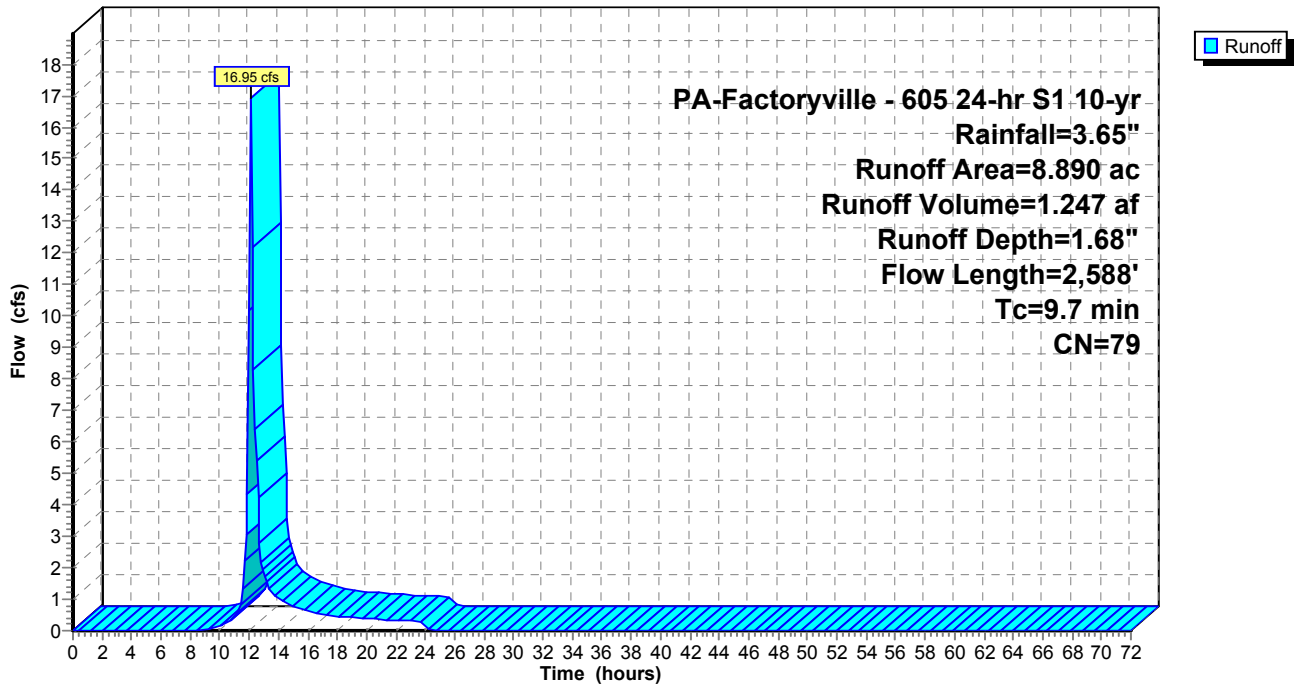
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 PA-Factoryville - 605 24-hr S1 10-yr Rainfall=3.65"

Area (ac)	CN	Description
8.250	78	Meadow, non-grazed, HSG D
* 0.640	98	Impervious areas, HSG D
8.890	79	Weighted Average
8.250		92.80% Pervious Area
0.640		7.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	266	0.0100	1.50		<b>Shallow Concentrated Flow, SCF-1</b>
					Grassed Waterway Kv= 15.0 fps
6.7	2,322	0.0700	5.82	40.72	<b>Channel Flow,</b>
					Area= 7.0 sf Perim= 11.0' r= 0.64' n= 0.050
9.7	2,588	Total			

**Subcatchment 32S: DRAINAGE AREA TO SWALE 2B**

Hydrograph



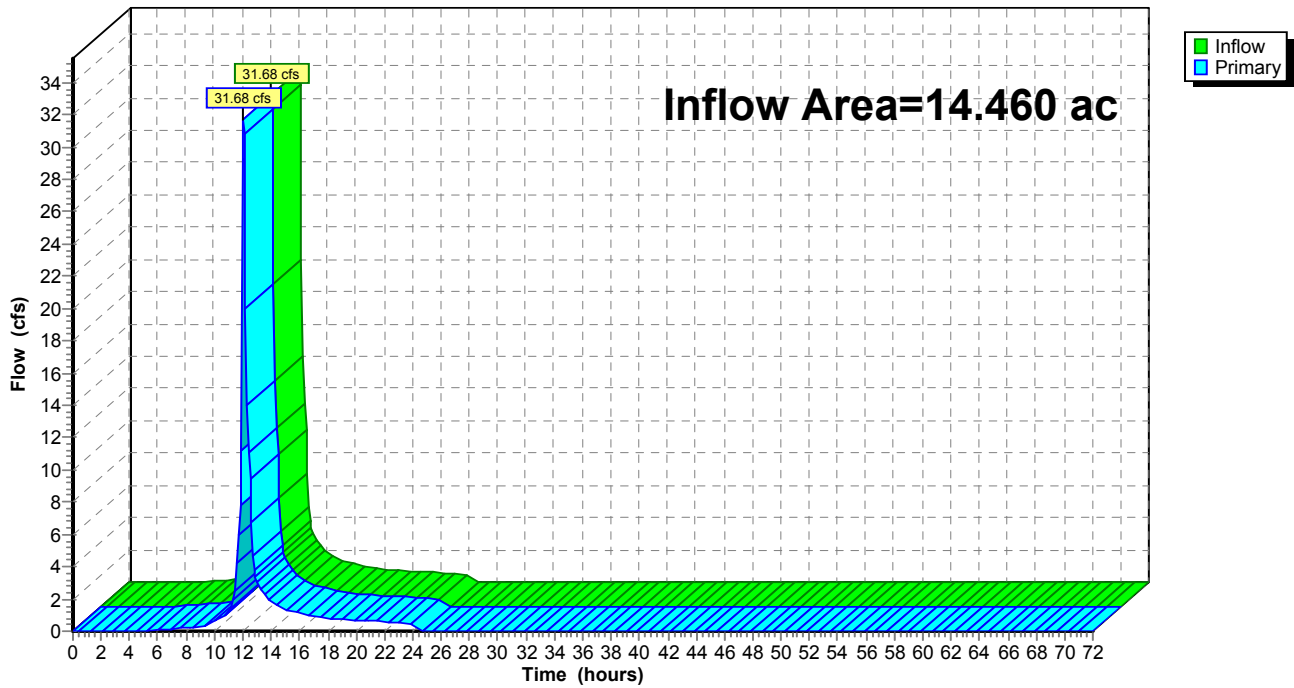
### Summary for Link 33L: SWALE 2B

Inflow Area = 14.460 ac, 15.70% Impervious, Inflow Depth = 2.07" for 10-yr event  
Inflow = 31.68 cfs @ 12.06 hrs, Volume= 2.493 af  
Primary = 31.68 cfs @ 12.06 hrs, Volume= 2.493 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs

### Link 33L: SWALE 2B

Hydrograph



**Summary for Subcatchment 21S: DRAINAGE AREA FROM PAD**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 28.53 cfs @ 12.02 hrs, Volume= 2.292 af, Depth= 4.94"

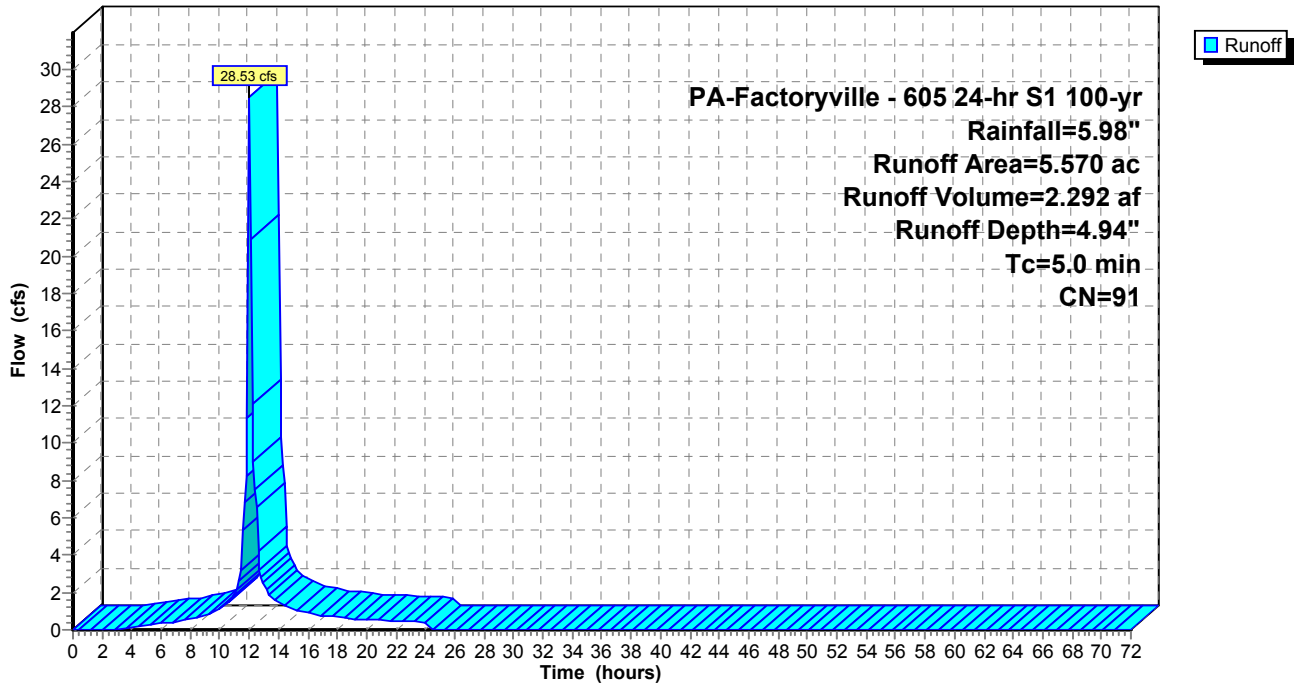
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.10$  hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
0.760	78	Meadow, non-grazed, HSG D
* 3.180	91	Gravel areas, HSG D
* 1.630	98	Impervious areas, HSG D
5.570	91	Weighted Average
3.940		70.74% Pervious Area
1.630		29.26% Impervious Area

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

**Subcatchment 21S: DRAINAGE AREA FROM PAD**

Hydrograph



**Summary for Subcatchment 32S: DRAINAGE AREA TO SWALE 2B**

[49] Hint:  $T_c < 2dt$  may require smaller  $dt$

Runoff = 30.96 cfs @ 12.10 hrs, Volume= 2.713 af, Depth= 3.66"

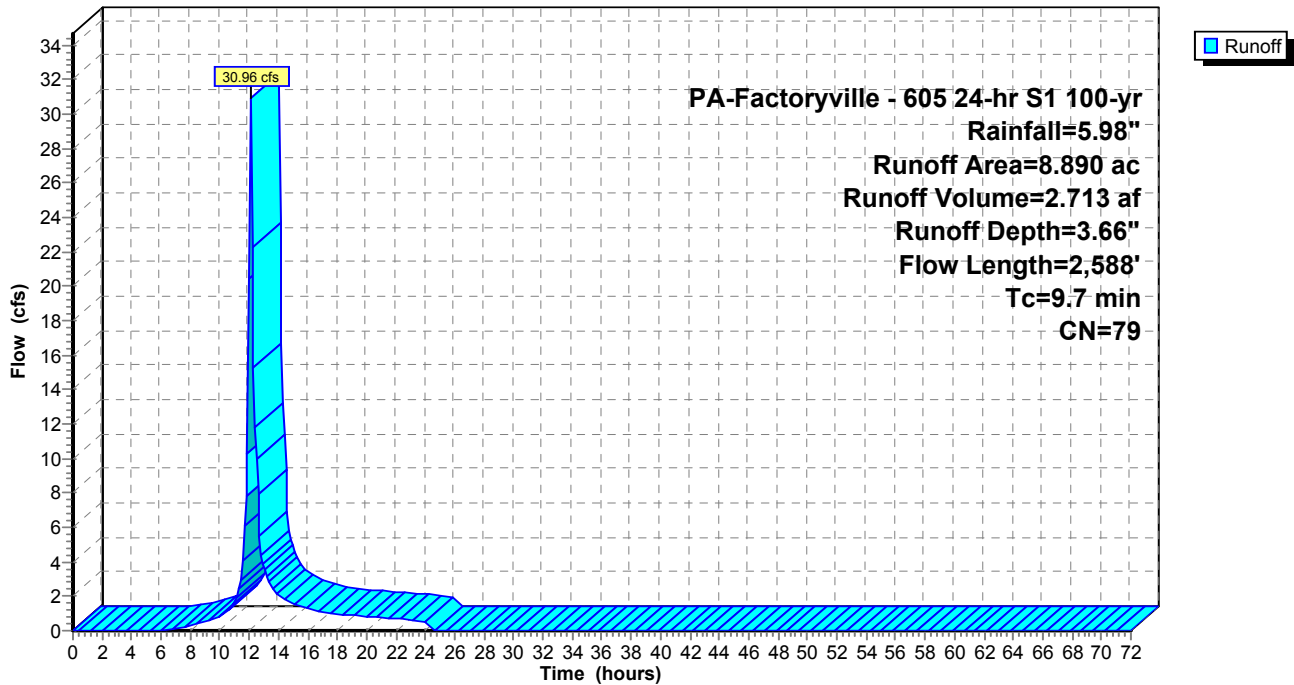
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs,  $dt= 0.10$  hrs  
 PA-Factoryville - 605 24-hr S1 100-yr Rainfall=5.98"

Area (ac)	CN	Description
8.250	78	Meadow, non-grazed, HSG D
* 0.640	98	Impervious areas, HSG D
8.890	79	Weighted Average
8.250		92.80% Pervious Area
0.640		7.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	266	0.0100	1.50		<b>Shallow Concentrated Flow, SCF-1</b>
					Grassed Waterway Kv= 15.0 fps
6.7	2,322	0.0700	5.82	40.72	<b>Channel Flow,</b>
					Area= 7.0 sf Perim= 11.0' r= 0.64' n= 0.050
9.7	2,588	Total			

**Subcatchment 32S: DRAINAGE AREA TO SWALE 2B**

Hydrograph



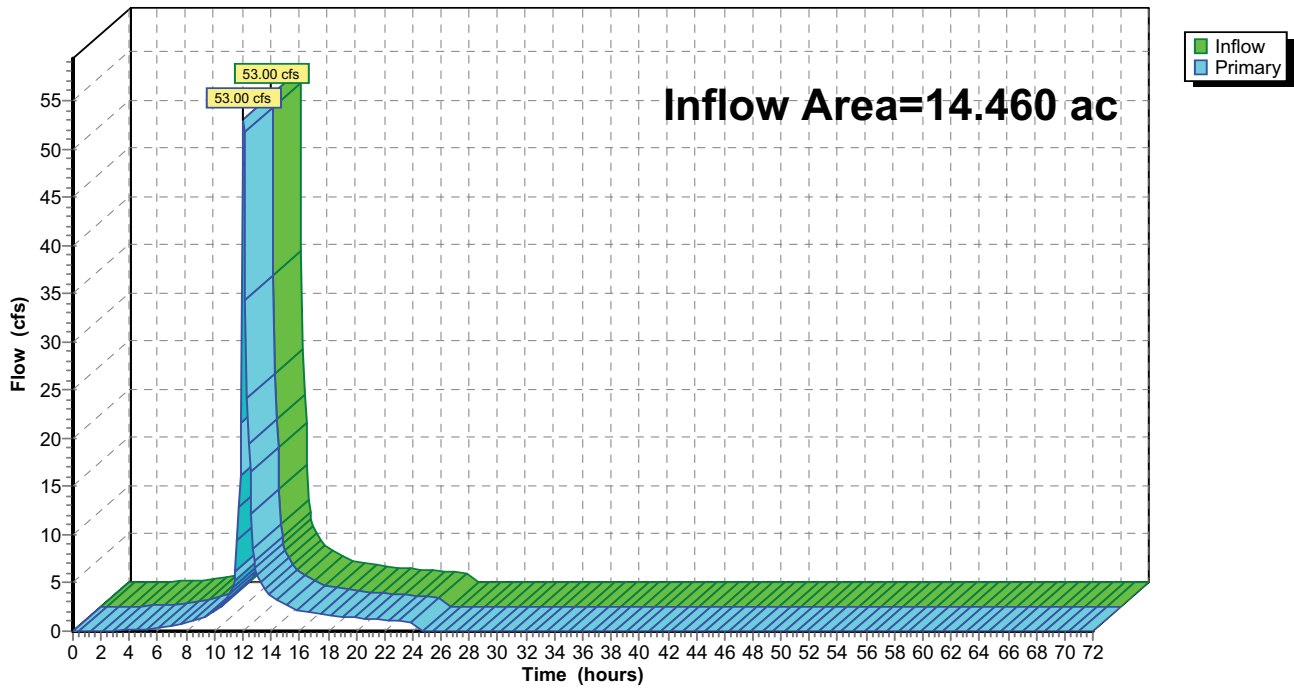
### Summary for Link 33L: SWALE 2B

Inflow Area = 14.460 ac, 15.70% Impervious, Inflow Depth = 4.15" for 100-yr event  
Inflow = 53.00 cfs @ 12.07 hrs, Volume= 5.005 af  
Primary = 53.00 cfs @ 12.07 hrs, Volume= 5.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs

### Link 33L: SWALE 2B

Hydrograph



**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY, PA

PREPARED BY: AOE

DATE: 02/05/16

CHECKED BY: AJB

DATE: 02/05/16

CHANNEL OR CHANNEL SECTION	DITCH 1	DITCH 3	DITCH 5	DITCH 6	DITCH 8
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	P
DESIGN STORM (2, 5, OR 10 YR)	10	10	10	10	10
ACRES (AC)	0.34	4.06	1.65	1.38	1.08
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	2.75	2.75	2.75	2.75	2.75
Qr (REQUIRED CAPACITY) (CFS)	0.94	11.17	4.54	3.80	2.97
Q (CALCULATED AT FLOW DEPTH d) (CFS)	0.90	7.44	4.61	3.81	2.98
PROTECTIVE LINING <sup>2</sup>	R-4	R-4	R-4	R-4	R-4
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.063	0.05	0.063	0.063	0.063
Va (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	N/A
V (CALCULATED AT FLOW DEPTH d) (FPS)	1.60	2.07	2.99	2.47	2.50
ta (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	2.00	2.00	2.00	2.00	2.00
td (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	0.62	0.58	2.00	1.37	1.42
CHANNEL BOTTOM WIDTH (FT)	2	2	2	2	2
CHANNEL SIDE SLOPES (H:V)	2	2	2	2	2
D (TOTAL DEPTH) (FT)	3.0	3.0	4.0	5.0	4.0
CHANNEL TOP WIDTH @ D (FT)	14	14	18	22	18
d (CALCULATED FLOW DEPTH) (FT)	0.23	0.93	0.51	0.51	0.42
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	2.92	5.72	4.04	4.04	3.68
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	8.70	2.15	3.92	3.92	4.76
d50 STONE SIZE (IN)	6	6	6	6	6
A (CROSS-SECTIONAL AREA) (SQ. FT.)	0.57	3.59	1.54	1.54	1.19
R (HYDRAULIC RADIUS)	0.19	0.58	0.36	0.36	0.31
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.043	0.01	0.063	0.043	0.054
Sc (CRITICAL SLOPE) (FT/FT)	0.033	0.131	0.089	0.089	0.069
.7Sc (FT/FT)	0.023	0.091	0.062	0.062	0.048
1.3Sc (FT/FT)	0.043	0.170	0.116	0.116	0.090
STABLE FLOW? (Y/N)	Y	Y	N	Y	N
FREEBOARD BASED ON UNSTABLE FLOW (FT)	0.0	0.1	0.1	0.1	0.1
FREEBOARD BASED ON STABLE FLOW (FT)	0.5	0.5	0.5	0.5	0.5
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	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 1/4 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.

## E&S WORKSHEET # 11

### Channel Design Data

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY, PA

PREPARED BY: AOE

DATE: 08/16/15

CHECKED BY: AJB

DATE: 08/16/15

CHANNEL OR CHANNEL SECTION	DITCH 9	DITCH 10	DITCH 11	DITCH 13	DITCH 14
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	P
DESIGN STORM (2, 5, OR 10 YR)	10	10	10	10	10
ACRES (AC)	0.86	4.40	0.42	0.91	0.54
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>	2.75	2.75	2.75	2.75	2.75
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	2.37	12.10	1.16	2.50	1.49
Q (CALCULATED AT FLOW DEPTH d) (CFS)	2.38	12.02	1.21	2.56	1.53
PROTECTIVE LINING <sup>2</sup>	R-4	R-4	R-4	R-4	R-4
n (MANNING'S COEFFICIENT) <sup>2</sup>	0.063	0.047	0.063	0.063	0.063
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	N/A
V (CALCULATED AT FLOW DEPTH d) (FPS)	1.88	2.46	1.55	2.15	1.24
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	2.00	2.00	2.00	2.00	2.00
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	0.80	0.71	0.56	1.05	0.35
CHANNEL BOTTOM WIDTH (FT)	2	2	2	2	2
CHANNEL SIDE SLOPES (H:V)	2	2	2	2	2
D (TOTAL DEPTH) (FT)	5.0	5.0	6.0	5.0	2.0
CHANNEL TOP WIDTH @ D (FT)	22	22	26	22	10
d (CALCULATED FLOW DEPTH) (FT)	0.44	1.14	0.30	0.42	0.43
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	3.76	6.56	3.20	3.68	3.72
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	4.55	1.75	6.67	4.76	4.65
d <sub>50</sub> STONE SIZE (IN)	6	6	6	6	6
A (CROSS-SECTIONAL AREA) (SQ. FT.)	1.27	4.88	0.78	1.19	1.23
R (HYDRAULIC RADIUS)	0.32	0.69	0.23	0.31	0.31
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.029	0.01	0.03	0.04	0.013
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	0.073	0.157	0.045	0.069	0.071
.7S <sub>c</sub> (FT/FT)	0.051	0.110	0.032	0.048	0.050
1.3S <sub>c</sub> (FT/FT)	0.095	0.204	0.059	0.090	0.092
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW (FT)	0.1	0.2	0.0	0.1	0.0
FREEBOARD BASED ON STABLE FLOW (FT)	0.5	0.5	0.5	0.5	0.5
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	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.

