Architecture
Engineering
Environmental
Land Surveying
Companies

An Employee-Owned Company

Post Construction Stormwater Management/Site Restoration Plans Narrative

Atlantic Sunrise Project
Phase 2

West Diamond Regulator Station
Jackson & Sugarloaf Townships
Columbia County
Pennsylvania

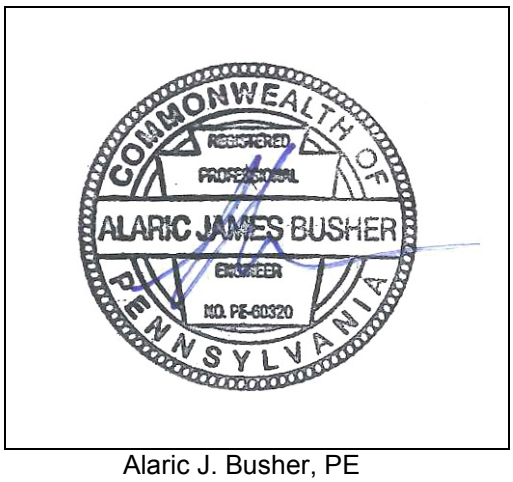
Prepared For:

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

Issued: August 2015
Revised: April 2017

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

APPENDICES

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 PCSM/SR narrative is intended to describe the post construction stormwater management/site restoration (PCSM/SR) design for the West Diamond Regulator Station ("Site") to be constructed as part of the Project, within Jackson/Sugarloaf Township, Columbia 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 2 of the Atlantic Sunrise Project in Columbia County is the following:

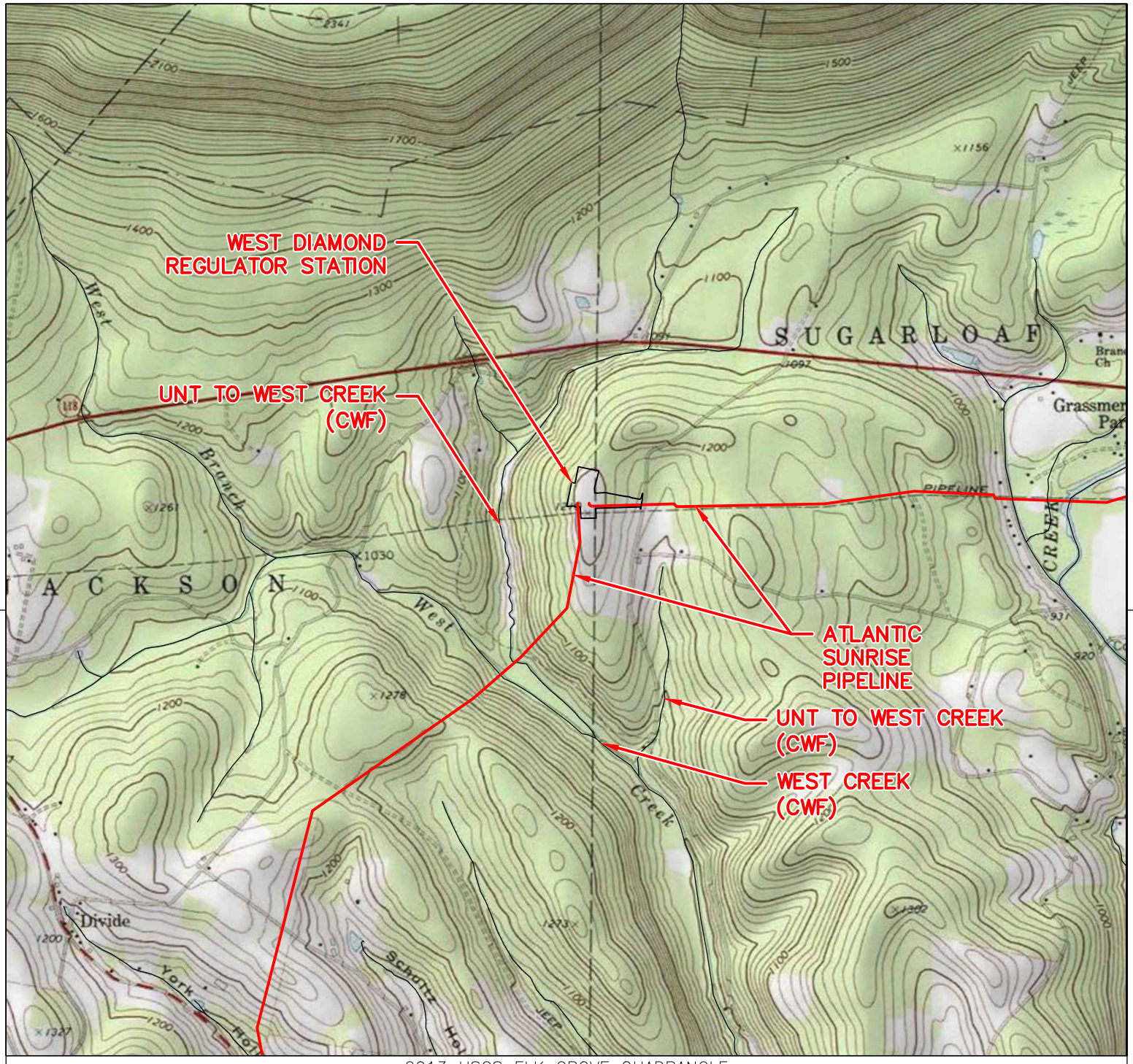
Facility Name	Facility Description	Facility Coordinates
West Diamond Regulator Station	Regulator Station	N41°16'24.28", W76°24'25.32"

The West Diamond Regulator Station will be approximately 7.65 acres in area including a 706 linear foot permanent gravel access road, 51,522 square feet (1.18 acre) of gravel pad and 561 square feet (0.01 acers) of building that total 67,002 square feet (1.54 acres) of impervious area. The Site will utilize existing public and private roads for access to the Site during and after construction. PCSM/SR Best Management Practices (BMPs), in accordance with the standards and specifications in the Pennsylvania Department of Environmental Protection's (PADEP's) "Pennsylvania's Stormwater Best Management Practices Manual," document No. 363-0300-002 as amended and updated (PCSM Manual), 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 ELK GROVE QUADRANGLE

N

GRAPHIC SCALE
2000 1000 0 2000
SCALE IN FEET

ATLANTIC SUNRISE PROJECT
WEST DIAMOND REGULATOR STATION
USGS LOCATION MAP
JACKSON/SUGARLOAF TOWNSHIP
COLUMBIA COUNTY, PENNSYLVANIA

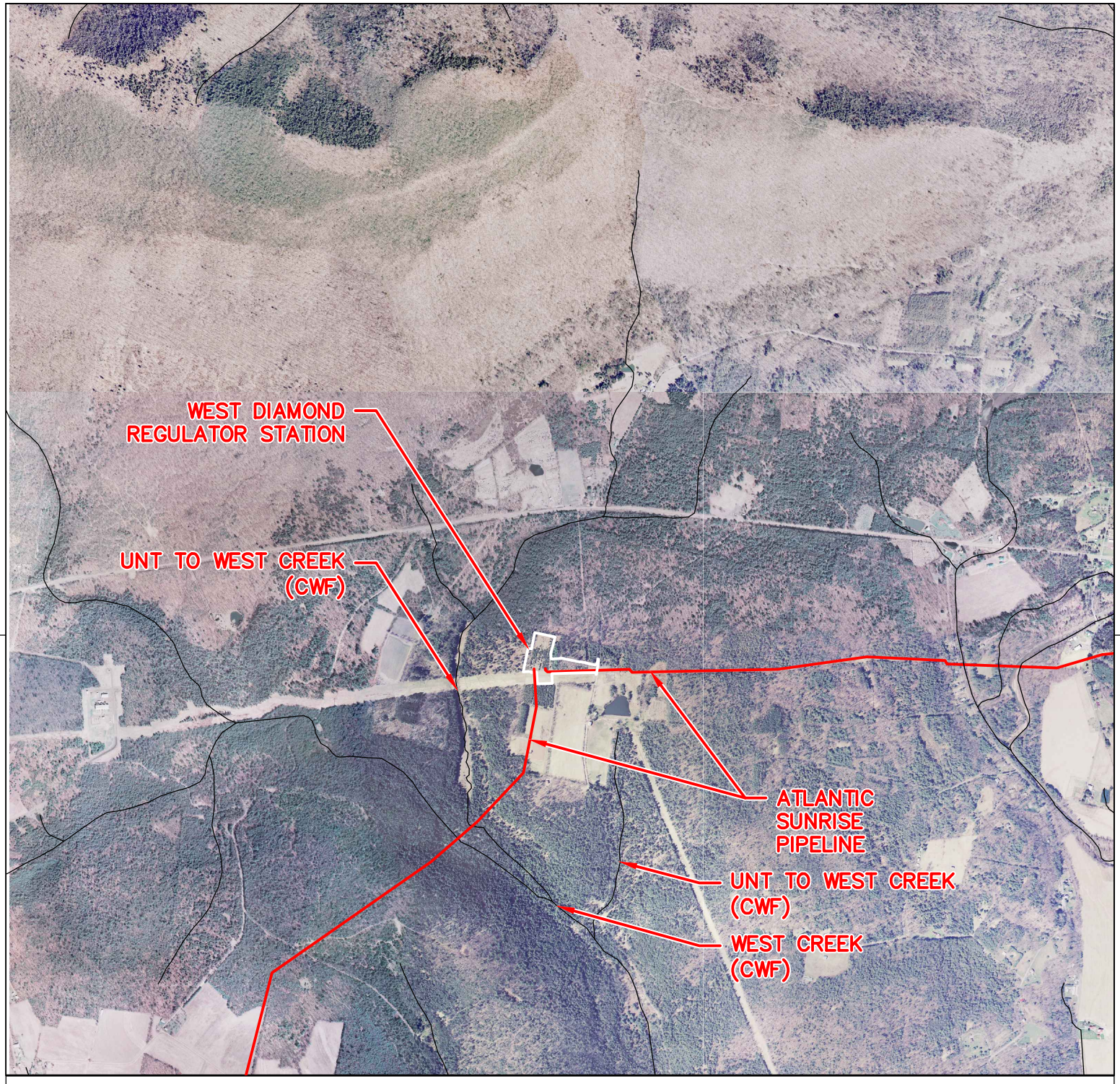
Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161501	SMK	
1	*12-02-15*	*BL*	*ISSUED FOR PADEP RESUBMITTAL*	*1161501*	*AJB*	

DRAWN BY: JEC	DATE: 04/03/15	ISSUED FOR BID:	SCALE: 1"=2,000'
CHECKED BY: AOE	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: AJB	DATE: 04/03/15	DRAWING NUMBER: WEST DIAMOND RS LOCATION	SHEET 1 OF 1
WO: 1161501			

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING
Companies

An Employee-Owned Company



N

GRAPHIC SCALE
2000 1000 0 2000
SCALE IN FEET

ATLANTIC SUNRISE PROJECT

WEST DIAMOND REGULATOR STATION

AERIAL LOCATION MAP

JACKSON/SUGARLOAF TOWNSHIP
COLUMBIA COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161501	SMK	
1	*12-02-15*	*BL*	*ISSUED FOR PADEP RESUBMITTAL*	*1161501*	*AJB*	

DRAWN BY: JEC	DATE: 04/03/15	ISSUED FOR BID:	SCALE: 1"=2,000'
CHECKED BY: AOE	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: AJB	DATE: 04/03/15	DRAWING NUMBER: WEST DIAMOND RS LOCATION	SHEET 1 OF 1
WO: 1161501			

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
OsB	Oquaga very stony silt loam	0-12%	X	C	X	X			X		X			X				
OcB2	Oquaga channery silt loam, moderately eroded	2-12%	X	C	X	X			X		X			X				
OcC2	Oquaga channery silt loam, moderately eroded	12-20%	X	C	X	X			X		X			X				
OsD	Oquaga very stony silt loam	12-35%	X	C	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

Proposed Improvements and Land Use

The proposed West Diamond Regulator Station will be constructed in Lehman Township, Luzerne County. West Diamond Regulator Station will include construction of a regulator station and associated access road. The earthmoving activity will involve the stripping and stockpiling of top soil, Site grading, Site excavation, placement of fill, trenching and backfill, construction of equipment with gravel pad/parking lot, construction of a gravel access drive, construction of a stormwater management system, finish grading, and stabilization of disturbed surfaces. Approximately 67,002 square feet (1.54 acres) of additional gravel area will result on-site.

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 West Diamond Regulator Station 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. Land uses appear to have remained similar for the past 50 years.

Table 1.3.1
Land Requirements for the New Aboveground Facilities[a]

Facility	Milepost	County	Agricultural Land (acres)		Upland Forest / Woodland (acres)		Open Land (acres)		Total (acres)	
			Cons	Op	Cons	Op	Cons	Op	Cons	Op
West Diamond Regulator Station with pig launcher and receiver	L114.0	Columbia	0.0	0.0	3.0	3.0	1.8	1.4	4.8	4.4
Columbia County Subtotal			**32.8**	**32.8**	**0.7**	**0.7**	**1.8**	**1.4**	**38.3**	**37.9**

Notes:
[a] 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 are included in Appendix A.

Pre-development and Post Development runoff hydrographs were developed for the 1-, 2-, 10-, 25-, 50-, and 100-year storm events using the Soil Conservation Service's TR-55 Method. The PCSM/SR BMPs will meet the PADEP water quality requirements. Water Quality Worksheets #4 and #5 were used to complete the Control Guideline (CG 1) volume analysis for the 2-year storm event. Stormwater models were created using the HydroCAD Version 10.0 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 PADEP Requirements.) National Oceanic Atmospheric Administration (NOAA) Atlas 14 rainfall intensities were used in the calculations. See Appendix A for calculations and results.

Rate Controls

Because the Site is not subject to more restrictive release rates, it has been designed to reduce the post-development flows to equal to or less than the pre-development flows for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year storm events, as required by the Act 167 study.

Infiltration and Water Quality

To minimize runoff volume increases a number of non-structural BMP's were considered for the site. Sensitive and natural resources were protected to the maximum extent practical, but no protected resources are applicable for use as a stormwater BMP. To minimize disturbance, the Site Limit of Disturbance was reduced to the minimum needed to construct the facility and associated pipeline. However, the majority of the right-of-way will be disturbed, making minimized total disturbance applicable for use as a PCSM BMP. Gravel cover was used in lieu of pavement to minimize impervious cover. Additionally, Impervious and gravel areas are disconnected from stormwater conveyance systems. Landscape Restoration with native species has been proposed to reduce the need for fertilizers, herbicides and pesticides. Rain Gardens will be installed to treat runoff. A vegetated swale with check dams will be utilized to convey runoff from the access road to one of the rain gardens. Finally, amended soils are proposed to manage stormwater runoff volume and quality. As a result of these BMP's, some, but not all of the 2 year, 24-hr stormwater volume increase was managed. Therefore, structural BMP's were evaluated for further stormwater volume reduction.

Multiple structural volume reduction BMP's were evaluated to determine if CG1 volume control guidelines could be met. During evaluation of the site, it was discovered that seasonal high groundwater is present. As a result, the construction of infiltration BMP's is not feasible. Vegetative roofs and water reuse BMP's are impractical due to the nature of the use including operation and maintenance concerns. As a result the post development runoff volume will exceed the pre development runoff volume for the site.

Because the Site cannot meet volume control guidelines recommended in the BMP Manual the stormwater management design was developed to comply with water quality criteria set forth in the BMP Manual. PADEP water quality and pollutant removal worksheets 12 and 13 were prepared to demonstrate compliance with the BMP manual requirements. Due to this increase in runoff volume, in accordance with 25 Pa. Code §§102.8(g)(3)(iii) and 96.3(c), the applicant is required to demonstrate that the design will maintain and protect existing water quality and existing and designated uses by maintaining the preconstruction site hydrologic impact. This requires a demonstration that the water quality (including increase of stormwater volume) shall be achieved in all surface waters at least 99% of the time. Therefore, to supplement water quality worksheets 12 and 13, the stormwater volume increase was evaluated to verify that the expected volume increase is less than 1% of the volume of the stream at the discharge point to the stream for the 2-yr 24 hour stormwater runoff event. This analysis is provided in Appendix A.5 of this narrative.

<u>POI Summary</u>:

POI A: Subarea of POI 1 (Improvements associated with pad area and basins) (UNT to West Creek)

POI B: Subarea of POI 1 (Improvements associated with permanent access road and roadside swale) (UNT to West Creek)

POI 1: Where POI A and POI B combine (downstream at West Creek)

Overall Site: West Creek

Volume Summary Table

VOLUME SUMMARY							
	2- YR PRE (FT^3)	2- YR POST (FT^3)	2- YR VOLUME INCREASE (FT^3)	2- YR STRUCTURAL AND NONSTRUCTURAL CREDITS (FT^3)	2-YR PRE VOLUME TO RECEIVING WATER	INCREASE (FT^3)	INCREASE (%)
POI A	11,839	18,452	6,613	2,632	495,451	3,981	0.8%
POI B	8,148	8,593	445	547	112,080	(-102)	(-0.1%)
POI 1	19,987	27,045	7,058	3,179	607,531	3,879	0.6%

*See Appendix A.5 for calculations.

Runoff Rate Summary Table

STORM EVENT	POINT OF INTEREST A			POINT OF INTEREST B			POINT OF INTEREST 1		
	PRE (CFS)	POST (CFS)	REDUCTION (CFS)	PRE (CFS)	POST (CFS)	REDUCTION (CFS)	PRE (CFS)	POST (CFS)	REDUCTION (CFS)
1-yr	1.39	1.30	0.09	1.05	0.53	0.52	2.41	1.81	0.6
2-yr	2.51	2.17	0.34	1.87	1	0.87	4.3	3.07	1.23
5-yr	4.20	3.43	0.77	3.24	2.53	0.71	7.18	4.94	2.24
10-yr	5.63	4.45	1.18	4.34	3.87	0.47	9.6	6.88	2.72
25-yr	7.74	5.95	1.79	5.99	5.21	0.78	13.18	10.73	2.45
50-yr	9.48	7.16	2.32	7.34	6.2	1.14	16.14	13.09	3.05
100-yr	11.31	10.56	0.75	8.75	7.21	1.54	19.25	17.69	1.56

*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 was designed to meet requirements of the PADEP PCSM Manual.

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 drain to two different UNT to West Creek, which are not High Quality (HQ) or Exceptional Value (EV) streams. The receiving waters are designated as Cold Water Fishery (CWF) under PA Code 25 Chapter 93. The Site's watersheds are not listed as impaired in the PADEP Chapter 93 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**).

Vegetated Swales with Earthen Check Dams: A vegetated swale with earthen check dams will be utilized to manage post construction stormwater runoff rate and quality.

Rain Garden: Infiltration will not occur within Rain Garden #1 or Rain Garden #2, but both with be utilized to for runoff rate and water quality management.

Minimize Total Disturbed Area: Minimizing the total disturbed area serves to conserve the existing site vegetation. Construction activities will be conducted in a manner that avoids affecting and encroaching upon these areas wherever practical so that the valuable functions are preserved. Orange construction fence will be used to protect areas during construction.

Disconnection from Storm Sewers: In order to enhance infiltration and pollutant removal, reduce stormwater runoff volume, slow runoff velocities, and reduce peak discharge rates, stormwater runoff from impervious areas will be directed to infiltration areas and vegetated swales. This will also reduce or eliminate the need for curbs, gutters, inlets and storm sewers.

Soil Amendment and Restoration: Soil amendments shall be added to the Site areas after construction in order to restore soil porosity, long term infiltration and provide water quality treatment.

Reduce parking impervious area: Impervious parking areas will be minimized to the maximum extent practicable. All roads and pads will be gravel areas.

Landscape Restoration: Landscape restoration will be performed on areas within the site that require landscaping. These areas include the berms/embankments of the rain garden and the areas adjacent to the proposed gravel pad. Meadow, planted with native species that will not require significant chemical maintenance by fertilizers, herbicides and pesticides is proposed in these areas.

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. Install orange construction fence around areas to be protected.

4. Locate staging areas and access points including construction entrances. Field locate limits of disturbance.

5. Install rock construction entrance (RCE) at temporary access road.

6. 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.

7. 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.

8. Install temporary access road. Construction of temporary access road shall be fully completed and stabilized prior to any additional disturbance occurs on site.

9. Install waterbars. Any E&SC BMPs associated with the construction of the pipeline should remain in place until construction of pipeline and facility is completed and the areas are stabilized.

10. *** Install Sediment Trap with temporary riser orifice configuration, including clay core, antiseep collars, slope liners, cleanout stake, and associated improvements. Install orange construction fence at perimeter of trap to prevent compaction of soils.**

11. Proceed with major clearing and grubbing.

12. Begin construction staking for grading.

13. Begin grading and strip and stockpile topsoil within the regulator station area and install sediment barriers around stockpiles.

14. 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).

15. Rough grade Site.

16. Grade the regulator station pad 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. Construct remainder of stormwater management Basin 1 area. All earth moving associated with this work shall be completed prior to converting temporary riser to the permanent riser configuration. Any excess excavation material that will not be used onsite shall be hauled offsite.

21. 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.

22. * Convert trap to permanent Basin 1 configuration by removing all accumulated sediments, removing baffles and installing underdrains and engineered soils on basin bottom. Immediately seed and stabilize basin, install erosion control blanket on basin slopes, and install CFS and landscape restoration on interior toe of slope. Haul off site any excess material not used and left over from the conversion of the basin.

23. * Reconfigure temporary riser to permanent outlet structure by permanently sealing the 1" orifices. Install emergency spillway.

24. * Once construction for the regulator station and the pipeline is complete and the areas are stabilized, relocate rock construction entrance to apron of permanent access road, install permanent access road and associated BMPs (RCE, vegetated roadside swales with earthen check dams, amend soils, erosion control blanket, rain garden 2, culverts, water bars and riprap outlet protection). Any portion of waterbars associated with the pipeline construction that are impacted by the construction of the permanent access road should be removed.

25. Remove temporary access road. Restore temporary access road area to pre-development grades. De-compact, immediately seed and stabilize area disturbed during removal of access road.

26. *Amend soils throughout remainder of site. Immediately seed and stabilize.

27. 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**).

28. After seeding, fertilizing and mulching is complete, install ECBs as required or ordered or on slopes of 3:1 or greater.

29. 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.

30. * Complete Site stabilization, including soil amendment, seed application, ECB installation in basins, landscape restoration, and mulching.

31. Upon completion of all earth disturbance activities, the Owner and/or Operators shall contact the local CCD for a final inspection.

32. Maintain E&SC BMPs until site work is complete and uniform 70% perennial vegetative cover is established.

33. 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 West Diamond Regulator Station 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. Rain Gardens

Inspect the rain gardens annually and inspect soil, landscaping, 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 rain garden bottoms 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. Disconnection from Storm Sewers

Disconnected impervious areas shall continue to be directed to infiltration areas and vegetated swales as shown on the PCSM/SR Plans (**Section 3 of the ESCGP-2 NOI**). Infiltration areas and vegetated swales shall be maintained as indicated on the PCSM/SR Plans (**Section 3 of the ESCGP-2 NOI**).

4. Soil Amendments and Restoration

Restrict vehicle access. Monitor settlement of amended soil areas annually. If settlement exceeds 2", repeat soil amendment process.

5. Landscape Restoration

Once the landscape restoration is established, seasonal mowing may be required to maintain meadow areas. Additionally, in the first year weeds must be mowed back to 4 to 6 inches tall when they reach 12 inches in height. In the second year weeds should continue to be mowed and rhizomatous weeds should be hand treated with herbicide. Sprayed herbicide shall not be used. In the beginning of the third season the meadow should be mowed close to the ground to encourage rapid soil warming.

6. Water Deflectors

The water deflectors shall be inspected weekly and after each rainfall event. Accumulated sediment shall be removed from deflector within 24 hours of inspection. Deflector belt shall be replaced when worn or no longer effective.

7. Reduce Parking Area/Street 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. Level Spreader

Inspect area below the level spreader on a quarterly basis for the first two years after installation and annually thereafter. Remove sediment and debris from the level spreader when it interferes with proper function. Regrade and reseed any channelized or eroded areas that develop below the level spreader. Regrade any newly occurring areas where water stands for longer than 72 hours. Inspect vegetation for the first growing season. Conduct health, diversity and density inspection twice a year after the first growing season. Maintain vegetative cover at 85%.

9. Minimized Total Disturbed Area `update per plan redlines`

- Protected Areas – Restrict vehicle access, do not clear vegetation, avoid earth disturbance.
- Minimum Disturbance Areas - Restrict vehicle access.

10. 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.

11. 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

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

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 ***Earthen*** 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.

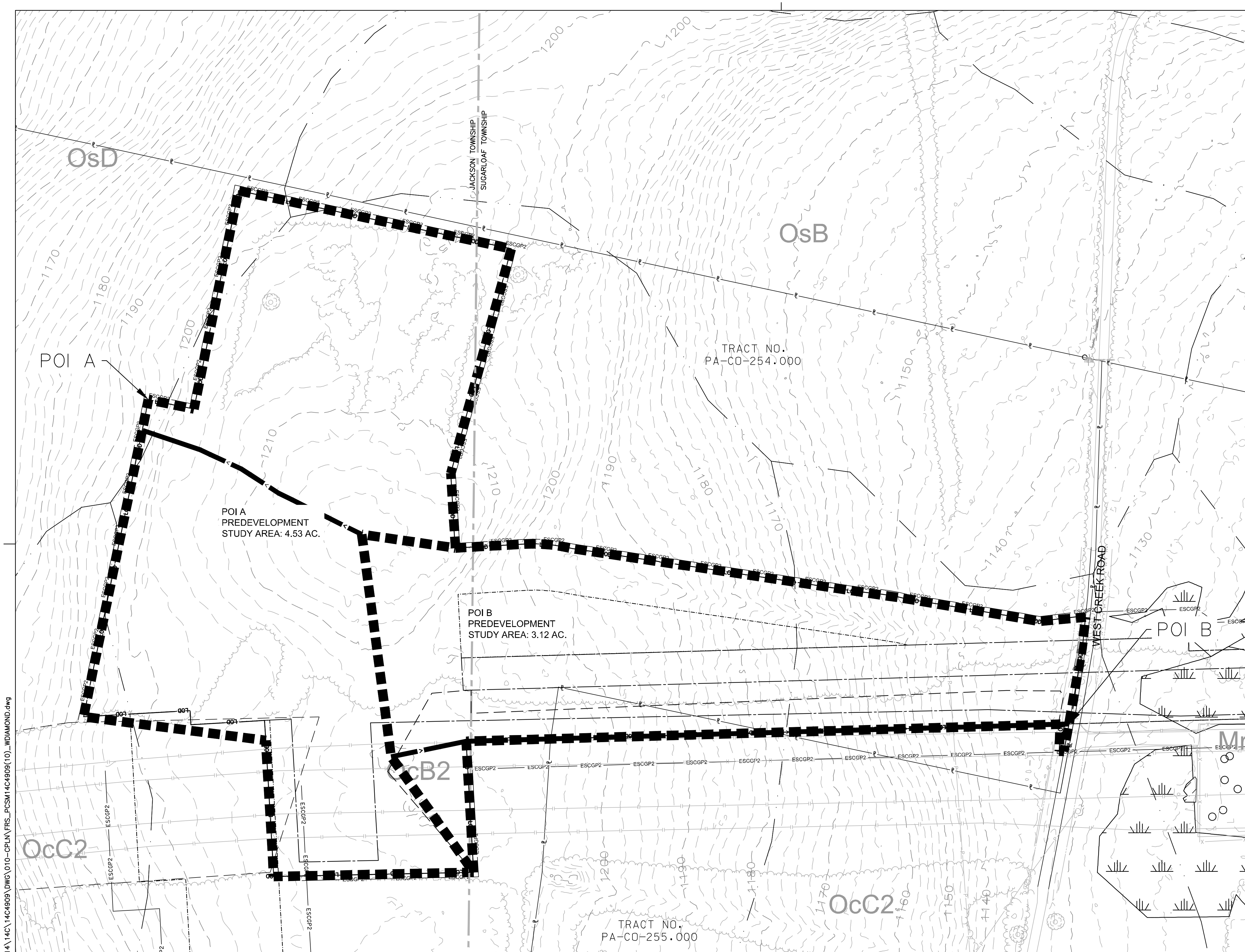
APPENDICES

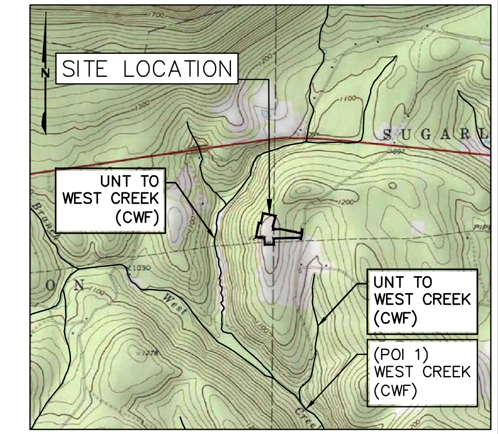
Appendix A	West Diamond Regulator Station Supporting Calculations
	A.1 Pre-Development Calculations
	A.2 Post Development Calculations
	A.3 Conveyance Calculations
	A.4 PCSM BMP Calculations
	A.5 Water Quality Worksheets
	A.6 Site Characterization Assessment
	A.7 Supporting Documentation
Appendix B	Preparer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

APPENDIX A

West Diamond Regulator Station Supporting Calculations

A.1 Pre-Development Calculations





LOCATION MAP

USGS ELK GROVE QUADRANGLE
SCALE: 1"=2,000'

LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- × 1353.0 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)
- WsB SOIL TYPE DESIGNATION
- ESCGP2 ESCGP-2 PERMIT BOUNDARY
- LOD LIMIT OF DISTURBANCE (WEST DIAMOND REGULATOR STATION)
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- EXISTING ROAD
- ROW
- TOWNSHIP LINE
- STUDY DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH

GRAPHIC SCALE
50 25 0 50
SCALE IN FEET
1 inch = 50 ft.