**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION # 605

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY

PREPARED BY: AOE DATE: 11/16/15

CHECKED BY: AJB DATE: 11/16/15

CHANNEL OR CHANNEL SECTION		<b>EX. ROADSIDE SWALE</b>			
TEMPORARY OR PERMANENT? (T OR P)		<b>P</b>			
DESIGN STORM (2, 5, OR 10 YR)		<b>10</b>			
ACRES (AC)		<b>106.43</b>			
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>		<b>N/A</b>			
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)		<b>68 - 10 YEAR DESIGN STORM, SEE CULVERT A HYDROCAD REPORT</b>			
Q (CALCULATED AT FLOW DEPTH d) (CFS)		<b>68.00</b>			
PROTECTIVE LINING <sup>2</sup>		<b>N/A</b>			
n (MANNING'S COEFFICIENT) <sup>2</sup>		<b>0.106</b>	<b>SEE CHANNEL REPORT</b>		
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)		<b>3</b>			
V (CALCULATED AT FLOW DEPTH d) (FPS)		<b>2.41</b>			
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )		<b>N/A</b>			
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )		<b>N/A</b>			
CHANNEL BOTTOM WIDTH (FT)		<b>11</b>			
CHANNEL SIDE SLOPES (H:V)		<b>VARIES</b>	<b>SEE CHANNEL REPORT</b>		
D (TOTAL DEPTH) (FT)		<b>1.9</b>			
CHANNEL TOP WIDTH @ D (FT)		<b>23.26</b>			
d (CALCULATED FLOW DEPTH) (FT)		<b>1.88</b>			
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)		<b>23.26</b>			
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)		<b>5.85</b>			
d <sub>50</sub> STONE SIZE (IN)		<b>N/A</b>			
A (CROSS-SECTIONAL AREA) (SQ. FT.)		<b>28.20</b>			
R (HYDRAULIC RADIUS)		<b>1.18</b>			
S (BED SLOPE) <sup>3</sup> (FT/FT)		<b>0.024</b>			
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)		<b>0.159</b>			
.7S <sub>c</sub> (FT/FT)		<b>0.111</b>			
1.3S <sub>c</sub> (FT/FT)		<b>0.207</b>			
STABLE FLOW? (Y/N)		<b>Y</b>			
FREEBOARD BASED ON UNSTABLE FLOW (FT)		<b>0.34</b>			
FREEBOARD BASED ON STABLE FLOW (FT)		<b>0.50</b>			
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)		<b>0.50</b>			
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		<b>V</b>			

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 1/4 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 Report

## EXISTING ROAD SWALE 10 YEAR STORM

### User-defined

Invert Elev (ft) = 941.17  
Slope (%) = 2.40  
N-Value = 0.106

### Calculations

Compute by: Known Q  
Known Q (cfs) = 68.00

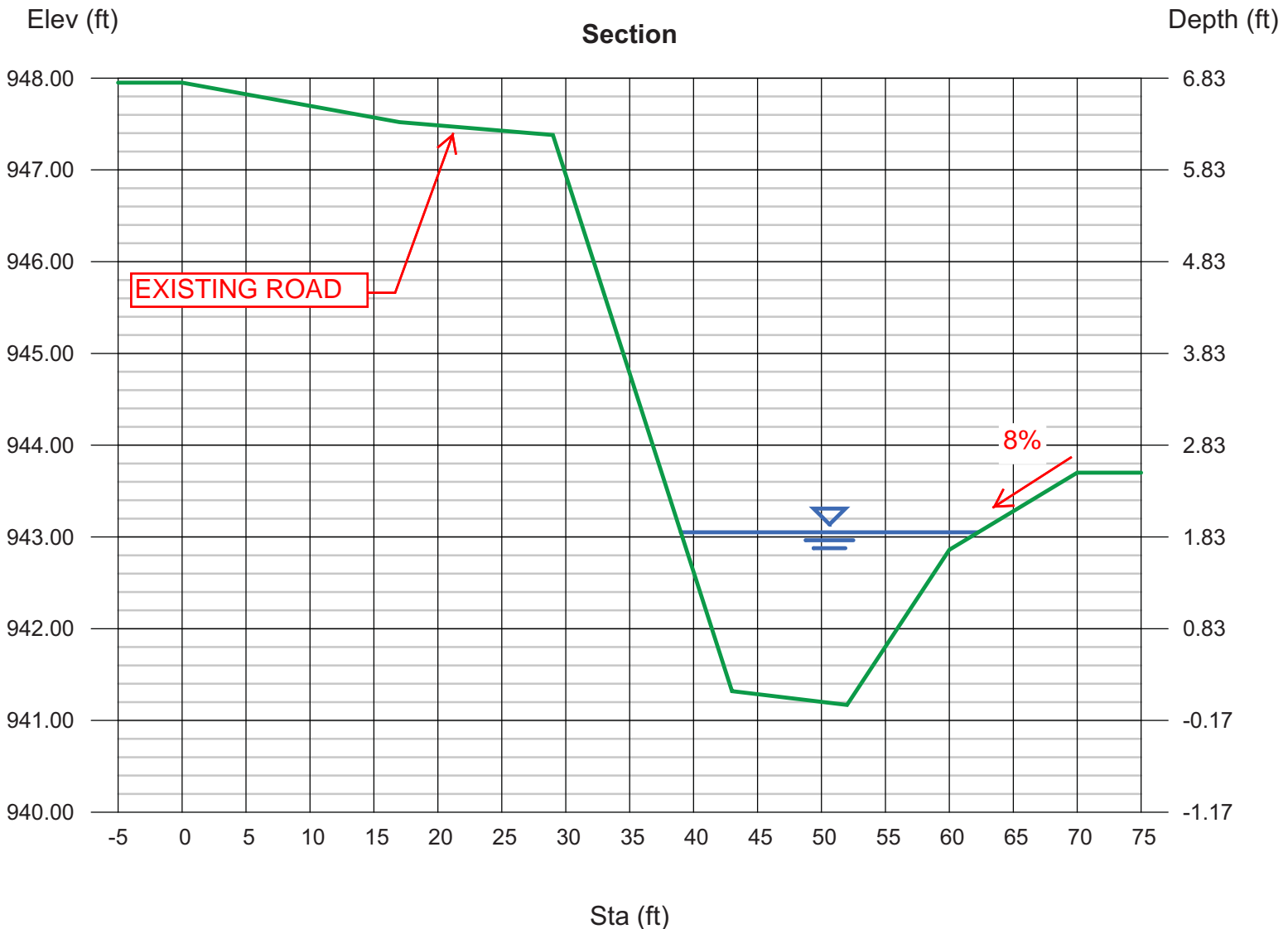
### Highlighted

Depth (ft) = 1.88  
Q (cfs) = 68.00  
Area (sqft) = 28.20  
Velocity (ft/s) = 2.41  
Wetted Perim (ft) = 23.80  
Crit Depth, Yc (ft) = 1.12  
Top Width (ft) = 23.26  
EGL (ft) = 1.97

### (Sta, El, n)-(Sta, El, n)...

(0.00, 947.95)-(17.00, 947.52, 0.015)-(29.00, 947.38, 0.015)-(43.00, 941.32, 0.065)-(52.00, 941.17, 0.065)-(60.00, 942.86, 0.150)-(70.00, 943.70, 0.150)

THE FLOW TO THE EXISTING ROAD SIDE SWALE IS THE DISCHARGE FROM PROPOSED CULVERT A DURING A 10 YEAR STORM. THE FLOW VELOCITY IS LESS THAN 3 FPS THEREFORE THE SWALE IS STABLE.



**CULVERT A**

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PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 1

**Summary for Subcatchment 17: DRAINAGE AREA TO BASIN 2**

Runoff = 9.41 cfs @ 0.09 hrs, Volume= 0.661 af, Depth= 1.29"

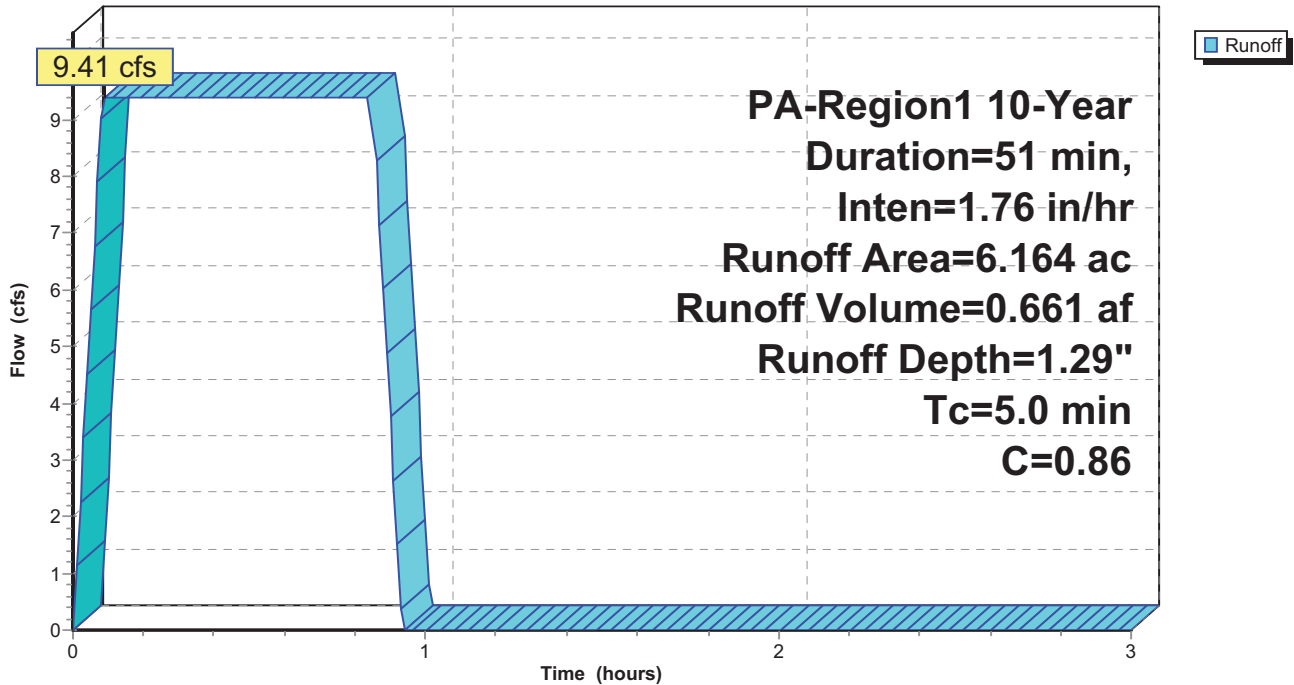
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

Area (ac)	C	Description
0.880	0.95	Impervious, HSG D
1.506	0.70	Grass/Meadow/Pasture, HSG D
3.778	0.90	Gravel Areas, HSG D
6.164	0.86	Weighted Average
5.284		85.72% Pervious Area
0.880		14.28% Impervious Area

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

**Subcatchment 17: DRAINAGE AREA TO BASIN 2**

Hydrograph



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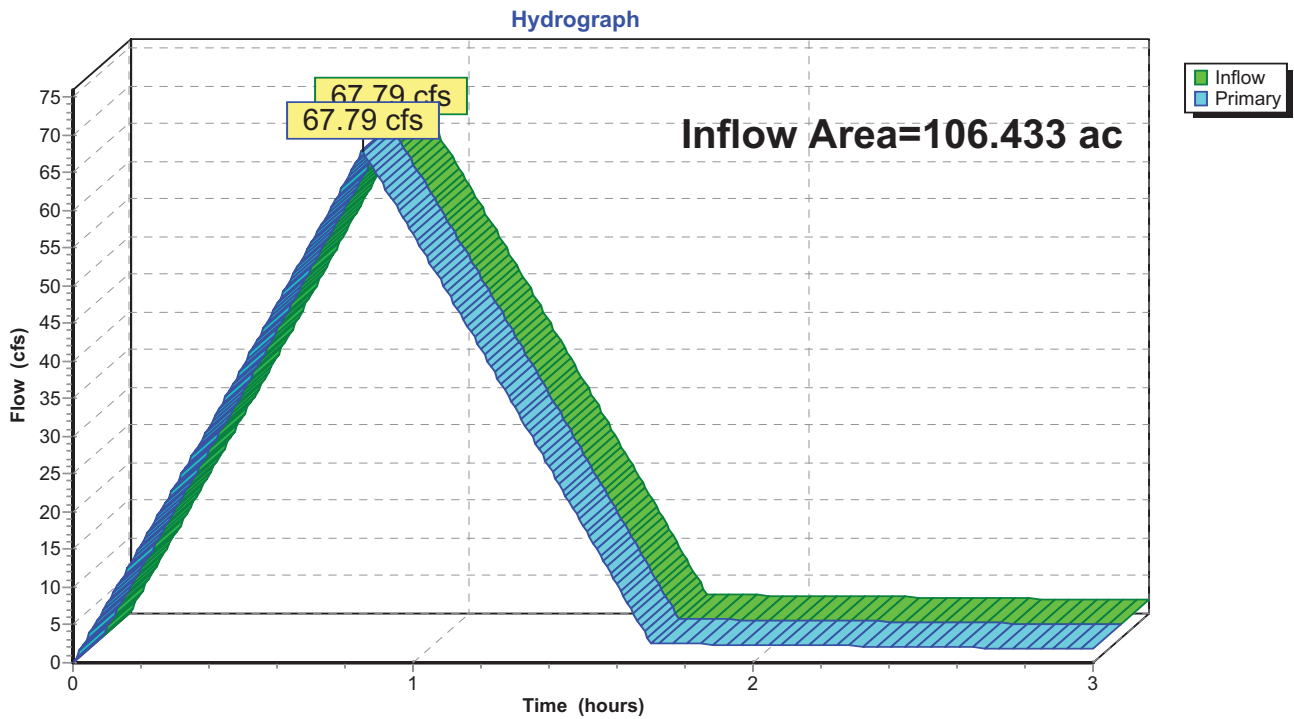
Page 11

## Summary for Link 25: FLOW TO CULVERT A

Inflow Area = 106.433 ac, 4.95% Impervious, Inflow Depth > 0.57" for 10-Year event  
Inflow = 67.79 cfs @ 0.85 hrs, Volume= 5.088 af  
Primary = 67.79 cfs @ 0.85 hrs, Volume= 5.088 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs

## Link 25: FLOW TO CULVERT A



# CULVERT A

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Page 2

## Summary for Subcatchment 20: PAD DA TO BASIN 1

Runoff = 8.35 cfs @ 0.09 hrs, Volume= 0.587 af, Depth= 1.35"

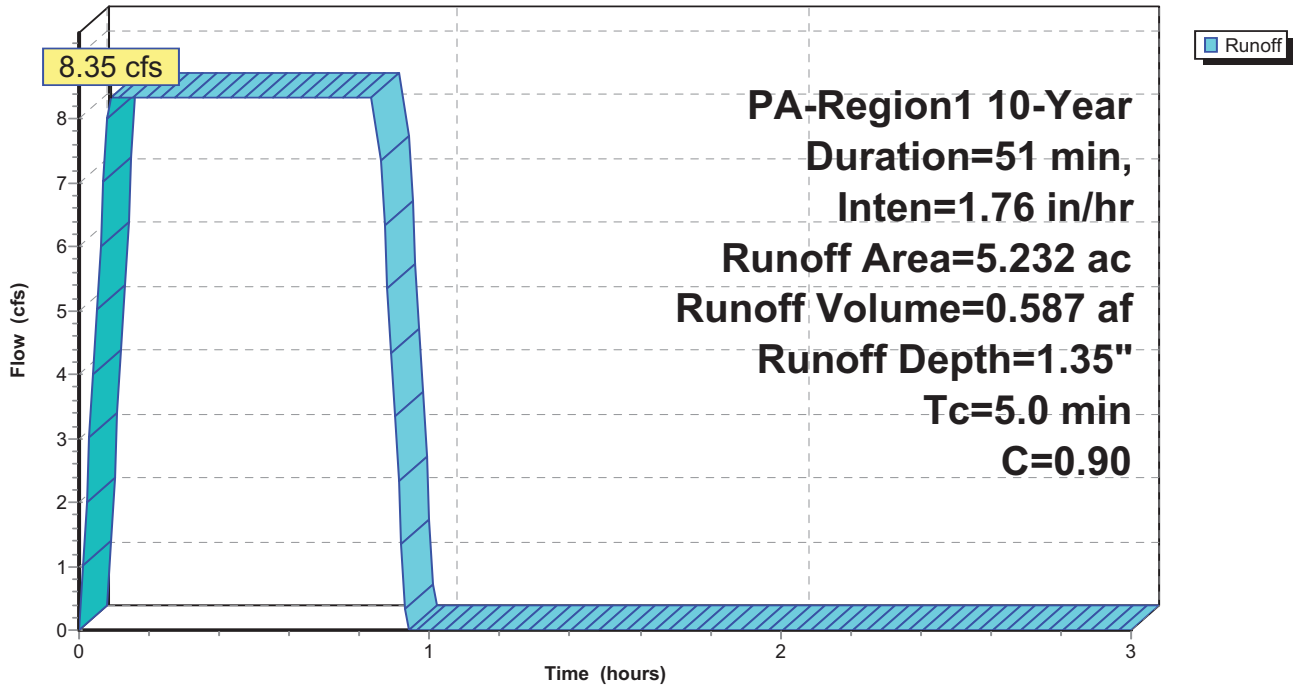
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

Area (ac)	C	Description
0.481	0.70	Meadow/grassland/range, Good, HSG D
3.149	0.90	Gravel areas, HSG D
1.602	0.95	Impervious areas, HSG D
5.232	0.90	Weighted Average
3.630		69.38% Pervious Area
1.602		30.62% Impervious Area

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

## Subcatchment 20: PAD DA TO BASIN 1

Hydrograph



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PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 3

**Summary for Subcatchment 22: OVERLAND DA TO BASIN 1**

Runoff = 26.62 cfs @ 0.09 hrs, Volume= 1.870 af, Depth= 1.06"

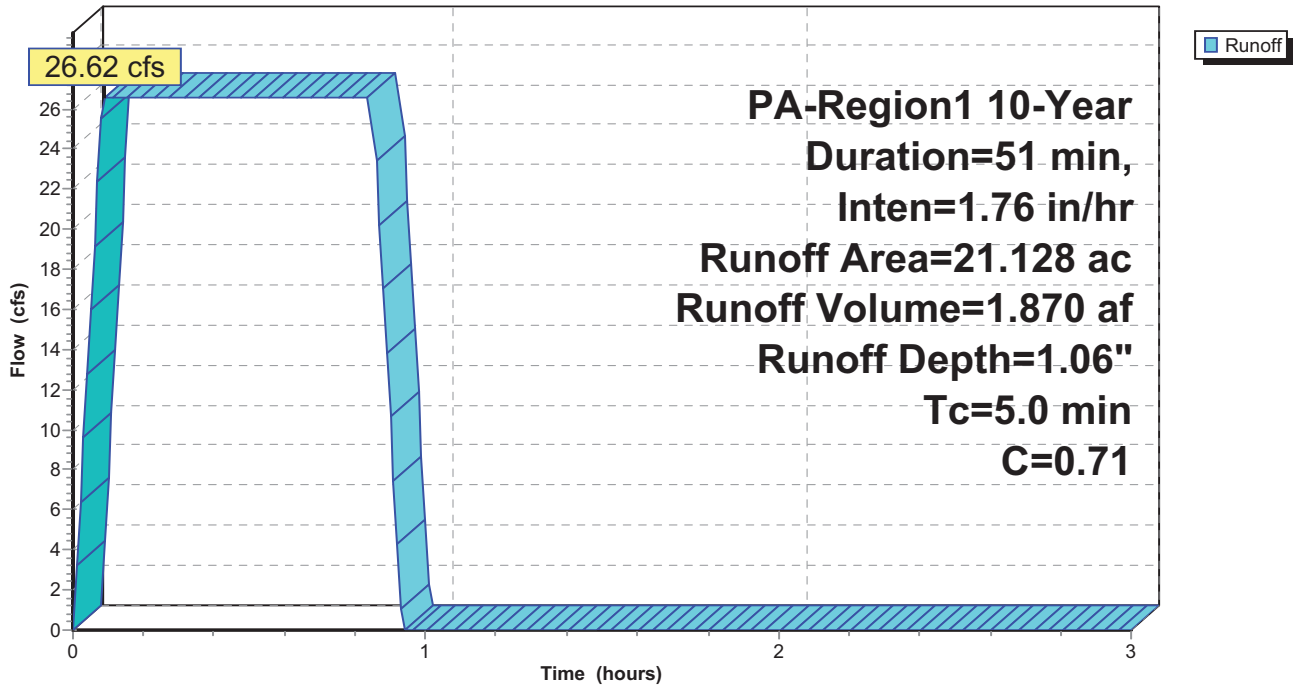
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

Area (ac)	C	Description
19.580	0.70	Meadow/grassland/range, Good, HSG D
0.269	0.30	Woods, Good, HSG D
1.279	0.95	Impervious areas, HSG D
21.128	0.71	Weighted Average
19.849		93.95% Pervious Area
1.279		6.05% Impervious Area

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

**Subcatchment 22: OVERLAND DA TO BASIN 1**

Hydrograph



**CULVERT A**

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Page 4

**Summary for Subcatchment 24: POST DEVELOPMENT BYPASS DRAINAGE AREA TO CULVERT A**

Runoff = 66.36 cfs @ 0.85 hrs, Volume= 4.661 af, Depth= 0.76"

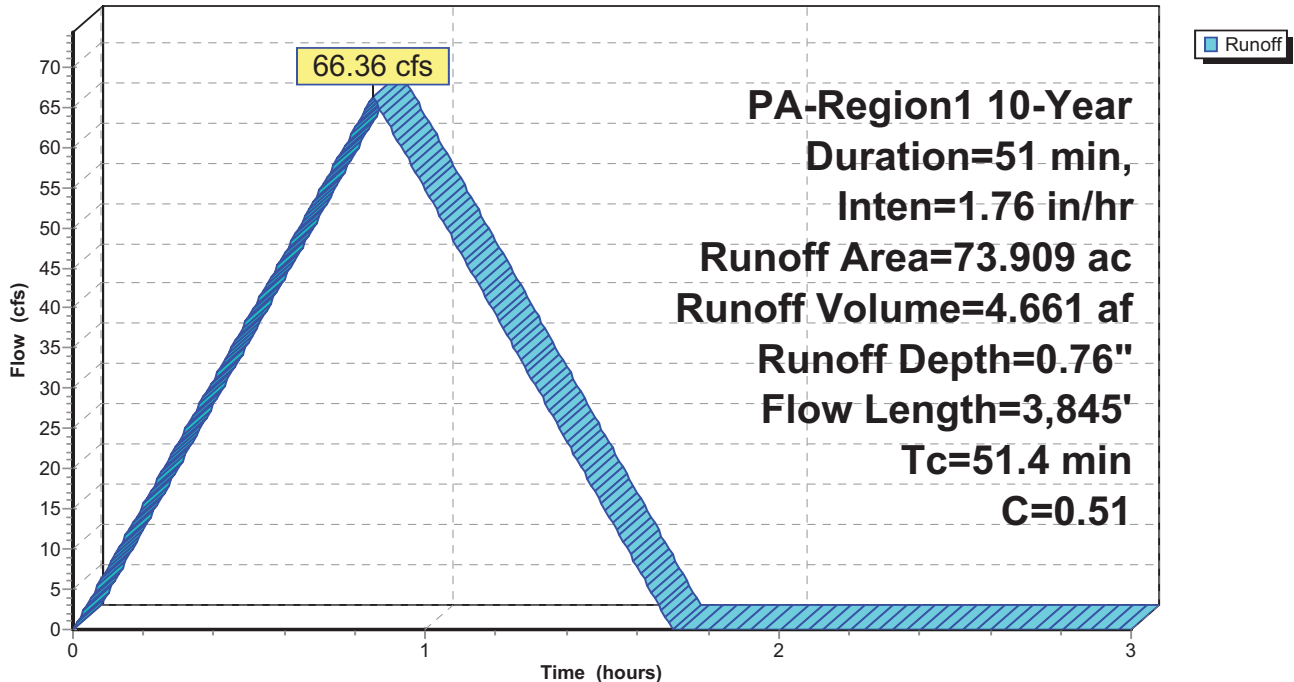
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

Area (ac)	C	Description
36.847	0.30	Woods, Good, HSG D
35.556	0.70	Pasture/grassland/range, Good, HSG D
1.506	0.95	Impervious areas, HSG D
73.909	0.51	Weighted Average
72.403		97.96% Pervious Area
1.506		2.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0420	0.14		<b>Sheet Flow, SHT 1</b> Grass: Dense n= 0.240 P2= 2.54"
6.2	685	0.0700	1.85		<b>Shallow Concentrated Flow, SCF 1</b> Short Grass Pasture Kv= 7.0 fps
8.8	1,028	0.1500	1.94		<b>Shallow Concentrated Flow, SCF 2</b> Woodland Kv= 5.0 fps
24.5	2,032	0.0085	1.38		<b>Shallow Concentrated Flow, SCF 3</b> Grassed Waterway Kv= 15.0 fps
51.4	3,845	Total			

**Subcatchment 24: POST DEVELOPMENT BYPASS DRAINAGE AREA TO CULVERT A**

Hydrograph



# CULVERT A

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Page 5

## Summary for Reach 19: REACH 1

Inflow Area = 6.164 ac, 14.28% Impervious, Inflow Depth = 0.93" for 10-Year event  
Inflow = 8.94 cfs @ 0.85 hrs, Volume= 0.476 af  
Outflow = 8.91 cfs @ 0.97 hrs, Volume= 0.475 af, Atten= 0%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
Max. Velocity= 4.93 fps, Min. Travel Time= 7.0 min  
Avg. Velocity = 2.08 fps, Avg. Travel Time= 16.5 min

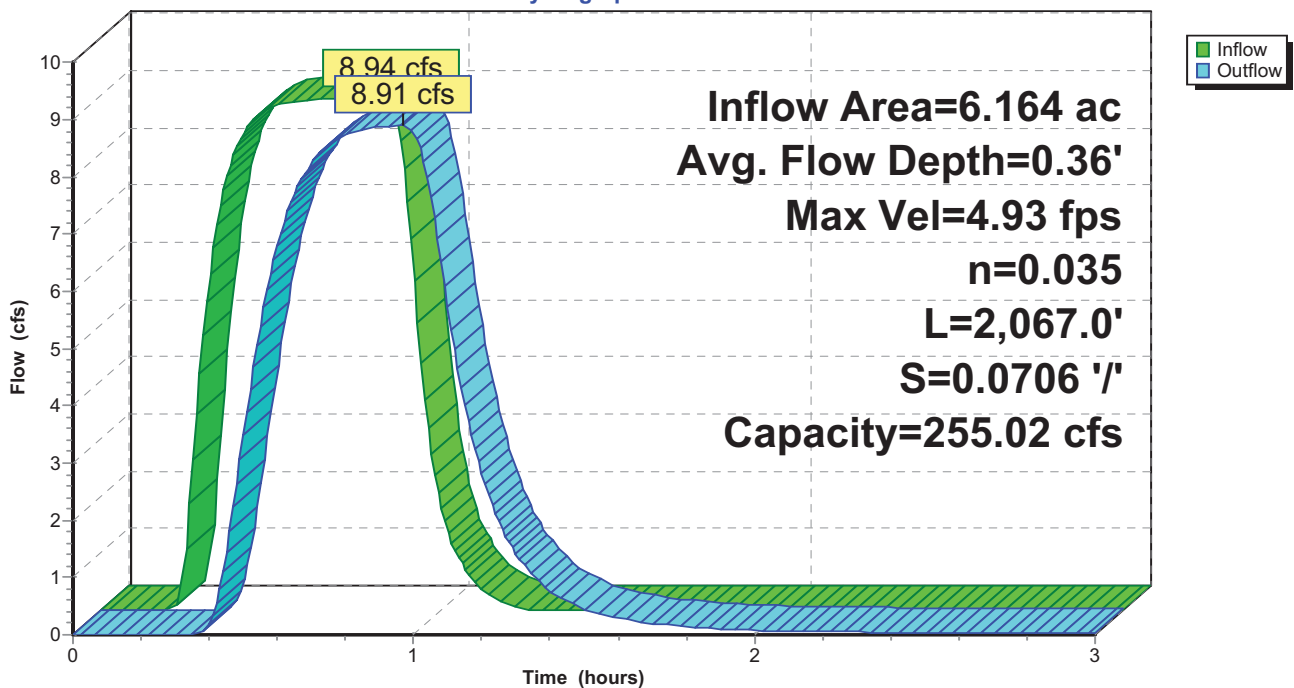
Peak Storage= 3,735 cf @ 0.85 hrs  
Average Depth at Peak Storage= 0.36'  
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 255.02 cfs