ALARIC J. BUSHER REG NO. PE 60320

BL Companies — ARCHITECTURE ENGINEERING ENVIRONMENTAL LAND SURVEYING

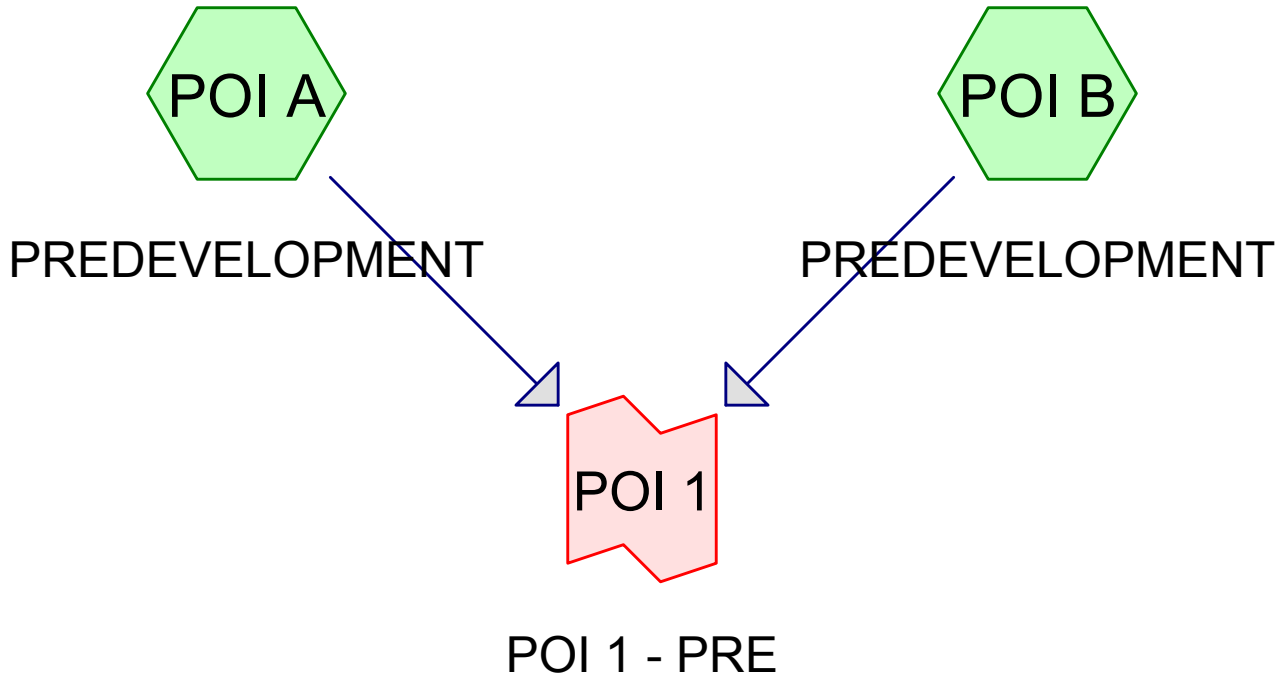
REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W01161501	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	DAK	AJB
2	02/04/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	AJB	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	AJB	AJB
4	OCT. 2016	BL	PADEP TECHNICAL DIFICIENCY RESPONSE #1	W01161501	AJB	AJB
5	*April 2017*	*BL*	*PADEP TECHNICAL DIFICIENCY RESPONSE #2*	*W01161501*	*AJB*	*AJB*

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 30"/42" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS FOR WEST DIAMOND REGULATOR STATION & ASSOCIATED PERMANENT ACCESS ROADS
JACKSON/SUGARLOAF TOWNSHIPS, COLUMBIA COUNTY, PENNSYLVANIA
PRE–DEVELOPMENT DRAINAGE AREA MAP

DRAWN BY: JEC	DATE: 04/03/15	ISSUED FOR BID:		SCALE:	AS NOTED
CHECKED BY: AJB	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:		REVISION:	5
APPROVED BY: AJB	DATE: 07/17/15	DRAWING NUMBER:	(36–7943)MF–1A–9	SHEET 1	OF 1
WO: 1161501					

Drawing Location & Name: G:\JOBS14\14C\14C4909\DWG\010-CPLN\FRS_PCSM14C4909(10)_WDIAMOND.dwg



Subcat Reach Pond Link

Routing Diagram for C-DAT-14C4909-WDIAMOND-TD2
Prepared by BL Companies, Printed 4/26/2017

Summary for Subcatchment POI A: PREDEVELOPMENT

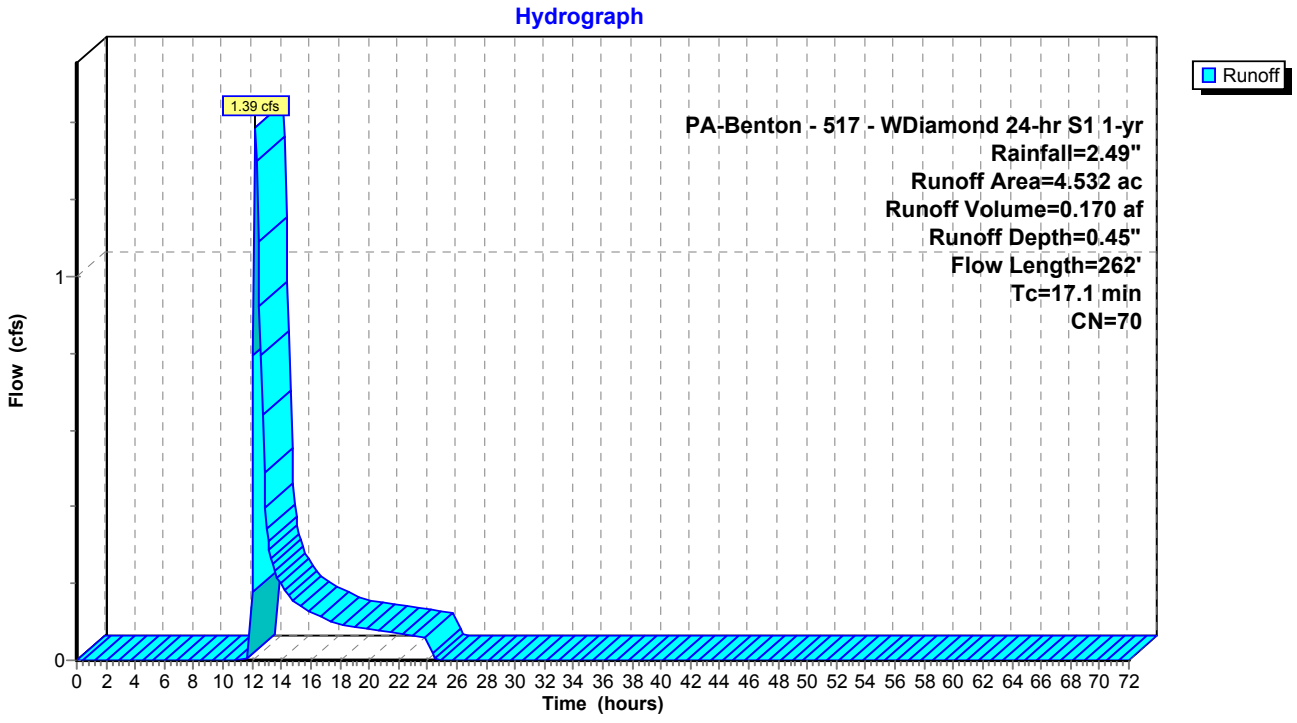
Runoff = 1.39 cfs @ 12.24 hrs, Volume= 0.170 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

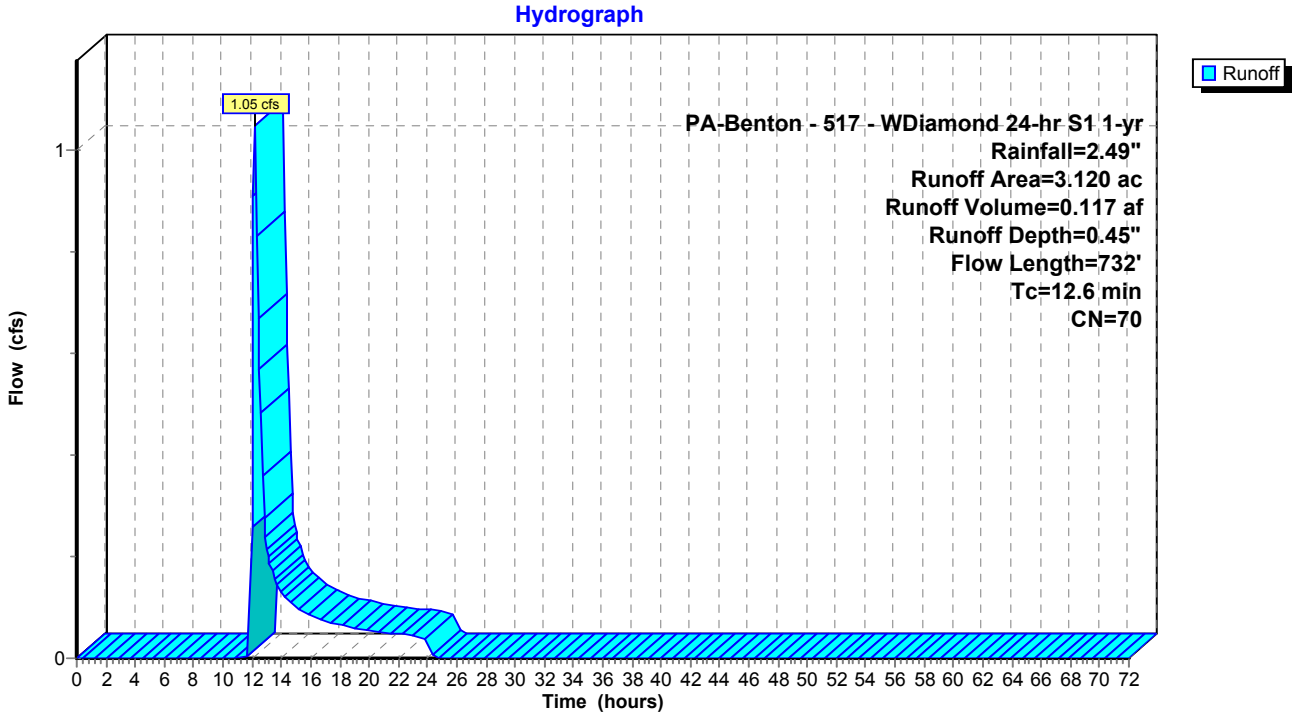
Runoff = 1.05 cfs @ 12.19 hrs, Volume= 0.117 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

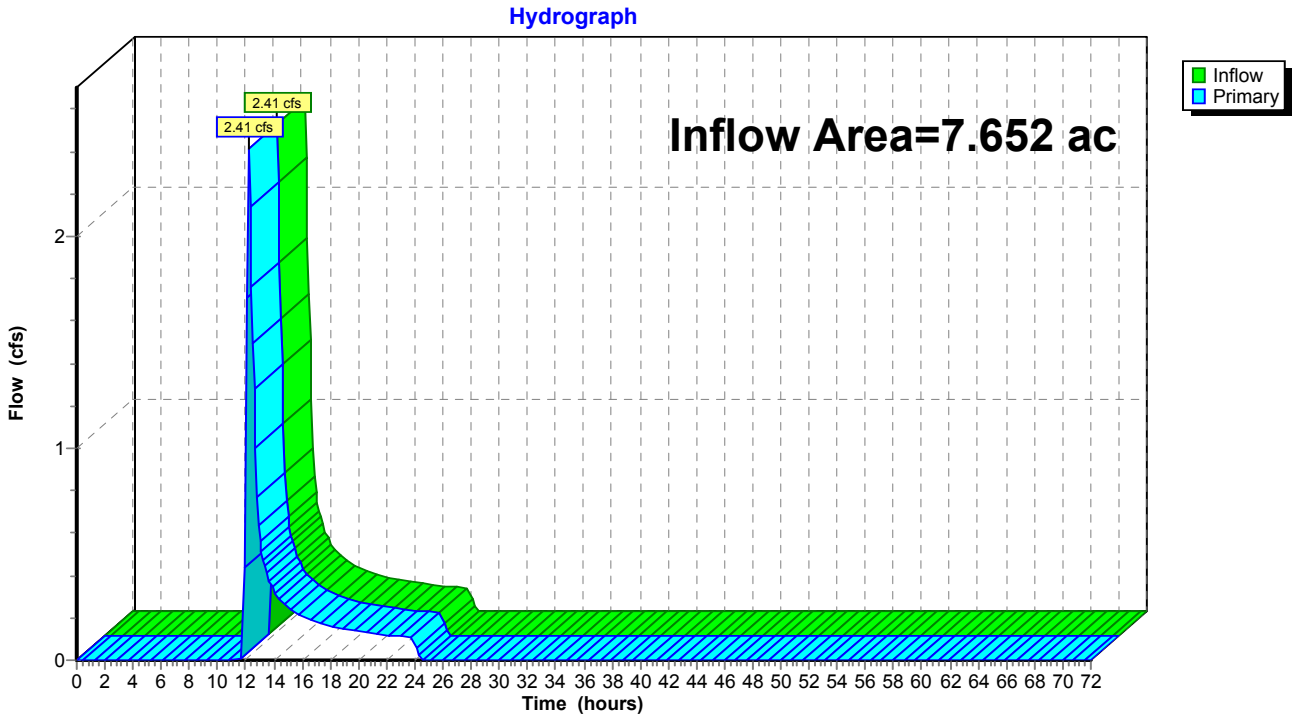


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 0.45" for 1-yr event
Inflow = 2.41 cfs @ 12.22 hrs, Volume= 0.287 af
Primary = 2.41 cfs @ 12.22 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

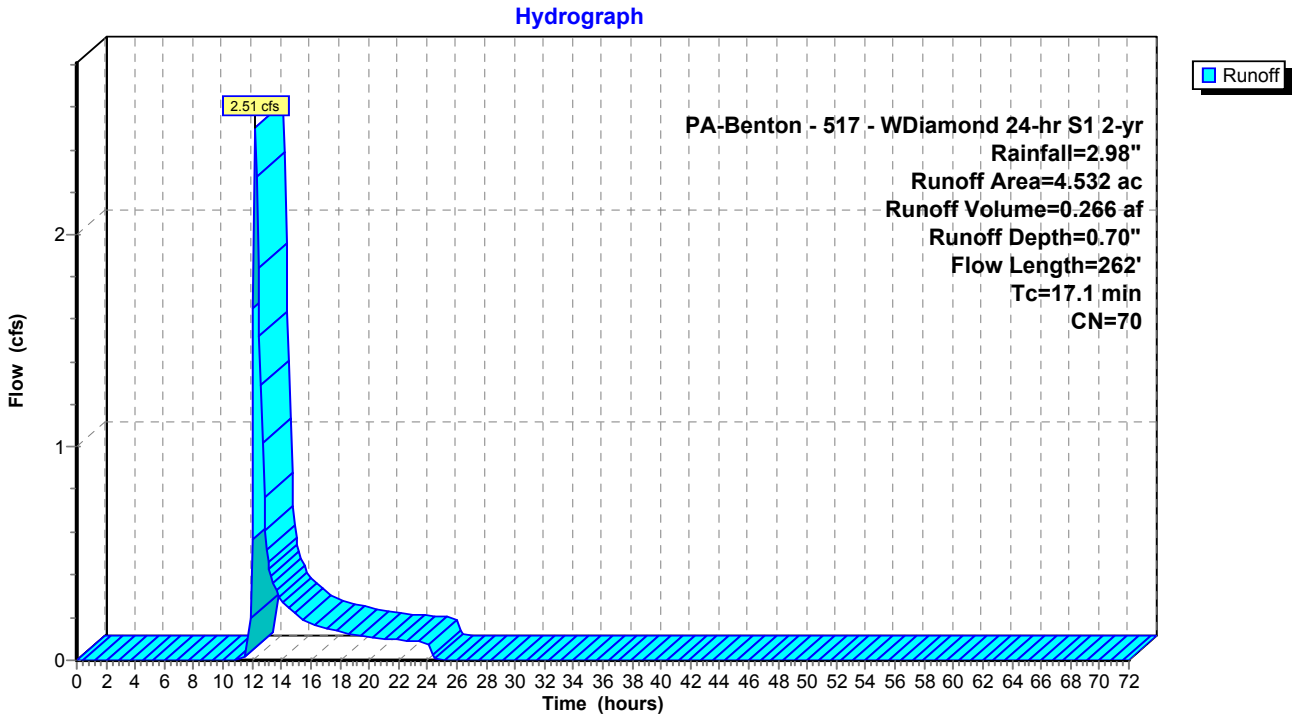
Runoff = 2.51 cfs @ 12.23 hrs, Volume= 0.266 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

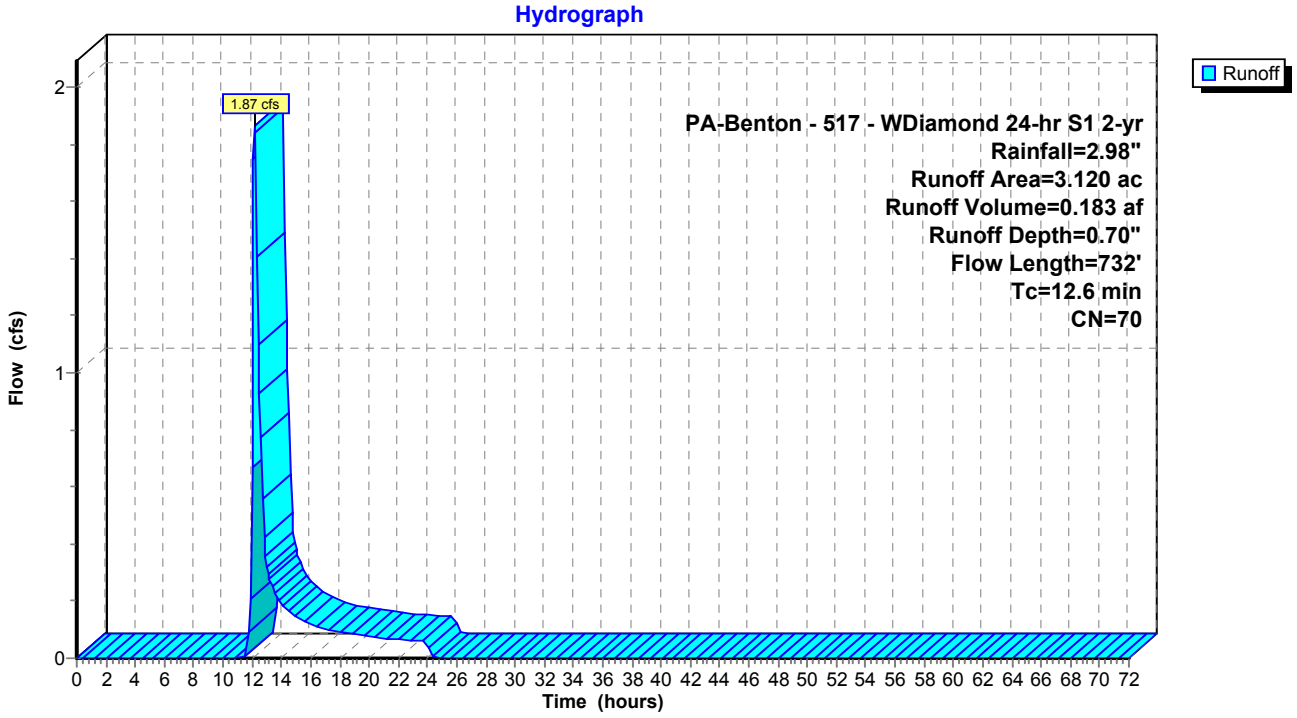
Runoff = 1.87 cfs @ 12.17 hrs, Volume= 0.183 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

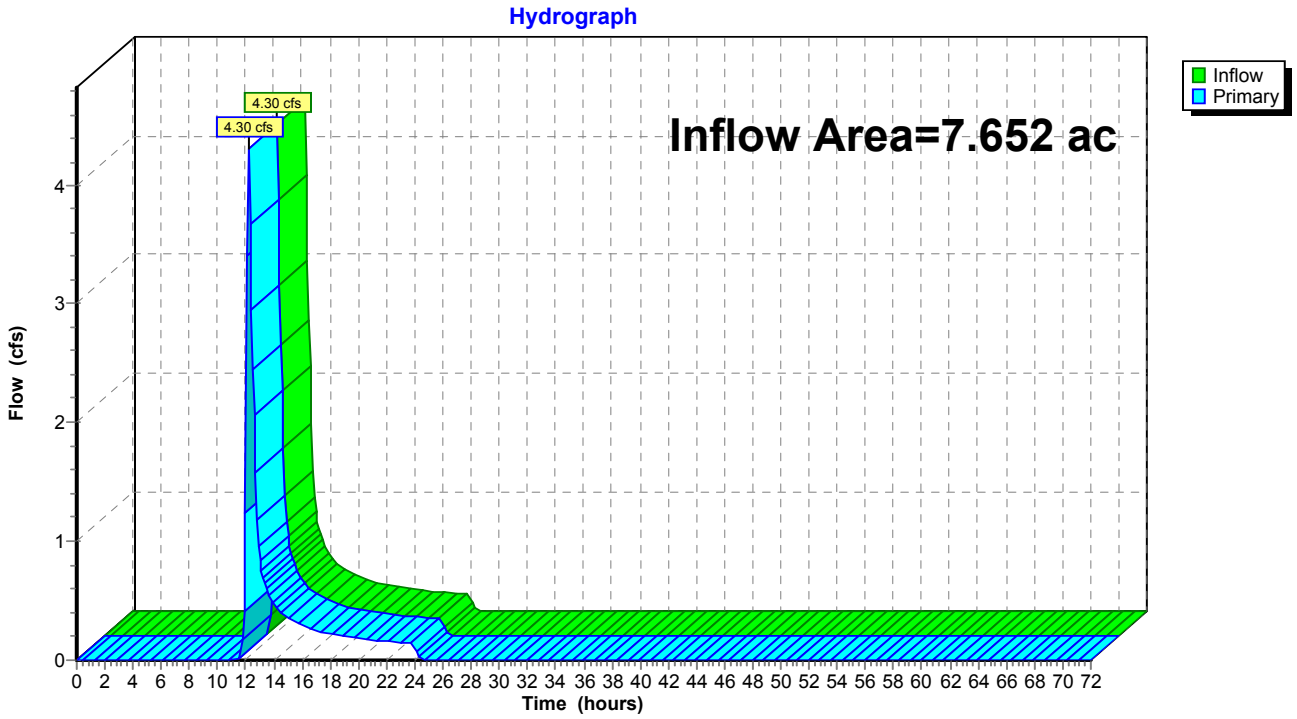


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 0.70" for 2-yr event
Inflow = 4.30 cfs @ 12.21 hrs, Volume= 0.448 af
Primary = 4.30 cfs @ 12.21 hrs, Volume= 0.448 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

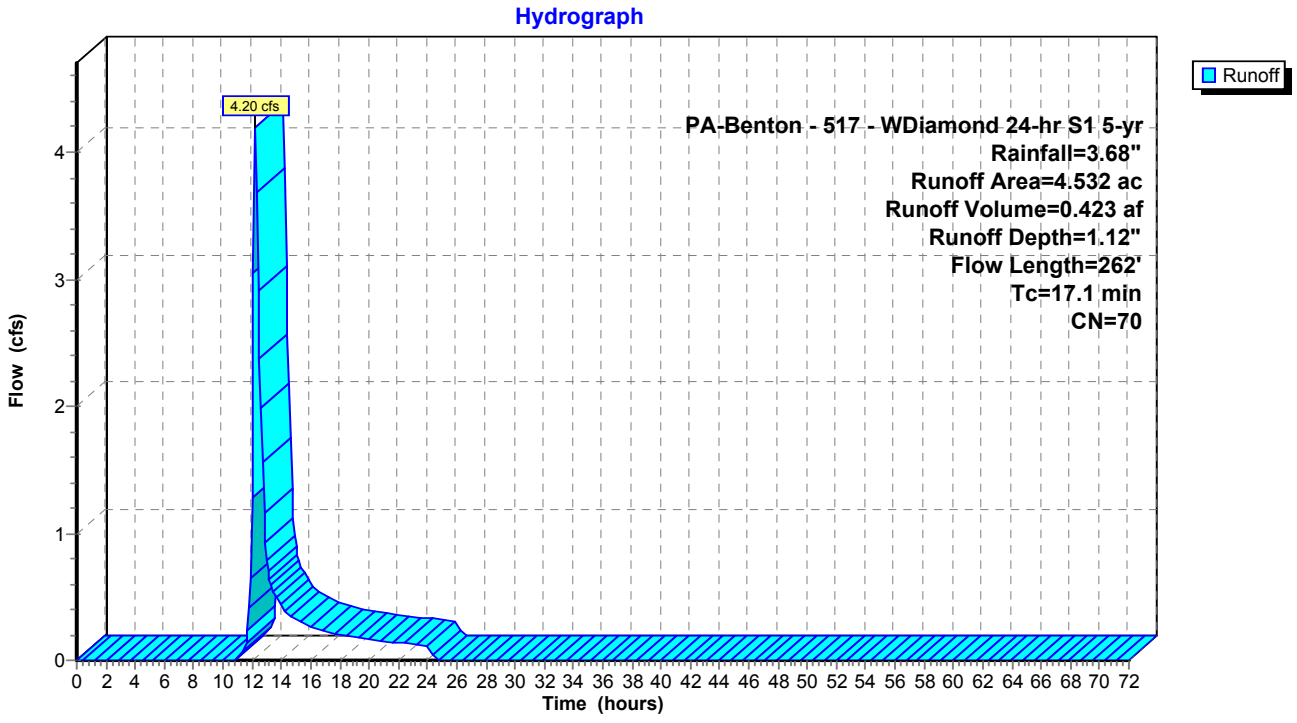
Runoff = 4.20 cfs @ 12.22 hrs, Volume= 0.423 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

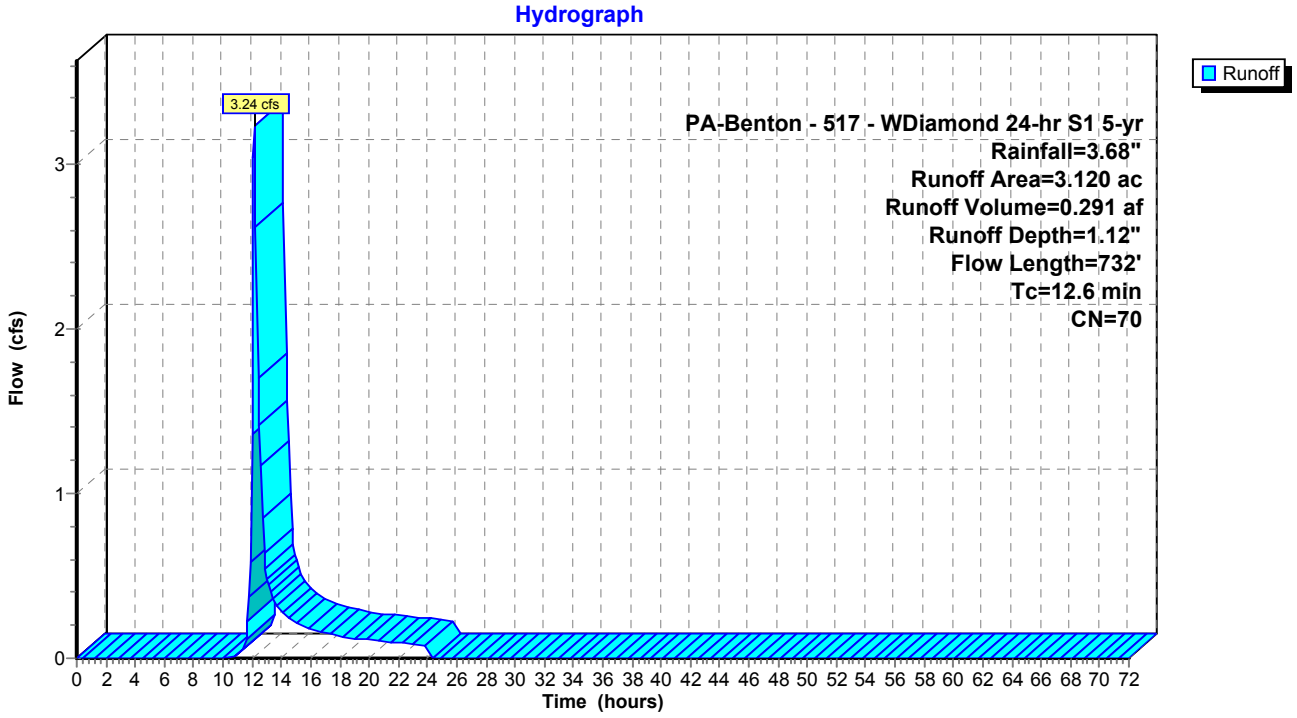
Runoff = 3.24 cfs @ 12.15 hrs, Volume= 0.291 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