4.00' x 2.00' deep channel, n= 0.035  
Side Slope Z-value= 3.0 '/' Top Width= 16.00'  
Length= 2,067.0' Slope= 0.0706 '/'  
Inlet Invert= 1,106.00', Outlet Invert= 960.00'



### Reach 19: REACH 1

Hydrograph



# CULVERT A

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Page 6

## Summary for Reach 21: REACH 2

Inflow Area = 5.232 ac, 30.62% Impervious, Inflow Depth = 1.35" for 10-Year event  
Inflow = 8.35 cfs @ 0.09 hrs, Volume= 0.587 af  
Outflow = 8.17 cfs @ 1.11 hrs, Volume= 0.578 af, Atten= 2%, Lag= 61.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
Max. Velocity= 2.40 fps, Min. Travel Time= 15.6 min  
Avg. Velocity = 1.26 fps, Avg. Travel Time= 29.7 min

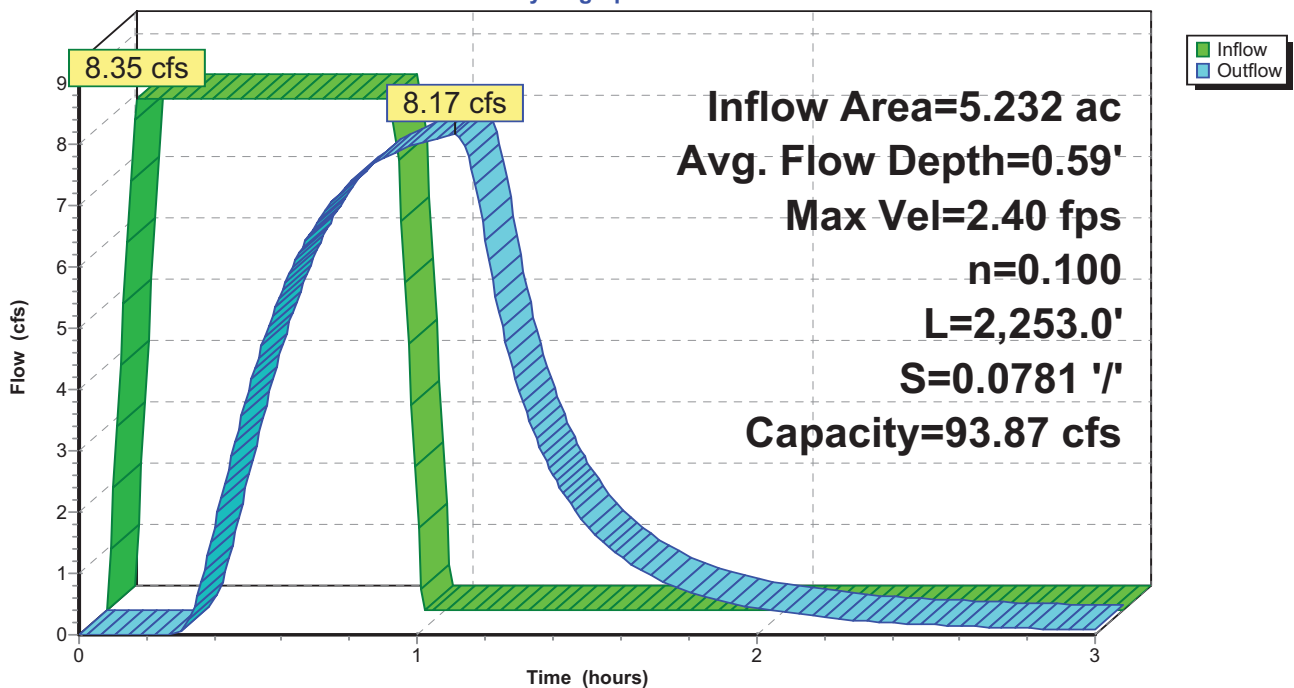
Peak Storage= 7,663 cf @ 0.85 hrs  
Average Depth at Peak Storage= 0.59'  
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 93.87 cfs

4.00' x 2.00' deep channel, n= 0.100  
Side Slope Z-value= 3.0 '/ Top Width= 16.00'  
Length= 2,253.0' Slope= 0.0781 '/  
Inlet Invert= 1,130.00', Outlet Invert= 954.00'



## Reach 21: REACH 2

Hydrograph



**CULVERT A**

PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 7

**Summary for Pond 18: INFILTRATION BASIN 2**

Inflow Area = 6.164 ac, 14.28% Impervious, Inflow Depth = 1.29" for 10-Year event  
 Inflow = 9.41 cfs @ 0.09 hrs, Volume= 0.661 af  
 Outflow = 9.40 cfs @ 0.85 hrs, Volume= 0.568 af, Atten= 0%, Lag= 45.6 min  
 Discarded = 0.46 cfs @ 0.85 hrs, Volume= 0.092 af  
 Primary = 8.94 cfs @ 0.85 hrs, Volume= 0.476 af

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 Peak Elev= 1,120.37' @ 0.85 hrs Surf.Area= 7,549 sf Storage= 8,811 cf

Plug-Flow detention time= 21.2 min calculated for 0.566 af (86% of inflow)  
 Center-of-Mass det. time= 18.0 min ( 46.0 - 28.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,118.00'	56,769 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,118.00	0	0	0
1,120.00	6,243	6,243	6,243
1,122.00	13,256	19,499	25,742
1,124.00	17,771	31,027	56,769

Device	Routing	Invert	Outlet Devices
#1	Primary	1,117.00'	<b>18.0" Round Culvert</b> L= 66.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,117.00' / 1,111.00' S= 0.0909 ' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	1,118.00'	<b>2.660 in/hr Exfiltration over Surface area</b>
#3	Device 1	1,120.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Primary	1,120.50'	<b>20.0' long x 17.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.46 cfs @ 0.85 hrs HW=1,120.37' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.46 cfs)

**Primary OutFlow** Max=8.92 cfs @ 0.85 hrs HW=1,120.37' (Free Discharge)  
 ↳ **1=Culvert** (Passes 8.92 cfs of 13.78 cfs potential flow)  
 ↳ **3=Orifice/Grate** (Weir Controls 8.92 cfs @ 2.00 fps)  
 ↳ **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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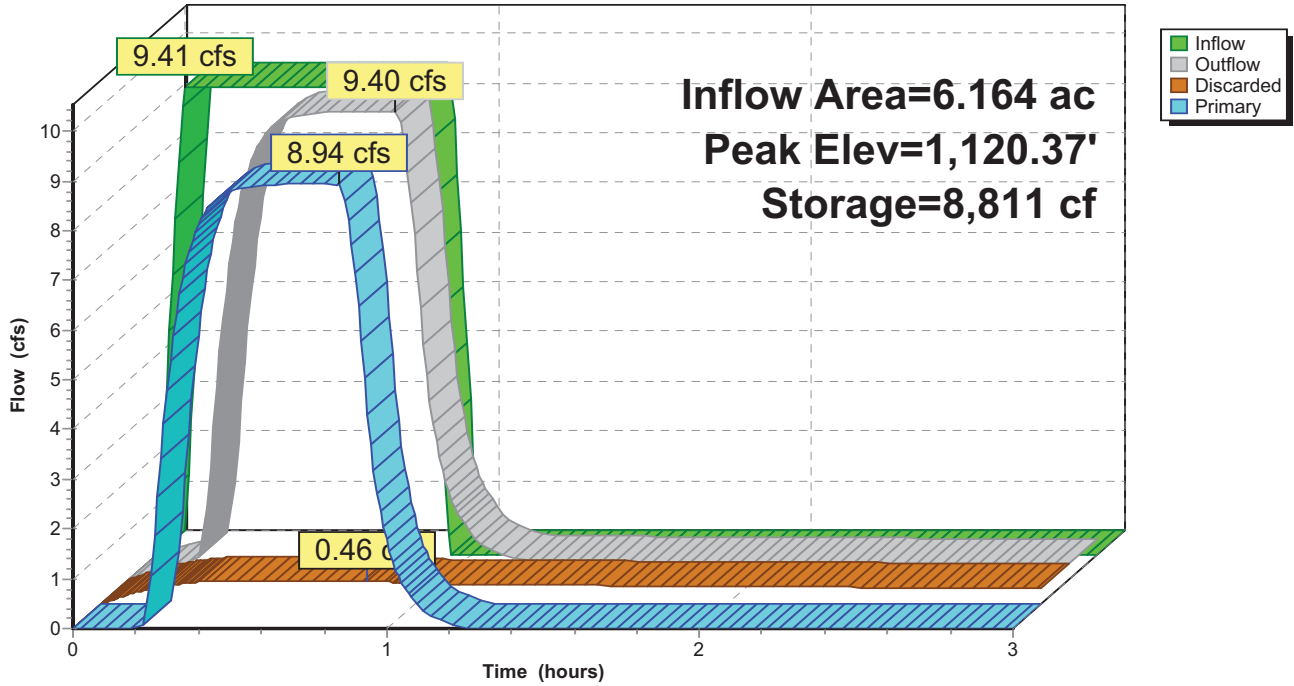
PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 8

**Pond 18: INFILTRATION BASIN 2**

Hydrograph



**CULVERT A**

PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 9

**Summary for Pond 23: INFILTRATION BASIN 1**

Inflow Area = 32.524 ac, 11.56% Impervious, Inflow Depth > 1.08" for 10-Year event  
 Inflow = 43.05 cfs @ 0.85 hrs, Volume= 2.923 af  
 Outflow = 3.63 cfs @ 1.38 hrs, Volume= 0.654 af, Atten= 92%, Lag= 32.0 min  
 Discarded = 1.06 cfs @ 1.38 hrs, Volume= 0.228 af  
 Primary = 2.57 cfs @ 1.38 hrs, Volume= 0.427 af

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs  
 Peak Elev= 953.80' @ 1.38 hrs Surf.Area= 38,139 sf Storage= 113,828 cf

Plug-Flow detention time= 93.7 min calculated for 0.652 af (22% of inflow)  
 Center-of-Mass det. time= 66.7 min ( 105.3 - 38.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.00'	314,703 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.00	5,082	0	0
950.00	16,872	10,977	10,977
952.00	27,255	44,127	55,104
954.00	39,375	66,630	121,734
956.00	51,198	90,573	212,307
958.00	51,198	102,396	314,703

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 77.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0065 ' S= 0.0065 ' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.00'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>8.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	955.00'	<b>8.0" Vert. Orifice/Grate</b> C= 0.600
#6	Primary	957.00'	<b>30.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.06 cfs @ 1.38 hrs HW=953.80' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 1.06 cfs)

**Primary OutFlow** Max=2.58 cfs @ 1.38 hrs HW=953.80' (Free Discharge)

↑ **1=Culvert** (Passes 2.58 cfs of 18.90 cfs potential flow)  
 ↑ **3=Orifice/Grate** (Orifice Controls 1.43 cfs @ 7.30 fps)  
 ↑ **4=Orifice/Grate** (Orifice Controls 1.14 cfs @ 3.28 fps)  
 ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**CULVERT A**

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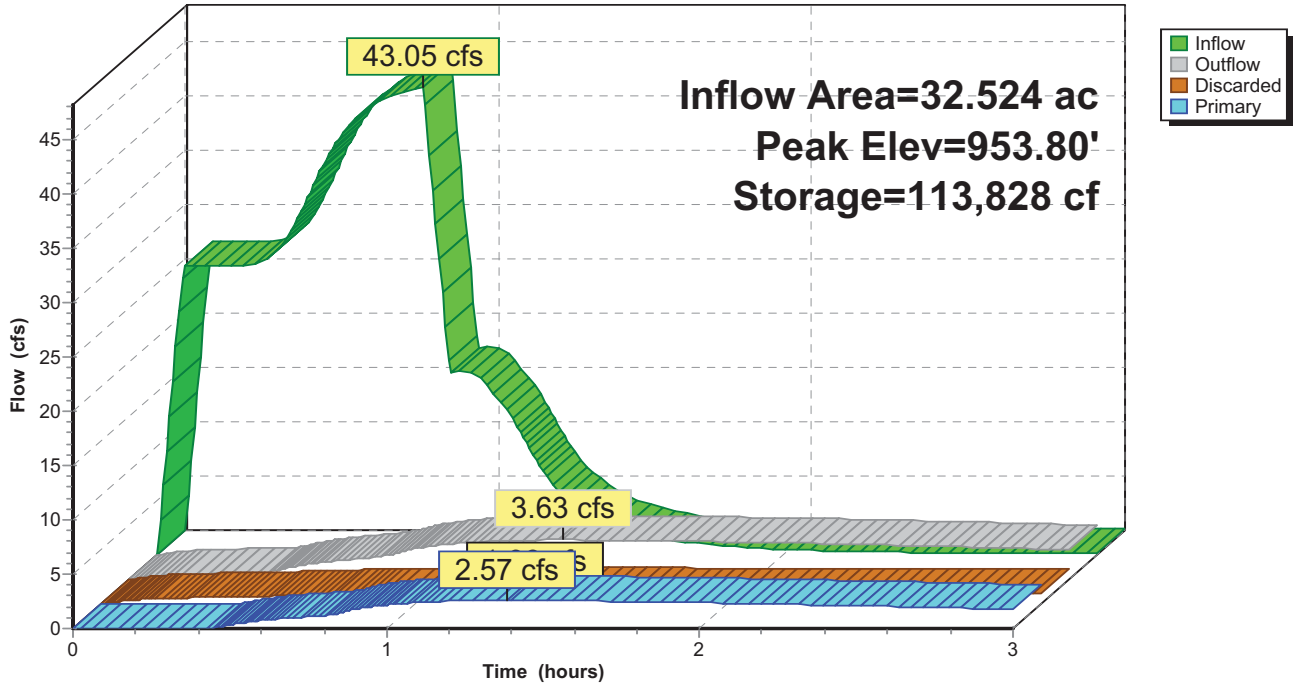
PA-Region1 10-Year Duration=51 min, Inten=1.76 in/hr

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Page 10

**Pond 23: INFILTRATION BASIN 1**

Hydrograph





An Employee-Owned Company

## **A.4 PCSM BMP Calculations**





**E&S WORKSHEET # 11**

**Channel Design Data**

PROJECT NAME: ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION 605

LOCATION: CLINTON TOWNSHIP, WYOMING COUNTY, PENNSYLVANIA

PREPARED BY: AOE

DATE: 11/18/2015

CHECKED BY: AJB

DATE: 11/18/2015

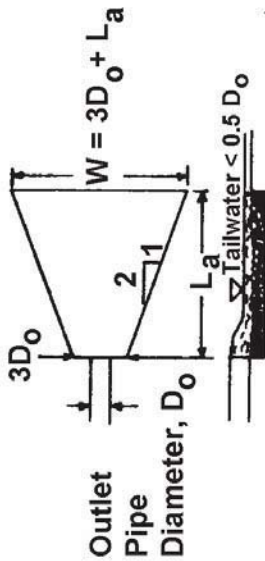
CHANNEL OR CHANNEL SECTION	EMERGENCY SPILLWAY BASIN 1 WEIR	EMERGENCY SPILLWAY BASIN 1 CHANNEL	EMERGENCY SPILLWAY BASIN 2 WEIR	EMERGENCY SPILLWAY BASIN 2 CHANNEL	
TEMPORARY OR PERMANENT? (T OR P)	P	P	P	P	
DESIGN STORM (2, 5, OR 10 YR)	100	100	100	100	
ACRES (AC)	THE REQUIRED CAPACITY IS THE 100 YEAR STORM DISCHARGE THROUGH THE EMERGENCY SPILLWAY IF THE OUTLET STRUCTURE IS NOT FUNCTIONING				
MULTIPLIER <sup>1</sup> (1.6, 2.25, or 2.75) <sup>1</sup>					
Q <sub>r</sub> (REQUIRED CAPACITY) (CFS)	<b>7.27</b>	<b>7.27</b>	<b>26.96</b>	<b>26.96</b>	
Q (CALCULATED AT FLOW DEPTH d) (CFS)	<b>7.27</b>	<b>7.32</b>	<b>27.18</b>	<b>27.64</b>	
PROTECTIVE LINING <sup>2</sup>	<b>GRASS/P550</b>	<b>GRASS/P550</b>	<b>GRASS/P550</b>	<b>GRASS/P550</b>	
n (MANNING'S COEFFICIENT) <sup>2</sup>	<b>0.136</b>	<b>0.121</b>	<b>0.076</b>	<b>0.067</b>	
V <sub>a</sub> (ALLOWABLE VELOCITY) (FPS)	N/A	N/A	N/A	N/A	
V (CALCULATED AT FLOW DEPTH d) (FPS)	<b>0.72</b>	<b>2.35</b>	<b>1.66</b>	<b>5.60</b>	
τ <sub>a</sub> (MAX ALLOWABLE SHEAR STRESS) (LB/FT <sup>2</sup> )	12.00	12.00	12.00	12.00	
τ <sub>d</sub> (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT <sup>2</sup> )	<b>0.37</b>	<b>4.12</b>	<b>0.57</b>	<b>6.38</b>	
CHANNEL BOTTOM WIDTH (FT)	15	15	15	15	
CHANNEL SIDE SLOPES (H:V)	3	3	3	3	
D (TOTAL DEPTH) (FT)	1.0	1.0	1.0	1.0	
CHANNEL TOP WIDTH @ D (FT)	21	21	21	21	
d (CALCULATED FLOW DEPTH) (FT)	<b>0.60</b>	<b>0.20</b>	<b>0.92</b>	<b>0.31</b>	
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	<b>18.60</b>	<b>16.20</b>	<b>20.52</b>	<b>16.86</b>	
BOTTOM WIDTH: FLOW DEPTH RATIO (12:1 MAX)	<b>25.00</b>	<b>75.00</b>	<b>16.30</b>	<b>48.39</b>	
d50 STONE SIZE (IN)	N/A	N/A	N/A	N/A	
A (CROSS-SECTIONAL AREA) (SQ. FT.)	<b>10.08</b>	<b>3.12</b>	<b>16.34</b>	<b>4.94</b>	
R (HYDRAULIC RADIUS)	<b>0.54</b>	<b>0.19</b>	<b>0.78</b>	<b>0.29</b>	
S (BED SLOPE) <sup>3</sup> (FT/FT)	0.01	0.33	0.01	0.33	
S <sub>c</sub> (CRITICAL SLOPE) (FT/FT)	<b>0.335</b>	<b>0.371</b>	<b>0.092</b>	<b>0.099</b>	
.7S <sub>c</sub> (FT/FT)	<b>0.234</b>	<b>0.260</b>	<b>0.065</b>	<b>0.069</b>	
1.3S <sub>c</sub> (FT/FT)	<b>0.435</b>	<b>0.482</b>	<b>0.120</b>	<b>0.129</b>	
STABLE FLOW? (Y/N)	<b>Y</b>	<b>N</b>	<b>Y</b>	<b>Y</b>	
FREEBOARD BASED ON UNSTABLE FLOW (FT)	<b>0.03</b>	<b>0.04</b>	<b>0.11</b>	<b>0.13</b>	
FREEBOARD BASED ON STABLE FLOW (FT)	0.50	0.50	0.50	0.50	
MINIMUM REQUIRED FREEBOARD <sup>4</sup> (FT)	0.50	0.50	0.50	0.50	
DESIGN METHOD FOR PROTECTIVE LINING <sup>5</sup> 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.

**INFILTRATION BASIN 1 OUTFALL - RIP RAP APRON DESIGN**

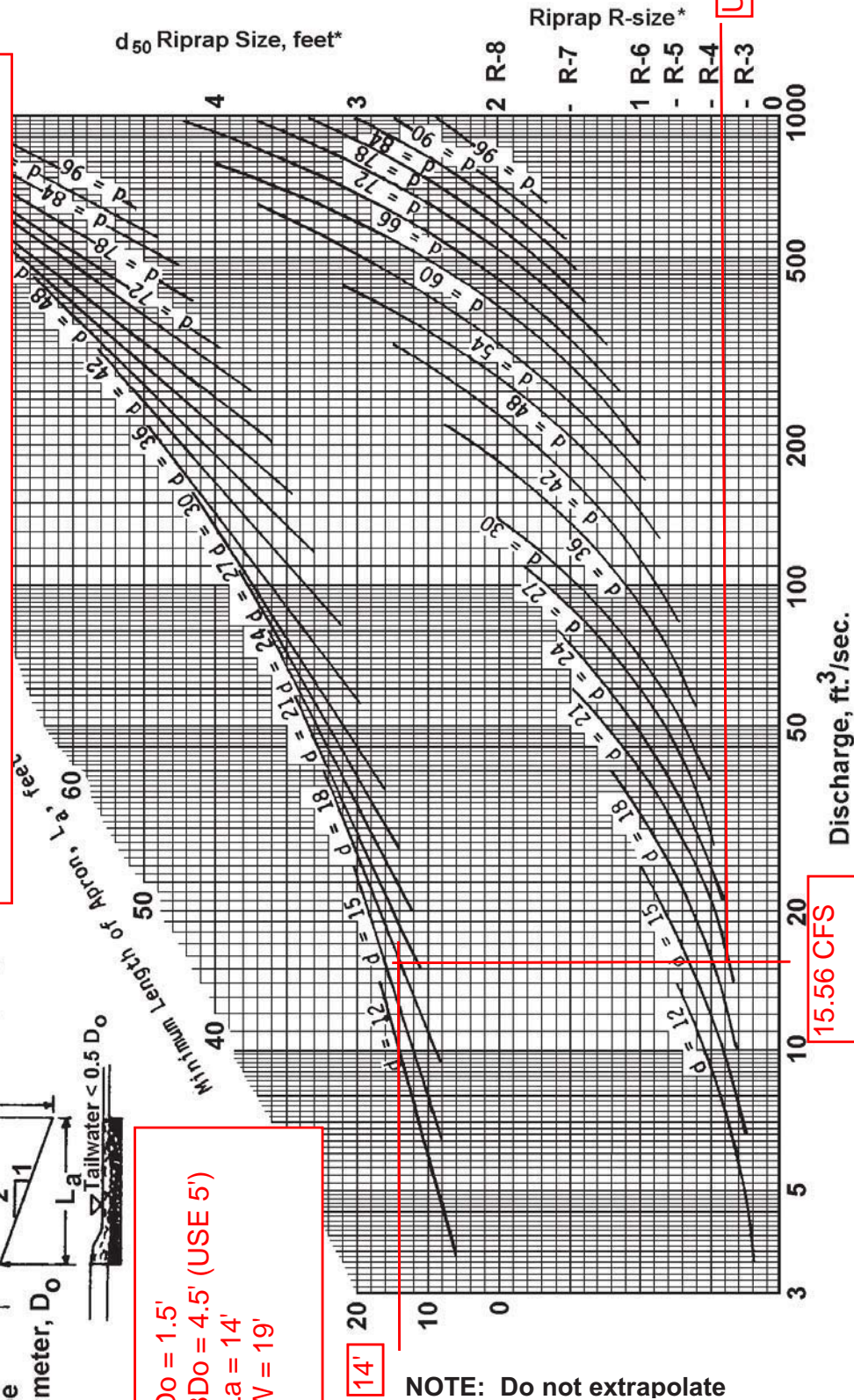
DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = 9.0 FPS  
 (E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.7)  
 CALCULATED VELOCITY = 8.87 FPS  
 (INFILTRATION BASIN 1 CULVERT REPORT)



$D_o = 1.5'$   
 $3D_o = 4.5'$  (USE 5')  
 $L_a = 14'$   
 $W = 19'$

**FIGURE 9.3**  
**Riprap Apron Design, Minimum Tailwater Condition**



Use R-5

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

Not to be used for Box Culverts

# Culvert Report

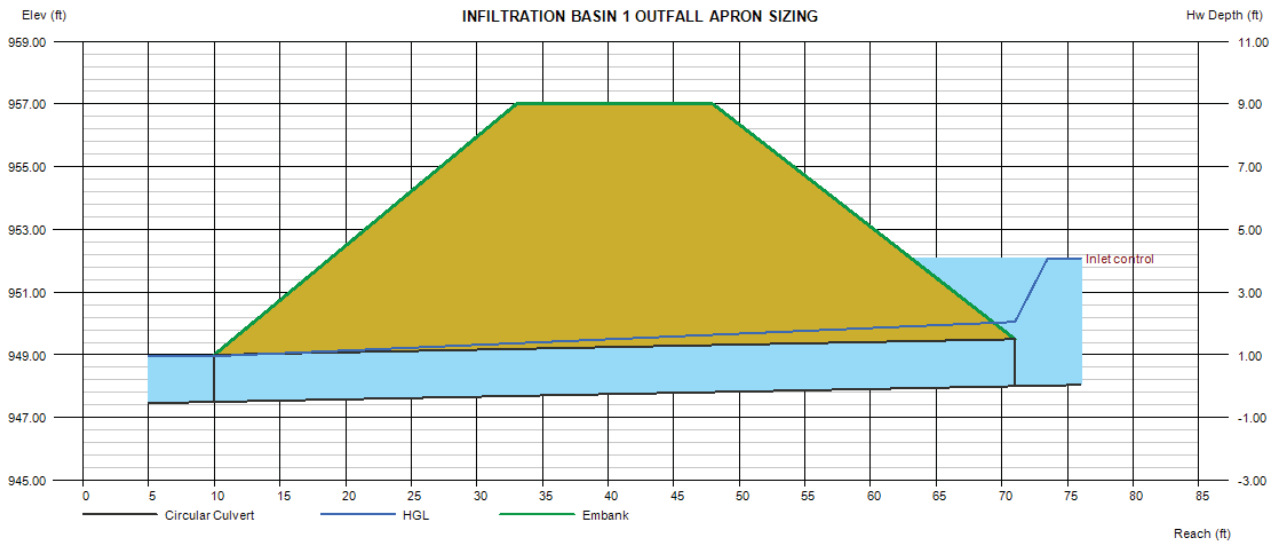
## INFILTRATION BASIN 1 OUTFALL APRON SIZING

Invert Elev Dn (ft)	= 947.50
Pipe Length (ft)	= 61.00
Slope (%)	= 0.82
Invert Elev Up (ft)	= 948.00
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

<b>Embankment</b>	
Top Elevation (ft)	= 957.00
Top Width (ft)	= 15.00
Crest Width (ft)	= 15.00

<b>Calculations</b>	
Qmin (cfs)	= 15.56
Qmax (cfs)	= 15.56
Tailwater Elev (ft)	= (dc+D)/2

<b>Highlighted</b>	
Qtotal (cfs)	= 15.56
Qpipe (cfs)	= 15.56
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 8.87
Veloc Up (ft/s)	= 8.81
HGL Dn (ft)	= 948.96
HGL Up (ft)	= 950.05
Hw Elev (ft)	= 952.08
Hw/D (ft)	= 2.72
Flow Regime	= Inlet Control



**Summary for Pond 10: INFILTRATION BASIN 1**

[62] Hint: Exceeded Reach 8 OUTLET depth by 1.99' @ 13.20 hrs

Inflow Area = 32.560 ac, 9.98% Impervious, Inflow Depth = 3.77" for 100-yr event  
 Inflow = 81.74 cfs @ 12.22 hrs, Volume= 10.217 af  
 Outflow = 17.16 cfs @ 13.09 hrs, Volume= 10.217 af, Atten= 79%, Lag= 52.0 min  
 Discarded = 1.46 cfs @ 13.09 hrs, Volume= 3.040 af  
 Primary = 15.70 cfs @ 13.09 hrs, Volume= 7.177 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 956.32' @ 13.09 hrs Surf.Area= 52,410 sf Storage= 226,358 cf

Plug-Flow detention time= 403.6 min calculated for 10.202 af (100% of inflow)  
 Center-of-Mass det. time= 405.5 min ( 1,238.1 - 832.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	949.25'	319,438 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
949.25	5,082	0	0
950.00	16,872	8,233	8,233
952.00	27,255	44,127	52,360
954.00	39,375	66,630	118,990
956.00	51,198	90,573	209,563
958.00	58,677	109,875	319,438

Device	Routing	Invert	Outlet Devices
#1	Primary	948.00'	<b>18.0" Round Culvert</b> L= 61.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 948.00' / 947.50' S= 0.0082 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	949.25'	<b>1.200 in/hr Exfiltration over Surface area</b>
#3	Device 1	951.25'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	953.00'	<b>12.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	956.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#6	Primary	957.00'	<b>15.0' long x 15.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=1.46 cfs @ 13.09 hrs HW=956.32' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 1.46 cfs)

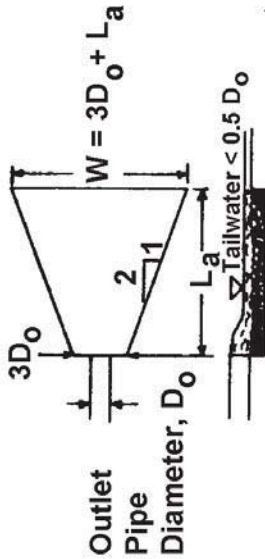
**Primary OutFlow** Max=15.65 cfs @ 13.09 hrs HW=956.32' (Free Discharge)  
 ↳ **1=Culvert** (Passes 15.65 cfs @ 23.42 cfs potential flow)  
 ↳ **3=Orifice/Grate** (Orifice Controls 2.08 cfs @ 10.57 fps)  
 ↳ **4=Orifice/Grate** (Orifice Controls 6.35 cfs @ 8.09 fps)  
 ↳ **5=Orifice/Grate** (Weir Controls 7.22 cfs @ 1.86 fps)  
 ↳ **6=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**INFILTRATION BASIN  
 1 OUTFALL  
 DISCHARGE**

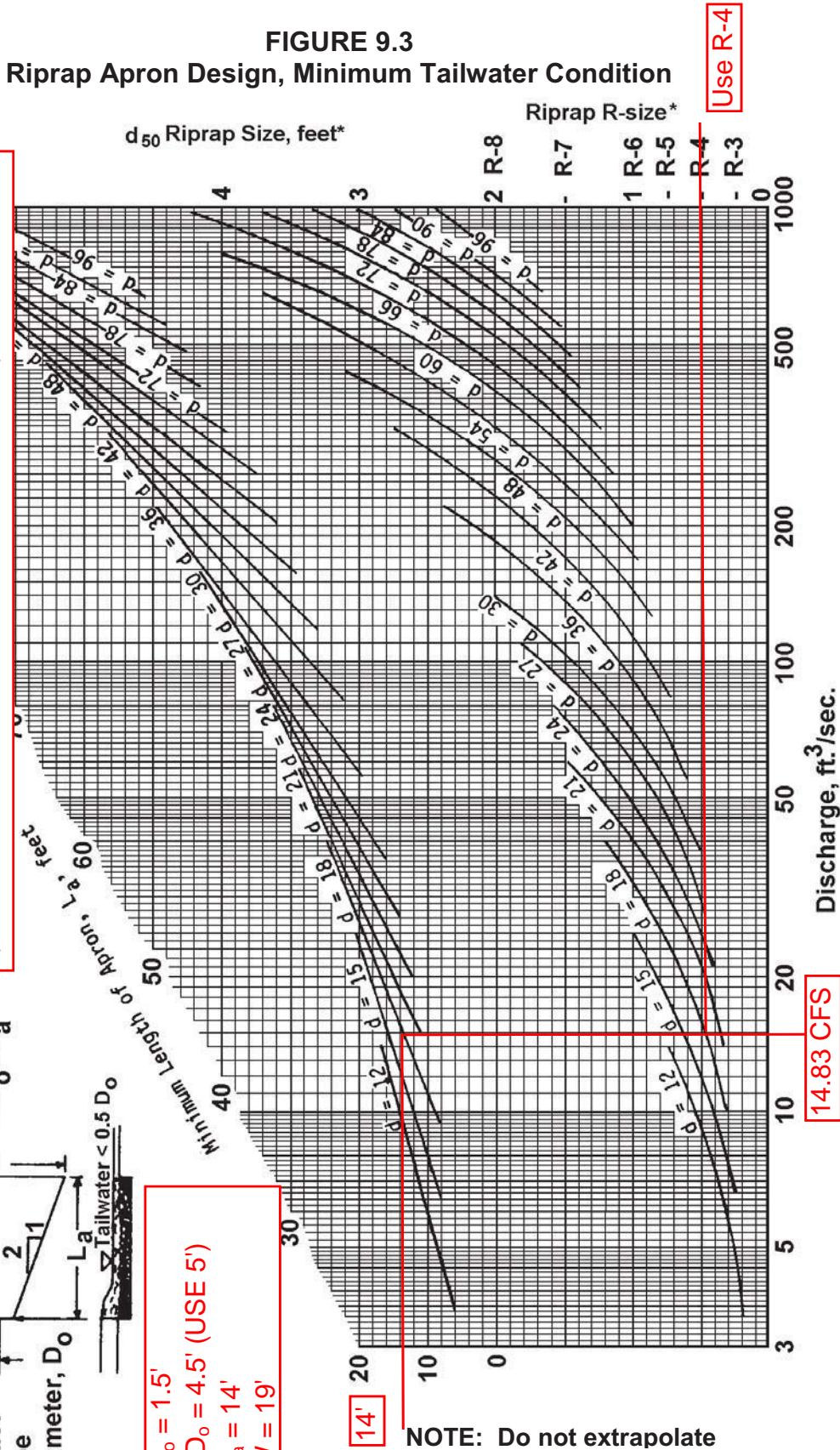
**INFILTRATION BASIN 2 OUTFALL - RIP RAP APRON DESIGN**

DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = 9.0 FPS  
 (E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.7)  
 CALCULATED VELOCITY = 8.39 FPS  
 (INFILTRATION BASIN 2, 100 YEAR SUMMARY)



$D_o = 1.5'$   
 $3D_o = 4.5'$  (USE 5')  
 $L_a = 14'$   
 $W = 19'$



NOTE: Do not extrapolate

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

Not to be used for Box Culverts

**Summary for Pond 5: INFILTRATION BASIN 2**

Inflow Area = 6.090 ac, 6.08% Impervious, Inflow Depth = 4.39" for 100-yr event  
 Inflow = 28.49 cfs @ 12.02 hrs, Volume= 2.228 af  
 Outflow = 23.89 cfs @ 12.10 hrs, Volume= 2.228 af, Atten= 16%, Lag= 4.7 min  
 Discarded = 0.56 cfs @ 12.10 hrs, Volume= 0.681 af  
 Primary = 23.33 cfs @ 12.10 hrs, Volume= 1.547 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs  
 Peak Elev= 1,120.79' @ 12.10 hrs Surf.Area= 9,018 sf Storage= 12,282 cf

Plug-Flow detention time= 74.1 min calculated for 2.225 af (100% of inflow)  
 Center-of-Mass det. time= 74.7 min ( 881.3 - 806.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,118.00'	56,769 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,118.00	0	0	0
1,120.00	6,243	6,243	6,243
1,122.00	13,256	19,499	25,742
1,124.00	17,771	31,027	56,769

Device	Routing	Invert	Outlet Devices
#1	Primary	1,117.00'	<b>18.0" Round Culvert</b> L= 126.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,117.00' / 1,106.00' S= 0.0873 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Discarded	1,118.00'	<b>2.660 in/hr Exfiltration over Surface area</b>
#3	Device 1	1,120.00'	<b>24.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Primary	1,120.50'	<b>20.0' long x 17.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.55 cfs @ 12.10 hrs HW=1,120.79' (Free Discharge)  
 2=Exfiltration (Exfiltration Controls 0.55 cfs)

**Primary OutFlow** Max=23.21 cfs @ 12.10 hrs HW=1,120.79' (Free Discharge)  
 1=Culvert (Inlet Controls 14.83 cfs @ 8.39 fps)  
 3=Orifice/Grate (Passes 14.83 cfs of 27.53 cfs potential flow)  
 4=Broad-Crested Rectangular Weir (Weir Controls 8.38 cfs @ 1.45 fps)

**INFILTRATION BASIN**  
**2** **OUTFALL**  
**DISCHARGE**

# Weir Report

## BERM 1 WEIR FLOW (100 YR DISCHARGE FROM SWALE 1B)

### Rectangular Weir

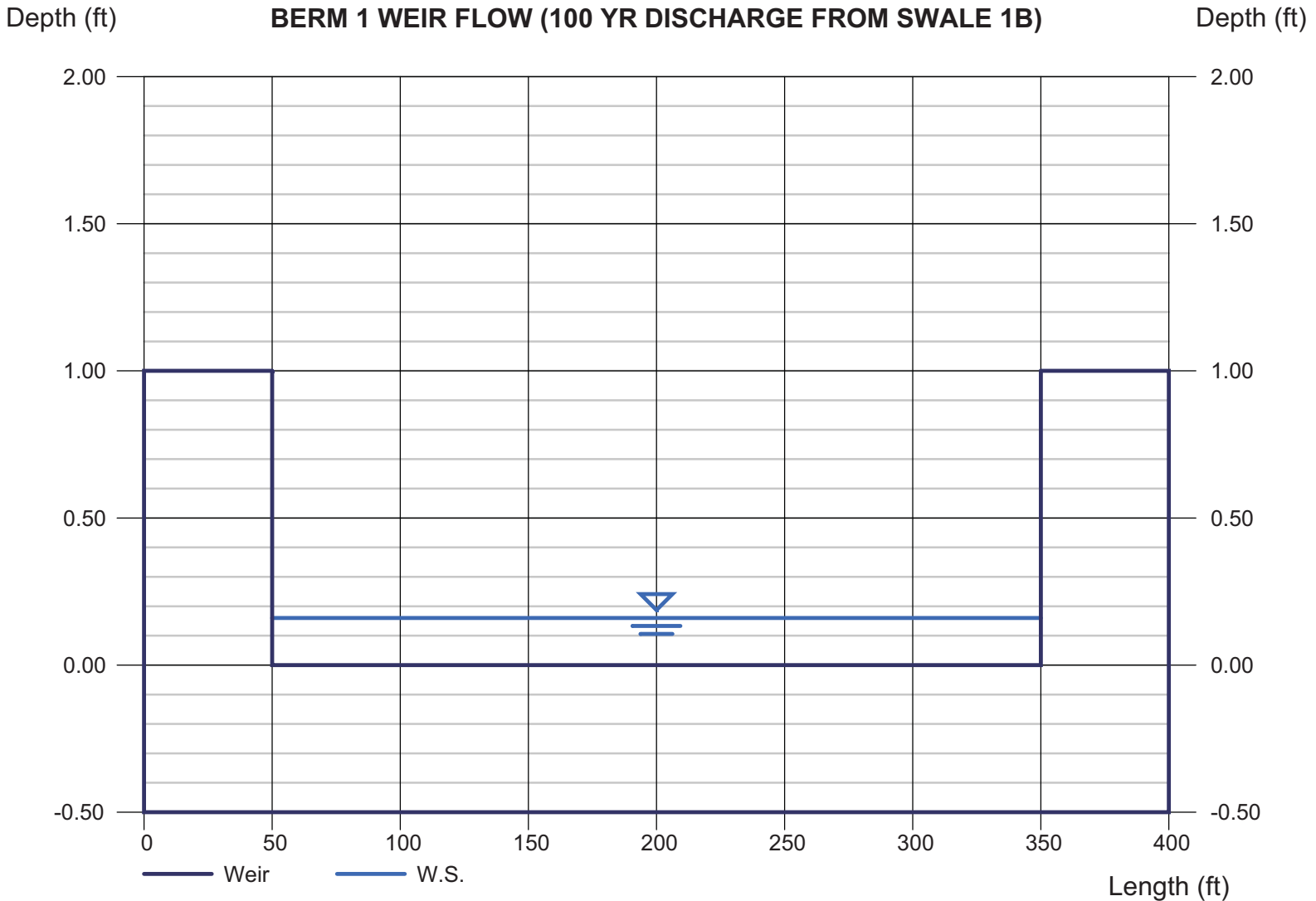
Crest = Broad  
Bottom Length (ft) = 300.00  
Total Depth (ft) = 1.00

### Highlighted

Depth (ft) = 0.16  
Q (cfs) = 50.00  
Area (sqft) = 48.01  
Velocity (ft/s) = 1.04  
Top Width (ft) = 300.00

### Calculations

Weir Coeff. Cw = 2.60  
Compute by: Known Q  
Known Q (cfs) = 50.00



# Weir Report

## BERM 2 WEIR FLOW (100 YR DISCHARGE FROM SWALE 1B)

### Rectangular Weir

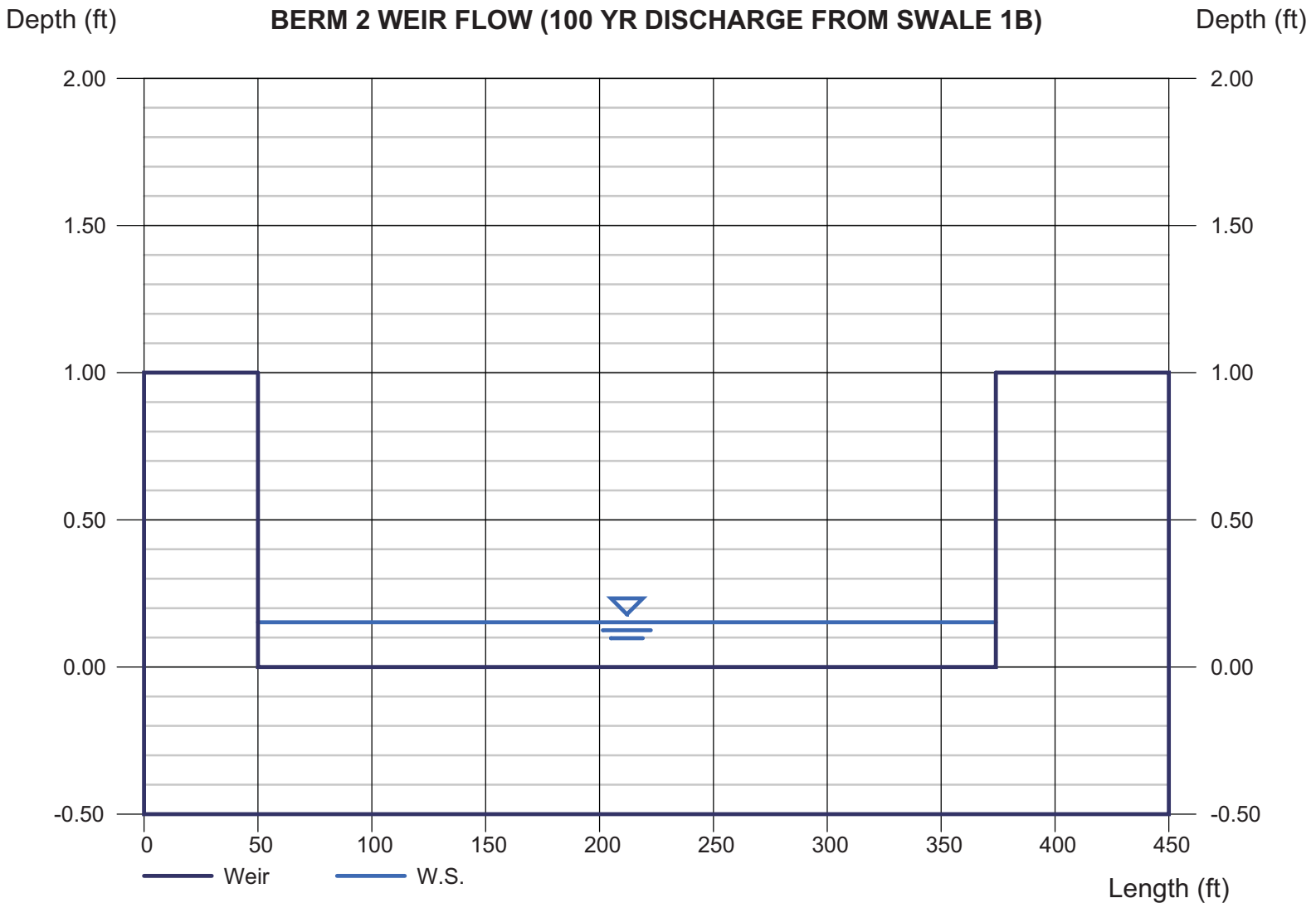
Crest = Broad  
Bottom Length (ft) = 324.00  
Total Depth (ft) = 1.00

### Highlighted

Depth (ft) = 0.15  
Q (cfs) = 50.00  
Area (sqft) = 49.25  
Velocity (ft/s) = 1.02  
Top Width (ft) = 324.00

### Calculations

Weir Coeff. Cw = 2.60  
Compute by: Known Q  
Known Q (cfs) = 50.00



# Weir Report

## BERM 3 WEIR FLOW (100 YR DISCHARGE FROM SWALE 1B)

### Rectangular Weir

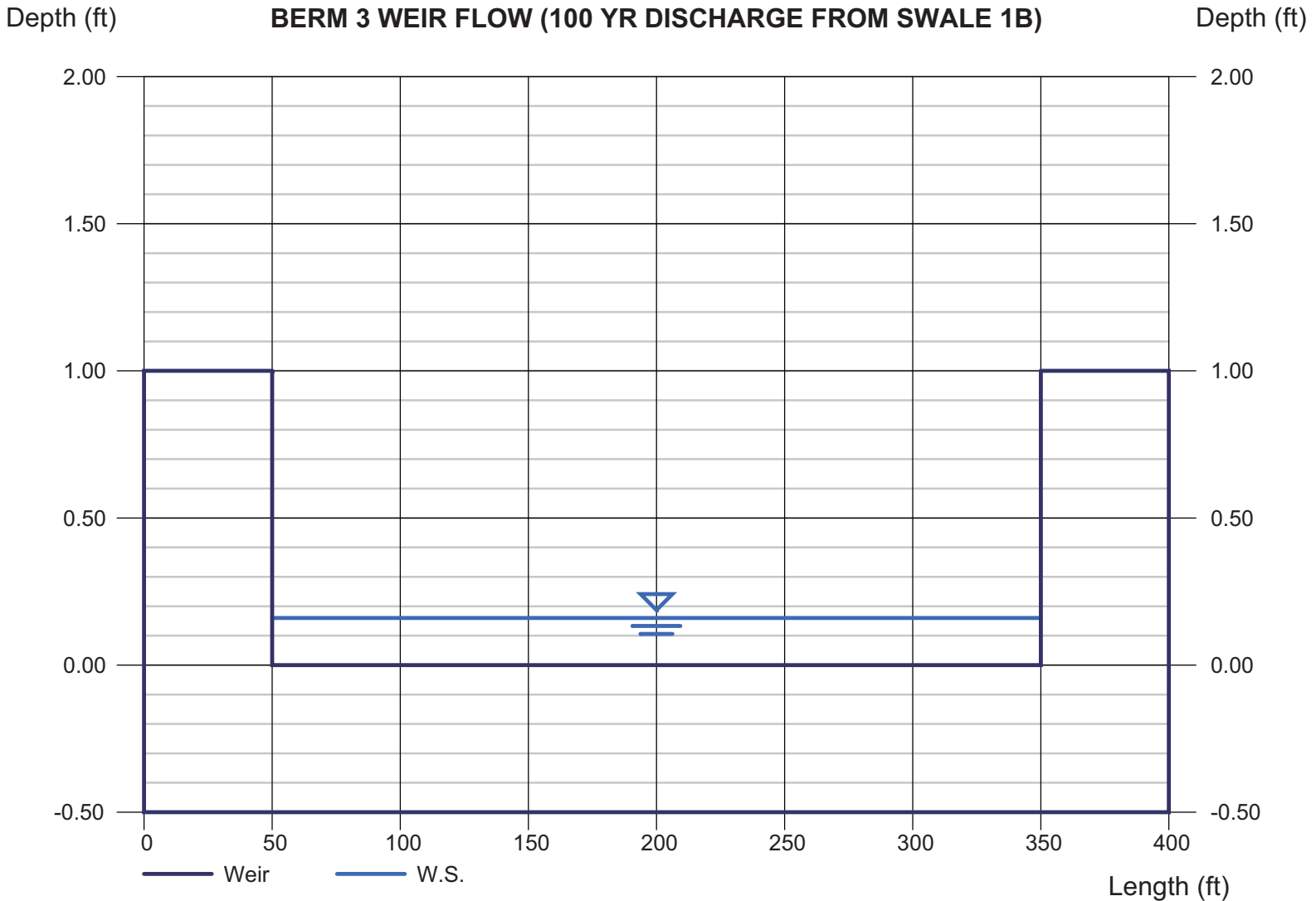
Crest = Broad  
Bottom Length (ft) = 300.00  
Total Depth (ft) = 1.00

### Highlighted

Depth (ft) = 0.16  
Q (cfs) = 50.00  
Area (sqft) = 48.01  
Velocity (ft/s) = 1.04  
Top Width (ft) = 300.00