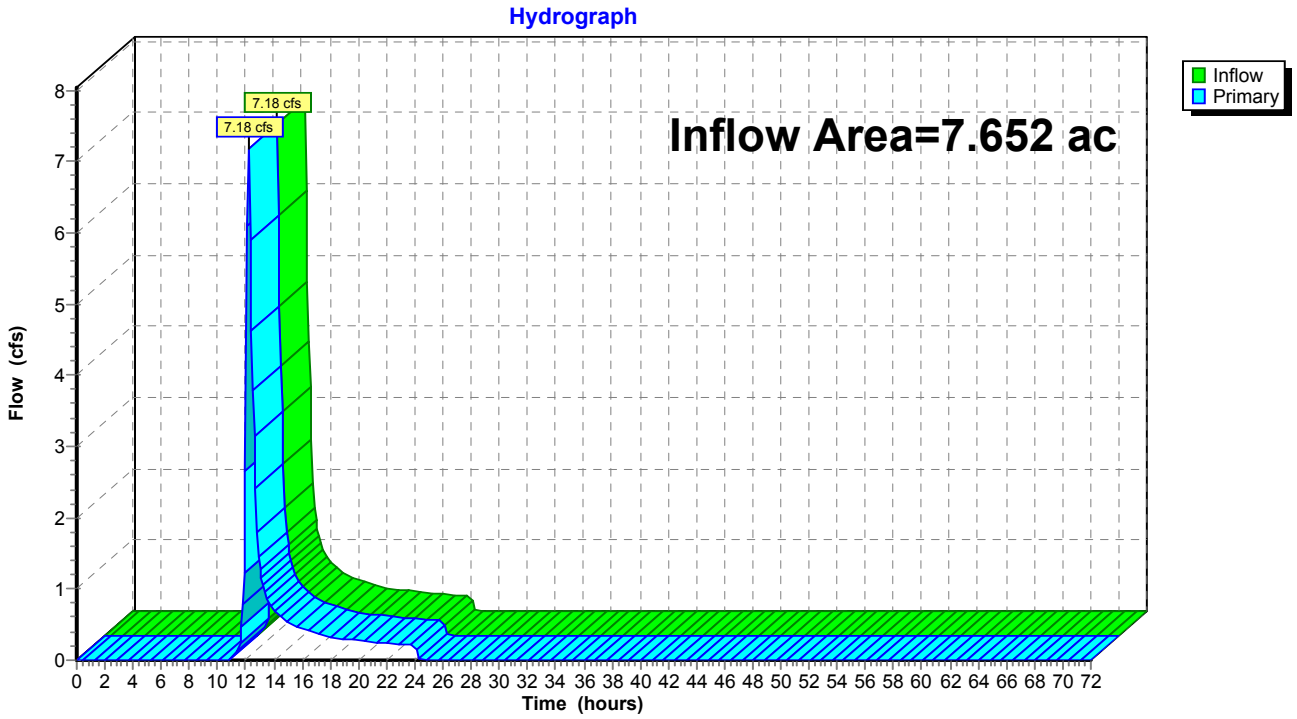


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 1.12" for 5-yr event
Inflow = 7.18 cfs @ 12.20 hrs, Volume= 0.715 af
Primary = 7.18 cfs @ 12.20 hrs, Volume= 0.715 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

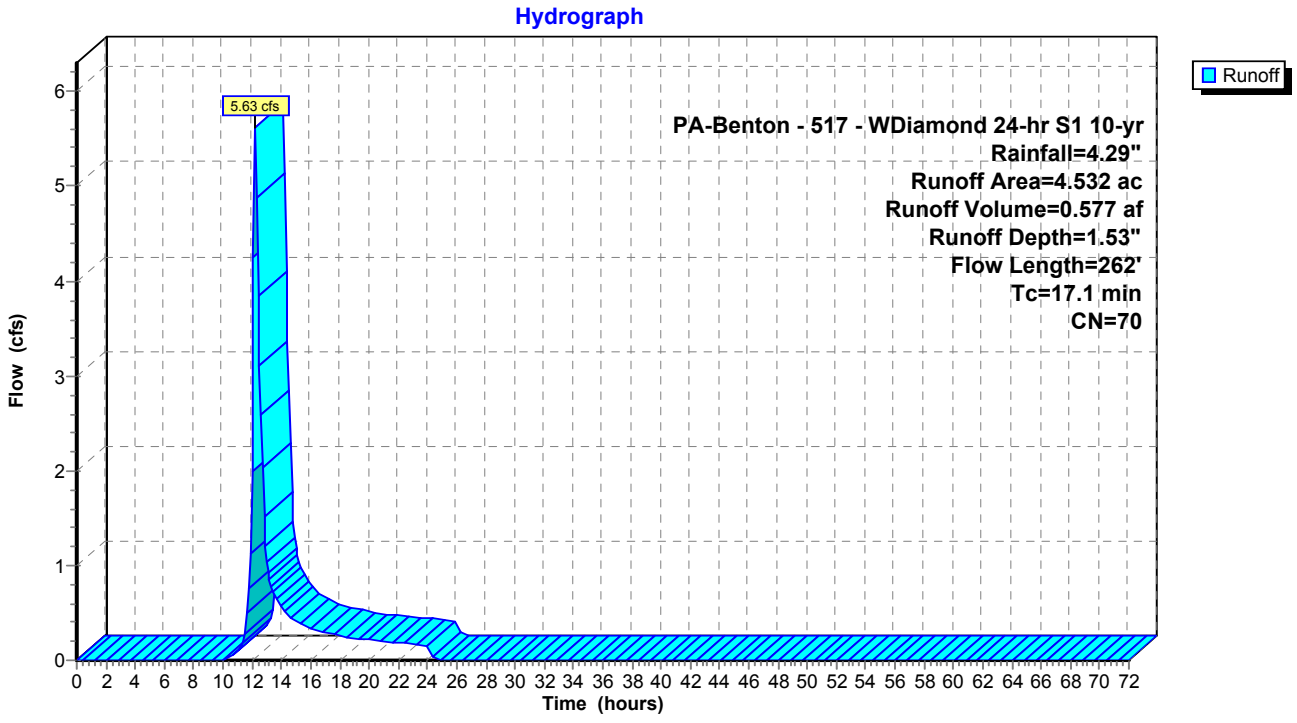
Runoff = 5.63 cfs @ 12.22 hrs, Volume= 0.577 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

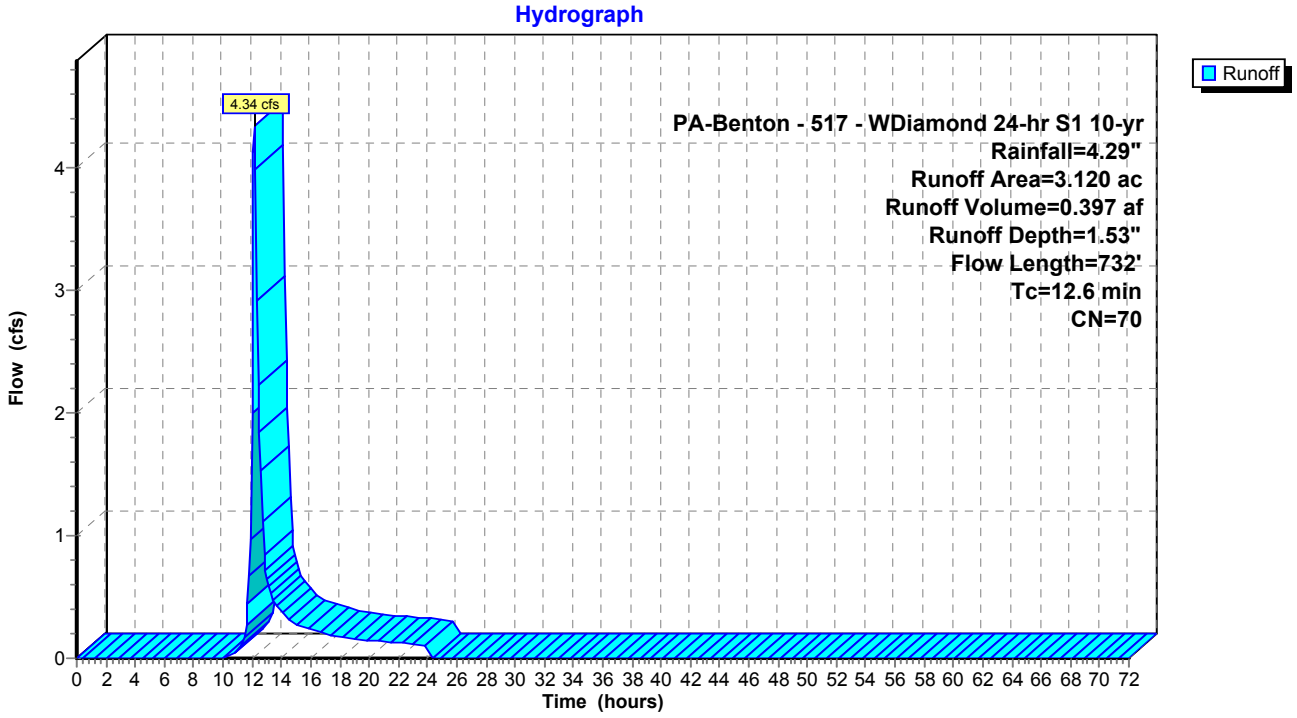
Runoff = 4.34 cfs @ 12.14 hrs, Volume= 0.397 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

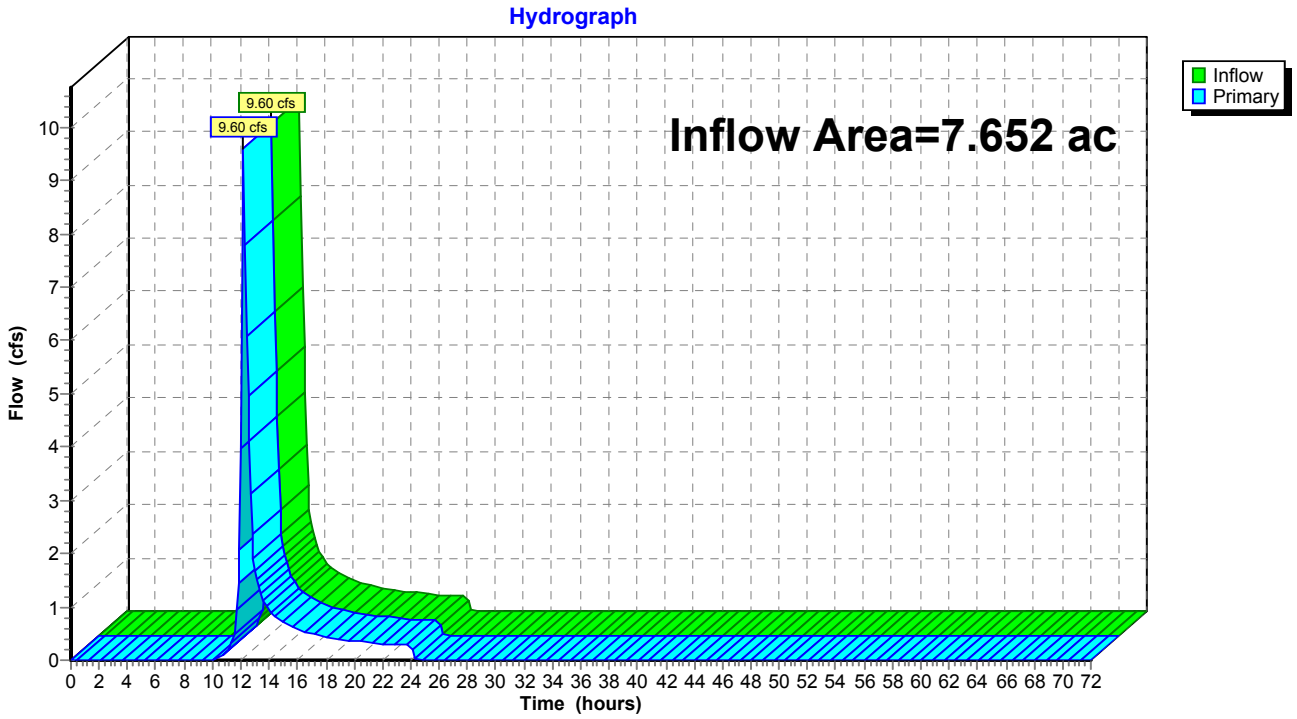


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10-yr event
Inflow = 9.60 cfs @ 12.19 hrs, Volume= 0.974 af
Primary = 9.60 cfs @ 12.19 hrs, Volume= 0.974 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

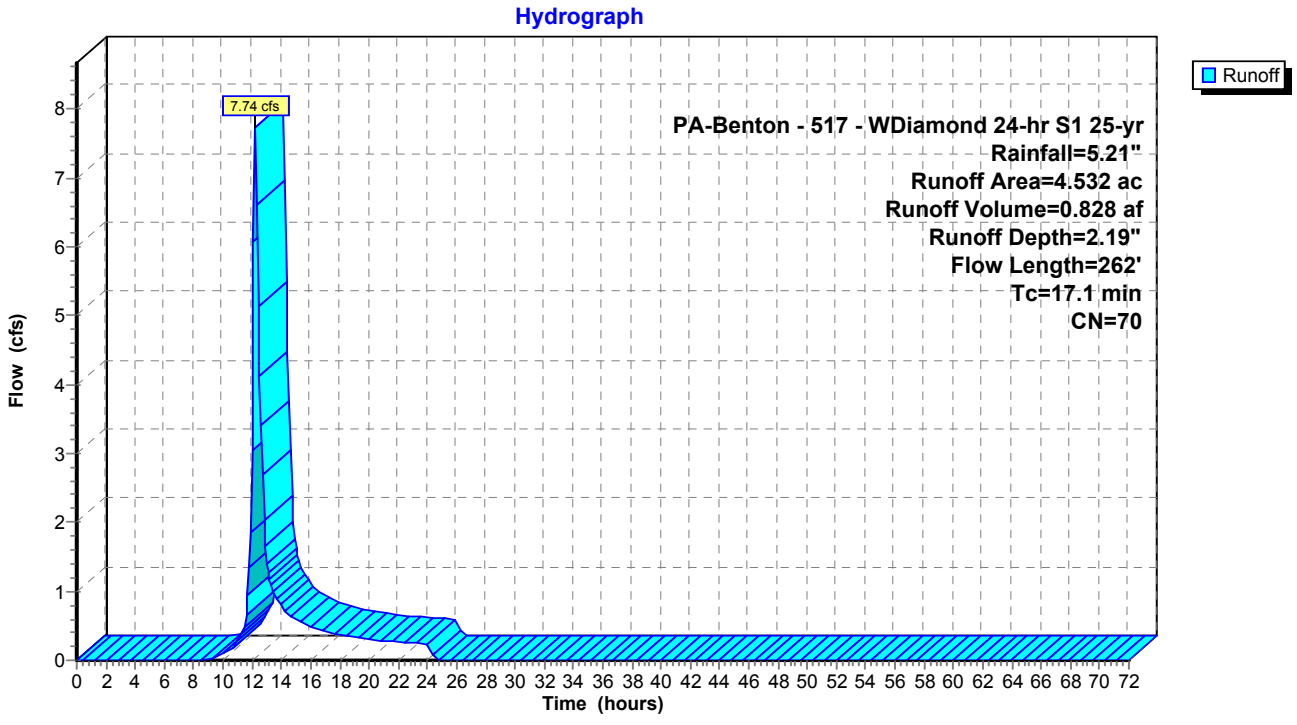
Runoff = 7.74 cfs @ 12.21 hrs, Volume= 0.828 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

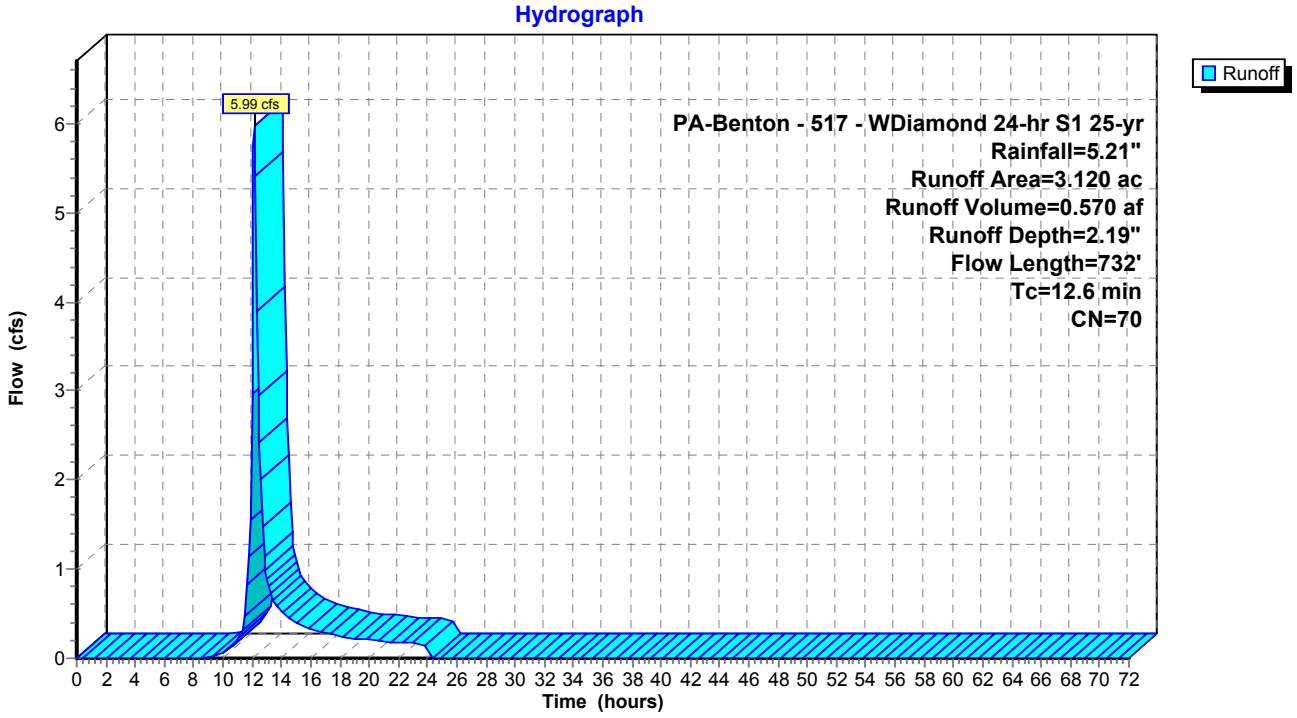
Runoff = 5.99 cfs @ 12.14 hrs, Volume= 0.570 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

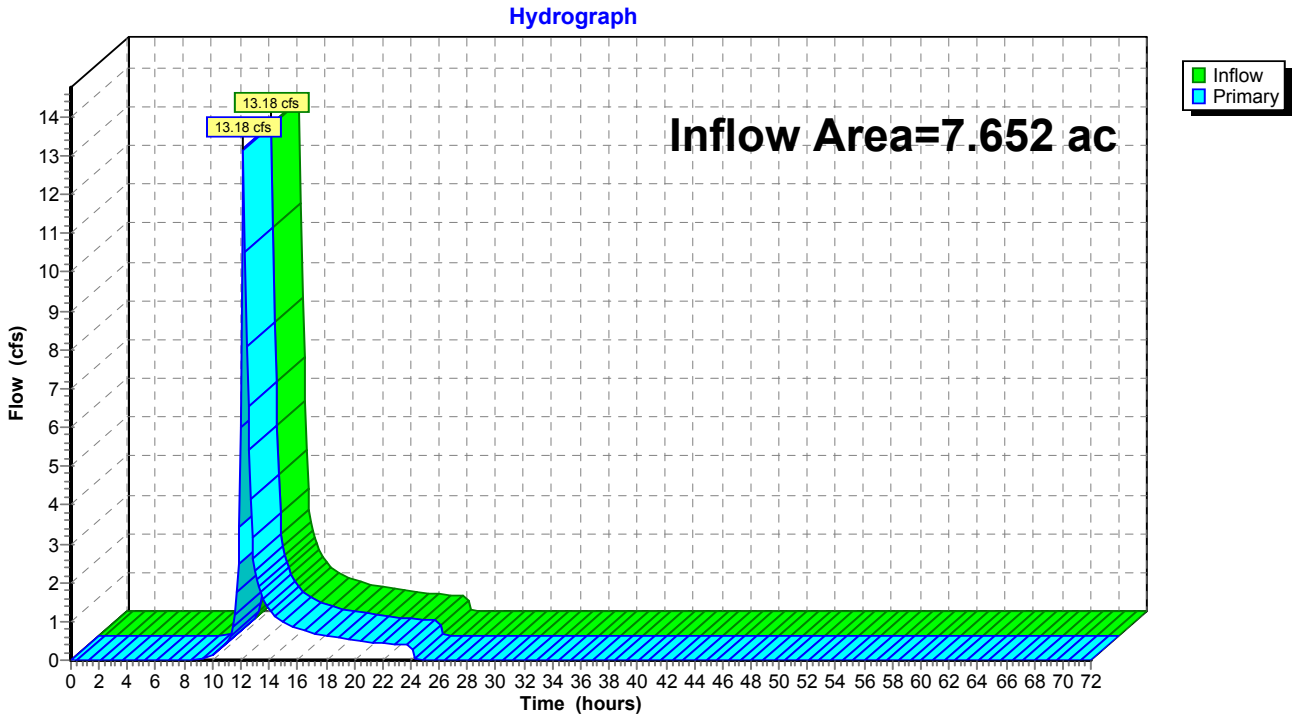


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 2.19" for 25-yr event
Inflow = 13.18 cfs @ 12.18 hrs, Volume= 1.399 af
Primary = 13.18 cfs @ 12.18 hrs, Volume= 1.399 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

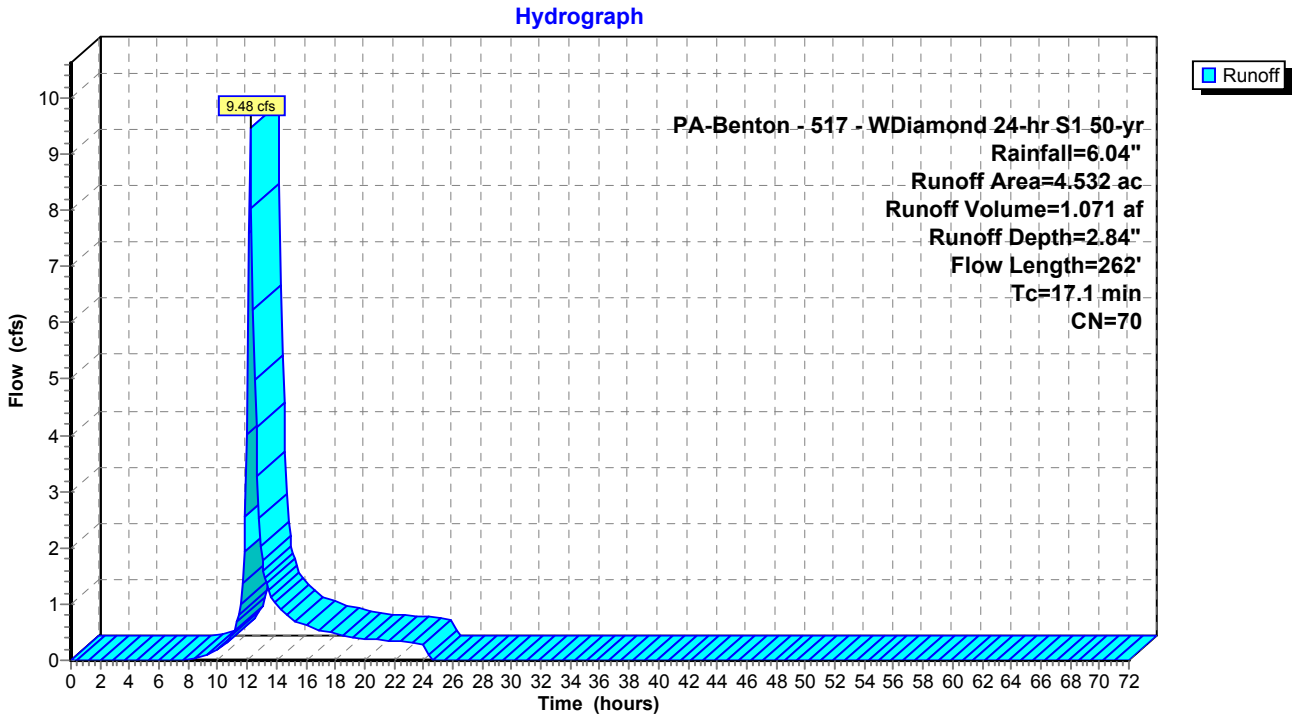
Runoff = 9.48 cfs @ 12.21 hrs, Volume= 1.071 af, Depth= 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

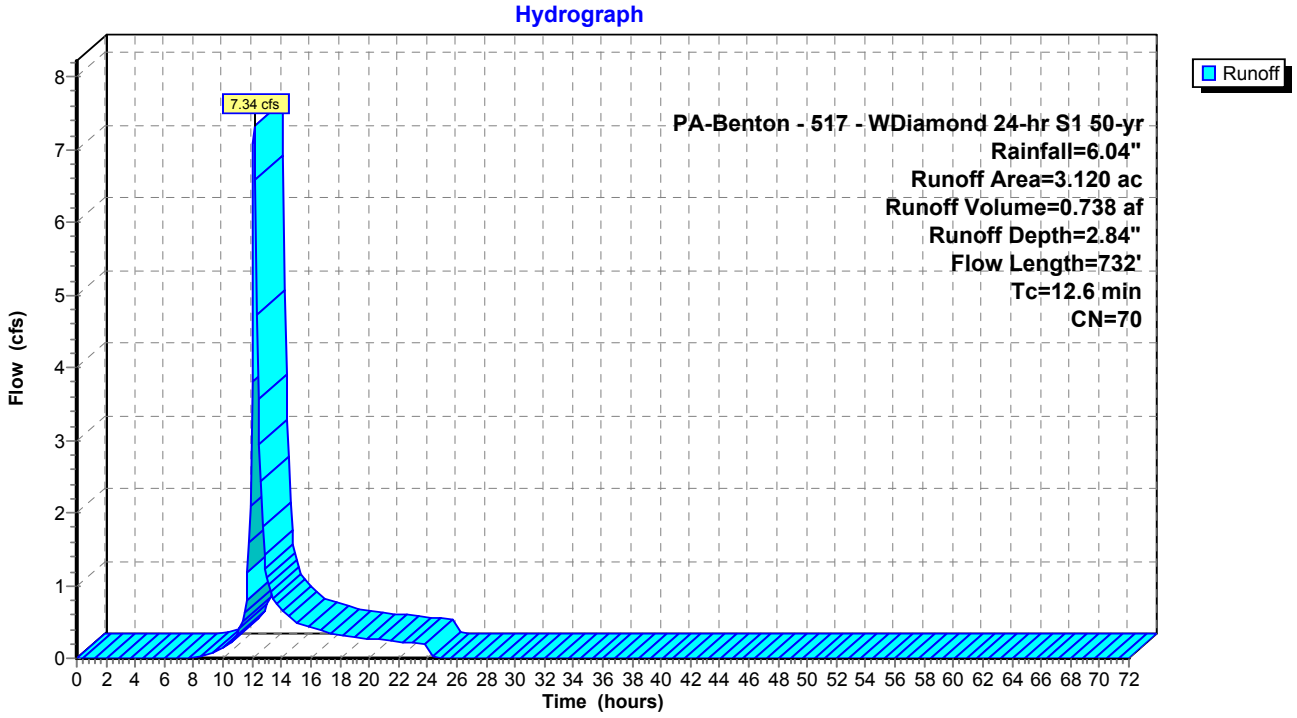
Runoff = 7.34 cfs @ 12.14 hrs, Volume= 0.738 af, Depth= 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

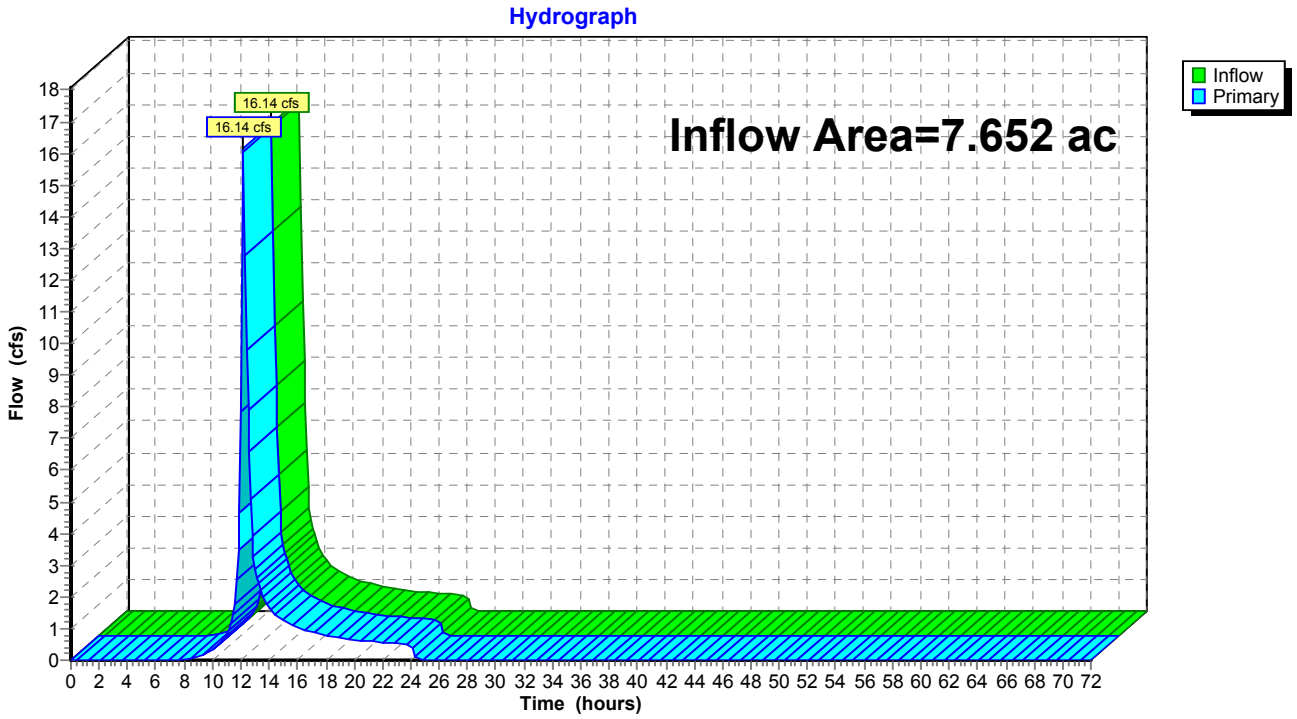


Summary for Link POI 1: POI 1 - PRE

Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 2.84" for 50-yr event
Inflow = 16.14 cfs @ 12.18 hrs, Volume= 1.809 af
Primary = 16.14 cfs @ 12.18 hrs, Volume= 1.809 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1: POI 1 - PRE



Summary for Subcatchment POI A: PREDEVELOPMENT

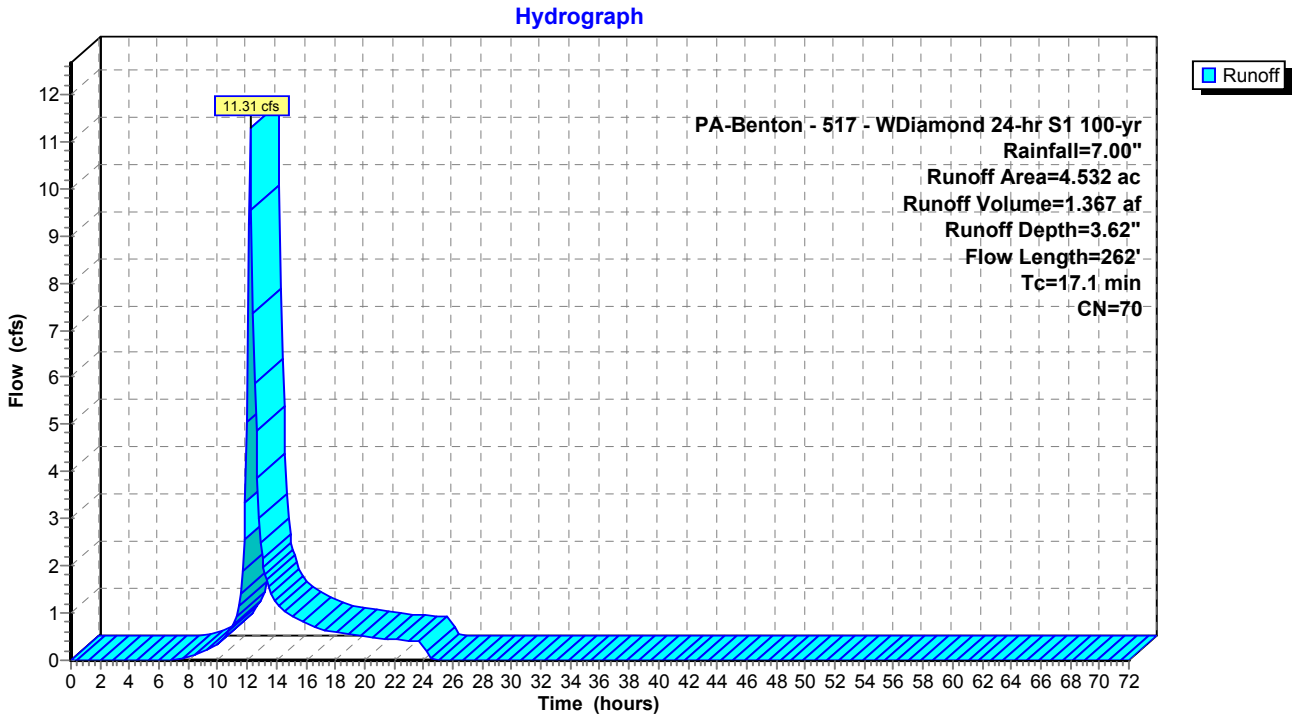
Runoff = 11.31 cfs @ 12.20 hrs, Volume= 1.367 af, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

Area (ac)	CN	Description
2.835	70	Woods, Good, HSG C
1.697	71	Meadow, non-grazed, HSG C
4.532	70	Weighted Average
4.532		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.0500	0.11		**Sheet Flow, SHT 1** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	127	0.0787	1.40		**Shallow Concentrated Flow, SCF 1** Woodland Kv= 5.0 fps
0.2	35	0.2290	2.39		**Shallow Concentrated Flow, SCF 2** Woodland Kv= 5.0 fps
17.1	262	Total			

Subcatchment POI A: PREDEVELOPMENT



Summary for Subcatchment POI B: PREDEVELOPMENT

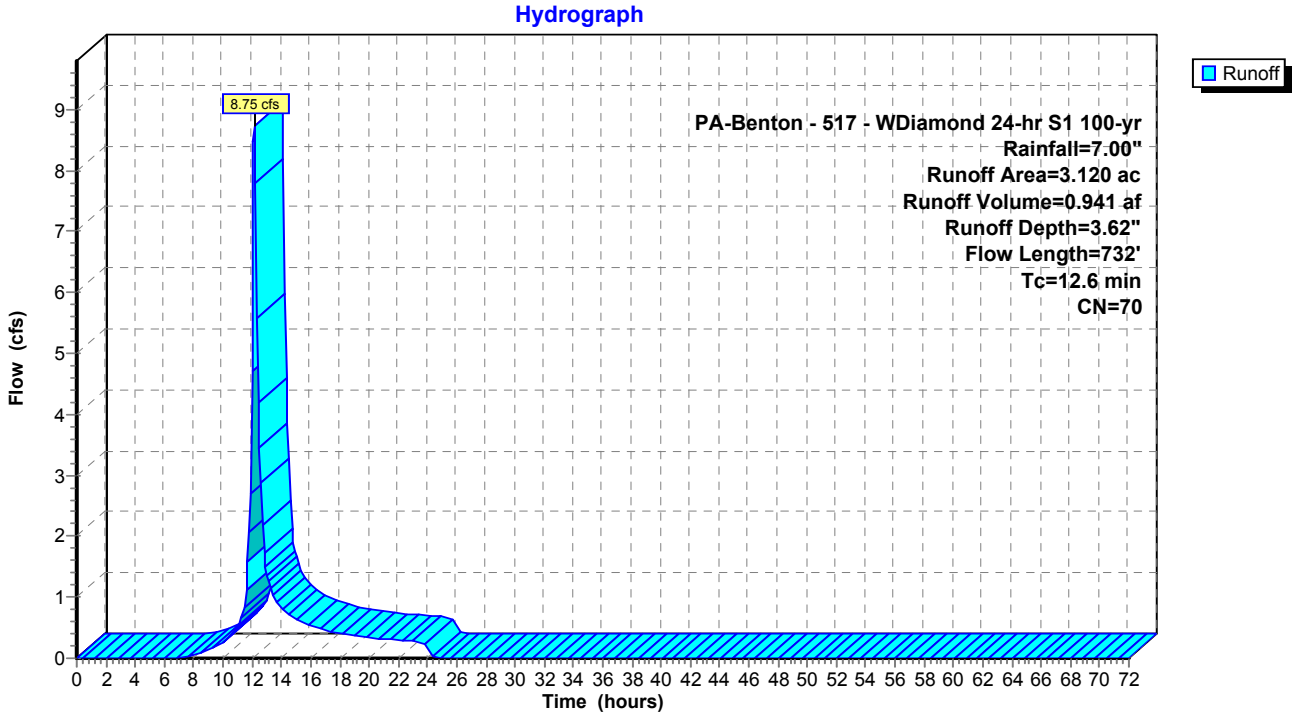
Runoff = 8.75 cfs @ 12.13 hrs, Volume= 0.941 af, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

Area (ac)	CN	Description
2.060	70	Woods, Good, HSG C
1.060	71	Meadow, non-grazed, HSG C
3.120	70	Weighted Average
3.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B: PREDEVELOPMENT

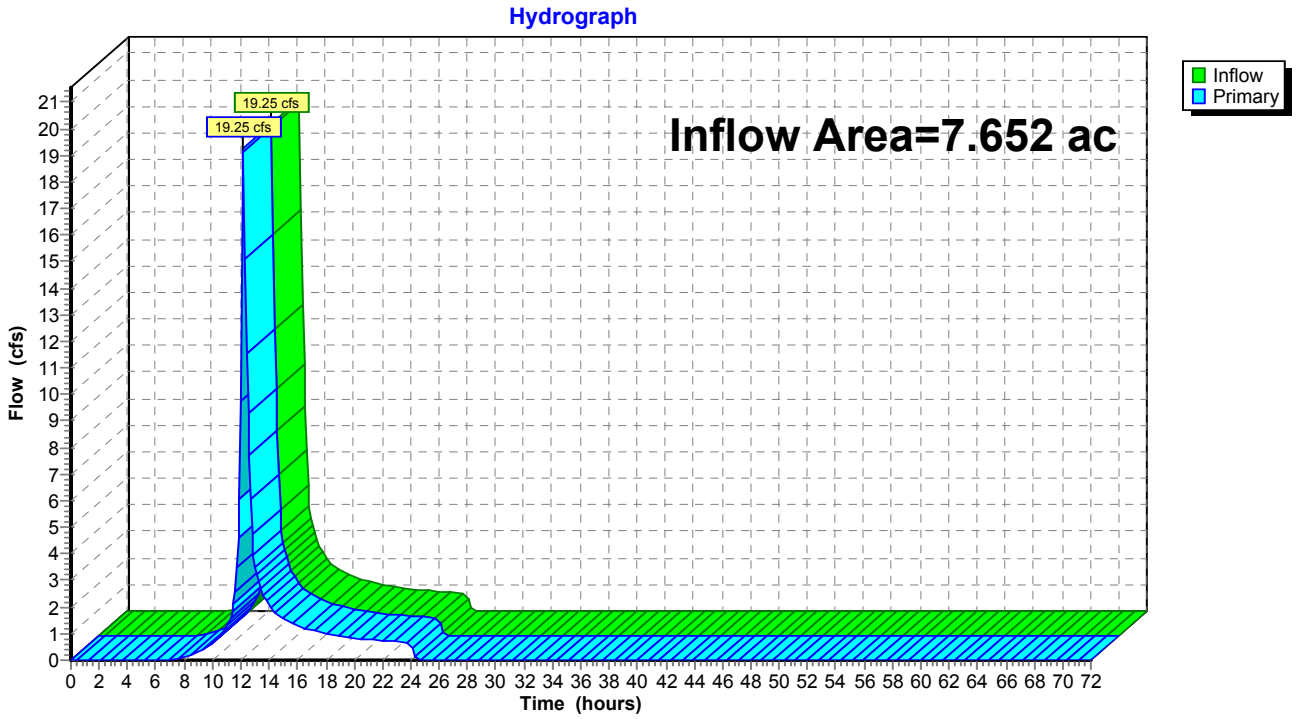


Summary for Link POI 1: POI 1 - PRE

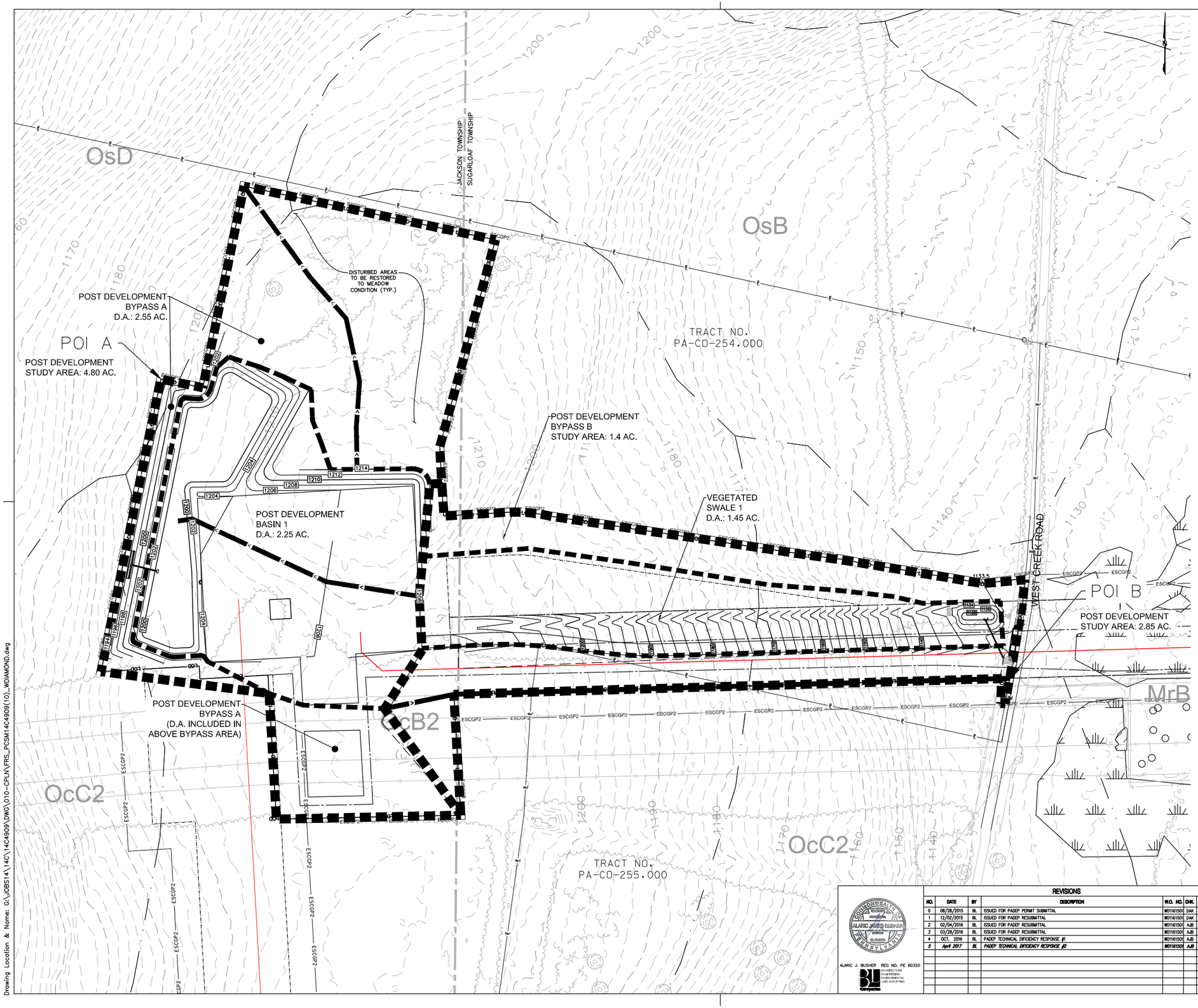
Inflow Area = 7.652 ac, 0.00% Impervious, Inflow Depth = 3.62" for 100-yr event
Inflow = 19.25 cfs @ 12.18 hrs, Volume= 2.307 af
Primary = 19.25 cfs @ 12.18 hrs, Volume= 2.307 af, Atten= 0%, Lag= 0.0 min

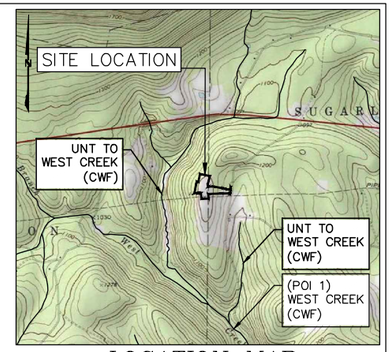
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs

Link POI 1: POI 1 - PRE



A.2 Post Development Calculations





LOCATION MAP

USGS ELK GROVE QUADRANGLE
SCALE: 1"=2,000'

LEGEND

- PROPERTY BOUNDARY LINE (MAP PROVIDED)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING 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)
- WsB — SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- PROPOSED MAJOR CONTOUR (10' INTERVAL)
- PROPOSED MINOR CONTOUR (2' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- LOD — LIMIT OF DISTURBANCE (WEST DIAMOND REGULATOR STATION)
- ESCGP2 — ESCGP-2 PERMIT BOUNDARY
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES
- TIME OF CONCENTRATION FLOW PATH

GRAPHIC SCALE
50 25 0 50
SCALE IN FEET
1 inch = 50 ft.

ALARIC J. BUSHER REG NO. PE 60320

BLC Companies — ARCHITECTURE, ENGINEERING, ENVIRONMENTAL, LAND SURVEYING

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	W01161501	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	DAK	AJB
2	02/04/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	AJB	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161501	AJB	AJB
4	OCT. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161501	AJB	AJB
5	April 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	W01161501	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

ATLANTIC SUNRISE PROJECT– PROPOSED 30"/42" NATURAL GAS PIPELINE

POST CONSTRUCTION STORMWATER MANAGEMENT PLANS FOR WEST DIAMOND REGULATOR STATION & ASSOCIATED PERMANENT ACCESS ROADS

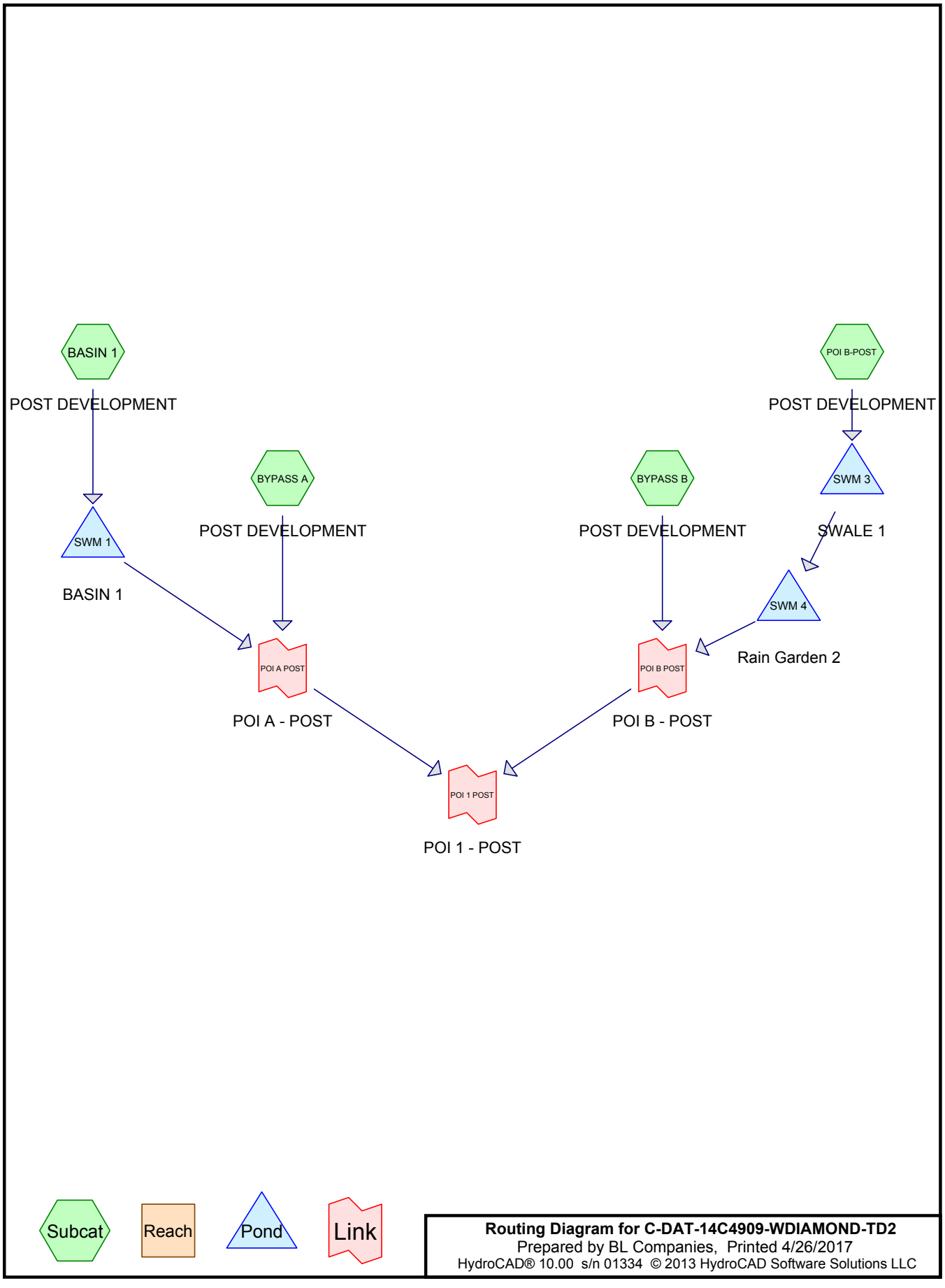
JACKSON/SUGARLOAF TOWNSHIPS, COLUMBIA COUNTY, PENNSYLVANIA

POST DEVELOPMENT DRAINAGE AREA MAP

Williams

DRAWN BY:	JEC	DATE:	04/03/15	ISSUED FOR BID:	SCALE: AS NOTED
CHECKED BY:	AJB	DATE:	04/03/15	ISSUED FOR CONSTRUCTION:	REVISION: 5
APPROVED BY:	AJB	DATE:	07/17/15	DRAWING NUMBER: (36–7943)MF–1A–9	SHEET 1 OF 1
W.O.	1161501				

Drawing Location & Name: G:\JOBS14\14C\14C4909\DWG\010-CPLN\FRS_PCSM14C4909(10)_WDIAMOND.dwg



Routing Diagram for C-DAT-14C4909-WDIAMOND-TD2
Prepared by BL Companies, Printed 4/26/2017

Summary for Subcatchment BASIN 1: POST DEVELOPMENT

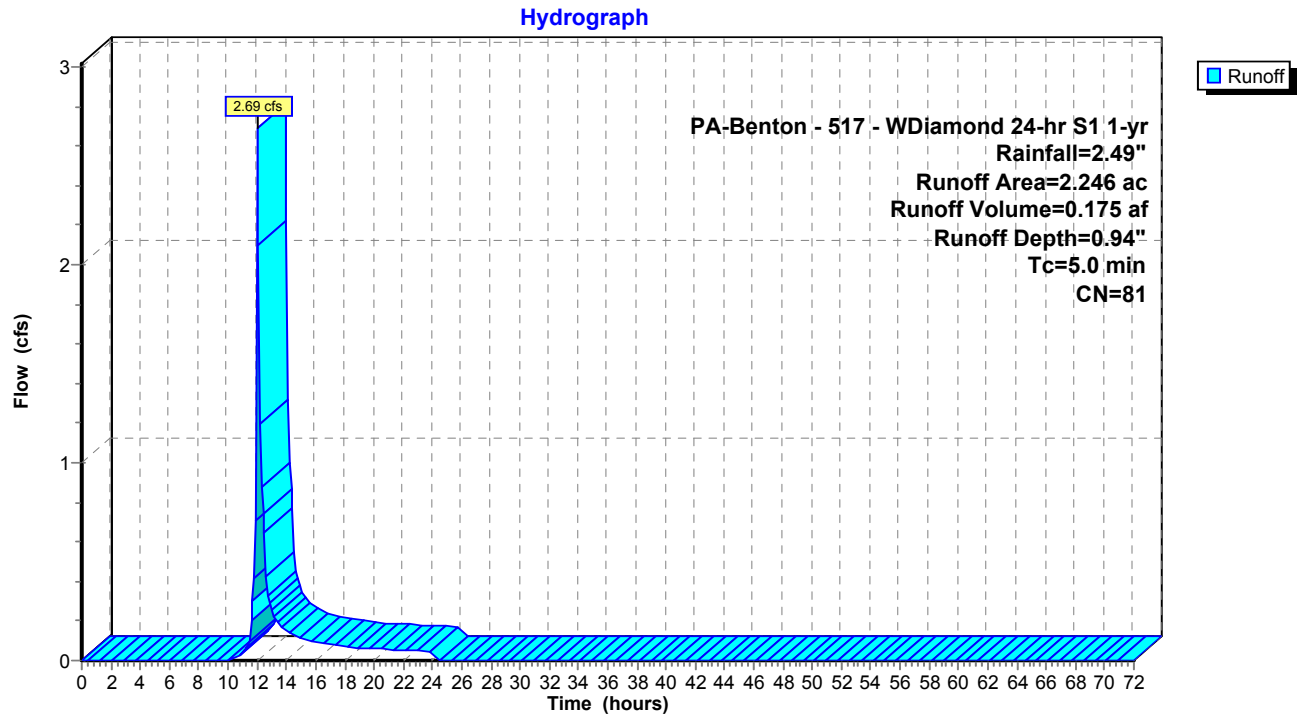
Runoff = 2.69 cfs @ 12.03 hrs, Volume= 0.175 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

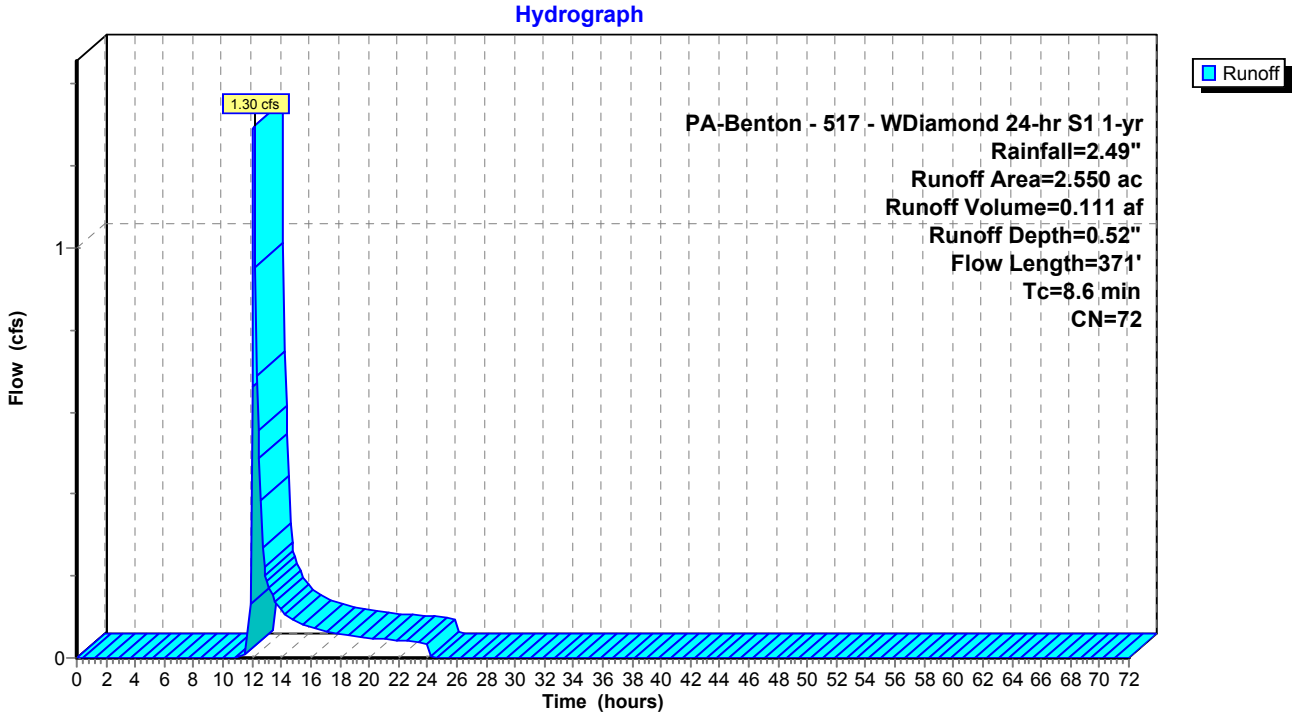
Runoff = 1.30 cfs @ 12.12 hrs, Volume= 0.111 af, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