### Calculations

Weir Coeff. Cw = 2.60  
Compute by: Known Q  
Known Q (cfs) = 50.00



# Weir Report

## BERM 4 WEIR FLOW (100 YR DISCHARGE FROM SWALE 1B)

### Rectangular Weir

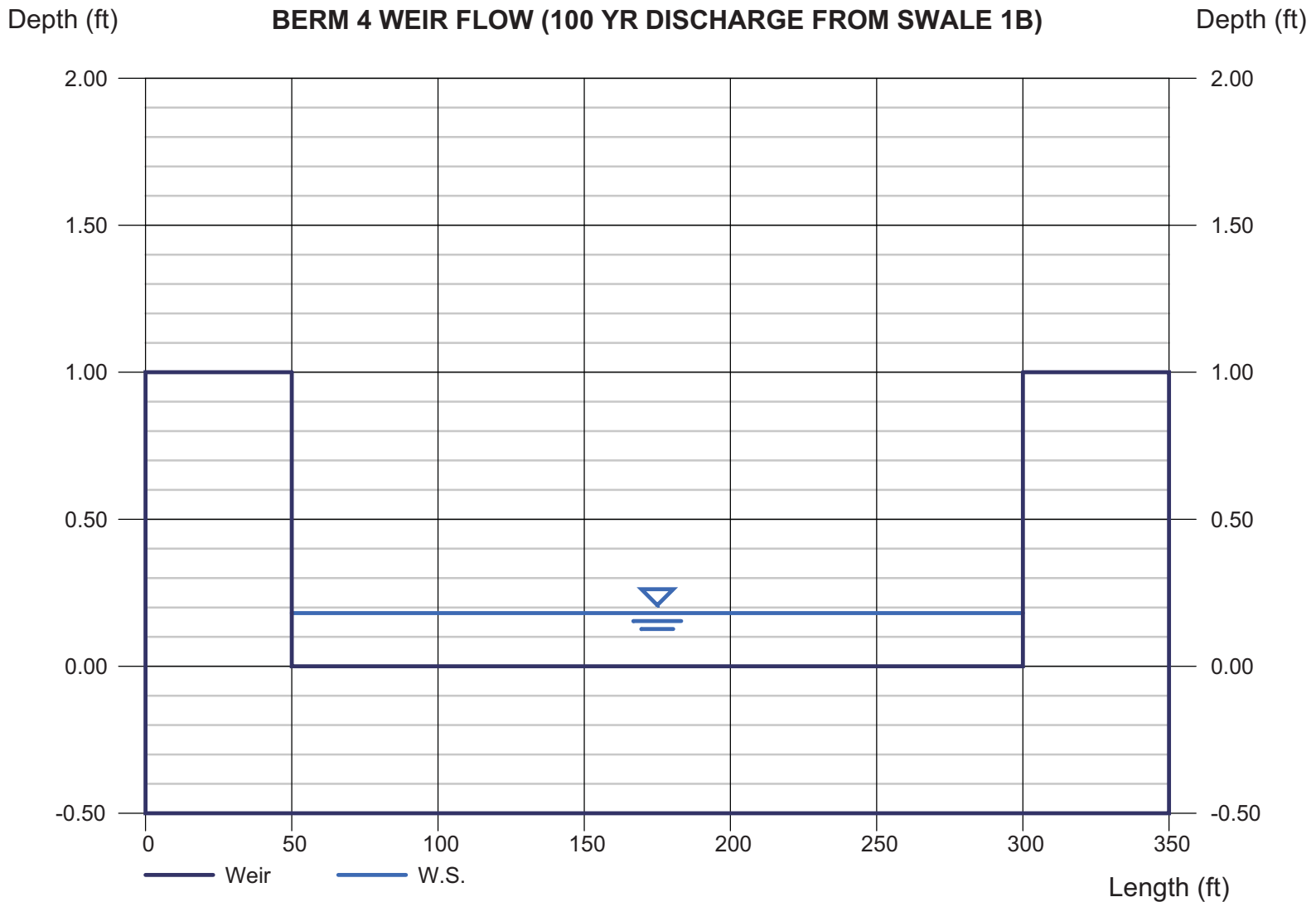
Crest = Broad  
Bottom Length (ft) = 250.00  
Total Depth (ft) = 1.00

### Highlighted

Depth (ft) = 0.18  
Q (cfs) = 50.00  
Area (sqft) = 45.18  
Velocity (ft/s) = 1.11  
Top Width (ft) = 250.00

### Calculations

Weir Coeff. Cw = 2.60  
Compute by: Known Q  
Known Q (cfs) = 50.00



# Weir Report

## BERM 5 WEIR FLOW (100 YR DISCHARGE FROM SWALE 1B)

### Rectangular Weir

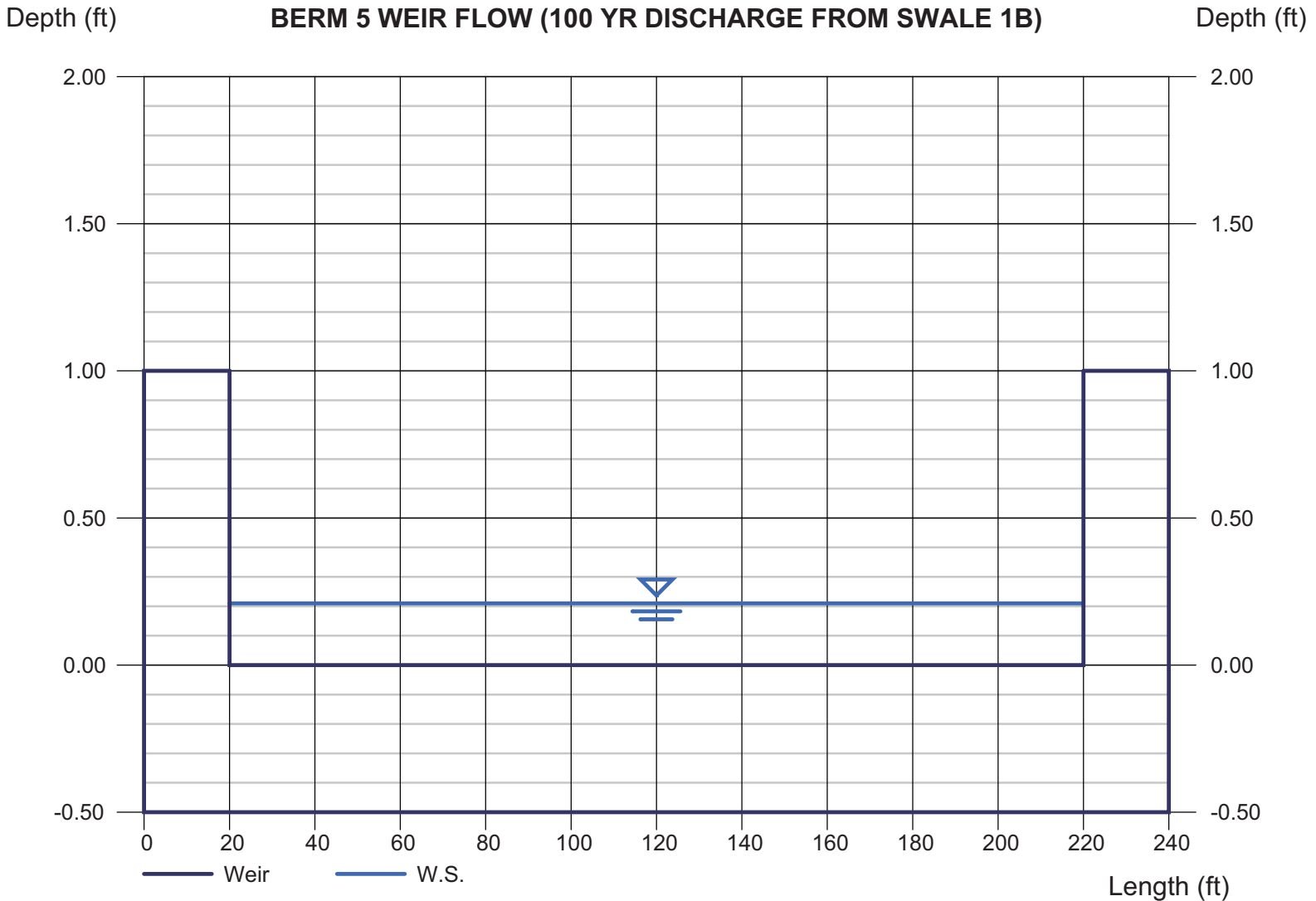
Crest = Broad  
Bottom Length (ft) = 200.00  
Total Depth (ft) = 1.00

### Highlighted

Depth (ft) = 0.21  
Q (cfs) = 50.00  
Area (sqft) = 41.94  
Velocity (ft/s) = 1.19  
Top Width (ft) = 200.00

### Calculations

Weir Coeff. Cw = 2.60  
Compute by: Known Q  
Known Q (cfs) = 50.00





An Employee-Owned Company

## **A.5 Water Quality Worksheets**



## Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 30-Oct-15

Project Name: Atlantic Sunrise Project - Compressor Station 605 - POI A & B

Municipality: Clinton Township

County: Wyoming County

Total Area (acres): 31.56

Major River Basin: Susquehanna River

<http://www.dep.state.pa.us/dep/depupdate/watermgt/wc/default.htm#newtopics>

Watershed: South Branch Tunkhannock Creek

Sub-Basin: UNT

Nearest Surface Water(s) to Receive Runoff: UNT

Chapter 93 - Designated Water Use: CWF

<http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

Impaired according to Chapter 303(d) List? Yes

<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm> No

List Causes of Impairment: \_\_\_\_\_

*Is project subject to, or part of:*

Municipal Separate Storm Sewer System (MS4) Requirements? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterM](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm) No

[anagement/GeneralPermits/default.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm)

Existing or planned drinking water supply? Yes

No

If yes, distance from proposed discharge (miles): \_\_\_\_\_

Approved Act 167 Plan? Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagem](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html) No

[ent/Approved\\_1.html](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html)

Existing River Conservation Plan? Yes

<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/> No

## Worksheet 2. Sensitive Natural Resources

**INSTRUCTIONS:**

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	NA	0.00	NA
Floodplains	NA	0.00	NA
Riparian Areas	NA	0.00	NA
Wetlands	NA	0.00	NA
Woodlands	Y	2.32	2.32
Natural Drainage Ways	NA	0.00	NA
Steep Slopes, 15% - 25%	Y	3.71	3.71
Steep Slopes, over 25%	Y	0.58	0.58
Other:			
Other:			
<b>TOTAL EXISTING:</b>		6.61	6.61

**Worksheet 3. Nonstructural BMP Credits**

**PROTECTED AREA**

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	<u>6.61</u> Ac.
1.2 Area of Riparian Forest Buffer Protection	<u>-</u> Ac.
3.1 Area of Minimum Disturbance/Reduced Grading	<u>2.25</u> Ac.
<b>TOTAL</b>	<u>8.86</u> Ac.

Site Area	minus	Protected Area	=	Stormwater Management Area
<u>31.56</u>	-	<u>8.86</u>	=	<u>22.7</u>
<i>This is the area that requires stormwater management</i>				

**VOLUME CREDITS**

**3.1 Minimum Soil Compaction**

Lawn	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
Meadow	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>

**3.3 Protect Existing Trees**

*For Trees within 100 feet of impervious area:*

Tree Canopy	<u>          </u> ft <sup>2</sup>	x 1/2" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For Trees within 20 feet of impervious area:*

Tree Canopy	<u>          </u>	x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**5.1 Disconnect Roof Leaders to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Roof Area	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For all other disconnected roof areas*

Roof Area	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**5.2 Disconnect Non-Roof impervious to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Impervious Area	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For all other disconnected roof areas*

Impervious Area	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**TOTAL NON-STRUCTURAL VOLUME CREDIT\***            - ft<sup>3</sup>

*\* For use on Worksheet 5*

**WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT**

**PROJECT:** Atlantic Sunrise Project - Compressor Station 605 - POI A & B

**DA:**

**2-Year Rainfall:** 2.54 in

**Total Site Area:** 31.56 acres

**Protected Site Area:** 8.86 acres

**Managed Area:** 22.70 acres

**Existing Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Impervious	D	-	0.00	98	0.20	0.04	2.31	-
Meadow	D	1,273,680.00	29.24	78	2.82	0.56	0.81	86,396
Woods	D	101,058.00	2.32	77	2.99	0.60	0.77	6,446.77
<b>TOTAL:</b>		1,374,738.00	31.56					92,842.36

**Developed Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Impervious	D	172,510.00	3.96	98	0.20	0.04	2.31	33,215
Meadow	D	1,103,279.00	25.33	78	2.82	0.56	0.81	74,837
Woods	D	101,058.00	2.32	77	2.99	0.60	0.77	6,447
Gravel	D	265,400.00	6.09	91	0.99	0.20	1.65	36,422
<b>TOTAL:</b>		1,642,247.00	37.70					150,921.40

**2-Year Volume Increase (ft<sup>3</sup>)** 58,079

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where

P = 2-Year Rainfall (in)

S =  $(1000 / CN) - 10$

2. Runoff Volume (CF) = Q x Area x 1/12

Q = Runoff (in)

Area = Land use area (sq. ft.)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

## WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

**PROJECT:** Atlantic Sunrise Project - Compressor Station 605 - POI A & B

**SUB-BASIN:** \_\_\_\_\_

Required Control Volume (ft<sup>3</sup>) - from Worksheet 4: 58,079  
 Non-structural Volume Credit (ft<sup>3</sup>) - from Worksheet 3: - 0

Structural Volume Reqmt (ft<sup>3</sup>) 58,079  
 (Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft <sup>2</sup> )	Storage Volume (ft <sup>3</sup> )
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin	29,604	39,622
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretenion		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale	16,976	NA
6.4.9	Vegetated Filter Strip		
6.4.10	Berm	24,005	25,468
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	25,468	NA
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft<sup>3</sup>): 65,090  
 Structural Volume Requirement (ft<sup>3</sup>): 58,079

DIFFERENCE 7,011

## WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

**PRIMARY BMPs FOR NITRATE:**

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.5.4 - Cluster Uses at Each Site	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.1 - Minimize Total Disturbed Area	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.9.1 - Street Sweeping / Vacuuming	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>

**SECONDARY BMPs FOR NITRATE:**

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.2 - Minimize Soil Compaction	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.5 - Rain Garden / Bioretention	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.8 - Vegetated Swale	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.9 - Vegetated Filter Strip	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.6.1 - Constructed Wetland	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.3 - Soils Amendment/Restoration	<input type="checkbox"/>	<input type="checkbox"/>

## Worksheet 1. General Site Information

**INSTRUCTIONS:** Fill out Worksheet 1 for each watershed

**Date:**

**Project Name:**

**Municipality:**

**County:**

**Total Area (acres):**

**Major River Basin:**

<http://www.dep.state.pa.us/dep/depupdate/watermgt/wc/default.htm#newtopics>

**Watershed:**

**Sub-Basin:**

**Nearest Surface Water(s) to Receive Runoff:**

**Chapter 93 - Designated Water Use:**

<http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

**Impaired according to Chapter 303(d) List?** Yes

<http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm> No

**List Causes of Impairment:**

*Is project subject to, or part of:*

**Municipal Separate Storm Sewer System (MS4) Requirements?** Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterM](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm) No

[anagement/GeneralPermits/default.htm](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm)

**Existing or planned drinking water supply?** Yes

No

**If yes, distance from proposed discharge (miles):** \_\_\_\_\_

**Approved Act 167 Plan?** Yes

[http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagem](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html) No

[ent/Approved\\_1.html](http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html)

**Existing River Conservation Plan?** Yes

<http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/> No

## Worksheet 2. Sensitive Natural Resources

### INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	NA	0.00	NA
Floodplains	NA	0.00	NA
Riparian Areas	NA	0.00	NA
Wetlands	NA	0.00	NA
Woodlands	NA	0.00	0.00
Natural Drainage Ways	NA	0.00	NA
Steep Slopes, 15% - 25%	NA	0.00	0.00
Steep Slopes, over 25%	NA	0.00	0.00
Other:			
Other:			
<b>TOTAL EXISTING:</b>		0.00	0.00

**Worksheet 3. Nonstructural BMP Credits**

**PROTECTED AREA**

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	<u>          </u>	Ac.
1.2 Area of Riparian Forest Buffer Protection	<u>    -    </u>	Ac.
3.1 Area of Minimum Disturbance/Reduced Grading	<u>    5.31    </u>	Ac.
<b>TOTAL</b>	<u>    5.31    </u>	Ac.

Site Area	minus	Protected Area	=	Stormwater Management Area
<u>    19.14    </u>	-	<u>    5.31    </u>	=	<u>    13.83    </u>
		<i>This is the area that requires stormwater management</i>		

**VOLUME CREDITS**

**3.1 Minimum Soil Compaction**

Lawn	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
Meadow	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>

**3.3 Protect Existing Trees**

*For Trees within 100 feet of impervious area:*

Tree Canopy	<u>          </u> ft <sup>2</sup>	x 1/2" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For Trees within 20 feet of impervious area:*

Tree Canopy	<u>          </u>	x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**5.1 Disconnect Roof Leaders to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Roof Area	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For all other disconnected roof areas*

Roof Area	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**5.2 Disconnect Non-Roof impervious to Vegetated Areas**

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

Impervious Area	<u>          </u> ft <sup>2</sup>	x 1/3" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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*For all other disconnected roof areas*

Impervious Area	<u>          </u> ft <sup>2</sup>	x 1/4" x 1/12	=	<u>          </u> - ft <sup>3</sup>
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**TOTAL NON-STRUCTURAL VOLUME CREDIT\***            - ft<sup>3</sup>

*\* For use on Worksheet 5*

**WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT**

**PROJECT:** Atlantic Sunrise Project - Compressor Station 605 - POI C

**DA:**

**2-Year Rainfall:** 2.54 in

**Total Site Area:** 19.14 acres

**Protected Site Area:** 5.31 acres

**Managed Area:** 13.83 acres

**Existing Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Impervious	D	-	0.00	98	0.20	0.04	2.31	-
Meadow	D	833,548.00	19.14	78	2.82	0.56	0.81	56,541
Woods	D	-	0.00	77	2.99	0.60	0.77	-
<b>TOTAL:</b>		833,548.00	19.14					56,540.79

**Developed Conditions:**

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Impervious	D	-	0.00	98	0.20	0.04	2.31	-
Meadow	D	521,814.00	11.98	78	2.82	0.56	0.81	35,395
Woods	D	-	0.00	77	2.99	0.60	0.77	-
Gravel	D	-	0.00	91	0.99	0.20	1.65	-
<b>TOTAL:</b>		521,814.00	11.98					35,395.41

**2-Year Volume Increase (ft<sup>3</sup>) (21,145)**

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where

P = 2-Year Rainfall (in)

S =  $(1000 / CN) - 10$

2. Runoff Volume (CF) = Q x Area x 1/12

Q = Runoff (in)

Area = Land use area (sq. ft.)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

## WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

**PROJECT:** Atlantic Sunrise Project - Compressor Station 605 - POI C

**SUB-BASIN:** \_\_\_\_\_

Required Control Volume (ft<sup>3</sup>) - from Worksheet 4: (21,145)  
 Non-structural Volume Credit (ft<sup>3</sup>) - from Worksheet 3: - 0

Structural Volume Reqmt (ft<sup>3</sup>) (21,145)  
 (Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft <sup>2</sup> )	Storage Volume (ft <sup>3</sup> )
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretenion		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft<sup>3</sup>): 0  
 Structural Volume Requirement (ft<sup>3</sup>): -21,145

**DIFFERENCE** 21,145

## WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

**PRIMARY BMPs FOR NITRATE:**

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.5.4 - Cluster Uses at Each Site	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.1 - Minimize Total Disturbed Area	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.9.1 - Street Sweeping / Vacuuming	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>

**SECONDARY BMPs FOR NITRATE:**

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.2 - Minimize Soil Compaction	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.5 - Rain Garden / Bioretention	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.8 - Vegetated Swale	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.9 - Vegetated Filter Strip	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.6.1 - Constructed Wetland	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.3 - Soils Amendment/Restoration	<input type="checkbox"/>	<input type="checkbox"/>

Note: No permanent impervious area is proposed within areas tributary to POI C. Therefore, no additional water quality BMPs are required or proposed.

## **A.6 Site Characterization Assessment**



COMPRESSOR STATION 605  
INFILTRATION LOADING RATIO

**Total drainage area to infiltration area = 1,416,745 sf.**

**Impervious area to infiltration area = 49,606 sf.**

**Impervious & Gravel area to infiltration area = 402,962 sf. (contributing gravel area x 0.91 to account for infiltration)**

**Infiltration area provided = 53,609 sf.**

**Impervious loading Ratio = 0.9 : 1**

**Impervious & Gravel loading Ratio = 7.5 : 1**

**Total DA loading Ratio = 26.4 : 1**

**SUMMARY**

**The site will comply with the recommended 5:1 ratio for impervious areas to infiltration areas as suggested in the PA Stormwater management BMP Manual. However, it will not be possible to comply with the recommended 8:1 ratio for over-all drainage area to infiltration areas. This is because there is a large drainage area, including offsite and unimproved areas, that will pass through the stormwater management system. The routing of the offsite drainage areas to the basin is unavoidable due to the construction of an accessible construction drive. Site constraints such as slope and a shallow limiting layer restrict the suitable locations for infiltration. The footprint of the infiltration basin has been maximized to provide the greatest infiltration area feasible. Any further enlargement would require the procurement of additional property as well as necessitate the clearing of more undisturbed land.**

**These measures will keep the infiltration BMPs operational for the life of the installation and result in a PCSM infiltration design that meets the standards of the PCSM Manual. Although the recommended overall drainage area to infiltration area ratio cannot be met, it is our opinion that the proposed design will meet the performance standards of the PA PCSM BMP Manual. The following components of the design will minimize the impacts of not meeting the recommended ratio of drainage area to infiltration area.:**

- 1. The majority of the 'impervious' area is actually gravel, resulting in a greater effective ratio impervious area to infiltration ratio.**
- 2. A factor of safety of 3 was applied to the infiltration rates to provide a conservative design infiltration rate.**
- 3. All infiltration areas will be monitored to ensure detection of any reduction in infiltration rates and repairs will be performed to restore the infiltration characteristics of the soil.**
- 4. Impoundment depth is limited to 2 feet or less to minimize the chances of "sealing" the infiltration bed.**

## **INFILTRATION RATE/DEWATERING TIME**

*Note: the infiltration tests were performed with a double ring infiltrometer. Therefore, no reduction factors were applied.*

*Note: Due to the slopes on site, there is variation in the elevation of the infiltration testing. To account for the variation, the average infiltration rates at the closest test sites are used for the dewatering calculations for the infiltration berms and basin.*

### **INFILTRATION BASIN 1**

#### ***Infiltration Rate***

Test pit 1	0.84	in/hr
Test pit 2	1.38	in/hr
Test pit 3	8.63	in/hr
Average	3.61	in/hr
Safety factor	3.00	
Adjusted rate	1.20	in/hr

#### **Limiting Layer**

*The limiting layer depth in this area of the site varies from below 38 inches to 21 inches. To accommodate the varying limiting layer the cut in this area will be limited to one foot depth. Reductions in the separation distance between the infiltration bed and the limiting layer for shallow or at grade systems are allowable per the PA PCSM BMP manual. The majority of the infiltration bed is expected to be at grade with only small areas requiring any reduction of separation. Therefore we do not expect the limiting layer to impact the effectiveness of the infiltration system.*

#### ***Dewatering time***

Infiltration depth	24	in
Dewatering time	19.9	hr

### **INFILTRATION BASIN 2**

#### ***Infiltration Rate***

Test pit 5	11.63	in/hr
Test pit 6	4.31	in/hr
Average	7.97	in/hr
Safety factor	3.00	
Adjusted rate	2.66	in/hr

#### **Limiting Layer**

*The limiting layer in this area varies from 33 inches to 22 inches. In this basin the majority of the infiltration area is at the existing ground surface. The minor areas of cut have been minimized and limited to one foot depth. Reductions in the separation distance between the infiltration bed and the limiting layer for shallow or at grade systems are allowable per the PA PCSM BMP manual. The majority of the infiltration bed is expected to be at grade with only small areas requiring any reduction of separation. Therefore we do not expect the limiting layer to impact the effectiveness of the infiltration system.*

#### ***Dewatering time***

Infiltration depth	24	in
Dewatering time	9.0	hr

**INFILTRATION BERMS 1 through 5**

***Infiltration Rate***

<b><i>Test pit 1</i></b>	<b>0.84</b>	<b>in/hr</b>
<b><i>Safety factor</i></b>	<b>3.00</b>	
<b><i>Adjusted rate</i></b>	<b>0.28</b>	<b>in/hr</b>

**Limiting Layer**

***The limiting layer in this area is 21 inches. To accommodate the shallow limiting zone the infiltration areas are located at the existing ground surface. These infiltration beds are very shallow and are expected to function well and will not reduce the existing separation between the infiltration ground surface and the limiting zone.***

***Dewatering time***

<b><i>Infiltration depth</i></b>	<b>18</b>	<b>in</b>
<b><i>Dewatering time</i></b>	<b>64.0</b>	<b>hr</b>

**Stage-Area-Storage for Pond 10: INFILTRATION BASIN 1**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
949.25	5,082	0	954.55	42,626	141,540
949.35	6,654	587	954.65	43,217	145,832
949.45	8,226	1,331	954.75	43,809	150,184
949.55	9,798	2,232	954.85	44,400	154,594
949.65	11,370	3,290	954.95	44,991	159,064
949.75	12,942	4,506	955.05	45,582	163,592
949.85	14,514	5,879	955.15	46,173	168,180
949.95	16,086	7,409	955.25	46,764	172,827
950.05	17,132	9,083	955.35	47,356	177,533
950.15	17,651	10,822	955.45	47,947	182,298
950.25	18,170	12,613	955.55	48,538	187,122
950.35	18,689	14,456	955.65	49,129	192,006
950.45	19,208	16,351	955.75	49,720	196,948
950.55	19,727	18,298	955.85	50,311	201,950
950.65	20,246	20,296	955.95	50,902	207,010
950.75	20,766	22,347	956.05	51,385	212,127
950.85	21,285	24,449	956.15	51,759	217,285
950.95	21,804	26,604	956.25	52,133	222,479
951.05	22,323	28,810	956.35	52,507	227,711
951.15	22,842	31,068	956.45	52,881	232,980
951.25	23,361	33,379	956.55	53,255	238,287
951.35	23,881	35,741	956.65	53,629	243,631
951.45	24,400	38,155	956.75	54,003	249,013
951.55	24,919	40,621	956.85	54,377	254,432
951.65	25,438	43,138	956.95	54,751	259,888
951.75	25,957	45,708	957.05	55,124	265,382
951.85	26,476	48,330	957.15	55,498	270,913
951.95	26,995	51,003	957.25	55,872	276,482
952.05	27,558	53,730	957.35	56,246	282,088
952.15	28,164	56,516	957.45	56,620	287,731
952.25	28,770	59,363	957.55	56,994	293,412
952.35	29,376	62,270	957.65	57,368	299,130
952.45	29,982	65,238	957.75	57,742	304,885
952.55	30,588	68,267	957.85	58,116	310,678
952.65	31,194	71,356	957.95	58,490	316,509
952.75	31,800	74,505			
952.85	32,406	77,716			
952.95	33,012	80,987			
953.05	33,618	84,318			
953.15	34,224	87,710			
953.25	34,830	91,163			
953.35	35,436	94,676			
953.45	36,042	98,250			
953.55	36,648	101,885			
953.65	37,254	105,580			
953.75	37,860	109,335			
953.85	38,466	113,152			
953.95	39,072	117,029			
954.05	39,671	120,966			
954.15	40,262	124,963			
954.25	40,853	129,018			
954.35	41,444	133,133			
954.45	42,035	137,307			