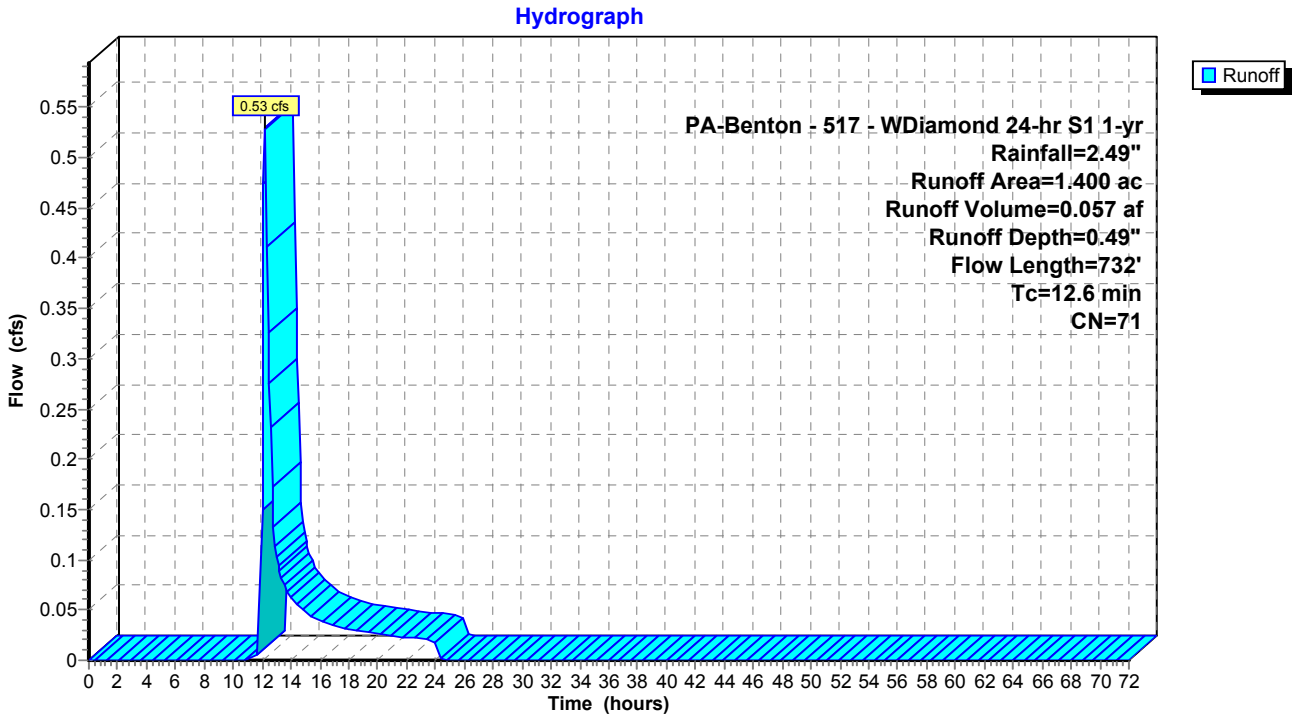
Runoff = 0.53 cfs @ 12.18 hrs, Volume= 0.057 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

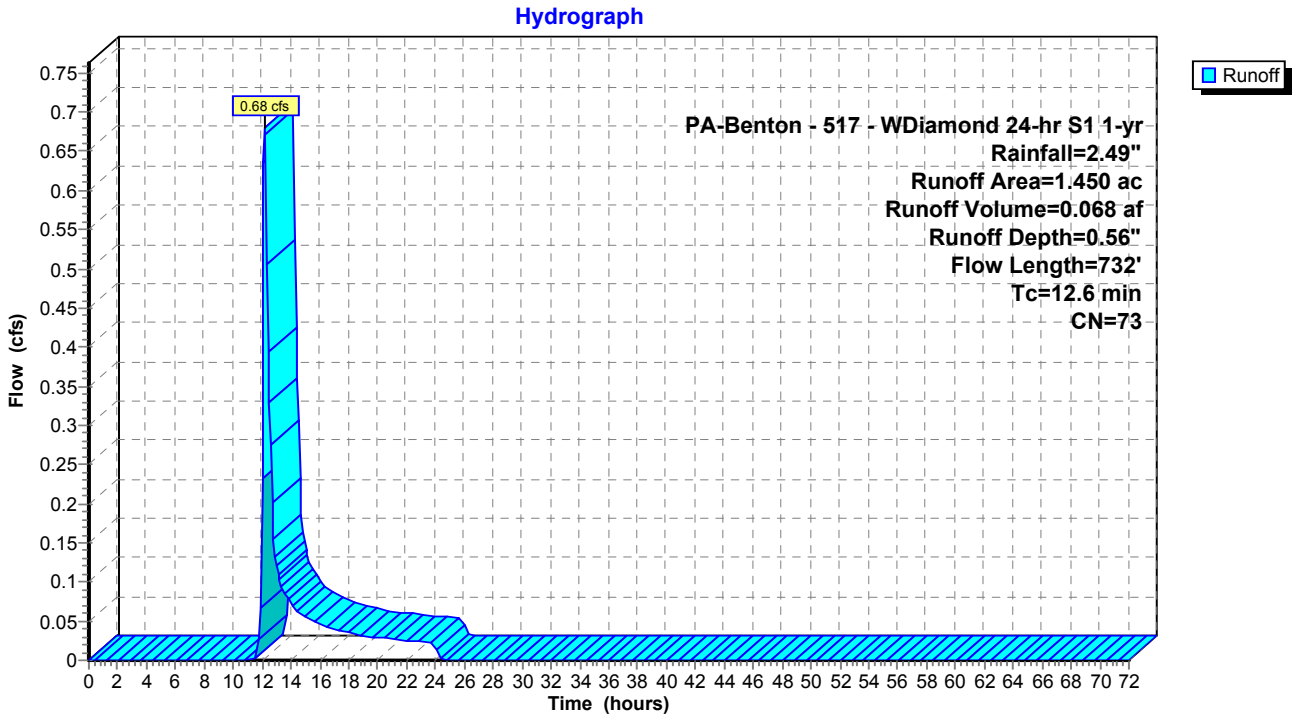
Runoff = 0.68 cfs @ 12.17 hrs, Volume= 0.068 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 1-yr Rainfall=2.49"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 0.94" for 1-yr event
Inflow = 2.69 cfs @ 12.03 hrs, Volume= 0.175 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.45' @ 24.40 hrs Surf.Area= 17,365 sf Storage= 7,625 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

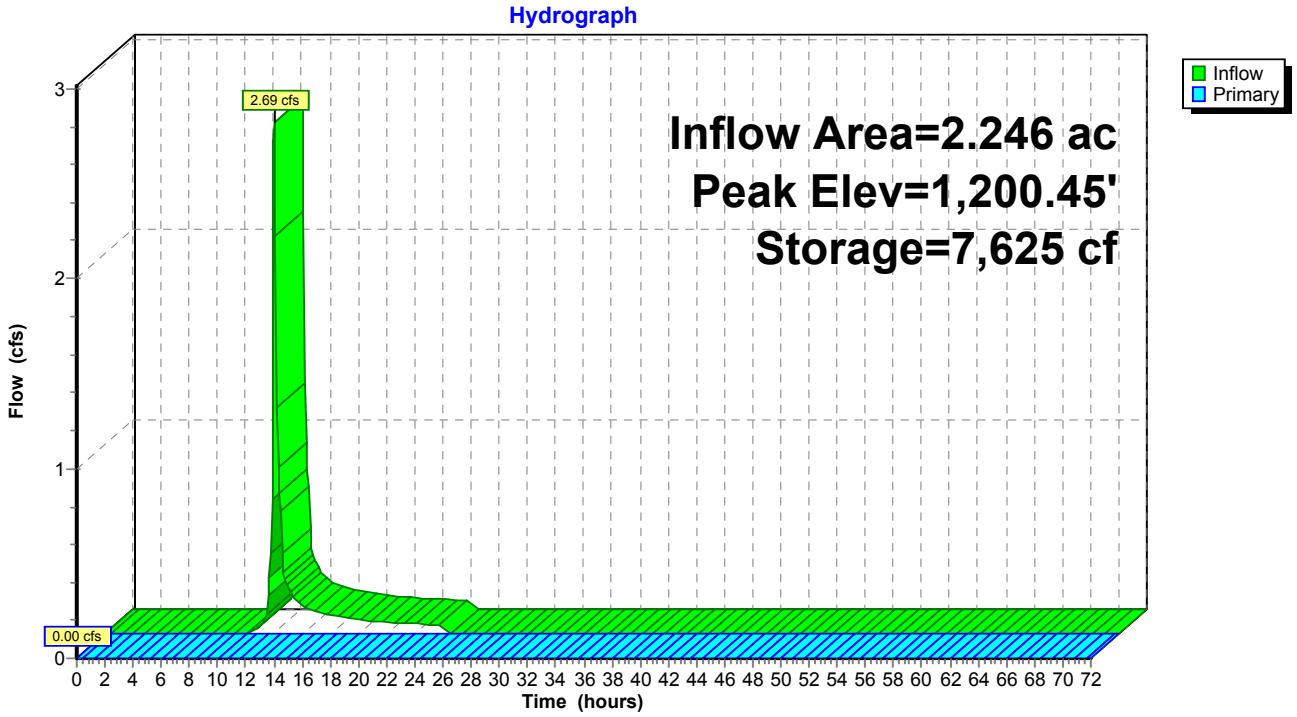
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,200.00' (Free Discharge)
- **1=Culvert** (Passes 0.00 cfs of 4.63 cfs potential flow)
  - **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 0.56" for 1-yr event
Inflow = 0.68 cfs @ 12.17 hrs, Volume= 0.068 af
Outflow = 0.20 cfs @ 12.74 hrs, Volume= 0.045 af, Atten= 70%, Lag= 34.3 min
Primary = 0.20 cfs @ 12.74 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.04' @ 12.74 hrs Surf.Area= 0 sf Storage= 1,101 cf

Plug-Flow detention time= 226.9 min calculated for 0.045 af (66% of inflow)
Center-of-Mass det. time= 97.8 min (999.9 - 902.0)

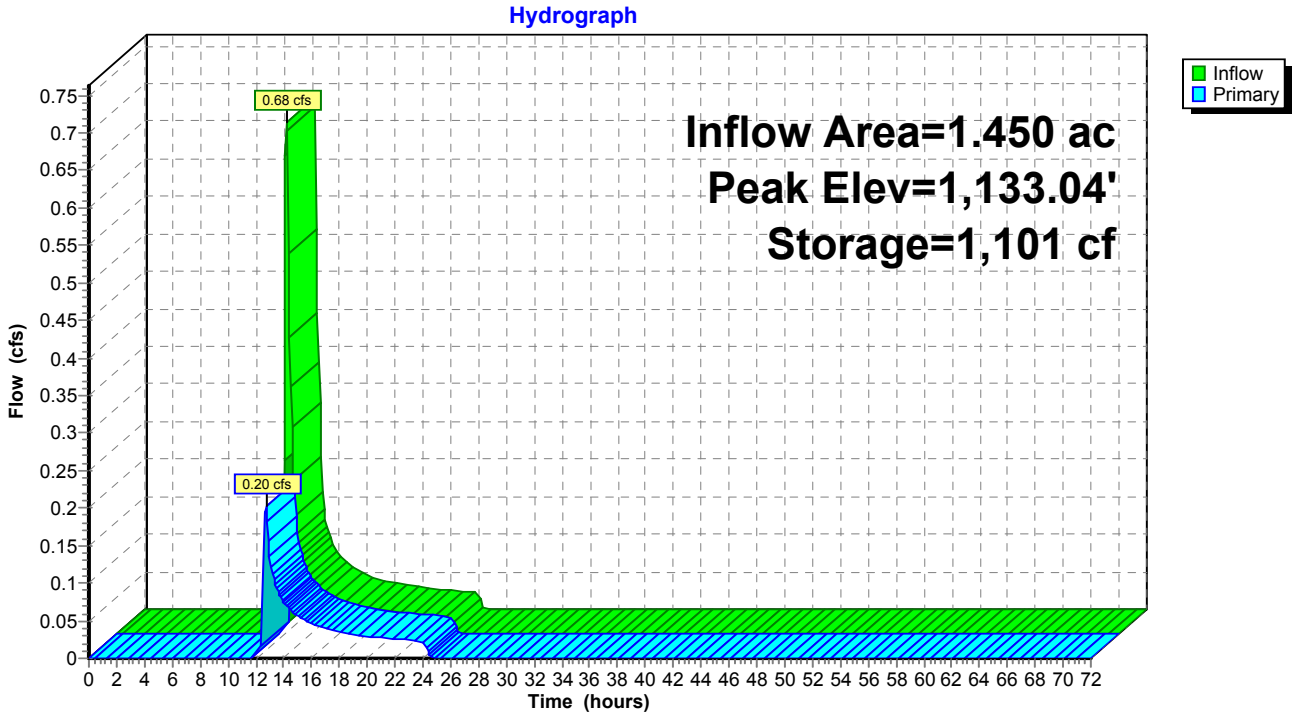
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.19 cfs @ 12.74 hrs HW=1,133.04' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.19 cfs @ 0.55 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 0.37" for 1-yr event
Inflow = 0.20 cfs @ 12.74 hrs, Volume= 0.045 af
Outflow = 0.11 cfs @ 13.22 hrs, Volume= 0.040 af, Atten= 44%, Lag= 29.0 min
Primary = 0.11 cfs @ 13.22 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,130.66' @ 13.22 hrs Surf.Area= 468 sf Storage= 257 cf

Plug-Flow detention time= 84.7 min calculated for 0.040 af (91% of inflow)
Center-of-Mass det. time= 41.7 min (1,041.6 - 999.9)

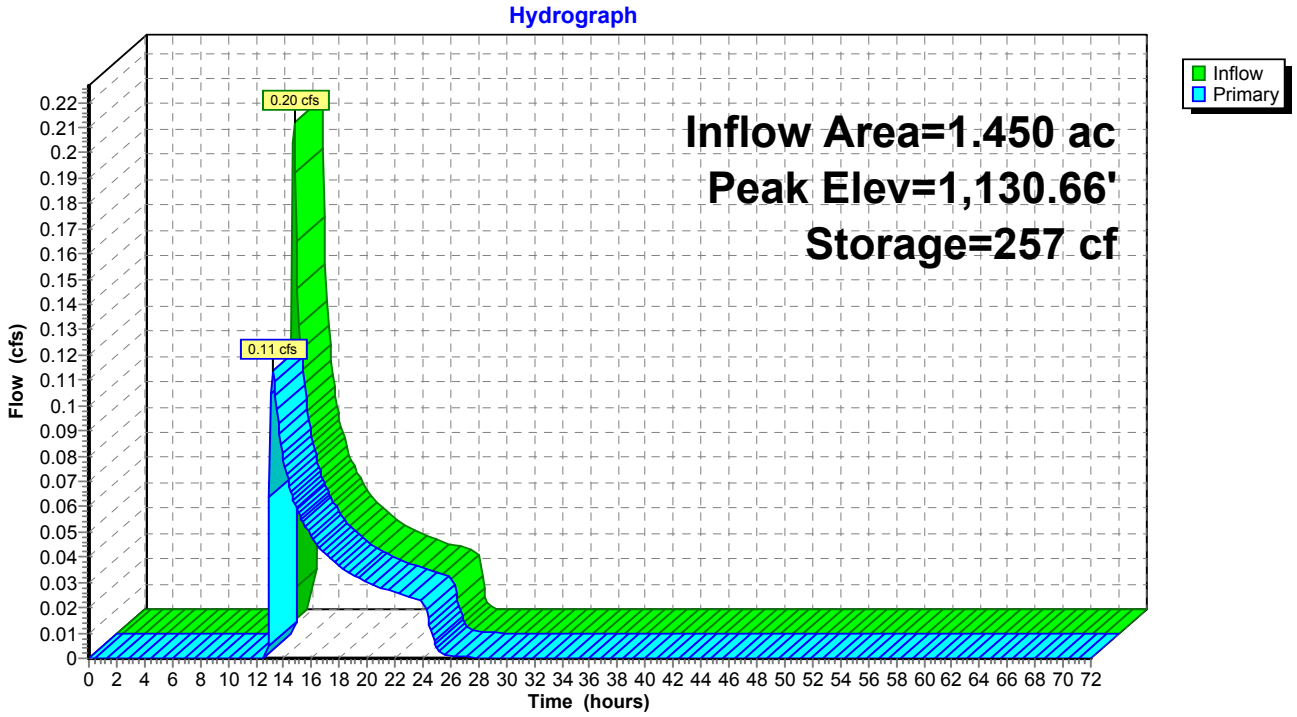
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.11 cfs @ 13.22 hrs HW=1,130.66' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.36 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

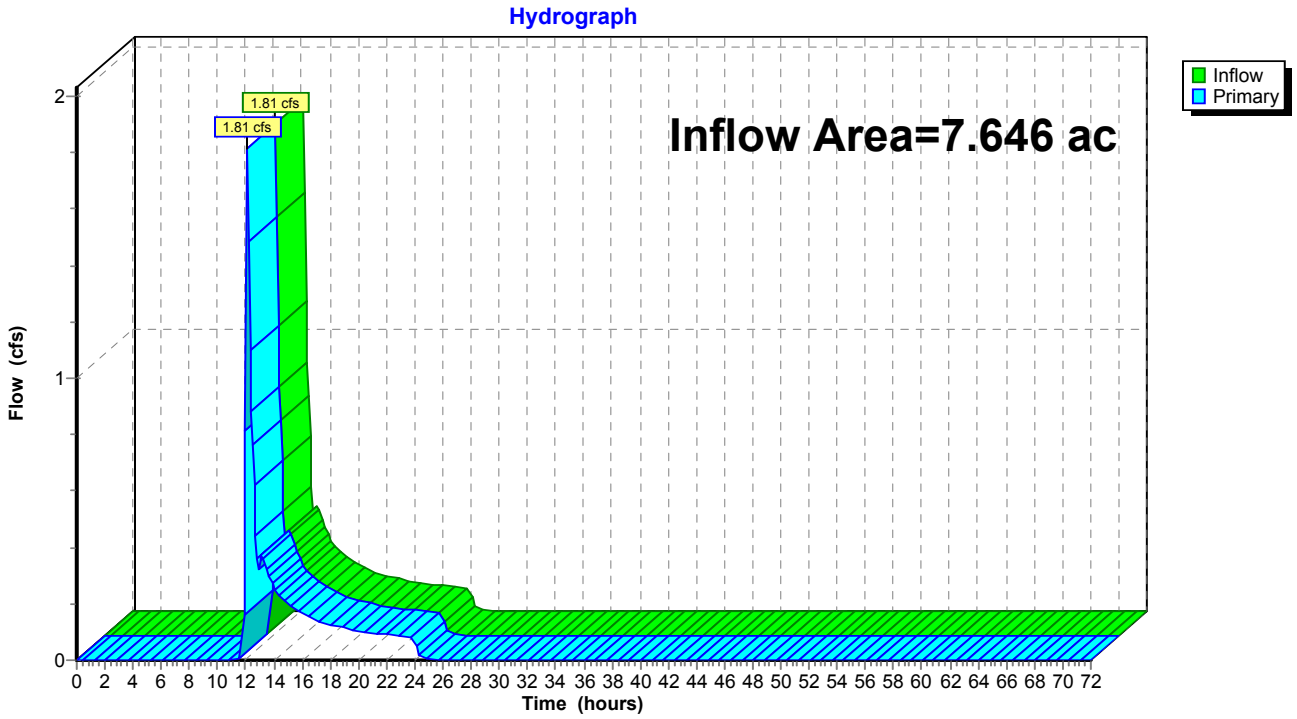
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 0.33" for 1-yr event
Inflow = 1.81 cfs @ 12.13 hrs, Volume= 0.208 af
Primary = 1.81 cfs @ 12.13 hrs, Volume= 0.208 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

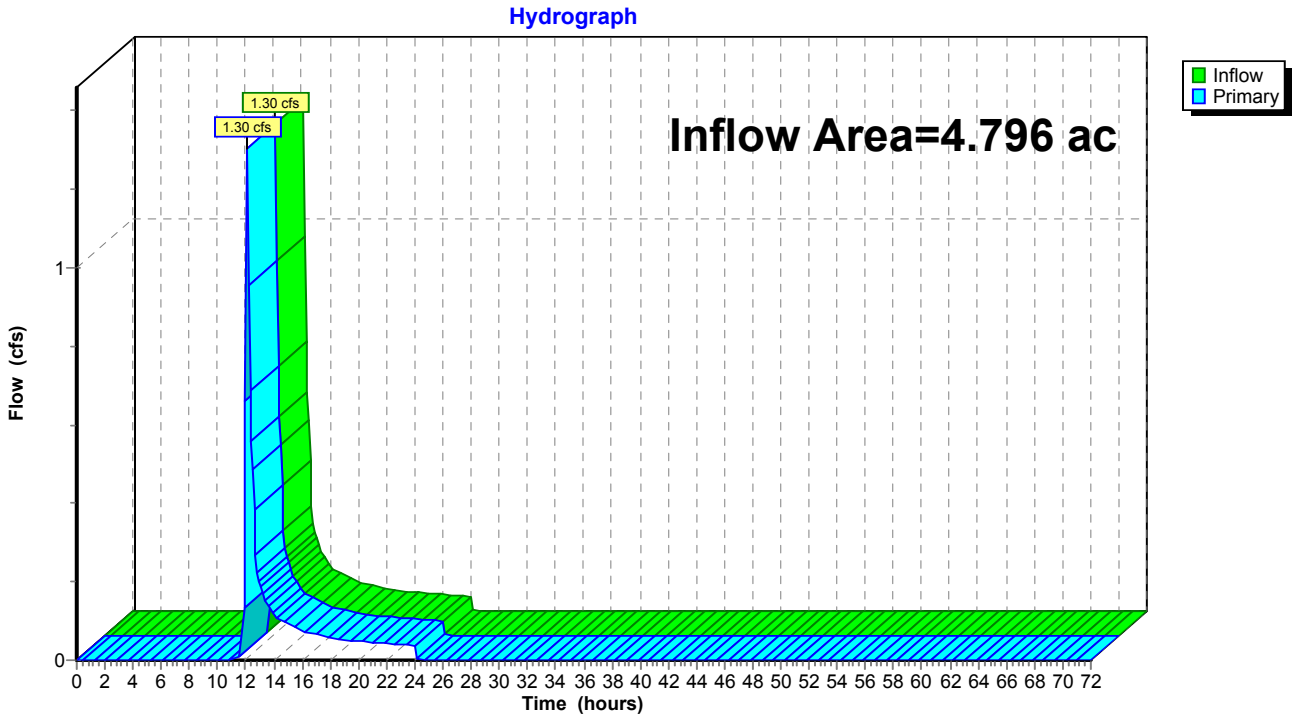


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 0.28" for 1-yr event
Inflow = 1.30 cfs @ 12.12 hrs, Volume= 0.111 af
Primary = 1.30 cfs @ 12.12 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

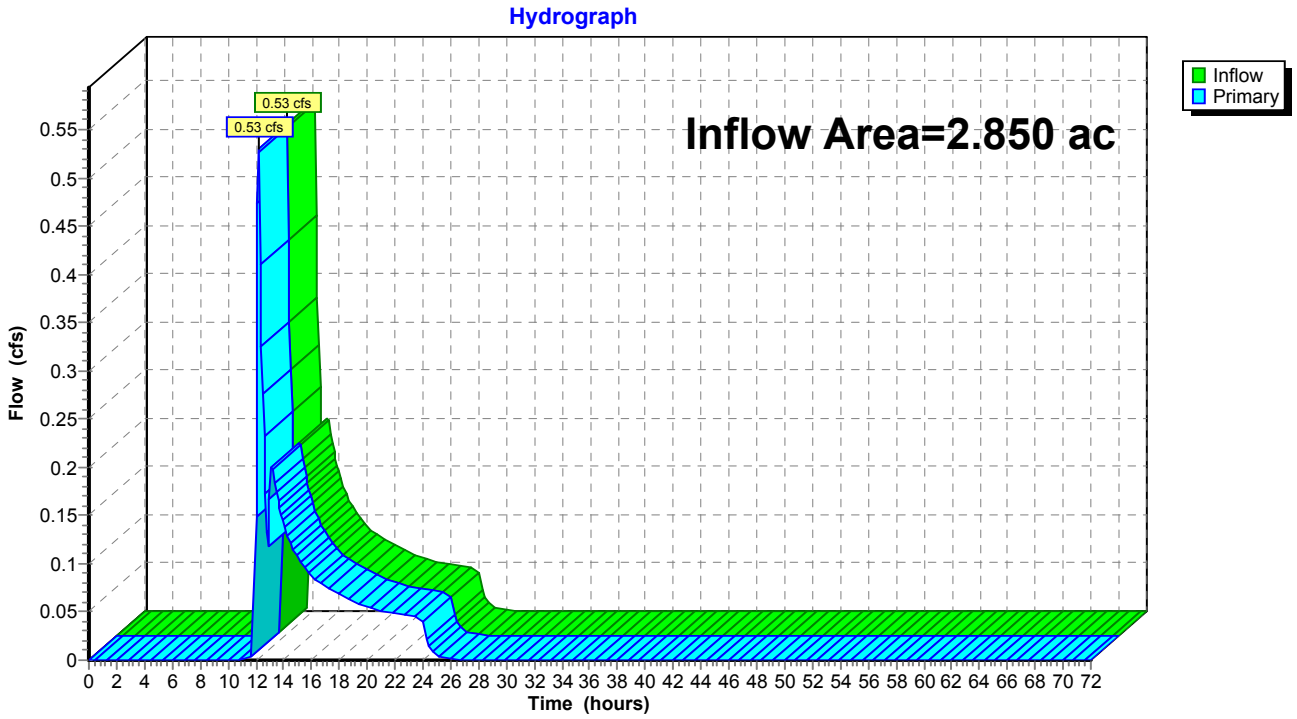


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 0.41" for 1-yr event
Inflow = 0.53 cfs @ 12.18 hrs, Volume= 0.097 af
Primary = 0.53 cfs @ 12.18 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

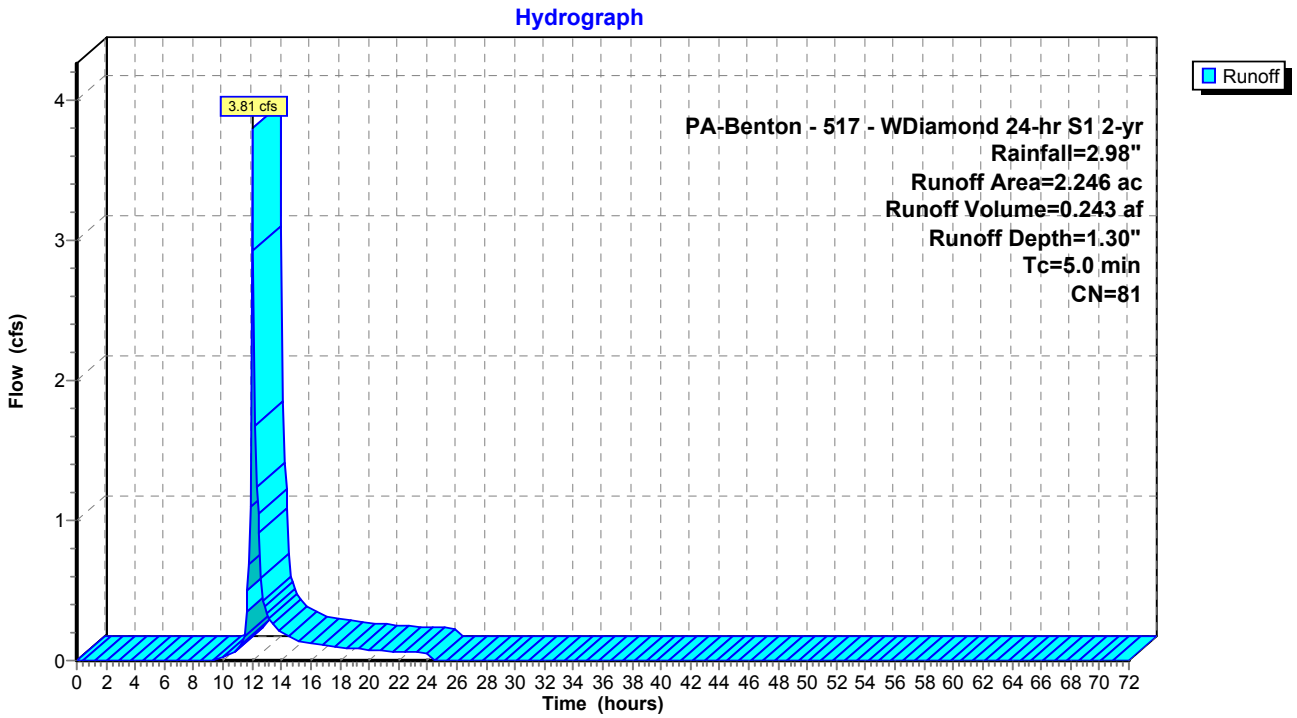
Runoff = 3.81 cfs @ 12.03 hrs, Volume= 0.243 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

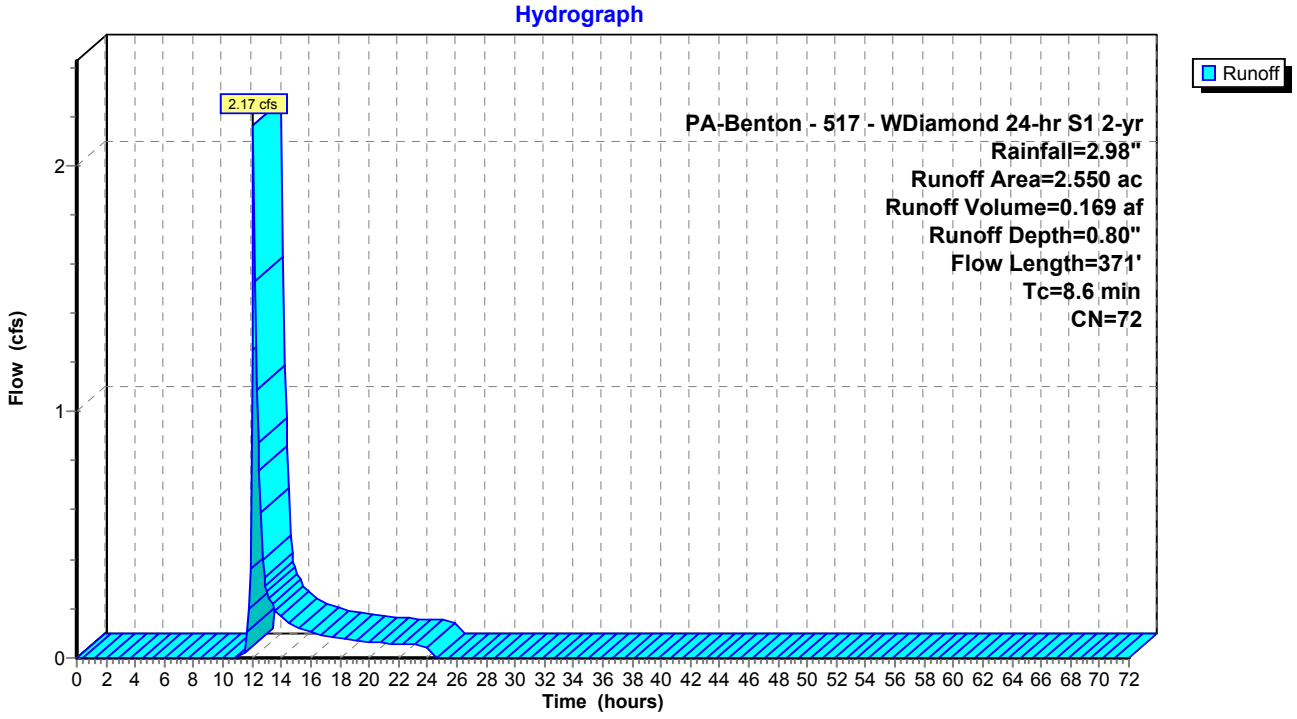
Runoff = 2.17 cfs @ 12.11 hrs, Volume= 0.169 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

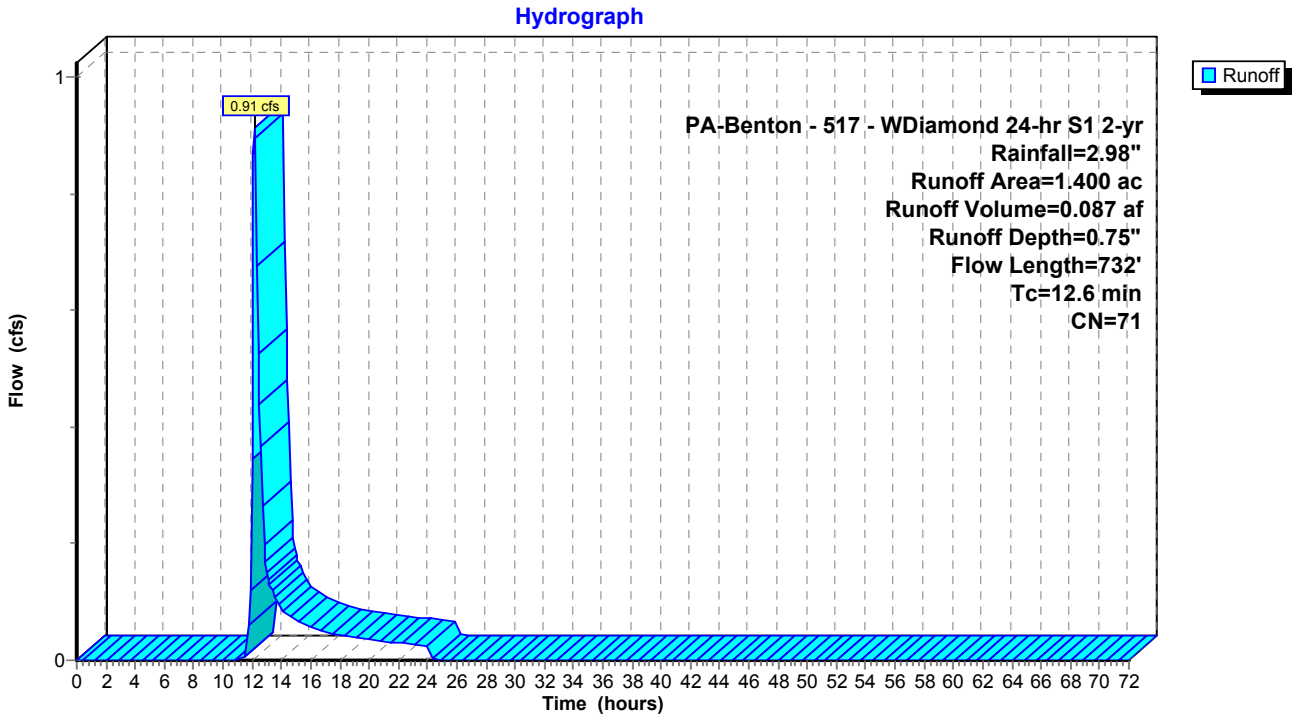
Runoff = 0.91 cfs @ 12.16 hrs, Volume= 0.087 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

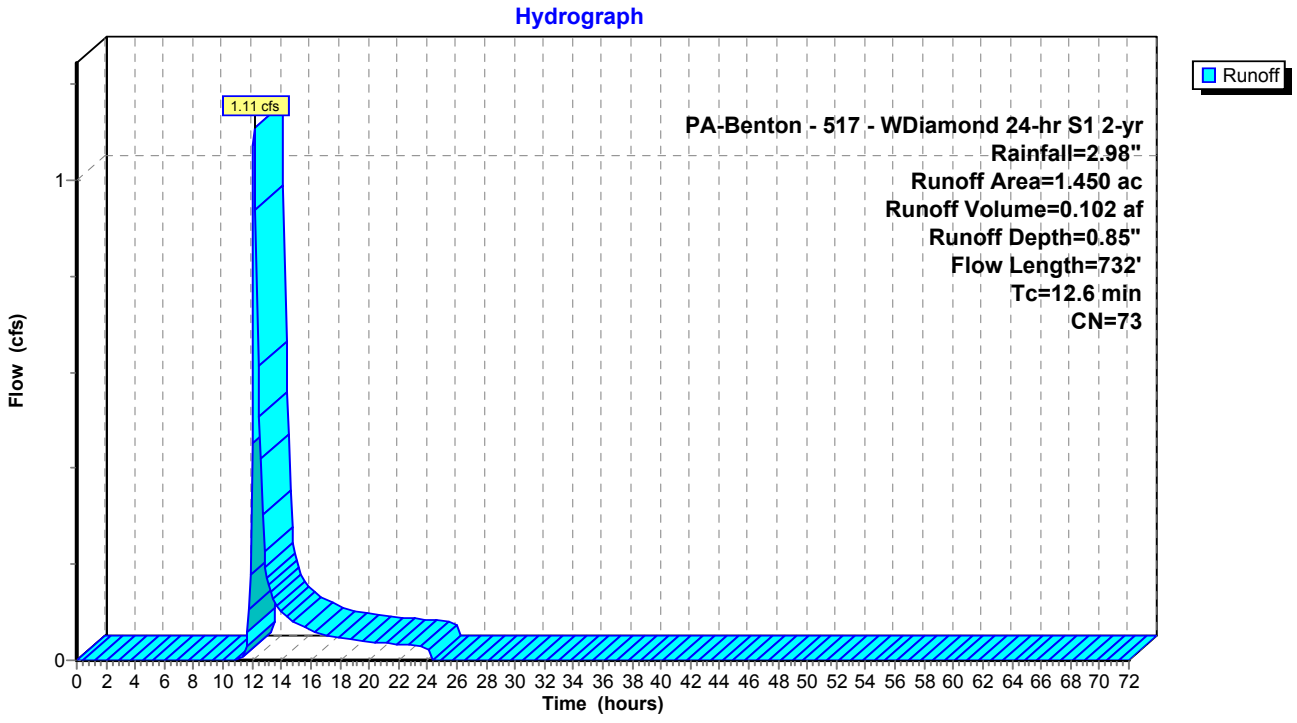
Runoff = 1.11 cfs @ 12.15 hrs, Volume= 0.102 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 1.30" for 2-yr event
Inflow = 3.81 cfs @ 12.03 hrs, Volume= 0.243 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.62' @ 24.40 hrs Surf.Area= 17,789 sf Storage= 10,584 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

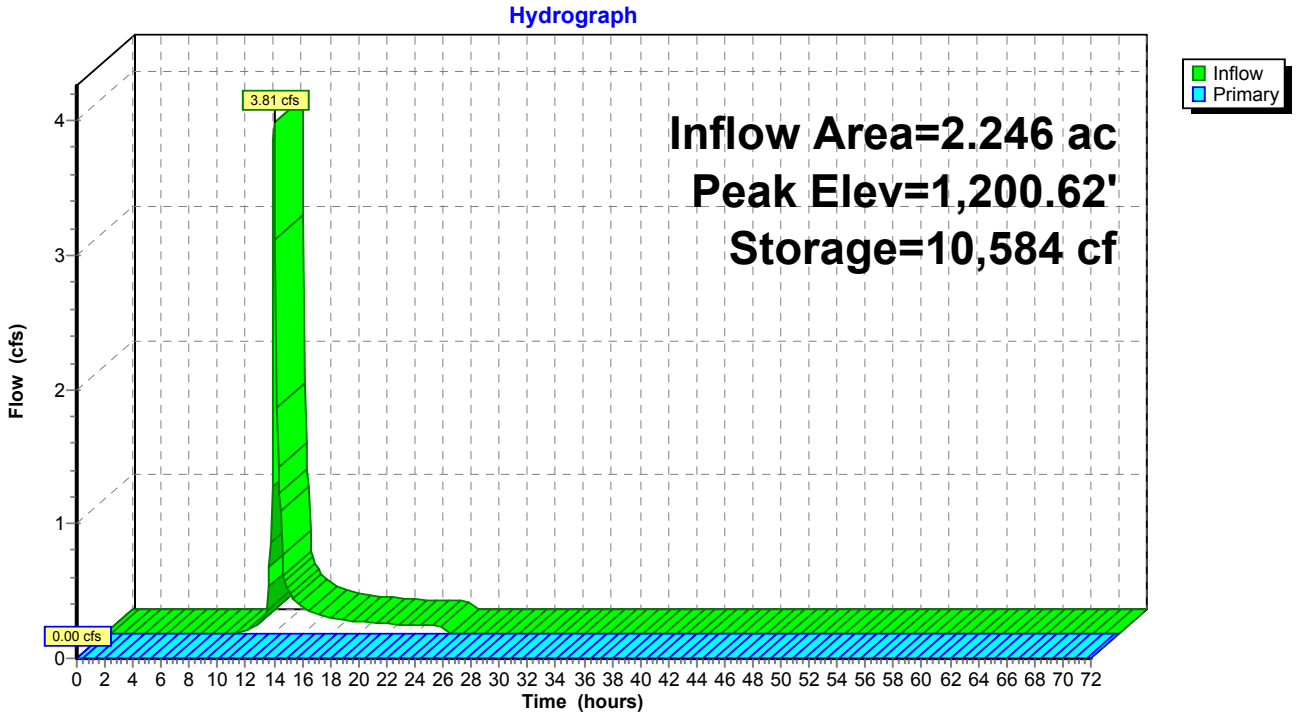
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,200.00' (Free Discharge)
- **1=Culvert** (Passes 0.00 cfs of 4.63 cfs potential flow)
  - **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 0.85" for 2-yr event
Inflow = 1.11 cfs @ 12.15 hrs, Volume= 0.102 af
Outflow = 0.69 cfs @ 12.42 hrs, Volume= 0.079 af, Atten= 38%, Lag= 16.2 min
Primary = 0.69 cfs @ 12.42 hrs, Volume= 0.079 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.10' @ 12.42 hrs Surf.Area= 0 sf Storage= 1,215 cf

Plug-Flow detention time= 152.9 min calculated for 0.079 af (77% of inflow)
Center-of-Mass det. time= 56.0 min (940.6 - 884.7)

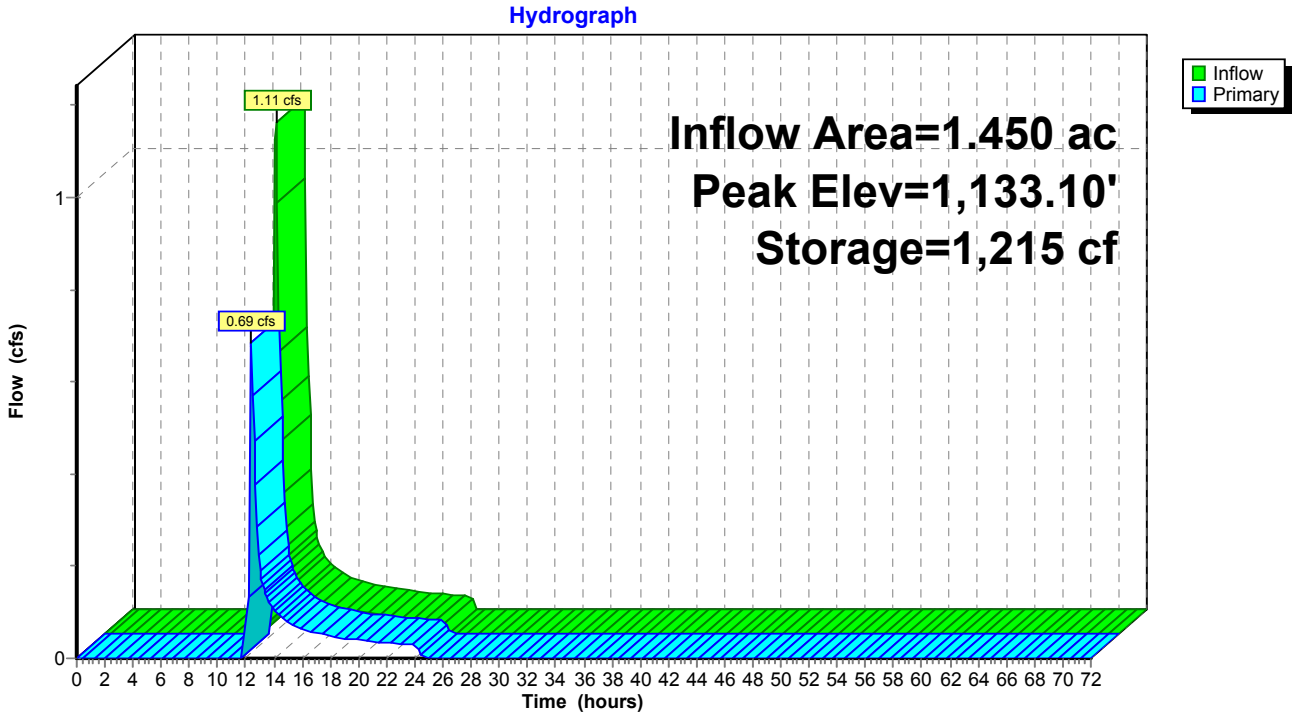
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.65 cfs @ 12.42 hrs HW=1,133.10' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.65 cfs @ 0.84 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 0.65" for 2-yr event
Inflow = 0.69 cfs @ 12.42 hrs, Volume= 0.079 af
Outflow = 0.59 cfs @ 12.55 hrs, Volume= 0.075 af, Atten= 14%, Lag= 7.4 min
Primary = 0.59 cfs @ 12.55 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,130.89' @ 12.55 hrs Surf.Area= 524 sf Storage= 372 cf

Plug-Flow detention time= 51.9 min calculated for 0.075 af (95% of inflow)
Center-of-Mass det. time= 23.9 min (964.5 - 940.6)

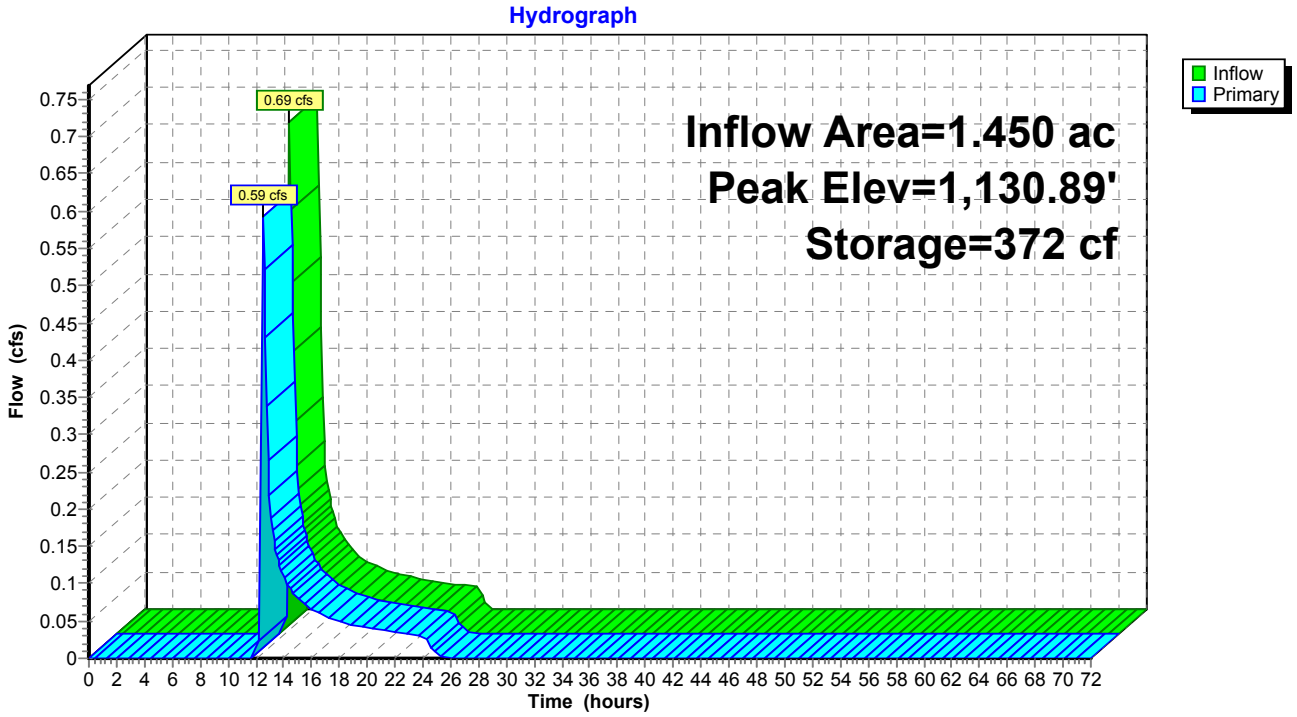
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.53 cfs @ 12.55 hrs HW=1,130.87' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.53 cfs @ 2.06 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

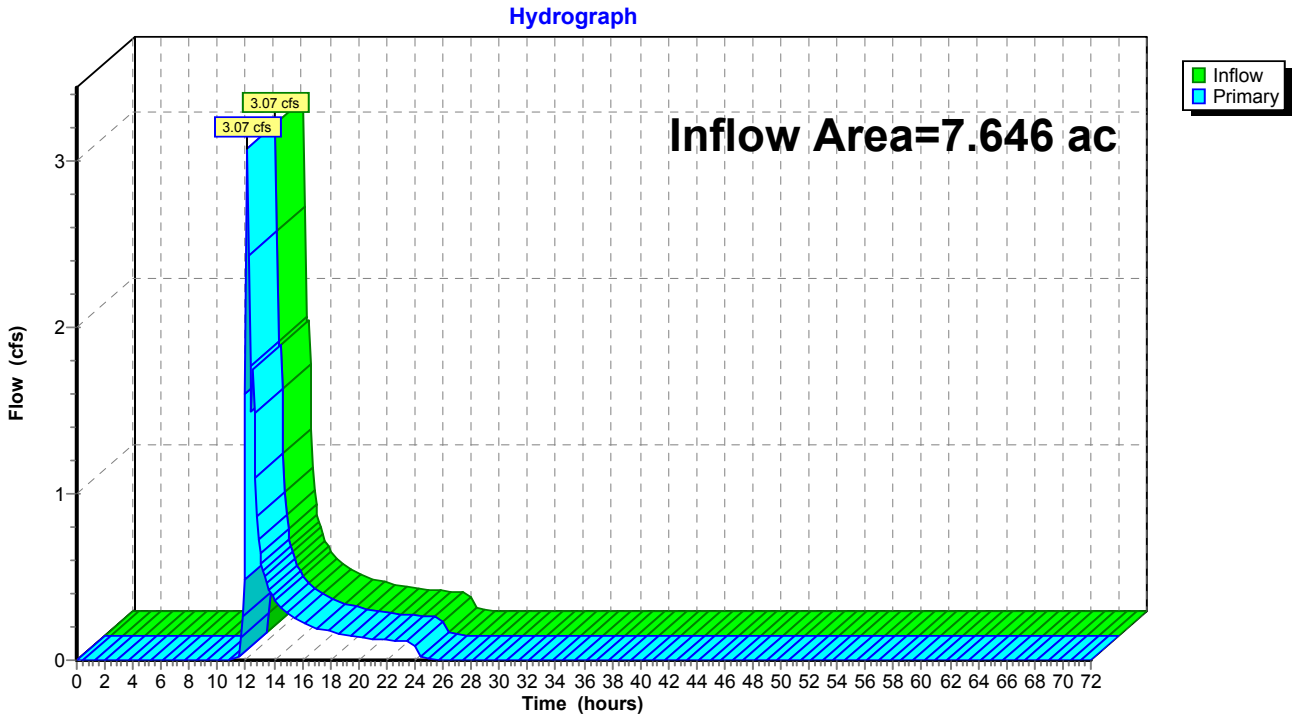
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 0.52" for 2-yr event
Inflow = 3.07 cfs @ 12.12 hrs, Volume= 0.331 af
Primary = 3.07 cfs @ 12.12 hrs, Volume= 0.331 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

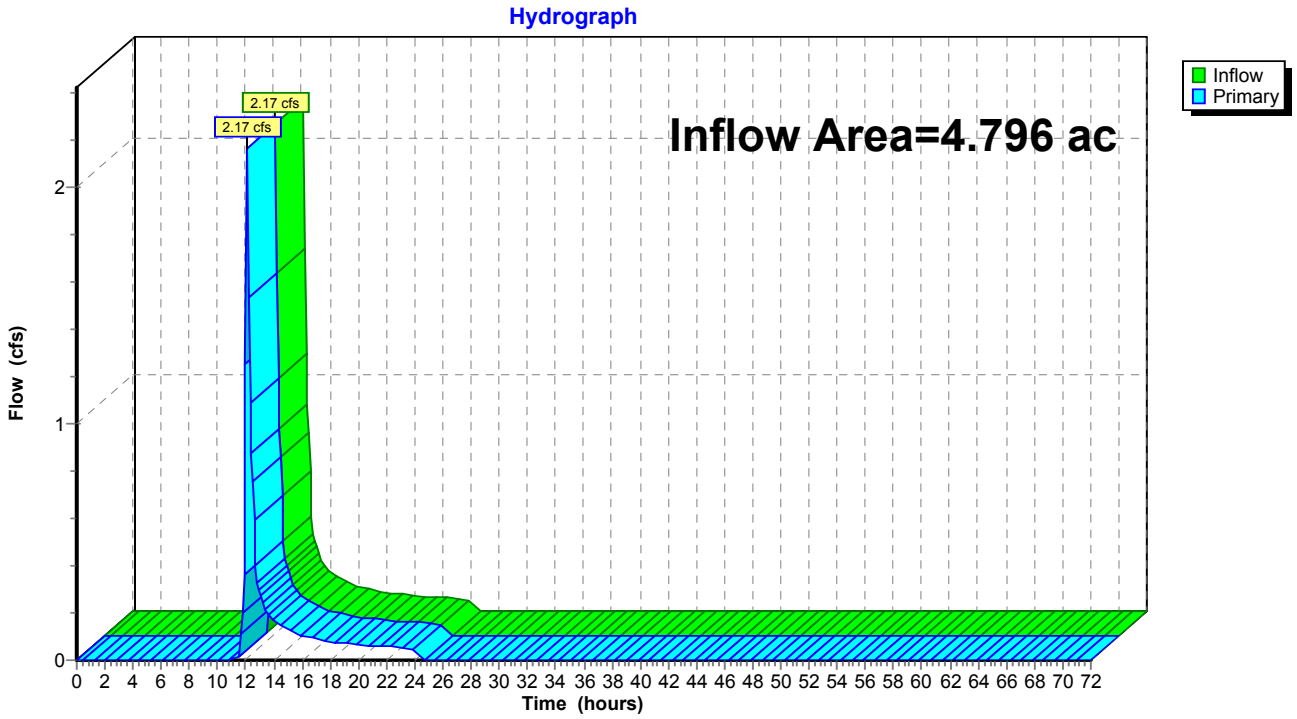


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 0.42" for 2-yr event
Inflow = 2.17 cfs @ 12.11 hrs, Volume= 0.169 af
Primary = 2.17 cfs @ 12.11 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

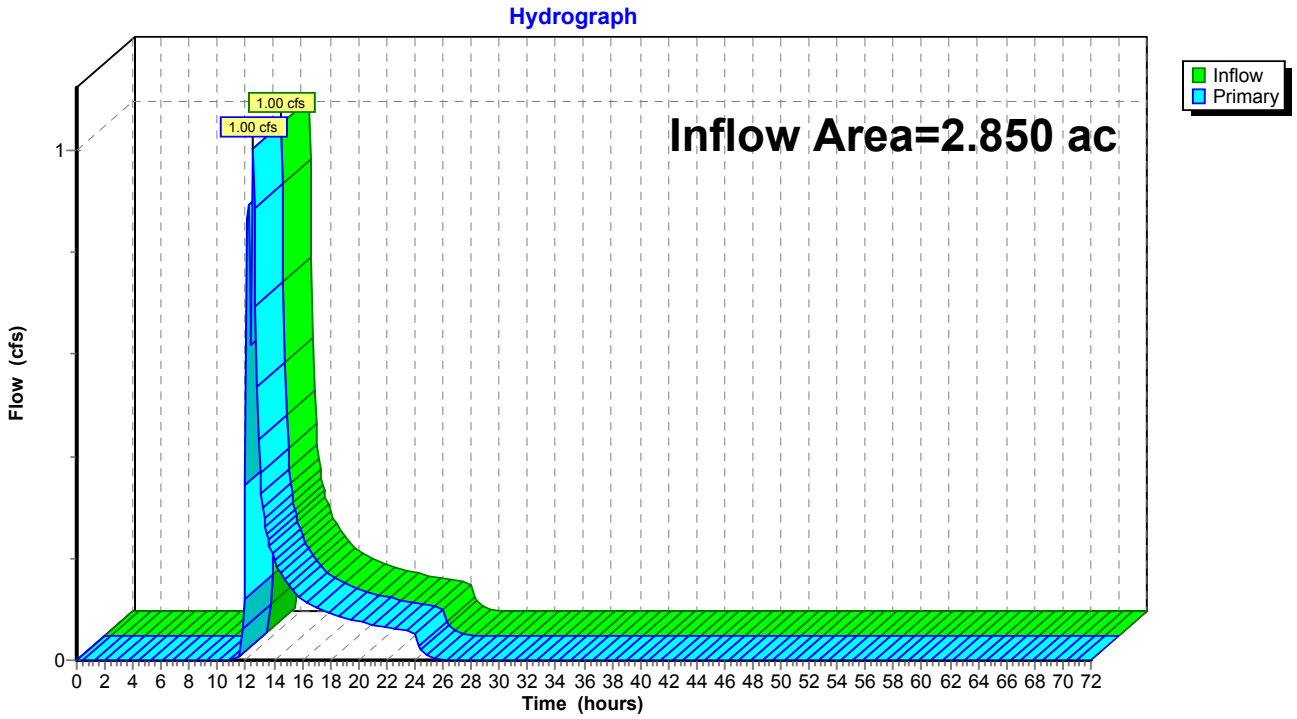


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 0.68" for 2-yr event
Inflow = 1.00 cfs @ 12.53 hrs, Volume= 0.162 af
Primary = 1.00 cfs @ 12.53 hrs, Volume= 0.162 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