← INFILTRATION VOLUME

**Stage-Area-Storage for Pond 5: INFILTRATION BASIN 2**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,118.00	0	0	1,123.30	16,191	44,882
1,118.10	312	16	1,123.40	16,417	46,513
1,118.20	624	62	1,123.50	16,642	48,166
1,118.30	936	140	1,123.60	16,868	49,841
1,118.40	1,249	250	1,123.70	17,094	51,539
1,118.50	1,561	390	1,123.80	17,319	53,260
1,118.60	1,873	562	1,123.90	17,545	55,003
1,118.70	2,185	765	1,124.00	<b>17,771</b>	<b>56,769</b>
1,118.80	2,497	999			
1,118.90	2,809	1,264			
1,119.00	3,122	1,561			
1,119.10	3,434	1,889			
1,119.20	3,746	2,247			
1,119.30	4,058	2,638			
1,119.40	4,370	3,059			
1,119.50	4,682	3,512			
1,119.60	4,994	3,996			
1,119.70	5,307	4,511			
1,119.80	5,619	5,057			
1,119.90	5,931	5,634			
1,120.00	6,243	6,243			
1,120.10	6,594	6,885			
1,120.20	6,944	7,562			
1,120.30	7,295	8,274			
1,120.40	7,646	9,021			
1,120.50	7,996	9,803			
1,120.60	8,347	10,620			
1,120.70	8,698	11,472			
1,120.80	9,048	12,359			
1,120.90	9,399	13,282			
1,121.00	9,750	14,239			
1,121.10	10,100	15,232			
1,121.20	10,451	16,259			
1,121.30	10,801	17,322			
1,121.40	11,152	18,420			
1,121.50	11,503	19,552			
1,121.60	11,853	20,720			
1,121.70	12,204	21,923			
1,121.80	12,555	23,161			
1,121.90	12,905	24,434			
1,122.00	13,256	25,742			
1,122.10	13,482	27,079			
1,122.20	13,708	28,438			
1,122.30	13,933	29,820			
1,122.40	14,159	31,225			
1,122.50	14,385	32,652			
1,122.60	14,610	34,102			
1,122.70	14,836	35,574			
1,122.80	15,062	37,069			
1,122.90	15,288	38,587			
1,123.00	15,514	40,127			
1,123.10	15,739	41,689			
1,123.20	15,965	43,275			

**INFILTRATION  
VOLUME**



**Stage-Area-Storage for Pond BERM 4: INFILTRATION BERM 5**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
973.00	0	0	974.06	3,054	1,629
973.02	58	1	974.08	3,105	1,691
973.04	116	2	974.10	3,156	1,753
973.06	174	5	974.12	3,207	1,817
973.08	232	9	974.14	3,258	1,882
973.10	290	15	974.16	3,309	1,947
973.12	348	21	974.18	3,360	2,014
973.14	406	28	974.20	3,411	2,082
973.16	464	37	974.22	3,462	2,150
973.18	522	47	974.24	3,513	2,220
973.20	580	58	974.26	3,563	2,291
973.22	638	70	974.28	3,614	2,363
973.24	696	84	974.30	3,665	2,435
973.26	754	98	974.32	3,716	2,509
973.28	812	114	974.34	3,767	2,584
973.30	870	131	974.36	3,818	2,660
973.32	928	149	974.38	3,869	2,737
973.34	986	168	974.40	3,920	2,815
973.36	1,044	188	974.42	3,971	2,894
973.38	1,102	209	974.44	4,022	2,974
973.40	1,160	232	974.46	4,073	3,055
973.42	1,218	256	974.48	4,124	3,137
973.44	1,276	281	974.50	<b>4,175</b>	<b>3,220</b>
973.46	1,334	307			
973.48	1,392	334			
973.50	1,451	363			
973.52	1,509	392			
973.54	1,567	423			
973.56	1,625	455			
973.58	1,683	488			
973.60	1,741	522			
973.62	1,799	558			
973.64	1,857	594			
973.66	1,915	632			
973.68	1,973	671			
973.70	2,031	711			
973.72	2,089	752			
973.74	2,147	794			
973.76	2,205	838			
973.78	2,263	882			
973.80	2,321	928			
973.82	2,379	975			
973.84	2,437	1,023			
973.86	2,495	1,073			
973.88	2,553	1,123			
973.90	2,611	1,175			
973.92	2,669	1,228			
973.94	2,727	1,282			
973.96	2,785	1,337			
973.98	2,843	1,393			
974.00	2,901	1,451			
974.02	2,952	1,509			
974.04	3,003	1,569			

**INFILTRATION  
VOLUME**



**Stage-Area-Storage for Pond BERM 3: INFILTRATION BERM 4**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
969.00	0	0	970.06	3,610	1,939
969.02	69	1	970.08	3,662	2,012
969.04	138	3	970.10	3,713	2,086
969.06	207	6	970.12	3,765	2,161
969.08	276	11	970.14	3,817	2,237
969.10	346	17	970.16	3,868	2,313
969.12	415	25	970.18	3,920	2,391
969.14	484	34	970.20	3,972	2,470
969.16	553	44	970.22	4,023	2,550
969.18	622	56	970.24	4,075	2,631
969.20	691	69	970.26	4,127	2,713
969.22	760	84	970.28	4,179	2,796
969.24	829	100	970.30	4,230	2,880
969.26	898	117	970.32	4,282	2,965
969.28	967	135	970.34	4,334	3,052
969.30	1,036	155	970.36	4,385	3,139
969.32	1,106	177	970.38	4,437	3,227
969.34	1,175	200	970.40	4,489	3,316
969.36	1,244	224	970.42	4,540	3,407
969.38	1,313	249	970.44	4,592	3,498
969.40	1,382	276	970.46	4,644	3,590
969.42	1,451	305	970.48	4,695	3,684
969.44	1,520	334	970.50	<b>4,747</b>	<b>3,778</b>
969.46	1,589	366			
969.48	1,658	398			
969.50	1,728	432			
969.52	1,797	467			
969.54	1,866	504			
969.56	1,935	542			
969.58	2,004	581			
969.60	2,073	622			
969.62	2,142	664			
969.64	2,211	708			
969.66	2,280	752			
969.68	2,349	799			
969.70	2,419	846			
969.72	2,488	896			
969.74	2,557	946			
969.76	2,626	998			
969.78	2,695	1,051			
969.80	2,764	1,106			
969.82	2,833	1,162			
969.84	2,902	1,219			
969.86	2,971	1,278			
969.88	3,040	1,338			
969.90	3,109	1,399			
969.92	3,179	1,462			
969.94	3,248	1,526			
969.96	3,317	1,592			
969.98	3,386	1,659			
970.00	3,455	1,728			
970.02	3,507	1,797			
970.04	3,558	1,868			

**INFILTRATION  
VOLUME**



**Stage-Area-Storage for Pond BERM2: INFILTRATION BERM 3**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
963.00	0	0	964.06	4,773	2,561
963.02	91	1	964.08	4,844	2,657
963.04	182	4	964.10	4,914	2,755
963.06	274	8	964.12	4,984	2,854
963.08	365	15	964.14	5,055	2,954
963.10	456	23	964.16	5,125	3,056
963.12	547	33	964.18	5,196	3,159
963.14	639	45	964.20	5,266	3,264
963.16	730	58	964.22	5,336	3,370
963.18	821	74	964.24	5,407	3,477
963.20	912	91	964.26	5,477	3,586
963.22	1,004	110	964.28	5,548	3,696
963.24	1,095	131	964.30	5,618	3,808
963.26	1,186	154	964.32	5,688	3,921
963.28	1,277	179	964.34	5,759	4,036
963.30	1,369	205	964.36	5,829	4,151
963.32	1,460	234	964.38	5,900	4,269
963.34	1,551	264	964.40	5,970	4,387
963.36	1,642	296	964.42	6,040	4,508
963.38	1,734	329	964.44	6,111	4,629
963.40	1,825	365	964.46	6,181	4,752
963.42	1,916	402	964.48	6,252	4,876
963.44	2,007	442	<b>964.50</b>	<b>6,322</b>	<b>5,002</b>
963.46	2,099	483			
963.48	2,190	526			
963.50	2,281	570			
963.52	2,372	617			
963.54	2,463	665			
963.56	2,555	715			
963.58	2,646	767			
963.60	2,737	821			
963.62	2,828	877			
963.64	2,920	934			
963.66	3,011	994			
963.68	3,102	1,055			
963.70	3,193	1,118			
963.72	3,285	1,182			
963.74	3,376	1,249			
963.76	3,467	1,318			
963.78	3,558	1,388			
963.80	3,650	1,460			
963.82	3,741	1,534			
963.84	3,832	1,609			
963.86	3,923	1,687			
963.88	4,015	1,766			
963.90	4,106	1,848			
963.92	4,197	1,931			
963.94	4,288	2,015			
963.96	4,380	2,102			
963.98	4,471	2,191			
964.00	4,562	2,281			
964.02	4,632	2,373			
964.04	4,703	2,466			

**INFILTRATION  
VOLUME**



**Stage-Area-Storage for Pond BERM 2: INFILTRATION BERM 2**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
957.00	0	0	958.06	6,694	3,639
957.02	130	1	958.08	6,763	3,774
957.04	260	5	958.10	6,832	3,910
957.06	389	12	958.12	6,901	4,047
957.08	519	21	958.14	6,969	4,186
957.10	649	32	958.16	7,038	4,326
957.12	779	47	958.18	7,107	4,468
957.14	908	64	958.20	7,176	4,610
957.16	1,038	83	958.22	7,244	4,755
957.18	1,168	105	958.24	7,313	4,900
957.20	1,298	130	958.26	7,382	5,047
957.22	1,427	157	958.28	7,451	5,195
957.24	1,557	187	958.30	7,519	5,345
957.26	1,687	219	958.32	7,588	5,496
957.28	1,817	254	958.34	7,657	5,649
957.30	1,946	292	958.36	7,726	5,802
957.32	2,076	332	958.38	7,794	5,958
957.34	2,206	375	958.40	7,863	6,114
957.36	2,336	420	958.42	7,932	6,272
957.38	2,465	468	958.44	8,001	6,432
957.40	2,595	519	958.46	8,069	6,592
957.42	2,725	572	958.48	8,138	6,754
957.44	2,855	628	<b>958.50</b>	<b>8,207</b>	<b>6,918</b>
957.46	2,984	686			
957.48	3,114	747			
957.50	3,244	811			
957.52	3,374	877			
957.54	3,504	946			
957.56	3,633	1,017			
957.58	3,763	1,091			
957.60	3,893	1,168			
957.62	4,023	1,247			
957.64	4,152	1,329			
957.66	4,282	1,413			
957.68	4,412	1,500			
957.70	4,542	1,590			
957.72	4,671	1,682			
957.74	4,801	1,776			
957.76	4,931	1,874			
957.78	5,061	1,974			
957.80	5,190	2,076			
957.82	5,320	2,181			
957.84	5,450	2,289			
957.86	5,580	2,399			
957.88	5,709	2,512			
957.90	5,839	2,628			
957.92	5,969	2,746			
957.94	6,099	2,866			
957.96	6,228	2,990			
957.98	6,358	3,116			
958.00	6,488	3,244			
958.02	6,557	3,374			
958.04	6,626	3,506			

**INFILTRATION  
VOLUME**



**Stage-Area-Storage for Pond 46P: INFILTRATION BERM 1**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
953.00	0	0	954.06	6,291	3,396
953.02	121	1	954.08	6,370	3,523
953.04	242	5	954.10	6,450	3,651
953.06	363	11	954.12	6,530	3,781
953.08	484	19	954.14	6,609	3,912
953.10	605	30	954.16	6,689	4,045
953.12	726	44	954.18	6,768	4,180
953.14	847	59	954.20	6,848	4,316
953.16	968	77	954.22	6,928	4,454
953.18	1,089	98	954.24	7,007	4,593
953.20	1,210	121	954.26	7,087	4,734
953.22	1,331	146	954.28	7,166	4,877
953.24	1,452	174	954.30	7,246	5,021
953.26	1,574	205	954.32	7,326	5,166
953.28	1,695	237	954.34	7,405	5,314
953.30	1,816	272	954.36	7,485	5,463
953.32	1,937	310	954.38	7,564	5,613
953.34	2,058	350	954.40	7,644	5,765
953.36	2,179	392	954.42	7,724	5,919
953.38	2,300	437	954.44	7,803	6,074
953.40	2,421	484	954.46	7,883	6,231
953.42	2,542	534	954.48	7,962	6,389
953.44	2,663	586	954.50	<b>8,042</b>	<b>6,550</b>
953.46	2,784	640			
953.48	2,905	697			
953.50	3,026	757			
953.52	3,147	818			
953.54	3,268	882			
953.56	3,389	949			
953.58	3,510	1,018			
953.60	3,631	1,089			
953.62	3,752	1,163			
953.64	3,873	1,239			
953.66	3,994	1,318			
953.68	4,115	1,399			
953.70	4,236	1,483			
953.72	4,357	1,569			
953.74	4,478	1,657			
953.76	4,600	1,748			
953.78	4,721	1,841			
953.80	4,842	1,937			
953.82	4,963	2,035			
953.84	5,084	2,135			
953.86	5,205	2,238			
953.88	5,326	2,343			
953.90	5,447	2,451			
953.92	5,568	2,561			
953.94	5,689	2,674			
953.96	5,810	2,789			
953.98	5,931	2,906			
954.00	6,052	3,026			
954.02	6,132	3,148			
954.04	6,211	3,271			

**INFILTRATION  
VOLUME**





# Field Observation Report

Project Number: 14C4909  
Project Name: Atlantic Sunrise Project – Compressor Station 605  
Date of Field Visit: March 4, 2015; March 12, 2015; April 7, 2015  
Weather Conditions: Overcast; Sunny; Overcast with light rain      Temperature: Approx 35-40°F; Approx 35-40°F; Approx. 48°F  
Prepared By: Krystal Bealing, APSS and Joseph Kempf

Copies of Report Have Been Sent To:  Client     Contractor     Other

Client:

Transcontinental Gas Pipe Line  
Company, LLC  
2800 Post Oak Blvd  
Houston, TX 77251

Contractor:

BL Companies  
4242 Carlisle Pike, Suite 260  
Camp Hill, PA 17011

Twelve soil pits were excavated by backhoe and described to varying depths. Pit #4 was not dug due to its location with a graveled staging area. Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at depths ranging from the surface to 42 inches.

Weather conditions at the original time of testing limited infiltration results for several pits due to frozen ground conditions. Some of these pits were revisited during April 7, 2015 to obtain infiltration testing results.

It should be noted that fill material was observed in several test pits. Conversation with the landowner and review of historical aeriels suggest the fill has been there for more than five years.

The test pit location map, soil profile descriptions, infiltration worksheet and photographs are attached. Determined limiting layer depths are listed below:

- Pit #1: 60 inches deep, Limiting Layer observed at 21 inches  
Infiltration conducted at 42 inches, Infiltration Rate = 0.844 inches/hour
- Pit #2: 48 inches deep, Limiting Layer observed at 36 inches  
Infiltration conducted at 24 inches, Infiltration Rate = 1.375 inches/hour
- Pit #3: 38 inches deep, No Limiting Layer observed, pit consisted entirely of fill material.  
Infiltration conducted at 6 inches, Infiltration Rate = 8.625 inches/hour

# Field Observation Report

Pit #4: Test pit was not dug.

Pit #5: 40 inches deep, Limiting Layer observed at 33 inches

Infiltration conducted at 12 inches, Infiltration Rate = 11.625 inches/hour

Pit #6: 45 inches deep, Limiting Layer observed at 22 inches

Infiltration conducted at 12 inches, Infiltration Rate = 4.313 inches/hour

Pit #7: 49 inches deep, Limiting Layer observed at 25 inches

Infiltration conducted at 24 inches, Infiltration Rate = 0.438 inches/hour

Pit #8: 48 inches deep, Limiting Layer observed at 13 inches

Infiltration conducted at 24 inches, Infiltration Rate = 0.063 inches/hour

Pit #9: 42 inches deep, Limiting Layer observed at 24 inches but could be shallower due to frozen ground. Pit consisted entirely of fill material.

Infiltration conducted at surface, Infiltration Rate = N/A due to failure

Pit #10: 52 inches deep, Limiting Layer observed at 22 inches

Infiltration conducted at surface, Infiltration Rate = N/A due to failure

Pit #11: 48 inches deep, Limiting Layer observed at 3 inches

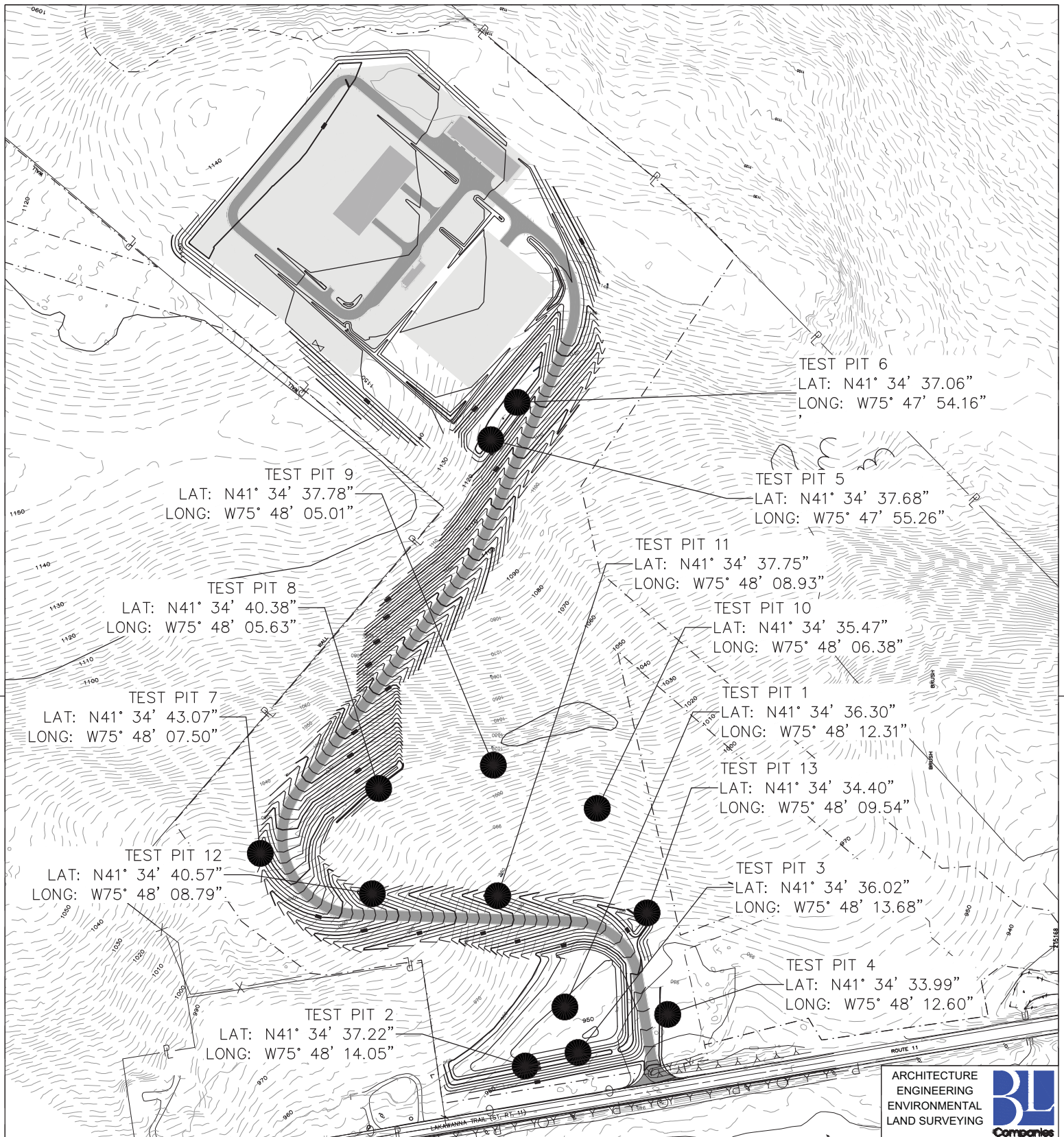
Infiltration conducted at surface, Infiltration Rate = 0.531 inches/hour

Pit #12: 60 inches deep, Limiting Layer observed at 27 inches


Infiltration conducted at three inches, Infiltration Rate = 1.219 inches/hour

Pit #13: 60 inches deep, Limiting Layer observed at 10 inches

Infiltration conducted at surface, Infiltration Rate = 3.094 inches/hour



ARCHITECTURE  
ENGINEERING  
ENVIRONMENTAL  
LAND SURVEYING



**ATLANTIC SUNRISE PROJECT**  
**COMPRESSOR STATION 605**  
 INFILTRATION TEST PIT LOCATIONS  
 CLINTON TOWNSHIP  
 WYOMING COUNTY, PENNSYLVANIA



NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY:	AOE	DATE:	3/27/15	ISSUED FOR BID:	SCALE:	1"=300'
							CHECKED BY:	AJB	DATE:	3/27/15	ISSUED FOR CONSTRUCTION:		
							APPROVED BY:	AJB	DATE:	3/27/15	DRAWING NUMBER:	CS 605 TEST PITS	SHEET
							WO:						1 OF 1



## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605  
**Test Pit #** 1  
**Name** Krystal Bealing  
**Date** March 4, 2015  
**Weather** 35-40°F; Overcast  
**Equipment** Mini Excavator

**Elevation** 957 AMSL  
**Soil Type** Morris channery loam, 8-18% slopes  
**Geology** Catskill Formation  
**Landscape Position/Slope** Hillslope bench, 2-5%  
**Land Use** Agriculture  
**Additional Comments** Approximately 10" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	11	SiL	15-35% Channery	10YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	11	21	SiL	15-35% Channery	10YR 4/4	-	Roots present; Weak, Granular	-	-	-
Bw2	21	36	SiL	15-35% Channery	10YR 4/3	10% 10YR 5/2 5% 7.5YR 5/8	Weak, Granular	-	-	Limiting Layer - Seasonal High Water Table
Bx	36	60+	SiL	15-35% Channery	7.5YR 4/3	20% 7.5YR 5/2 10% 10YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Fragipan

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

# Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 2

**Name** Krystal Bealing

**Date** March 4, 2015

**Weather** 35-40°F; Overcast

**Equipment** Mini Excavator

**Elevation** 954 AMSL

**Soil Type** Morris channery loam, 8-18% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope bench, 2-5%

**Land Use** Agriculture

**Additional Comments** Approximately 10" snow; Approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
F1	0	5	SiL	-	7.5YR 2.5/1	-	Weak, Granular	-	-	Fill Material
F2	5	16	SiL	60-90% Gravelly	10YR 2/2	-	None	-	-	Fill Material
Ab	16	24	SiL	-	10YR 3/3	-	Weak, Granular	-	-	-
Bw	36	48+	SiL	15-35% Channery	10YR 5/2	10% 7.5YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 3

**Name** Krystal Bealing

**Date** March 4, 2015

**Weather** 35-40°F; Overcast

**Equipment** Mini Excavator

**Elevation** 951 AMSL

**Soil Type** Morris channery loam, 8-18% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope bench, 2-5%

**Land Use** Agriculture

**Additional Comments** Approximately 10" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
F1	0	18	SiL	60-90% Channery	10YR 3/3	-	-	-	-	Fill Material
F2	18	32	*	*	-	-	-	-	-	Fill Material *Consisted of flags and cobbles
F3	32	38+	SiL	60-90% Channery	10YR 3/3	-	-	-	-	Fill Material

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

# Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 5

**Name** Krystal Bealing

**Date** March 4, 2015

**Weather** 35-40°F; Overcast

**Equipment** Mini Excavator

**Elevation** 1128 AMSL

**Soil Type** Wellsboro channery loam, 15-25% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Shoulder 10-15%

**Land Use** Agriculture

**Additional Comments** Approximately 10" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	14	SiL	-	10YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	14	22	SiL	-	7.5YR 4/4	-	Roots present; Weak, Subangular Blocky	-	-	-
Bw2	22	33	SiL	-	7.5YR 5/3	-	Weak, Subangular Blocky	-	-	-
Bx	33	40+	SiL	-	7.5YR 5/2	25% 7.5YR 5/6	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 6

**Name** Krystal Bealing

**Date** March 4, 2015

**Weather** 35-40°F; Overcast

**Equipment** Mini Excavator

**Elevation** 1127 AMSL

**Soil Type** Morris channery loam, 8-18% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Shoulder 10-15%

**Land Use** Agriculture

**Additional Comments** Approximately 10" snow; approximately 10" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	15	SiL	-	10YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	15	22	SiL	-	10YR 4/4	-	Roots present; Weak, Subangular Blocky	-	-	-
Bw2	22	30	SiL	-	5YR 3/3	20% 10YR 5/2 10% 7.5YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bx	30	45+	SiL	15-35% Channery	5YR 4/3	10% 10YR 5/2 5% 7.5YR 5/8	Moderate, Subangular Blocky	-	-	-

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 7

**Name** Krystal Bealing

**Date** March 12, 2015

**Weather** 35-40°F; Sunny

**Equipment** Mini Excavator

**Elevation** 1023 AMSL

**Soil Type** Morris channery loam, 8-18% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope, 5-8%

**Land Use** Agriculture

**Additional Comments** Approximately 2" snow; approximately 7" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	3	SiL	15-35% Channery	10YR 3/2	-	Roots present; Weak, Granular	-	-	-
Bw1	3	25	SiL	35-60% Channery	7.5YR 4/3	-	Roots present; Weak, Subangular Blocky	-	-	-
Bw2	25	31	SiL	15-35% Channery	10YR 5/3	10% 7.5YR 4/6	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bx	31	49+	L	15-35% Channery	5YR 3/3	15% 10YR 6/2 5% 7.5YR 5/8	Moderate, Subangular Blocky	-	-	-

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - Compressor Station 605

Test Pit # 8

Name Krystal Bealing

Date March 12, 2015

Weather 35-40°F; Sunny

Equipment Mini Excavator

Elevation 1025 AMSL

Soil Type Morris channery loam, 15-25% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope, 5-8%

Land Use Agriculture

Additional Comments Approximately 12" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
F	0	13	SiL	35-60% Channery	7.5YR 3/2	-	Weak, Granular	-	-	Fill Material
Ab	13	25	SiL	15-35% Channery	10YR 3/3	5% 7.5YR 4/6	Weak, Granular	-	-	Limiting Layer - Seasonal High Water Table
Bw1	25	32	SiL	15-35% Channery	7.5YR 4/3	15% 7.5YR 4/6	Weak, Subangular Blocky	-	-	-
Bw2	32	48+	SiL	15-35% Channery	10YR 4/3	15% 7.5YR 4/6	Weak, Subangular Blocky	-	-	-

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 9

**Name** Krystal Bealing

**Date** March 12, 2015

**Weather** 35-40°F; Sunny

**Equipment** Mini Excavator

**Elevation** 1020 AMSL

**Soil Type** Wellsboro channery loam, 15-25% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope, 5-8%

**Land Use** Agriculture

**Additional Comments** Approximately 2" snow; approximately 24" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
F	0	42+	SiL	35-60% Channery	7.5YR 3/2	-	*	-	24*	Fill Material *Frozen to 24 inches; depth to water is potentially shallower

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

**Project** 14C4909-A Atlantic Sunrise Project - Compressor Station 605

**Test Pit #** 10

**Name** Krystal Bealing

**Date** March 12, 2015

**Weather** 35-40°F; Sunny

**Equipment** Mini Excavator

**Elevation** 993 AMSL

**Soil Type** Wellsboro channery loam, 15-25% slopes

**Geology** Catskill Formation

**Landscape Position/Slope** Hillslope, 5-8%

**Land Use** Agriculture

**Additional Comments** Approximately 9" frozen soil; snow melt infiltration from surface observed

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	22	SiL	15-35% Channery	10YR 3/3	-	Roots present; Weak, Granular	-	9*	*Frozen to 9 inches; depth to water is potentially shallower; however seeps assumed to be due to snow melt
Bw	22	32	SiL	15-35% Channery	10YR 4/3	10% 7.5YR 4/6	Weak, Granular	-	-	Seeps observed; Limiting Layer - Seasonal High Water Table
BE	32	52+	L	15-35% Channery	2.5Y 5/1	40% 10YR 5/8	Strong, Subangular Blocky	-	-	Seeps observed; Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - Compressor Station 605

Test Pit # 11

Name Krystal Bealing

Date March 12, 2015

Weather 35-40°F; Sunny

Equipment Mini Excavator

Elevation 984 AMSL

Soil Type Morris channery loam, 8-18% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope bench, 2-5%

Land Use Agriculture

Additional Comments Approximately 9" frozen soil

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	3	SiL	-	10YR 3/3	-	*	-	-	*Frozen to 9 inches
Bw1	3	20	SiL	15-35% Channery	10YR 6/2	30% 7.5YR 5/6	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bw2	20	27	SiL	15-35% Channery	10YR 5/2	30% 7.5YR 4/6	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
BE	27	48+	L	-	10YR 6/2	40% 7.5YR 5/8	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - Compressor Station 605

Test Pit # 12

Name Joseph Kempf

Date April 7, 2015

Weather 48°F; Overcast with light rain

Equipment Mini Excavator

Elevation 1006 AMSL

Soil Type Morris channery loam, 8-18% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope, 5-8%

Land Use Agriculture

Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	8	SiL	15-35% Channery	10YR 4/2	-	Roots present; Weak, Granular	-	-	-
Bw1	8	30	SiL	15-35% Channery	7.5YR 5/3	-	Weak, Subangular Blocky	-	27	Seeps observed Limiting Layer - Seasonal High Water Table
Bw2	30	38	SiL	35-60% Channery	7.5YR 5/3	5% 10YR 5/6	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
BE	38	60+	L	15-35% Channery	5YR 4/3	10% 10YR 6/2 10% 10YR 5/6	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

## Soil Profile Log

Project 14C4909--A Atlantic Sunrise Project - Compressor Station 605

Test Pit # 13

Name Joseph Kempf

Date April 7, 2015

Weather 48°F; Overcast with light rain

Equipment Mini Excavator

Elevation 962 AMSL

Soil Type Morris channery loam, 8-18% slopes

Geology Catskill Formation

Landscape Position/Slope Hillslope bench, 2-5%

Land Use Agriculture

Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	10	SiL	15-35% Channery	10YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	10	22	SiL	15-35% Channery	7.5YR 3/2	5% 10YR 6/1 20% 10YR 5/6	Moderate, Subangular Blocky	-	14	Seeps observed; Limiting Layer - Seasonal High Water Table
Bw2	22	48	SiL	35-60% Channery	7.5YR 5/3	5% 10YR 6/2 5% 10YR 5/6	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bgx	48	54	CL	-	5G 5/1	-	Moderate, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bw3	54	60+	SL	15-35% Channery	10YR 5/1	5% 5G 5/1	Weak, Granular	-	-	Limiting Layer - Seasonal High Water Table

Note: Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION 605

SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD

Hole Number	Drop >2 inches after 30 minute presoak? <sup>1</sup>	Reading Interval (minutes)	Reading 1 (Inches of Drop)	Reading 2 (Inches of Drop)	Reading 3 (Inches of Drop)	Reading 4 (Inches of Drop)	Reading 5 (Inches of Drop)	Reading 6 (Inches of Drop)	Reading 7 (Inches of Drop)	Reading 8 (Inches of Drop)	Average Stabilized Reading <sup>2</sup> (Inches of Drop)	Infiltration Rate <sup>3</sup> (in/hr)	Comments
1	No	30	0.625	0.375	0.313	0.500	0.500				0.422	0.844	35-40 degrees, overcast. Test done at 42" below surface. Ground was frozen to approx. 18" below surface.
2	No	30	1.375	0.750	0.750	0.625	0.625				0.688	1.375	35-40 degrees, overcast. Test done at 24" below surface. Ground was frozen to approx. 18" below surface.
3	Yes	10	2.438	2.313	1.500	1.500	1.375	1.375			1.438	8.625	Approximately 48 degrees, overcast with a slight drizzle. Test done at 6" below surface.
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Testing not completed due to location of pit within a graveled staging area.
5	Yes	10	3.250	2.000	1.875	1.875	2.000				1.938	11.625	35-40 degrees, overcast. Test done at 12" below surface. Ground was frozen to approx. 8" below surface.
6	Yes	10	0.750	0.625	0.750	0.750					0.719	4.313	35-40 degrees, overcast. Test done at 12" below surface. Ground was frozen to approx. 10" below surface.
7	No	30	0.188	0.250	0.250	0.188					0.219	0.438	Approximately 35-40 degrees, sunny. Test done at 24" below surface. Ground was frozen to approx. 7" below surface.

ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION 605

SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTRMETER METHOD

Hole Number	Drop >2 inches after 30 minute presoak? <sup>1</sup>	Reading Interval (minutes)	Reading 1 (Inches of Drop)	Reading 2 (Inches of Drop)	Reading 3 (Inches of Drop)	Reading 4 (Inches of Drop)	Reading 5 (Inches of Drop)	Reading 6 (Inches of Drop)	Reading 7 (Inches of Drop)	Reading 8 (Inches of Drop)	Average Stabilized Reading <sup>2</sup> (Inches of Drop)	Infiltration Rate <sup>3</sup> (in/hr)	Comments
8	No	30	0.063	0.063	0.000	0.000					0.031	0.063	Approximately 35-40 degrees, sunny. Test done at 13" below surface. Ground was frozen to approx. 12" below surface.
9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Approximately 35-40 degrees, sunny. Test done at surface. Soil Frozen to 24", infiltrometer was unable to penetrate soil.
10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Approximately 35-40 degrees, sunny. Test done at surface. Soil Frozen to 9", infiltrometer was unable to penetrate soil.
11	30	0.438	0.688	0.250	0.313	0.250	0.250				0.266	0.531	Approximately 48 degrees, overcast with a slight drizzle. Test done at surface.
12	30	0.500	0.750	0.688	0.500						0.609	1.219	Approximately 48 degrees, overcast with a slight drizzle. Test done at 3" below surface..
13	30	1.313	1.500	1.688	1.500	1.500					1.547	3.094	Approximately 48 degrees, overcast with a slight drizzle. Test done at surface.

ATLANTIC SUNRISE PROJECT - COMPRESSOR STATION 605

SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD

Hole Number	Drop >2 inches after 30 minute presoak? <sup>1</sup>	Reading Interval (minutes)	Reading 1 (Inches of Drop)	Reading 2 (Inches of Drop)	Reading 3 (Inches of Drop)	Reading 4 (Inches of Drop)	Reading 5 (Inches of Drop)	Reading 6 (Inches of Drop)	Reading 7 (Inches of Drop)	Reading 8 (Inches of Drop)	Average Stabilized Reading <sup>2</sup> (Inches of Drop)	Infiltration Rate <sup>3</sup> (in/hr)	Comments

<sup>1</sup>Inches of drop greater than 2 inches after the 30 minute presoak? Yes, use 10 minute interval; No, use 30 minute interval.

<sup>2</sup>Calculated as the average of the last four stabilized (less than 0.25-inch difference overall) readings.

<sup>3</sup>Calculated as the average stabilized reading x 2 for 30 minute intervals; x 6 for 10 minute intervals.





View of Pit #1.



View of Pit #2.



View of Pit #3.



View of Pit #5.



View of Pit #6.



View of Pit #7.



View of Pit #9.



View of Pit #10.



View of Pit #11.



View of Pit #12.



View of Pit #13.

## **A.7 Supporting Documentation**



**TABLE 6.3**

**Manning's "n" for Trapezoidal Channels with Vegetative Stabilization (Retardance C)**

Flow Depth (FT)	Channel Bed Slope (FT/FT)									
	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
0.1	0.15	0.11	0.10	0.09	0.08	0.07	0.07	0.07	0.06	0.06
0.2	0.12	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05
0.3	0.10	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04
0.4	0.09	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
0.5	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
0.6	0.08	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03
0.7	0.08	0.06	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03
0.8	0.07	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03
0.9	0.07	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03
1.0	0.07	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
2.0	0.06	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02
3.0	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
4.0	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
5.0	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
6.0	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
7.0	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
8.0	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
9.0	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
10.0	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01

PA DEP

NOTE: For vegetated channels that are not anticipated to have a retardance C value (e.g. frequently mowed channels), the equation on page 134 and Table 6.3 should not be used. The designer is referred to NRCS publications for guidance on designing vegetative channels with Retardances other than C.



Westmoreland Conservation District



**NOAA Atlas 14, Volume 2, Version 3**  
**Location name: Factoryville, Pennsylvania, US\***  
**Latitude: 41.5778°, Longitude: -75.7965°**  
**Elevation: 1143 ft\***  
 \* source: Google Maps



**POINT PRECIPITATION FREQUENCY ESTIMATES**

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley  
 NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.300</b> (0.271-0.331)	<b>0.354</b> (0.321-0.392)	<b>0.418</b> (0.377-0.463)	<b>0.466</b> (0.420-0.515)	<b>0.527</b> (0.473-0.581)	<b>0.575</b> (0.514-0.636)	<b>0.622</b> (0.554-0.688)	<b>0.673</b> (0.596-0.745)	<b>0.746</b> (0.653-0.828)	<b>0.802</b> (0.696-0.893)
<b>10-min</b>	<b>0.466</b> (0.422-0.515)	<b>0.553</b> (0.501-0.612)	<b>0.649</b> (0.586-0.719)	<b>0.719</b> (0.649-0.795)	<b>0.805</b> (0.723-0.889)	<b>0.871</b> (0.779-0.964)	<b>0.937</b> (0.834-1.04)	<b>1.00</b> (0.889-1.11)	<b>1.10</b> (0.960-1.22)	<b>1.17</b> (1.01-1.30)
<b>15-min</b>	<b>0.571</b> (0.517-0.631)	<b>0.677</b> (0.613-0.748)	<b>0.797</b> (0.719-0.883)	<b>0.885</b> (0.798-0.978)	<b>0.995</b> (0.893-1.10)	<b>1.08</b> (0.965-1.19)	<b>1.16</b> (1.03-1.29)	<b>1.25</b> (1.11-1.38)	<b>1.37</b> (1.20-1.52)	<b>1.46</b> (1.27-1.63)
<b>30-min</b>	<b>0.756</b> (0.684-0.835)	<b>0.905</b> (0.820-1.00)	<b>1.09</b> (0.985-1.21)	<b>1.23</b> (1.11-1.36)	<b>1.41</b> (1.26-1.55)	<b>1.54</b> (1.38-1.71)	<b>1.68</b> (1.50-1.86)	<b>1.82</b> (1.61-2.02)	<b>2.03</b> (1.77-2.25)	<b>2.19</b> (1.90-2.44)
<b>60-min</b>	<b>0.923</b> (0.835-1.02)	<b>1.11</b> (1.01-1.23)	<b>1.37</b> (1.24-1.52)	<b>1.56</b> (1.41-1.73)	<b>1.82</b> (1.64-2.01)	<b>2.03</b> (1.82-2.25)	<b>2.25</b> (2.00-2.48)	<b>2.48</b> (2.19-2.74)	<b>2.80</b> (2.46-3.11)	<b>3.07</b> (2.67-3.42)
<b>2-hr</b>	<b>1.08</b> (0.978-1.20)	<b>1.29</b> (1.17-1.43)	<b>1.60</b> (1.45-1.78)	<b>1.85</b> (1.68-2.05)	<b>2.22</b> (1.99-2.46)	<b>2.53</b> (2.26-2.80)	<b>2.88</b> (2.56-3.19)	<b>3.27</b> (2.87-3.63)	<b>3.85</b> (3.34-4.30)	<b>4.36</b> (3.73-4.89)
<b>3-hr</b>	<b>1.17</b> (1.07-1.29)	<b>1.40</b> (1.27-1.55)	<b>1.73</b> (1.58-1.91)	<b>2.01</b> (1.82-2.21)	<b>2.42</b> (2.18-2.66)	<b>2.77</b> (2.48-3.06)	<b>3.17</b> (2.81-3.50)	<b>3.62</b> (3.18-4.01)	<b>4.31</b> (3.72-4.79)	<b>4.91</b> (4.19-5.50)
<b>6-hr</b>	<b>1.47</b> (1.34-1.63)	<b>1.75</b> (1.60-1.94)	<b>2.15</b> (1.96-2.38)	<b>2.49</b> (2.26-2.75)	<b>3.00</b> (2.70-3.29)	<b>3.44</b> (3.07-3.78)	<b>3.93</b> (3.48-4.32)	<b>4.49</b> (3.93-4.95)	<b>5.36</b> (4.61-5.93)	<b>6.11</b> (5.19-6.79)
<b>12-hr</b>	<b>1.82</b> (1.66-2.02)	<b>2.17</b> (1.98-2.41)	<b>2.68</b> (2.43-2.96)	<b>3.10</b> (2.81-3.43)	<b>3.76</b> (3.38-4.14)	<b>4.33</b> (3.86-4.78)	<b>4.98</b> (4.39-5.50)	<b>5.73</b> (4.99-6.34)	<b>6.89</b> (5.89-7.66)	<b>7.92</b> (6.67-8.84)
<b>24-hr</b>	<b>2.12</b> (1.95-2.34)	<b>2.54</b> (2.34-2.80)	<b>3.14</b> (2.88-3.44)	<b>3.65</b> (3.34-4.00)	<b>4.44</b> (4.04-4.84)	<b>5.16</b> (4.65-5.60)	<b>5.98</b> (5.34-6.47)	<b>6.93</b> (6.13-7.47)	<b>8.42</b> (7.36-9.05)	<b>9.77</b> (8.44-10.5)
<b>2-day</b>	<b>2.50</b> (2.31-2.74)	<b>2.99</b> (2.76-3.28)	<b>3.69</b> (3.40-4.03)	<b>4.29</b> (3.94-4.67)	<b>5.22</b> (4.76-5.66)	<b>6.06</b> (5.48-6.55)	<b>7.03</b> (6.31-7.58)	<b>8.15</b> (7.24-8.76)	<b>9.93</b> (8.69-10.6)	<b>11.5</b> (9.97-12.3)
<b>3-day</b>	<b>2.65</b> (2.46-2.89)	<b>3.17</b> (2.93-3.46)	<b>3.88</b> (3.59-4.23)	<b>4.50</b> (4.15-4.89)	<b>5.46</b> (5.00-5.91)	<b>6.33</b> (5.75-6.82)	<b>7.32</b> (6.60-7.87)	<b>8.47</b> (7.57-9.09)	<b>10.3</b> (9.07-11.0)	<b>11.9</b> (10.4-12.7)
<b>4-day</b>	<b>2.80</b> (2.60-3.05)	<b>3.34</b> (3.10-3.64)	<b>4.08</b> (3.78-4.43)	<b>4.72</b> (4.36-5.11)	<b>5.70</b> (5.24-6.16)	<b>6.59</b> (6.02-7.09)	<b>7.62</b> (6.90-8.16)	<b>8.80</b> (7.90-9.41)	<b>10.7</b> (9.45-11.4)	<b>12.3</b> (10.8-13.1)
<b>7-day</b>	<b>3.30</b> (3.07-3.58)	<b>3.93</b> (3.65-4.26)	<b>4.74</b> (4.40-5.14)	<b>5.43</b> (5.03-5.88)	<b>6.50</b> (5.98-7.00)	<b>7.45</b> (6.82-8.02)	<b>8.53</b> (7.76-9.16)	<b>9.77</b> (8.82-10.5)	<b>11.7</b> (10.5-12.5)	<b>13.4</b> (11.9-14.3)
<b>10-day</b>	<b>3.81</b> (3.56-4.11)	<b>4.53</b> (4.22-4.88)	<b>5.41</b> (5.04-5.83)	<b>6.16</b> (5.72-6.62)	<b>7.29</b> (6.75-7.82)	<b>8.29</b> (7.63-8.87)	<b>9.40</b> (8.61-10.0)	<b>10.7</b> (9.70-11.4)	<b>12.6</b> (11.3-13.4)	<b>14.3</b> (12.8-15.2)
<b>20-day</b>	<b>5.24</b> (4.93-5.61)	<b>6.17</b> (5.79-6.60)	<b>7.19</b> (6.75-7.68)	<b>8.05</b> (7.54-8.58)	<b>9.33</b> (8.71-9.93)	<b>10.4</b> (9.70-11.1)	<b>11.6</b> (10.8-12.3)	<b>13.0</b> (12.0-13.8)	<b>15.0</b> (13.7-15.9)	<b>16.7</b> (15.2-17.7)
<b>30-day</b>	<b>6.54</b> (6.17-6.95)	<b>7.65</b> (7.23-8.13)	<b>8.78</b> (8.29-9.32)	<b>9.72</b> (9.16-10.3)	<b>11.1</b> (10.4-11.7)	<b>12.2</b> (11.5-13.0)	<b>13.5</b> (12.6-14.3)	<b>14.8</b> (13.8-15.7)	<b>16.8</b> (15.6-17.8)	<b>18.5</b> (17.0-19.6)
<b>45-day</b>	<b>8.36</b> (7.93-8.83)	<b>9.74</b> (9.24-10.3)	<b>11.0</b> (10.4-11.6)	<b>12.1</b> (11.4-12.7)	<b>13.6</b> (12.8-14.3)	<b>14.8</b> (13.9-15.6)	<b>16.1</b> (15.1-17.0)	<b>17.5</b> (16.4-18.4)	<b>19.5</b> (18.2-20.5)	<b>21.1</b> (19.6-22.2)
<b>60-day</b>	<b>10.1</b> (9.62-10.7)	<b>11.8</b> (11.2-12.4)	<b>13.2</b> (12.5-13.9)	<b>14.4</b> (13.7-15.1)	<b>16.1</b> (15.2-16.9)	<b>17.5</b> (16.5-18.4)	<b>18.9</b> (17.9-19.9)	<b>20.5</b> (19.3-21.5)	<b>22.7</b> (21.2-23.8)	<b>24.5</b> (22.8-25.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

**PF graphical**

**TABLE 6.6**  
**Riprap Gradation, Filter Blanket Requirements, Maximum Velocities**

Percent Passing (Square Openings)						
Class, Size NO.	R-8	R-7	R-6	R-5	R-4	R-3
Rock Size (Inches)						
42	100					
30		100				
24	15-50		100			
18		15-50		100		
15	0-15					
12		0-15	15-50		100	
9				15-50		
6			0-15		15-50	100
4				0-15		
3					0-15	15-50
2						0-15
Nominal Placement Thickness (inches)	63	45	36	27	18	9
Filter Stone <sup>1</sup>	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V <sub>max</sub> (ft/sec)	17.0	14.5	13.0	11.5	9.0	6.5

Adapted from PennDOT Pub. 408, Section 703.2(c), Table C

- 1 This is a general standard. Soil conditions at each site should be analyzed to determine actual filter size. A suitable woven or non-woven geotextile underlayment, used according to the manufacturer's recommendations, may be substituted for the filter stone for gradients < 10%.

**TABLE 6.7**  
**Comparison of Various Gradations of Coarse Aggregates**

Total Percent Passing															
AASHTO NUMBER	6 ½"	4"	3 ½"	2 ½"	2"	1 ½"	1"	¾"	½"	⅜"	#4	#8	#16	#30	#100
1		100	90-100	25-60		0-15		0-5							
3				100	90-100	35-70	0-15		0-5						
5						100	90-100	20-55	0-10	0-5					
57						100	90-100		25-60		0-10	0-5			
67							100	90-100		20-55	0-10	0-5			
7								100	90-100	40-70	0-15	0-5			
8									100	85-100	10-30	0-10	0-5		
10										100	75-100				10-30

PennDOT Publication 408, Section 703.2(c), Table C

Tables 6.6 and 6.7 should be placed on the plan drawings of all sites where riprap channel linings are proposed.