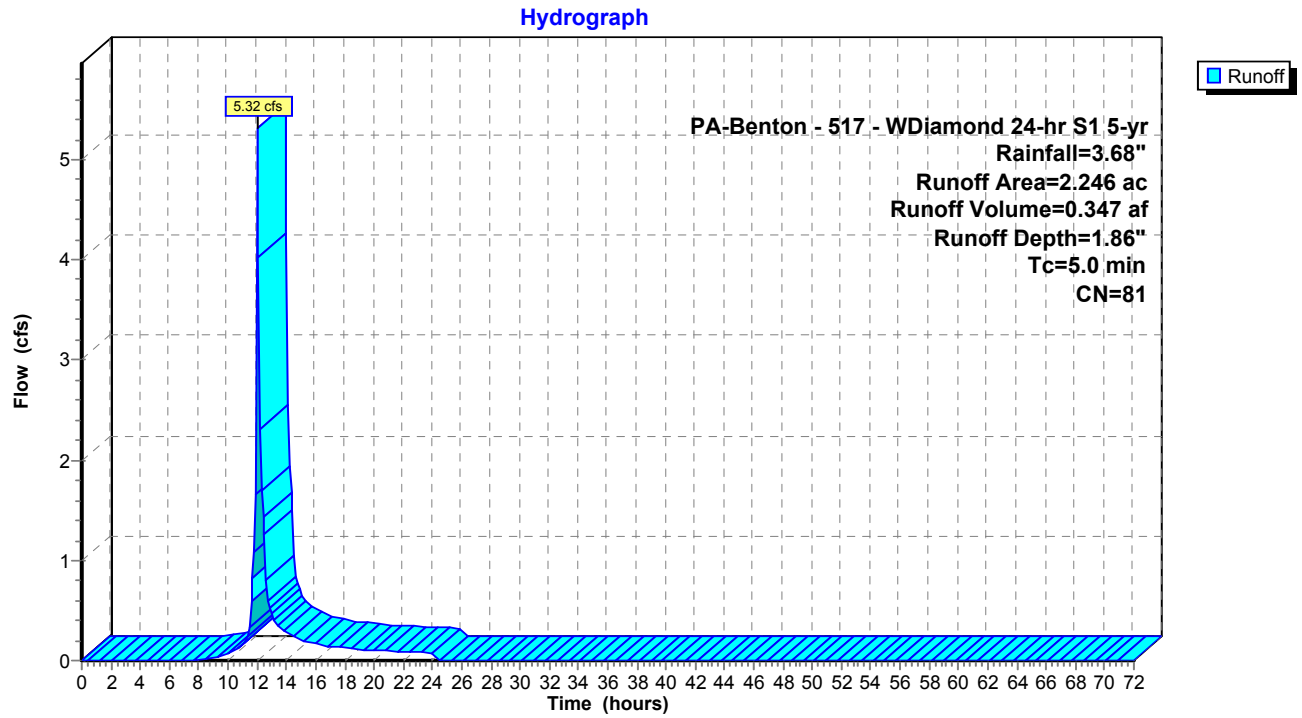
Runoff = 5.32 cfs @ 12.03 hrs, Volume= 0.347 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

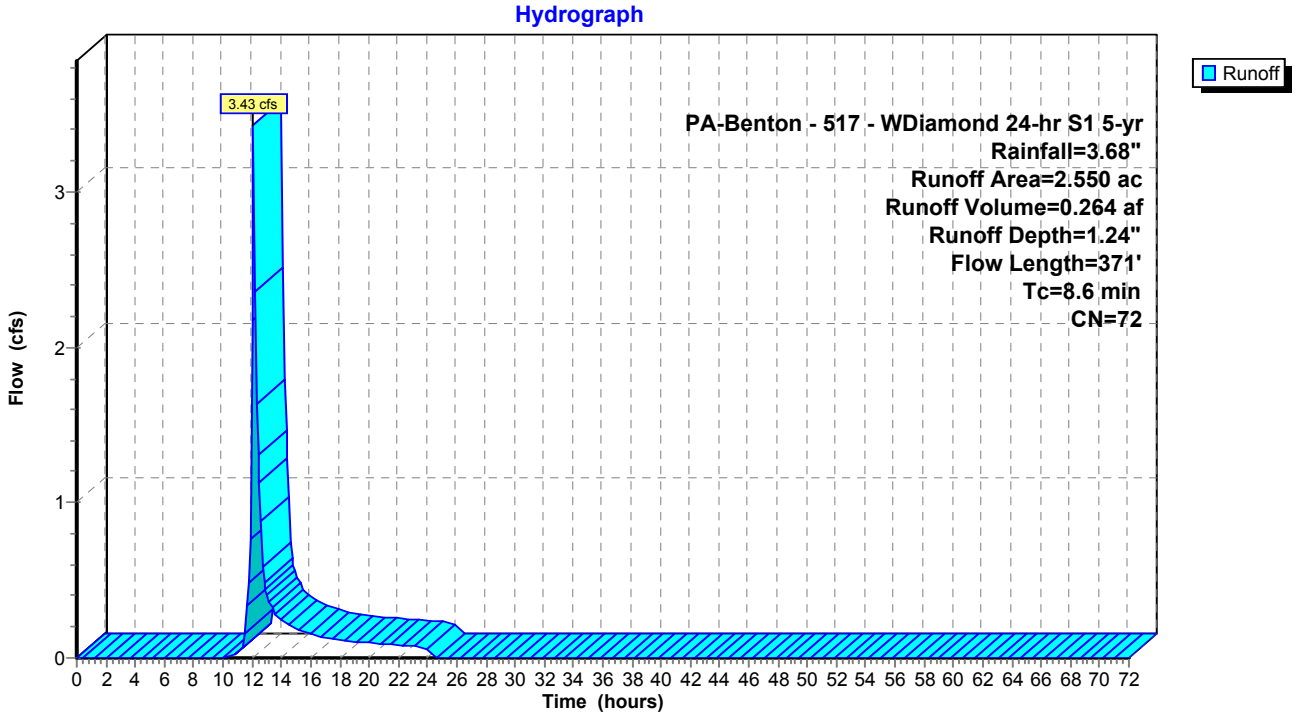
Runoff = 3.43 cfs @ 12.10 hrs, Volume= 0.264 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

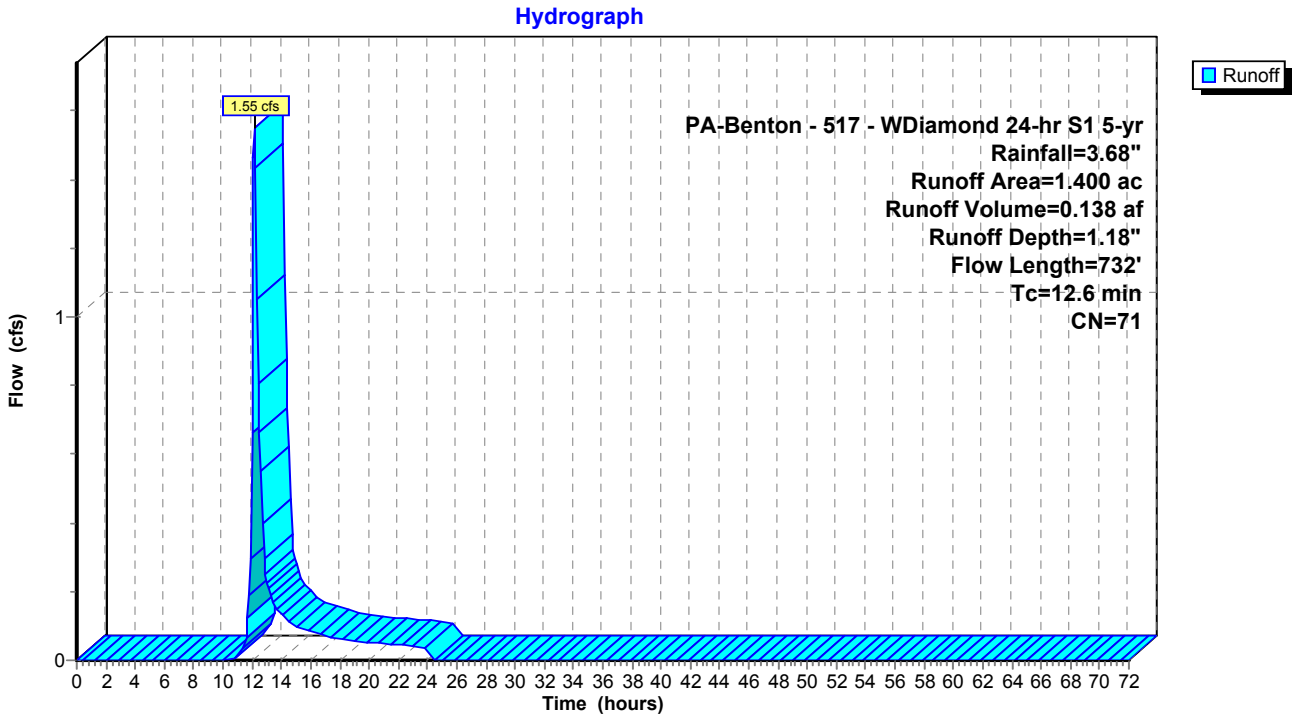
Runoff = 1.55 cfs @ 12.15 hrs, Volume= 0.138 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

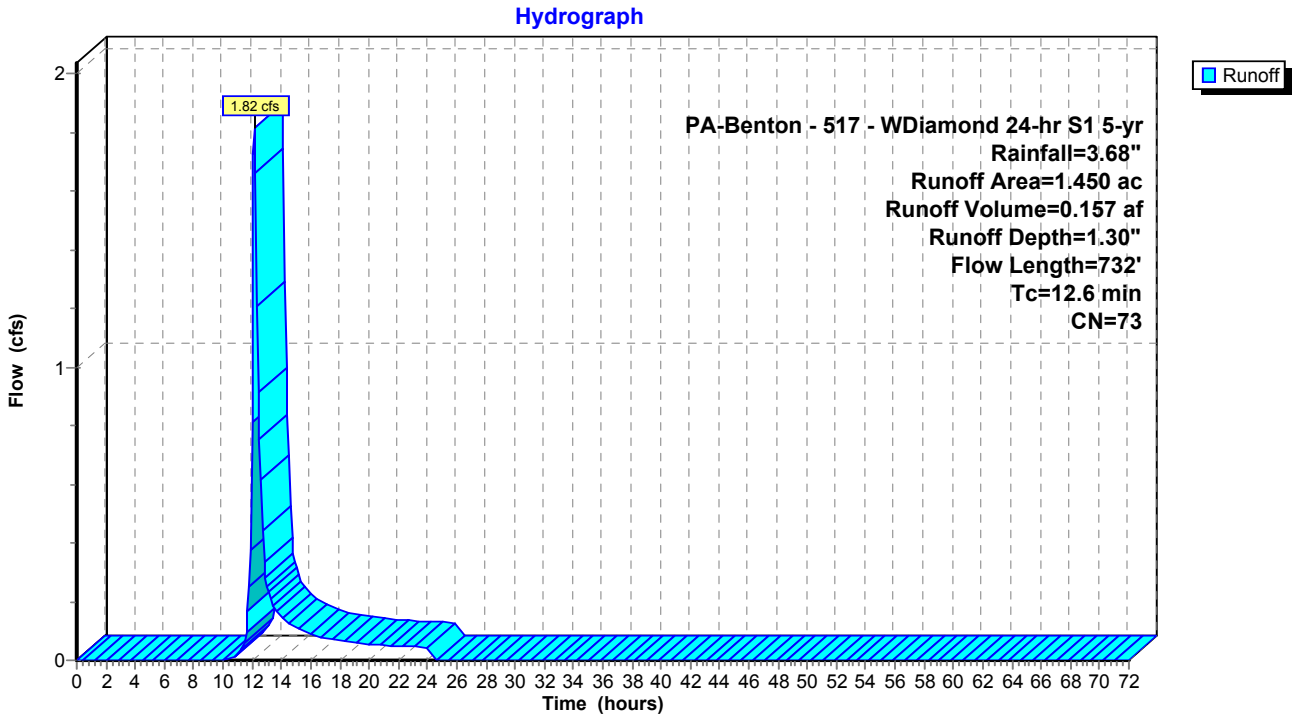
Runoff = 1.82 cfs @ 12.14 hrs, Volume= 0.157 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 5-yr Rainfall=3.68"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 1.86" for 5-yr event
Inflow = 5.32 cfs @ 12.03 hrs, Volume= 0.347 af
Outflow = 0.11 cfs @ 19.89 hrs, Volume= 0.052 af, Atten= 98%, Lag= 471.7 min
Primary = 0.11 cfs @ 19.89 hrs, Volume= 0.052 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.77' @ 19.89 hrs Surf.Area= 18,156 sf Storage= 13,202 cf

Plug-Flow detention time= 620.4 min calculated for 0.052 af (15% of inflow)
Center-of-Mass det. time= 456.0 min (1,296.4 - 840.4)

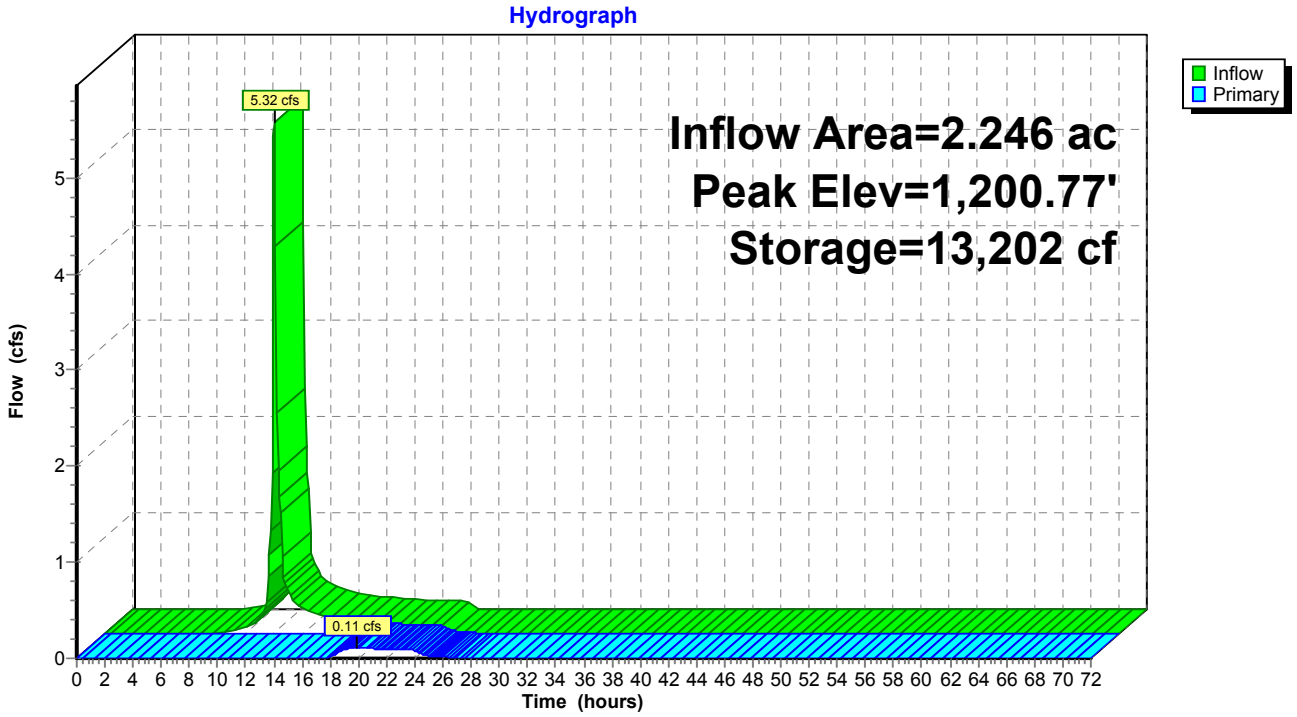
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.10 cfs @ 19.89 hrs HW=1,200.77' (Free Discharge)
- **1=Culvert** (Passes 0.10 cfs of 5.70 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 0.10 cfs @ 0.44 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 1.30" for 5-yr event
Inflow = 1.82 cfs @ 12.14 hrs, Volume= 0.157 af
Outflow = 1.69 cfs @ 12.24 hrs, Volume= 0.134 af, Atten= 7%, Lag= 6.0 min
Primary = 1.69 cfs @ 12.24 hrs, Volume= 0.134 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.19' @ 12.25 hrs Surf.Area= 0 sf Storage= 1,394 cf

Plug-Flow detention time= 104.7 min calculated for 0.134 af (85% of inflow)
Center-of-Mass det. time= 35.3 min (908.5 - 873.2)

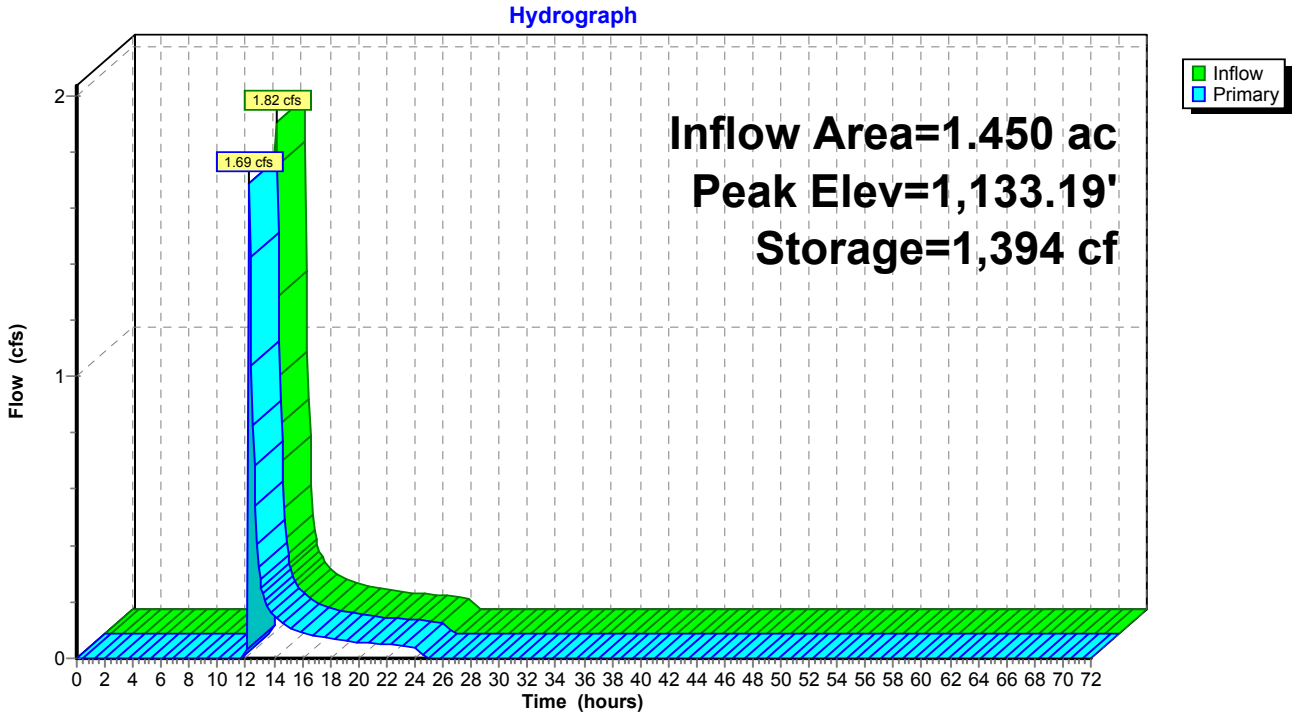
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=1.49 cfs @ 12.24 hrs HW=1,133.17' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 1.49 cfs @ 1.10 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 1.11" for 5-yr event
Inflow = 1.69 cfs @ 12.24 hrs, Volume= 0.134 af
Outflow = 1.55 cfs @ 12.33 hrs, Volume= 0.130 af, Atten= 8%, Lag= 5.5 min
Primary = 1.55 cfs @ 12.33 hrs, Volume= 0.130 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,131.18' @ 12.34 hrs Surf.Area= 593 sf Storage= 533 cf

Plug-Flow detention time= 33.4 min calculated for 0.130 af (97% of inflow)
Center-of-Mass det. time= 15.2 min (923.7 - 908.5)

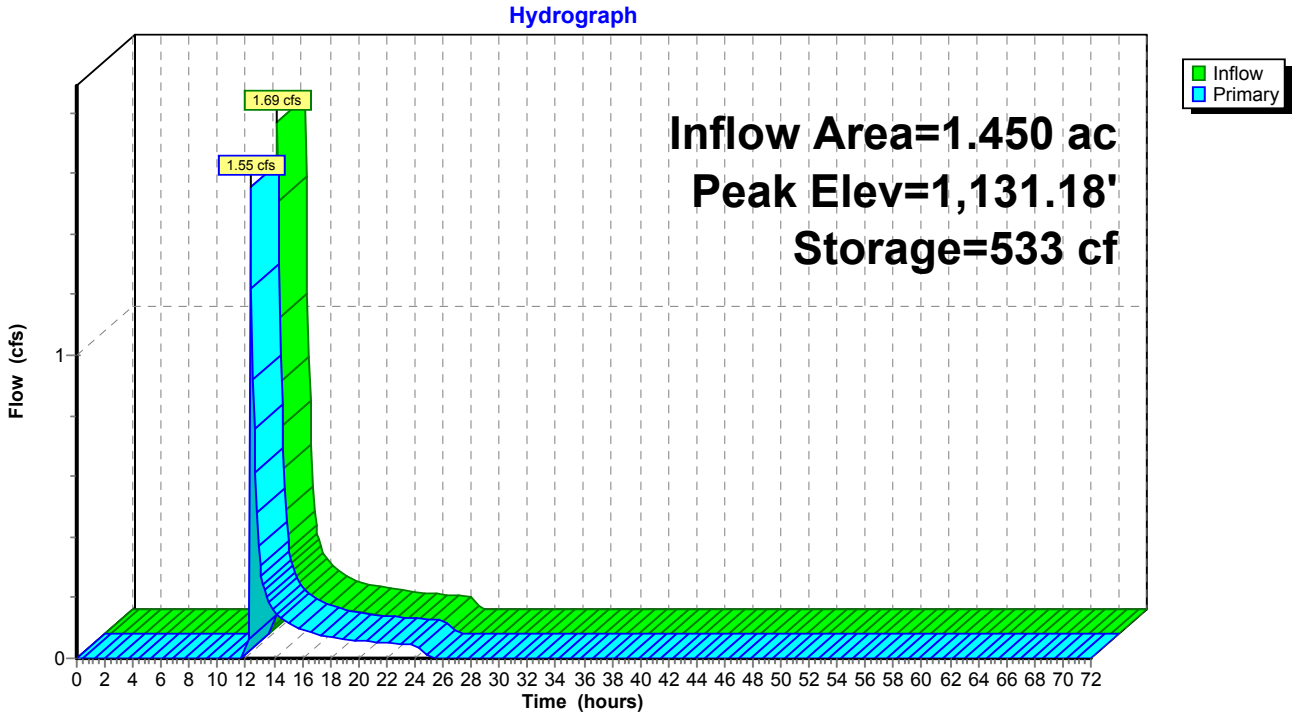
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.37 cfs @ 12.33 hrs HW=1,131.12' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.37 cfs @ 2.68 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

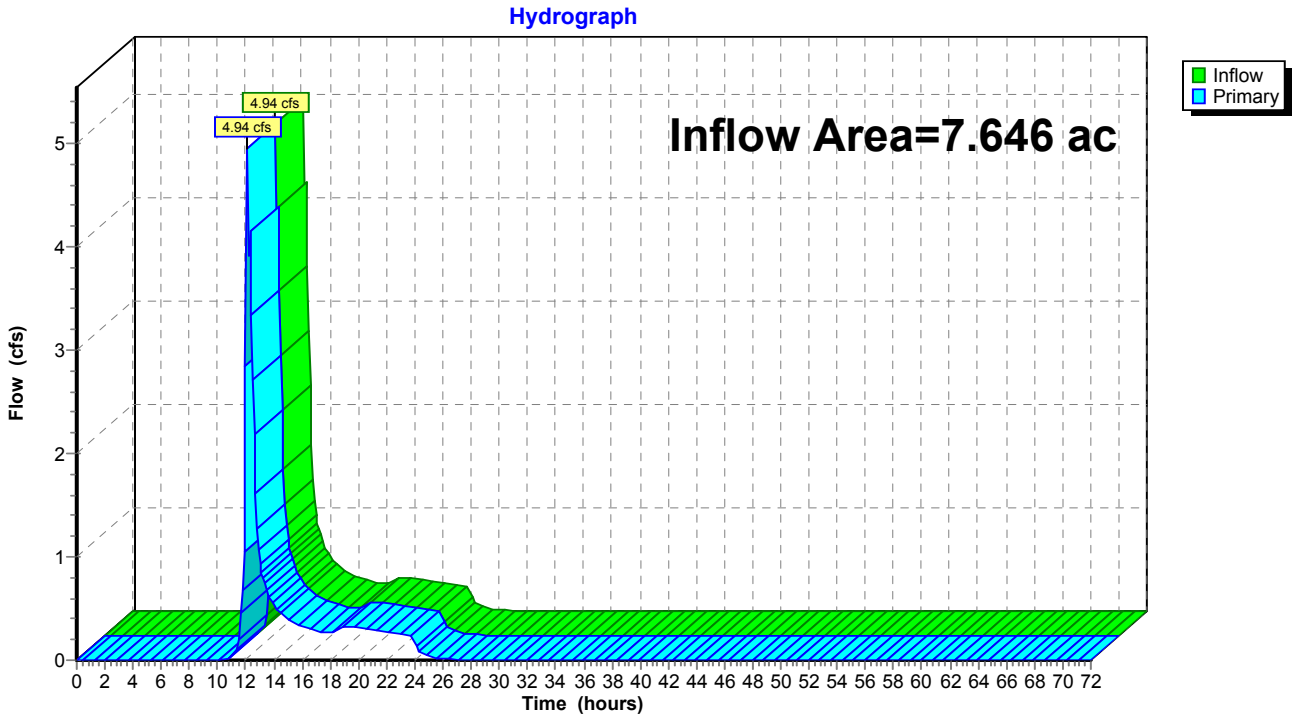
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 0.91" for 5-yr event
Inflow = 4.94 cfs @ 12.12 hrs, Volume= 0.583 af
Primary = 4.94 cfs @ 12.12 hrs, Volume= 0.583 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

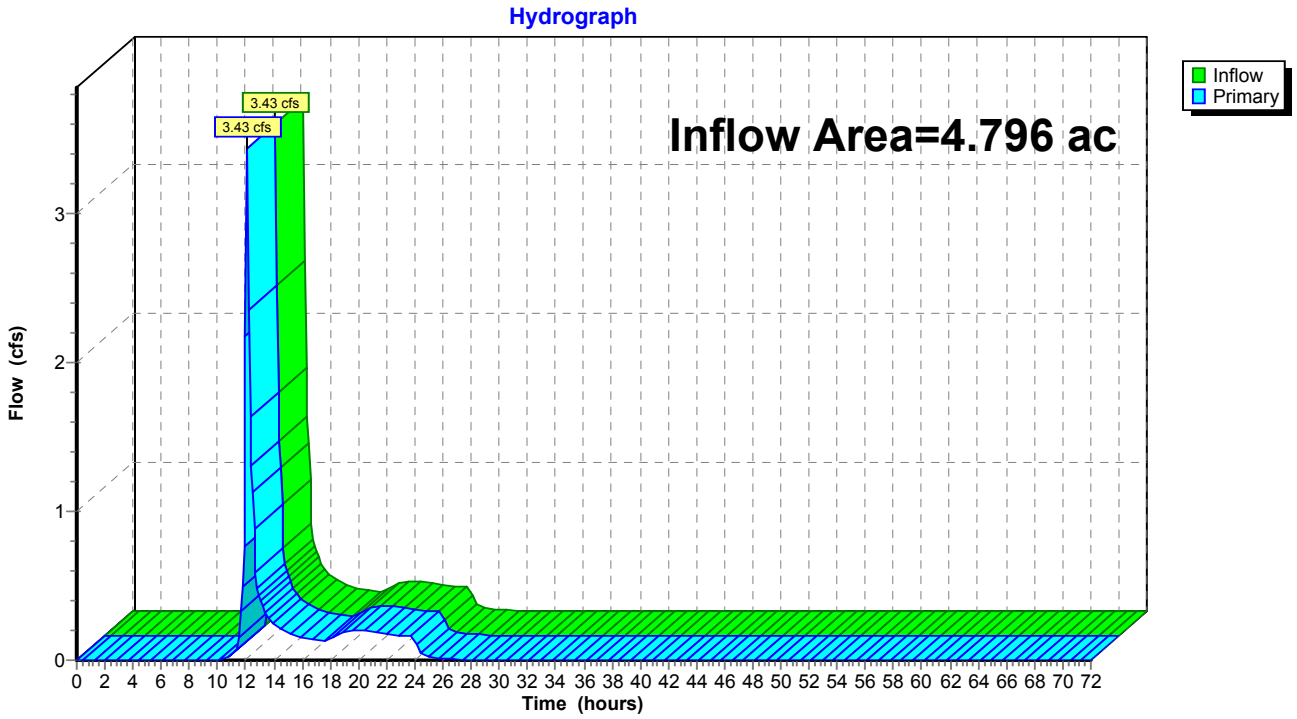


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 0.79" for 5-yr event
Inflow = 3.43 cfs @ 12.10 hrs, Volume= 0.315 af
Primary = 3.43 cfs @ 12.10 hrs, Volume= 0.315 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