**COMPRESSOR STATION 605  
INFILTRATION BASIN 1 OUTLET STRUCTURE FLOTATION CALCULATIONS**

**Assumptions**

**24" X 48" concrete inlet box riser**

**Total area of 24" x 48" inlet box = 10 sf**

**6" concrete wall thickness**

**6" thick bottom**

**Density of water = 62.4 lb/cf**

**Density of concrete = 150 lb/cf**

**Area of concrete in a 2' X 4' inlet box with a 6" thick wall = 3.5 sf**

**Volume of concrete per vertical foot of inlet box = 1' X 3.5 sf = 3.5 cf.**

**Weight of concrete per vertical foot of inlet box = 3.5 cf X 150 lb/cf = 525 Lbs**

**Buoyant force from water per vertical foot of inlet box = 62.4lb/cf X 10 sf X 1 ft = 624 lb.**

**Volume of bottom of inlet = 10 sf X 0.5 ft = 5 cf**

**Weight of bottom of inlet = 150 lb/cf X 5 cf = 750 lb**

**Buoyant force on bottom of inlet = 62.4 lb/cf X 5 = 312 lb**

**Basin 1 outlet structure height = 7.50 ft**

**Weight of outlet structure = 7.50 X 525 + 750 = 4,687 lb**

**Buoyant force = 312 + 624 X 7.50 = 4,992 lb**

**Weight of outlet structure with foot of concrete below invert:**

$$4,687 + 150 \times 10 = 6,187 \text{ lb OK}$$

**COMPRESSOR STATION 605  
INFILTRATION BASIN 2 OUTLET STRUCTURE FLOTATION CALCULATIONS**

**Assumptions**

**24" X 48" concrete inlet box riser**

**Total area of 24" x 48" inlet box = 10 sf**

**6" concrete wall thickness**

**6" thick bottom**

**Density of water = 62.4 lb/cf**

**Density of concrete = 150 lb/cf**

**Area of concrete in a 2' X 4' inlet box with a 6" thick wall = 3.5 sf**

**Volume of concrete per vertical foot of inlet box = 1' X 3.5 sf = 3.5 cf.**

**Weight of concrete per vertical foot of inlet box = 3.5 cf X 150 lb/cf = 525 Lbs**

**Buoyant force from water per vertical foot of inlet box = 62.4lb/cf X 10 sf X 1 ft = 624 lb.**

**Volume of bottom of inlet = 10 sf X 0.5 ft = 5 cf**

**Weight of bottom of inlet = 150 lb/cf X 5 cf = 750 lb**

**Buoyant force on bottom of inlet = 62.4 lb/cf X 5 = 312 lb**

**Basin 2 outlet structure height = 3.00 ft**

**Weight of outlet structure = 3.00 X 525 + 750 = 2325 lb**

**Buoyant force = 312 + 624 X 3.00 = 2184 lb**

**Weight of outlet structure with foot of concrete below invert:**

$$4,687 + 150 \times 10 = 3,825 \text{ lb OK}$$





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## **APPENDIX B**

### **Preparer Qualifications**



**STANDARD E&S WORKSHEET # 22  
 PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND  
 SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES**

**NAME OF PLAN PREPARER:** Alaric J. Busher, PE, CPESC

**FORMAL EDUCATION:**

**Name of College or Technical Institute:** The Pennsylvania State University

**Curriculum or Program:** Civil Engineering

**Dates of Attendance:** **From:** 9/1995 **To:** 5/1999

**Degree Received** Bachelor of Science - Civil Engineering

**OTHER TRAINING:**

<b>Name of Training:</b>	<u>Annual Oil and Gas Training</u>	<u>Chapter 102 Update Training for the Regulated Community</u>
<b>Presented By:</b>	<u>PADEP</u>	<u>PADEP</u>
<b>Date:</b>	<u>7/10/2013</u>	<u>11/12/2010</u>

**EMPLOYMENT HISTORY:**

**Current Employer:** BL Companies

**Telephone:** 717-651-9850

**Former Employer:** N/A

**Telephone:** \_\_\_\_\_

**RECENT E&S PLANS PREPARED:**

<b>Name of Project:</b>	<u>Constitution Pipeline, Access Roads and Meter Station (ES, PCSM)</u>	<u>Reynolds Alford Pipeline (E&amp;S, PCSM)</u>	<u>Annville Medical Office (E&amp;S, PCSM)</u>
<b>County:</b>	<u>Susquehanna</u>	<u>Susquehanna</u>	<u>Lebanon</u>
<b>Municipality:</b>	<u>Multiple</u>	<u>Brooklyn, Harford</u>	<u>Annville Twp</u>
<b>Permit Number:</b>	<u>ESG0011540002</u>	<u>ESX13-115-0152(01)</u>	<u>PAG-02-0038-15-010</u>
<b>Approving Agency:</b>	<u>Susquehanna CCD</u>	<u>PADEP (O&amp;G)</u>	<u>Lebanon CCD</u>





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## **APPENDIX C**

### **United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report**



# Custom Soil Resource Report for Wyoming County, Pennsylvania

## Compressor Station 605





# Preface

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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 (<http://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](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

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

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

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

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# Contents

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<b>Preface</b> .....	2
<b>How Soil Surveys Are Made</b> .....	5
<b>Soil Map</b> .....	7
Soil Map.....	8
Legend.....	9
Map Unit Legend.....	10
Map Unit Descriptions.....	10
Wyoming County, Pennsylvania.....	13
MhD—Mardin channery silt loam, 8 to 25 percent slopes, rubbly.....	13
MrB—Morris channery loam, 3 to 8 percent slopes.....	14
MrC—Morris channery loam, 8 to 18 percent slopes.....	15
MsB—Morris flaggy loam, 3 to 8 percent slopes.....	16
MsC—Morris flaggy loam, 8 to 15 percent slopes.....	18
MxB—Morris extremely stony loam, 0 to 8 percent slopes.....	19
MxD—Morris extremely stony loam, 8 to 25 percent slopes.....	20
NcB—Norwich and Chippewa channery silt loams, 3 to 8 percent slopes.....	21
NxB—Norwich and Chippewa channery silt loams, 0 to 8 percent slopes, rubbly.....	23
OcC—Oquaga channery loam, 8 to 15 percent slopes.....	26
OcD—Oquaga channery loam, 15 to 25 percent slopes.....	27
OfB—Oquaga flaggy loam, 3 to 8 percent slopes.....	28
OxD—Oquaga extremely stony loam, 8 to 25 percent slopes.....	29
WcC—Wellsboro channery loam, 8 to 15 percent slopes.....	30
WcD—Wellsboro channery loam, 15 to 25 percent slopes.....	31
<b>References</b> .....	33

# How Soil Surveys Are Made

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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

## Custom Soil Resource Report

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.

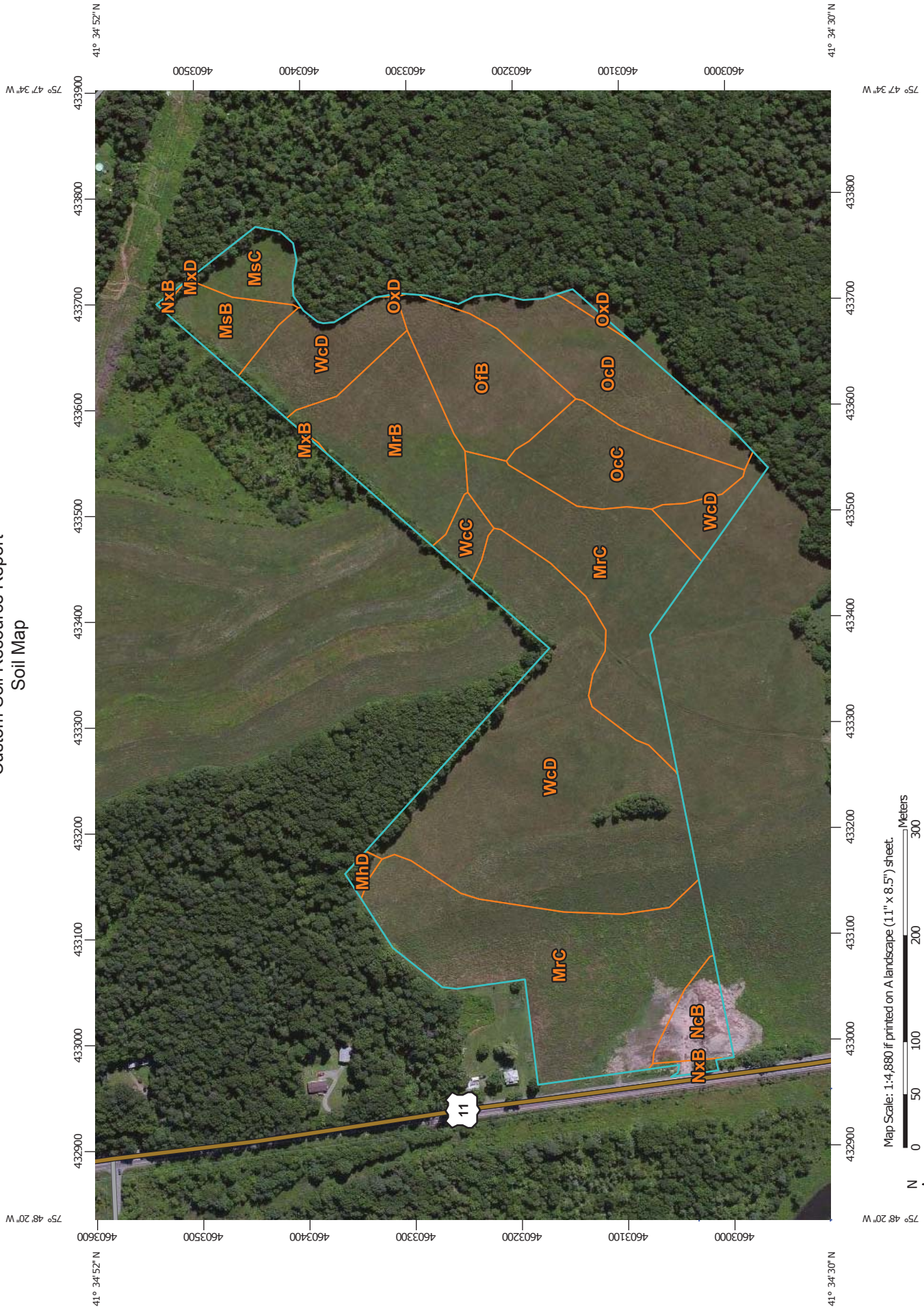
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

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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: 1:4,880 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

## 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: <http://websoilsurvey.nrcs.usda.gov>  
 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: Wyoming County, Pennsylvania  
 Survey Area Data: Version 7, Sep 22, 2014

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

Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

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

## MAP LEGEND

- 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 Unit Legend

Wyoming County, Pennsylvania (PA131)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MhD	Mardin channery silt loam, 8 to 25 percent slopes, rubbly	0.2	0.3%
MrB	Morris channery loam, 3 to 8 percent slopes	4.1	8.2%
MrC	Morris channery loam, 8 to 18 percent slopes	14.6	28.8%
MsB	Morris flaggy loam, 3 to 8 percent slopes	1.4	2.7%
MsC	Morris flaggy loam, 8 to 15 percent slopes	1.2	2.3%
MxB	Morris extremely stony loam, 0 to 8 percent slopes	0.0	0.0%
MxD	Morris extremely stony loam, 8 to 25 percent slopes	0.0	0.0%
NcB	Norwich and Chippewa channery silt loams, 3 to 8 percent slopes	1.1	2.1%
NxB	Norwich and Chippewa channery silt loams, 0 to 8 percent slopes, rubbly	0.2	0.3%
OcC	Oquaga channery loam, 8 to 15 percent slopes	3.2	6.3%
OcD	Oquaga channery loam, 15 to 25 percent slopes	4.0	7.9%
OfB	Oquaga flaggy loam, 3 to 8 percent slopes	3.4	6.7%
OxD	Oquaga extremely stony loam, 8 to 25 percent slopes	0.1	0.3%
WcC	Wellsboro channery loam, 8 to 15 percent slopes	0.6	1.1%
WcD	Wellsboro channery loam, 15 to 25 percent slopes	16.7	32.9%
<b>Totals for Area of Interest</b>		<b>50.7</b>	<b>100.0%</b>

## 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

## Custom Soil Resource Report

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.

## Wyoming County, Pennsylvania

### MhD—Mardin channery silt loam, 8 to 25 percent slopes, rubbly

#### Map Unit Setting

*National map unit symbol:* 2v307  
*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, rubbly, and similar soils:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Mardin, Rubbly

##### Setting

*Landform:* Till plains  
*Landform position (two-dimensional):* Backslope, shoulder  
*Landform position (three-dimensional):* Interfluve, side slope, head slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Linear  
*Parent material:* Loamy till

##### Typical profile

*Oe - 0 to 1 inches:* moderately decomposed plant material  
*A - 1 to 3 inches:* channery silt loam  
*BE - 3 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  
*Percent of area covered with surface fragments:* 20.0 percent  
*Depth to restrictive feature:* 14 to 26 inches to fragipan  
*Natural 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 storage in profile:* Low (about 3.7 inches)

##### Interpretive groups

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

## Minor Components

### Lordstown, very stony

*Percent of map unit:* 5 percent

*Landform:* Ridges

*Landform position (two-dimensional):* Summit, shoulder

*Landform position (three-dimensional):* Base slope, side slope

*Down-slope shape:* Linear, concave

*Across-slope shape:* Linear

### Volusia, rubbly

*Percent of map unit:* 5 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

### Bath, rubbly

*Percent of map unit:* 5 percent

*Landform:* Drumlinoid ridges, hills, till plains

*Landform position (two-dimensional):* Backslope, shoulder

*Landform position (three-dimensional):* Side slope, interfluvium, nose slope

*Down-slope shape:* Concave, linear

*Across-slope shape:* Linear

## MrB—Morris channery loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* b463

*Elevation:* 50 to 1,800 feet

*Mean annual precipitation:* 32 to 50 inches

*Mean annual air temperature:* 45 to 50 degrees F

*Frost-free period:* 110 to 180 days

*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Morris and similar soils:* 75 percent

*Minor components:* 25 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Morris

#### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

## Custom Soil Resource Report

### Typical profile

*A - 0 to 8 inches:* channery loam  
*Bw - 8 to 17 inches:* channery loam  
*Bx - 17 to 70 inches:* channery silt loam  
*C - 70 to 80 inches:* channery silt loam

### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* 11 to 22 inches to fragipan  
*Natural drainage class:* Somewhat poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 3 to 10 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3w  
*Hydrologic Soil Group:* D

### Minor Components

#### Norwich

*Percent of map unit:* 20 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

#### Wellsboro

*Percent of map unit:* 5 percent

## MrC—Morris channery loam, 8 to 18 percent slopes

### Map Unit Setting

*National map unit symbol:* b464  
*Elevation:* 50 to 1,800 feet  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 180 days  
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

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

## Description of Morris

### Setting

*Landform:* Till plains  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

### Typical profile

*A - 0 to 8 inches:* channery loam  
*Bw - 8 to 17 inches:* channery loam  
*Bx - 17 to 70 inches:* channery silt loam  
*C - 70 to 80 inches:* channery silt loam

### Properties and qualities

*Slope:* 8 to 18 percent  
*Depth to restrictive feature:* 11 to 22 inches to fragipan  
*Natural drainage class:* Somewhat poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 3 to 10 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* D

## Minor Components

### Norwich

*Percent of map unit:* 12 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

### Wellsboro

*Percent of map unit:* 8 percent

## MsB—Morris flaggy loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* b465  
*Elevation:* 600 to 1,800 feet  
*Mean annual precipitation:* 30 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 165 days

## Custom Soil Resource Report

*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Morris and similar soils:* 75 percent

*Minor components:* 25 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Morris

#### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

#### Typical profile

*A - 0 to 8 inches:* flaggy loam

*Bw - 8 to 17 inches:* flaggy loam

*Bx - 17 to 70 inches:* channery silt loam

*C - 70 to 80 inches:* channery silt loam

#### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* 11 to 22 inches to fragipan

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 3 to 10 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.0 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3w

*Hydrologic Soil Group:* D

### Minor Components

#### Chippewa

*Percent of map unit:* 20 percent

*Landform:* Depressions

*Down-slope shape:* Concave

*Across-slope shape:* Concave

#### Wellsboro

*Percent of map unit:* 5 percent

## **MsC—Morris flaggy loam, 8 to 15 percent slopes**

### **Map Unit Setting**

*National map unit symbol:* b466

*Elevation:* 600 to 1,800 feet

*Mean annual precipitation:* 30 to 50 inches

*Mean annual air temperature:* 45 to 50 degrees F

*Frost-free period:* 110 to 165 days

*Farmland classification:* Farmland of statewide importance

### **Map Unit Composition**

*Morris and similar soils:* 83 percent

*Minor components:* 17 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Morris**

#### **Setting**

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

#### **Typical profile**

*A - 0 to 8 inches:* flaggy loam

*Bw - 8 to 17 inches:* flaggy loam

*Bx - 17 to 70 inches:* channery silt loam

*C - 70 to 80 inches:* channery silt loam

#### **Properties and qualities**

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* 11 to 22 inches to fragipan

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 3 to 10 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.0 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* D

### Minor Components

#### Chippewa

*Percent of map unit:* 12 percent

*Landform:* Depressions

*Down-slope shape:* Concave

*Across-slope shape:* Concave

#### Wellsboro

*Percent of map unit:* 5 percent

## MxB—Morris extremely stony loam, 0 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* b467

*Elevation:* 600 to 1,800 feet

*Mean annual precipitation:* 32 to 50 inches

*Mean annual air temperature:* 45 to 50 degrees F

*Frost-free period:* 110 to 165 days

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Morris and similar soils:* 75 percent

*Minor components:* 25 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Morris

#### Setting

*Landform:* Till plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

#### Typical profile

*A - 0 to 8 inches:* channery loam

*Bw - 8 to 17 inches:* channery loam

*Bx - 17 to 70 inches:* channery silt loam

*C - 70 to 80 inches:* channery silt loam

#### Properties and qualities

*Slope:* 0 to 8 percent

*Percent of area covered with surface fragments:* 9.0 percent

*Depth to restrictive feature:* 11 to 22 inches to fragipan

*Natural drainage class:* Somewhat poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 3 to 10 inches

## Custom Soil Resource Report

*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.4 inches)

### Interpretive groups

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

### Minor Components

#### Norwich

*Percent of map unit:* 20 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

#### Wellsboro

*Percent of map unit:* 5 percent

## MxD—Morris extremely stony loam, 8 to 25 percent slopes

### Map Unit Setting

*National map unit symbol:* b468  
*Elevation:* 600 to 1,800 feet  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 165 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

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

### Description of Morris

#### Setting

*Landform:* Till plains  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

#### Typical profile

*A - 0 to 8 inches:* channery loam  
*Bw - 8 to 17 inches:* channery loam  
*Bx - 17 to 70 inches:* channery silt loam  
*C - 70 to 80 inches:* channery silt loam

#### Properties and qualities

*Slope:* 8 to 25 percent

## Custom Soil Resource Report

*Percent of area covered with surface fragments:* 9.0 percent  
*Depth to restrictive feature:* 11 to 22 inches to fragipan  
*Natural drainage class:* Somewhat poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 3 to 10 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.4 inches)

### Interpretive groups

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

### Minor Components

#### Wellsboro

*Percent of map unit:* 12 percent

#### Norwich

*Percent of map unit:* 8 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

## NcB—Norwich and Chippewa channery silt loams, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 2vcjd  
*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

*Norwich and similar soils:* 45 percent  
*Chippewa and similar soils:* 35 percent  
*Minor components:* 20 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Norwich

#### Setting

*Landform:* Depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

## Custom Soil Resource Report

*Parent material:* Loamy till dominated by reddish sandstone, siltstone and shale fragments

### Typical profile

*A - 0 to 6 inches:* channery silt loam  
*Eg - 6 to 10 inches:* channery silt loam  
*Bg - 10 to 16 inches:* channery silt loam  
*Bgx - 16 to 46 inches:* channery silt loam  
*C - 46 to 72 inches:* channery silt loam

### Properties and qualities

*Slope:* 3 to 8 percent  
*Percent of area covered with surface fragments:* 0.0 percent  
*Depth to restrictive feature:* 10 to 24 inches to fragipan  
*Natural 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  
*Available water storage in profile:* Low (about 3.2 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4w  
*Hydrologic Soil Group:* D

## 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:* channery silt loam  
*Eg - 7 to 15 inches:* channery silt loam  
*Bgx - 15 to 45 inches:* channery silt loam  
*C - 45 to 72 inches:* channery silt loam

### Properties and qualities

*Slope:* 3 to 8 percent  
*Percent of area covered with surface fragments:* 0.0 percent  
*Depth to restrictive feature:* 8 to 20 inches to fragipan  
*Natural 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 in profile:* 15 percent  
*Available water storage in profile:* Low (about 3.1 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

## Custom Soil Resource Report

*Land capability classification (nonirrigated): 4w*  
*Hydrologic Soil Group: D*

### Minor Components

#### **Volusia**

*Percent of map unit: 5 percent*  
*Landform: Hills*  
*Landform position (two-dimensional): Foothills, summit*  
*Landform position (three-dimensional): Base slope, side slope*  
*Down-slope shape: Concave*  
*Across-slope shape: Linear*

#### **Morris**

*Percent of map unit: 5 percent*  
*Landform: Hills*  
*Landform position (two-dimensional): Foothills, summit*  
*Landform position (three-dimensional): Base slope, side slope*  
*Down-slope shape: Concave*  
*Across-slope shape: Linear*

#### **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*

#### **Norwich, 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*

### **NxB—Norwich and Chippewa channery silt loams, 0 to 8 percent slopes, rubbly**

#### **Map Unit Setting**

*National map unit symbol: 2vcjq*  
*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

*Norwich, rubbly, and similar soils:* 45 percent

*Chippewa, rubbly, and similar soils:* 40 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Norwich, Rubbly

#### 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 reddish sandstone, siltstone and shale fragments

#### Typical profile

*Oe - 0 to 1 inches:* moderately decomposed plant material

*A - 1 to 5 inches:* channery silt loam

*Eg - 5 to 10 inches:* channery silt loam

*Bg - 10 to 16 inches:* channery silt loam

*Bgx - 16 to 46 inches:* channery silt loam

*C - 46 to 72 inches:* channery silt loam

#### Properties and qualities

*Slope:* 0 to 8 percent

*Percent of area covered with surface fragments:* 20.0 percent

*Depth to restrictive feature:* 10 to 24 inches to fragipan

*Natural 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

*Available water storage in profile:* Low (about 3.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s

*Hydrologic Soil Group:* D

### Description of Chippewa, Rubbly

#### 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

*Oe - 0 to 1 inches:* moderately decomposed plant material

*A - 1 to 5 inches:* channery silt loam

*Eg - 5 to 15 inches:* channery silt loam

## Custom Soil Resource Report

*Bgx - 15 to 45 inches: channery silt loam*

*C - 45 to 72 inches: channery silt loam*

### Properties and qualities

*Slope: 0 to 8 percent*

*Percent of area covered with surface fragments: 20.0 percent*

*Depth to restrictive feature: 8 to 20 inches to fragipan*

*Natural 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 in profile: 15 percent*

*Available water storage in profile: Low (about 3.0 inches)*

### Interpretive groups

*Land capability classification (irrigated): None specified*

*Land capability classification (nonirrigated): 7s*

*Hydrologic Soil Group: D*

### Minor Components

#### Chippewa, rubbly, 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*

#### Norwich, rubbly, 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*

#### Morris, extremely stony

*Percent of map unit: 3 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*

#### Volusia, extremely stony

*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*

## OcC—Oquaga channery loam, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* b46f

*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:* 85 percent

*Minor components:* 15 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

#### Typical profile

*Ap - 0 to 7 inches:* channery loam

*Bw - 7 to 30 inches:* extremely channery silt 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

*Natural 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 storage in profile:* Very low (about 2.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* C

**Minor Components**

**Arnot**

*Percent of map unit: 5 percent*

**Lordstown**

*Percent of map unit: 5 percent*

**Lackawanna**

*Percent of map unit: 5 percent*

**OcD—Oquaga channery loam, 15 to 25 percent slopes**

**Map Unit Setting**

*National map unit symbol: b46g  
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: 90 percent  
Minor components: 10 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*

**Typical profile**

*Ap - 0 to 7 inches: channery loam  
Bw - 7 to 30 inches: extremely channery silt 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  
Natural 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 storage in profile: Very low (about 2.7 inches)*

## Custom Soil Resource Report

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* C

### Minor Components

#### Arnot

*Percent of map unit:* 5 percent

#### Lackawanna

*Percent of map unit:* 5 percent

## OfB—Oquaga flaggy loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* b46h

*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:* 85 percent

*Minor components:* 15 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

#### Typical profile

*Ap - 0 to 7 inches:* flaggy loam

*Bw - 7 to 30 inches:* extremely channery silt 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

*Natural 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

## Custom Soil Resource Report

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.7 inches)

### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C

### **Minor Components**

#### **Arnot**

*Percent of map unit:* 5 percent

#### **Lordstown**

*Percent of map unit:* 5 percent

#### **Lackawanna**

*Percent of map unit:* 5 percent

## **OxD—Oquaga extremely stony loam, 8 to 25 percent slopes**

### **Map Unit Setting**

*National map unit symbol:* b46l

*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:* 85 percent

*Minor components:* 15 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

#### **Typical profile**

*A - 0 to 7 inches:* channery loam

*Bw - 7 to 30 inches:* extremely channery silt loam

*R - 30 to 42 inches:* unweathered bedrock

#### **Properties and qualities**

*Slope:* 8 to 25 percent

*Percent of area covered with surface fragments:* 9.0 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

## Custom Soil Resource Report

*Natural 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 storage in profile:* Very low (about 2.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s

*Hydrologic Soil Group:* C

### Minor Components

#### Arnot

*Percent of map unit:* 5 percent

#### Lordstown

*Percent of map unit:* 5 percent

#### Lackawanna

*Percent of map unit:* 5 percent

## WcC—Wellsboro channery loam, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* b47g

*Elevation:* 50 to 1,800 feet

*Mean annual precipitation:* 32 to 50 inches

*Mean annual air temperature:* 45 to 50 degrees F

*Frost-free period:* 110 to 180 days

*Farmland classification:* Farmland of statewide importance

### 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:* Valley sides

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Linear

#### Typical profile

*A - 0 to 8 inches:* channery loam

*Bw - 8 to 17 inches:* channery loam

## Custom Soil Resource Report

*BE - 17 to 21 inches:* channery loam  
*Bx - 21 to 60 inches:* channery silt loam  
*C - 60 to 80 inches:* channery loam

### Properties and qualities

*Slope:* 8 to 15 percent  
*Depth to restrictive feature:* 14 to 26 inches to fragipan  
*Natural 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 11 to 22 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.6 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* D

### Minor Components

#### Morris

*Percent of map unit:* 5 percent

#### Lackawanna

*Percent of map unit:* 5 percent

#### Norwich

*Percent of map unit:* 5 percent  
*Landform:* Depressions  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

## WcD—Wellsboro channery loam, 15 to 25 percent slopes

### Map Unit Setting

*National map unit symbol:* b47h  
*Elevation:* 600 to 1,800 feet  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 165 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

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

## Description of Wellsboro

### Setting

*Landform:* Valley sides

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Linear

### Typical profile

*A - 0 to 8 inches:* channery loam

*Bw - 8 to 17 inches:* channery loam

*BE - 17 to 21 inches:* channery loam

*Bx - 21 to 60 inches:* channery silt loam

*C - 60 to 80 inches:* channery loam

### Properties and qualities

*Slope:* 15 to 25 percent

*Depth to restrictive feature:* 14 to 26 inches to fragipan

*Natural 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 11 to 22 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.6 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* D

## Minor Components

### Lackawanna

*Percent of map unit:* 5 percent

### Morris

*Percent of map unit:* 5 percent

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