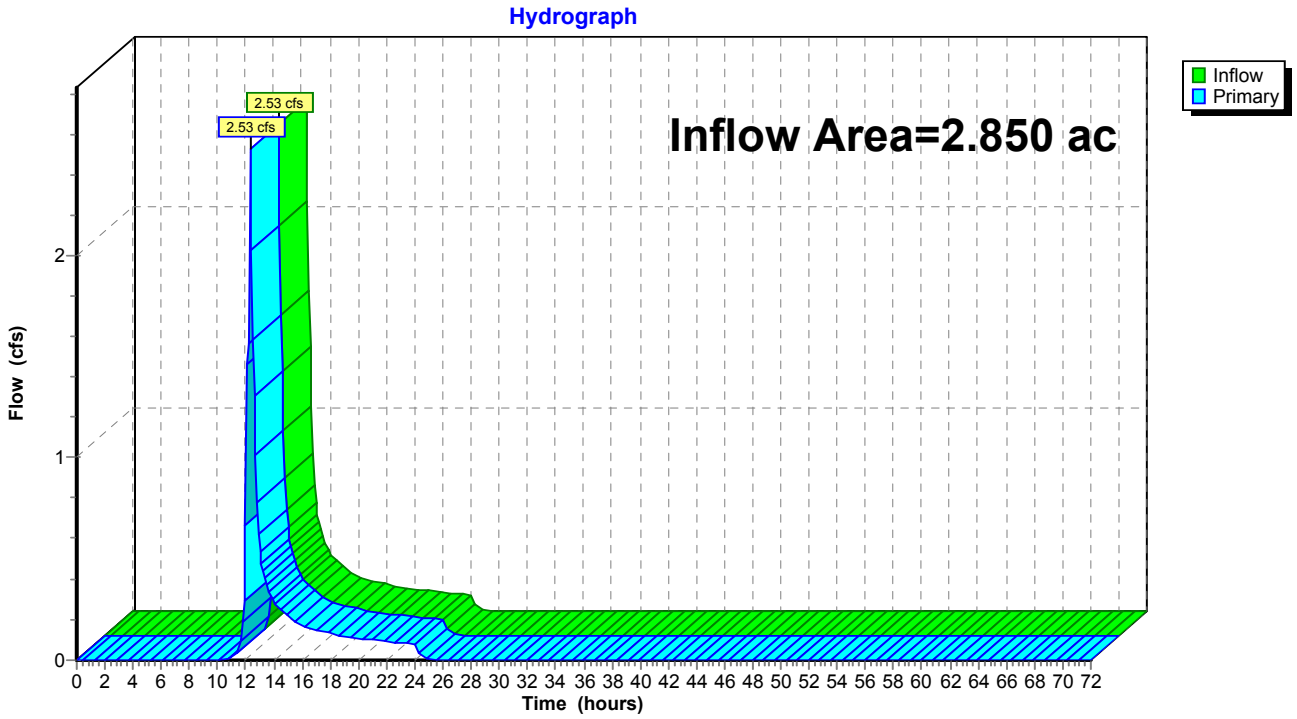


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 1.13" for 5-yr event
Inflow = 2.53 cfs @ 12.32 hrs, Volume= 0.268 af
Primary = 2.53 cfs @ 12.32 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

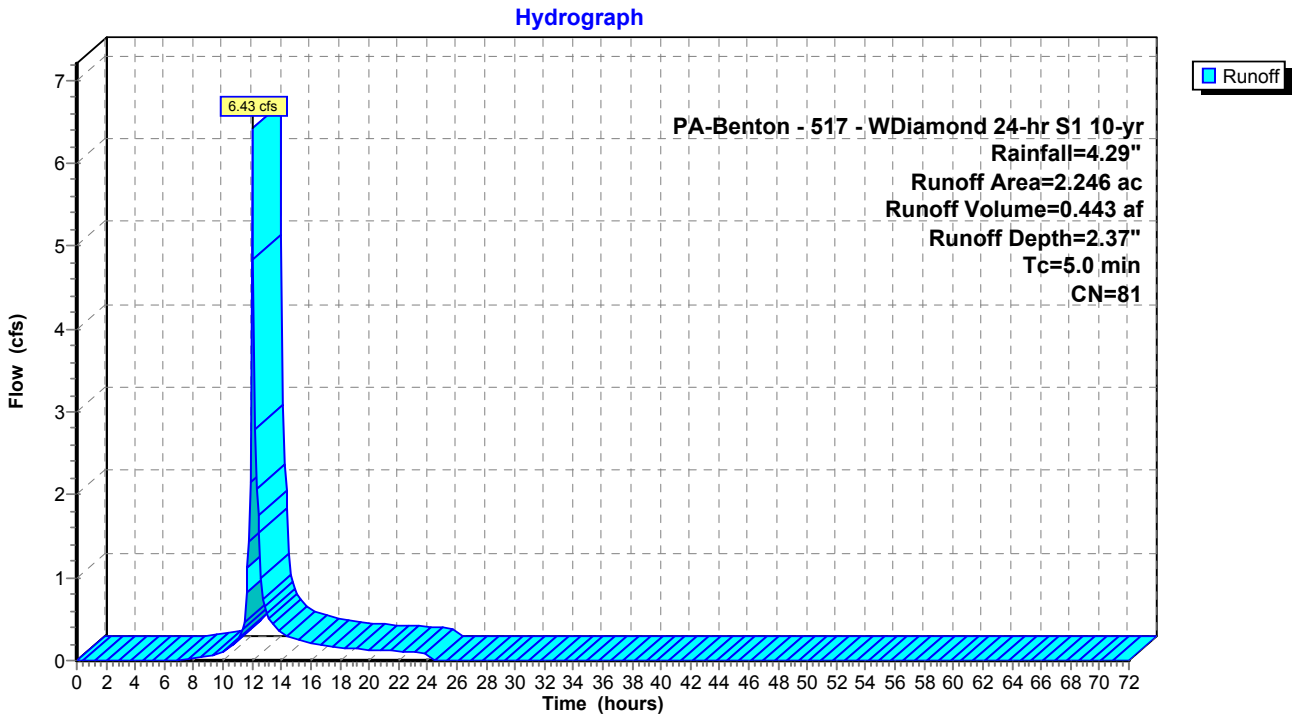
Runoff = 6.43 cfs @ 12.02 hrs, Volume= 0.443 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

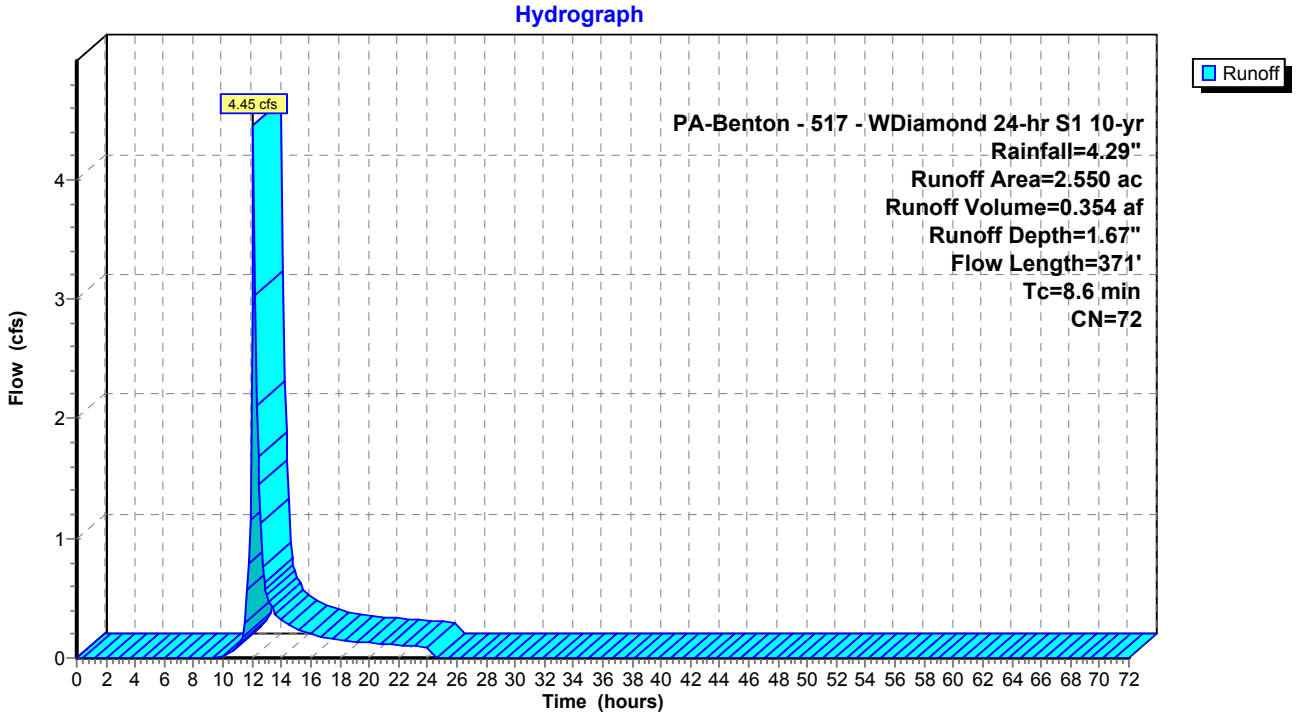
Runoff = 4.45 cfs @ 12.10 hrs, Volume= 0.354 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

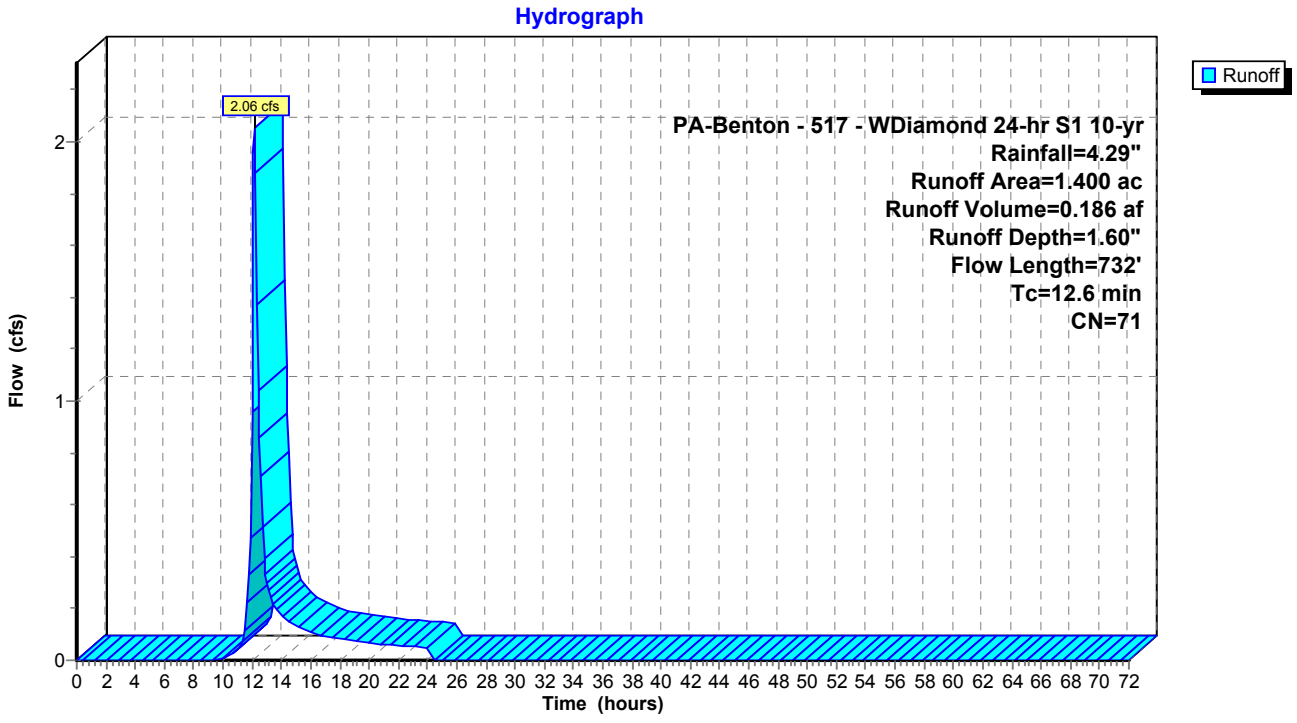
Runoff = 2.06 cfs @ 12.14 hrs, Volume= 0.186 af, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

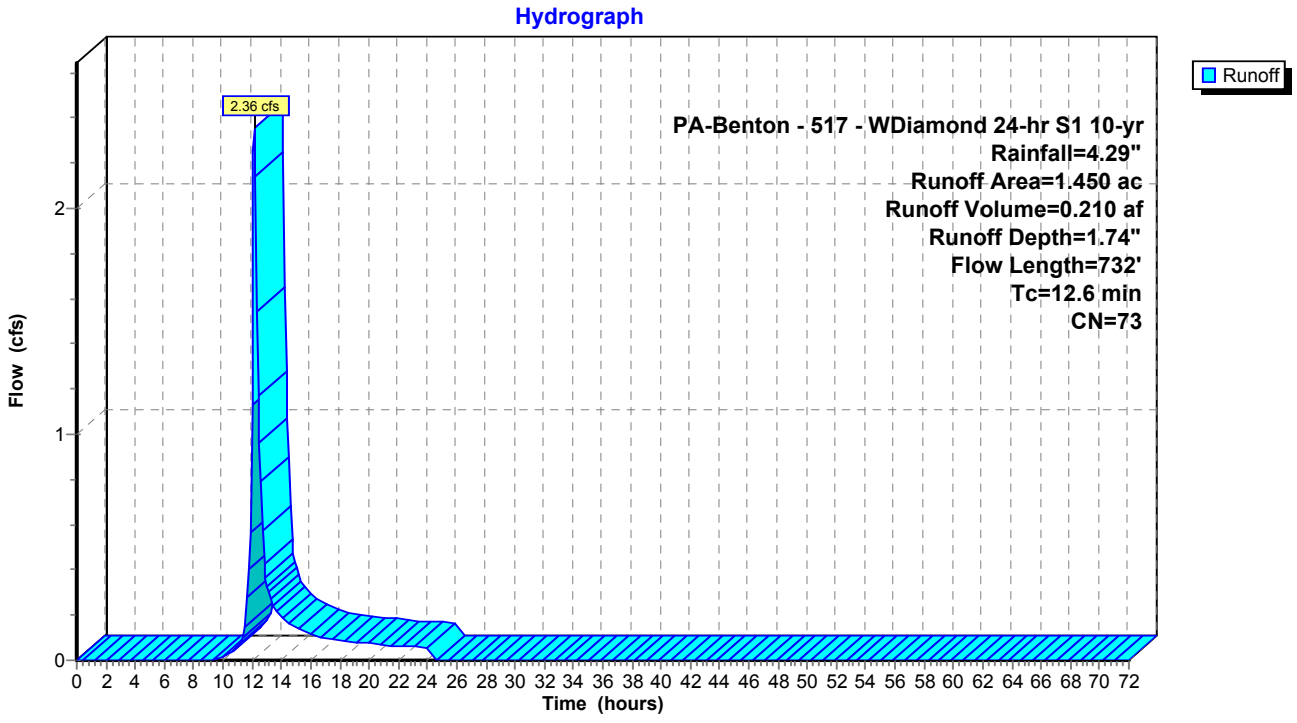
Runoff = 2.36 cfs @ 12.14 hrs, Volume= 0.210 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 10-yr Rainfall=4.29"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 2.37" for 10-yr event
Inflow = 6.43 cfs @ 12.02 hrs, Volume= 0.443 af
Outflow = 0.26 cfs @ 14.90 hrs, Volume= 0.148 af, Atten= 96%, Lag= 172.7 min
Primary = 0.26 cfs @ 14.90 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.79' @ 14.90 hrs Surf.Area= 18,199 sf Storage= 13,513 cf

Plug-Flow detention time= 420.1 min calculated for 0.148 af (33% of inflow)
Center-of-Mass det. time= 275.3 min (1,111.0 - 835.6)

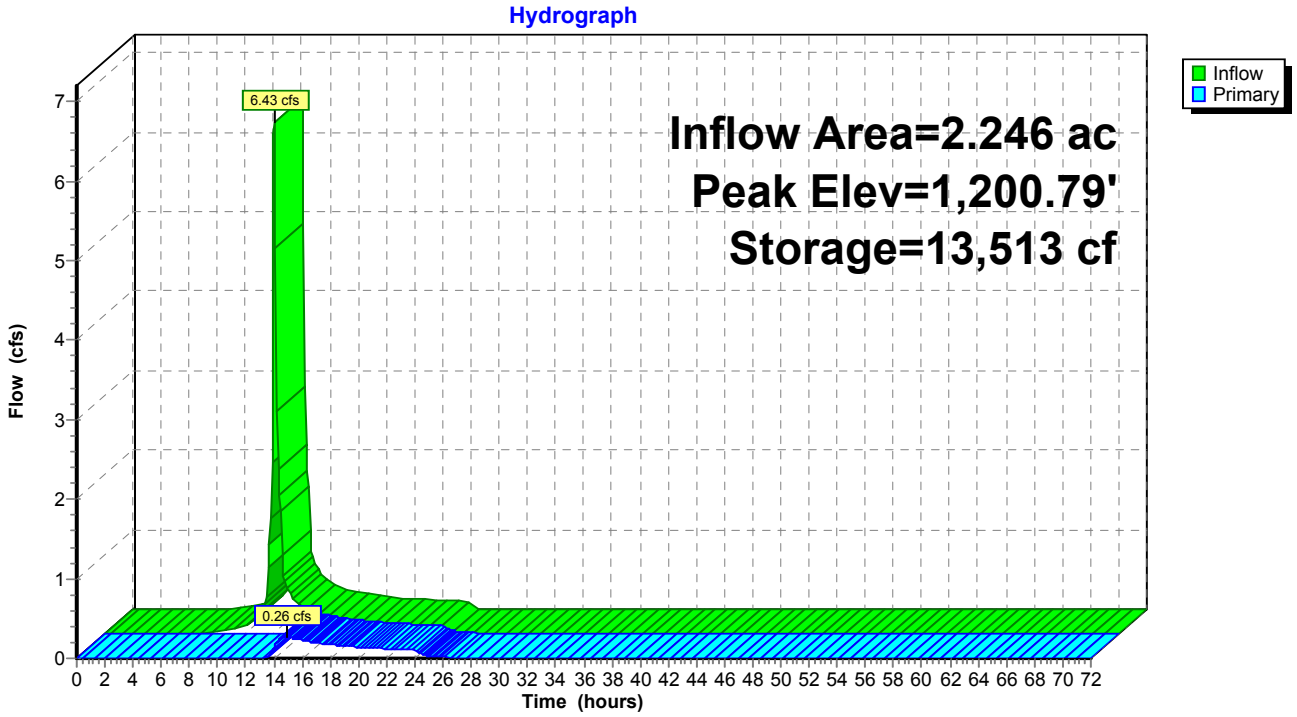
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.26 cfs @ 14.90 hrs HW=1,200.79' (Free Discharge)
- **1=Culvert** (Passes 0.26 cfs of 5.72 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 0.26 cfs @ 0.61 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 1.74" for 10-yr event
Inflow = 2.36 cfs @ 12.14 hrs, Volume= 0.210 af
Outflow = 2.29 cfs @ 12.21 hrs, Volume= 0.187 af, Atten= 3%, Lag= 4.2 min
Primary = 2.29 cfs @ 12.21 hrs, Volume= 0.187 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.22' @ 12.21 hrs Surf.Area= 0 sf Storage= 1,464 cf

Plug-Flow detention time= 83.0 min calculated for 0.187 af (89% of inflow)
Center-of-Mass det. time= 28.0 min (895.7 - 867.7)

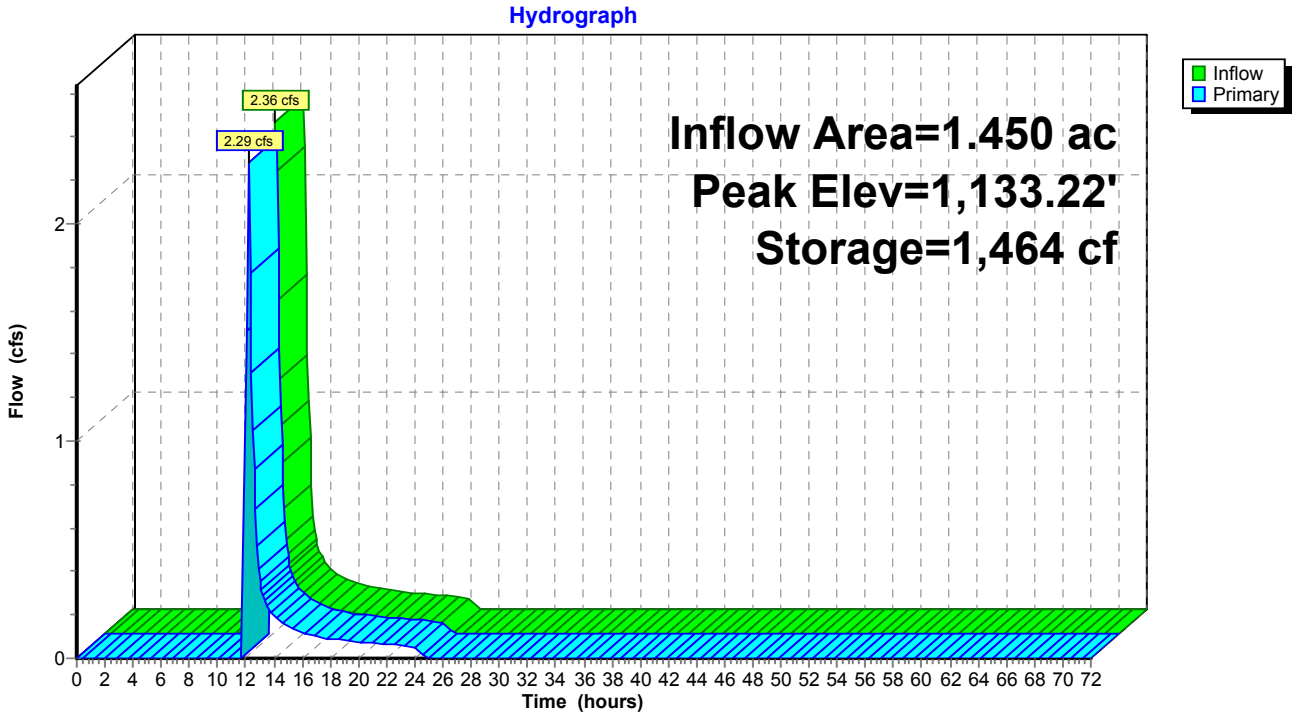
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=2.22 cfs @ 12.21 hrs HW=1,133.22' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.22 cfs @ 1.26 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 1.55" for 10-yr event
Inflow = 2.29 cfs @ 12.21 hrs, Volume= 0.187 af
Outflow = 2.06 cfs @ 12.27 hrs, Volume= 0.183 af, Atten= 10%, Lag= 3.7 min
Primary = 2.06 cfs @ 12.27 hrs, Volume= 0.183 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,131.30' @ 12.27 hrs Surf.Area= 622 sf Storage= 607 cf

Plug-Flow detention time= 25.7 min calculated for 0.183 af (98% of inflow)
Center-of-Mass det. time= 11.9 min (907.6 - 895.7)

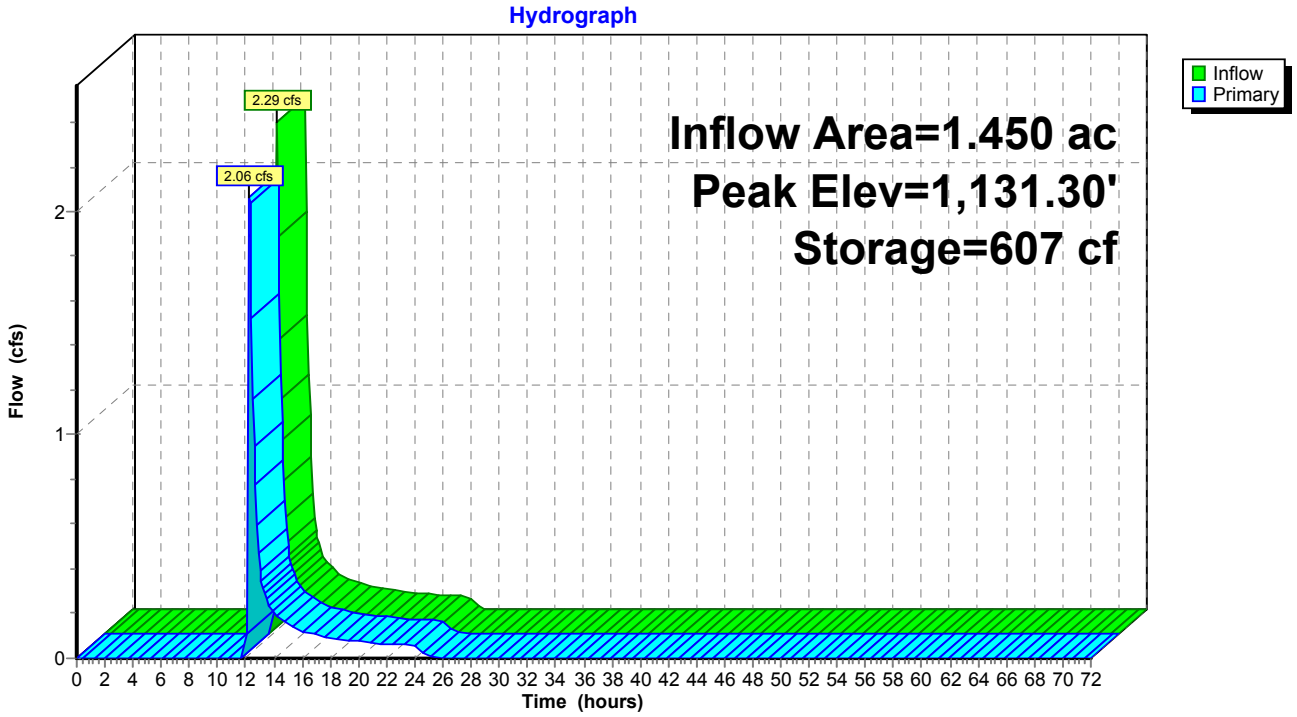
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.00 cfs @ 12.27 hrs HW=1,131.29' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 2.00 cfs @ 3.02 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

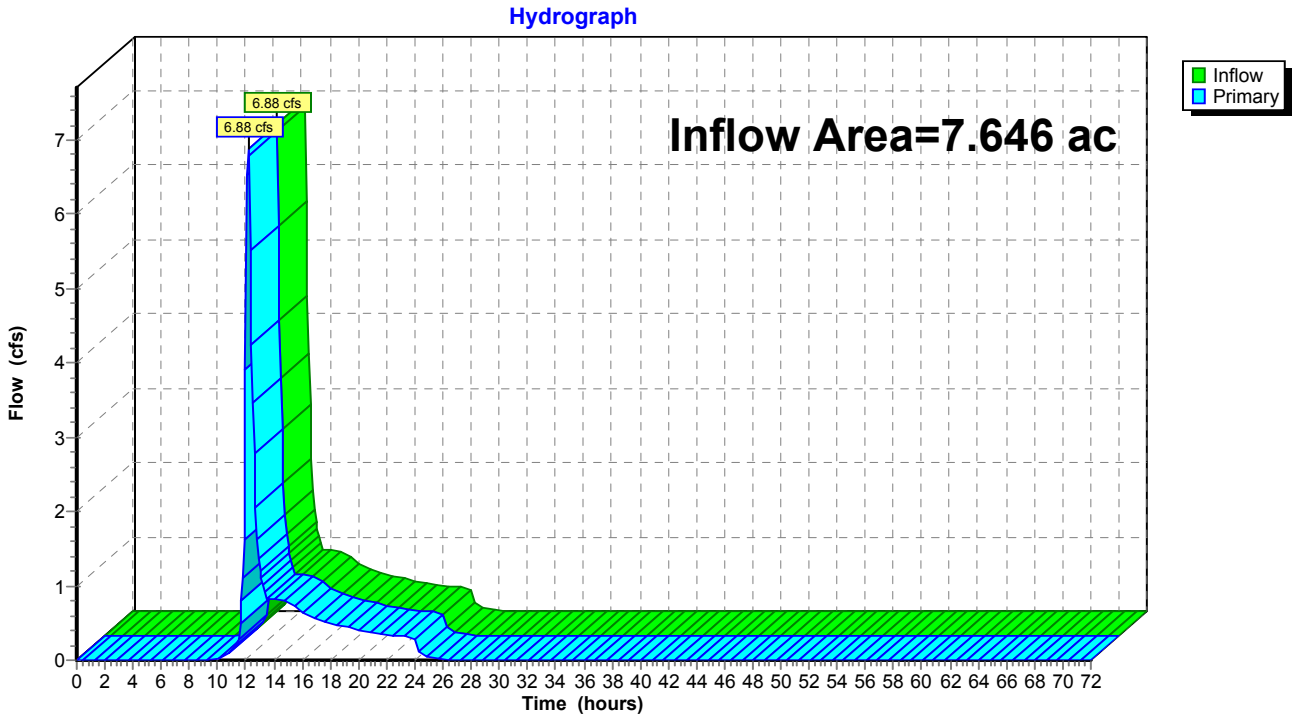
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 1.37" for 10-yr event
Inflow = 6.88 cfs @ 12.17 hrs, Volume= 0.871 af
Primary = 6.88 cfs @ 12.17 hrs, Volume= 0.871 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

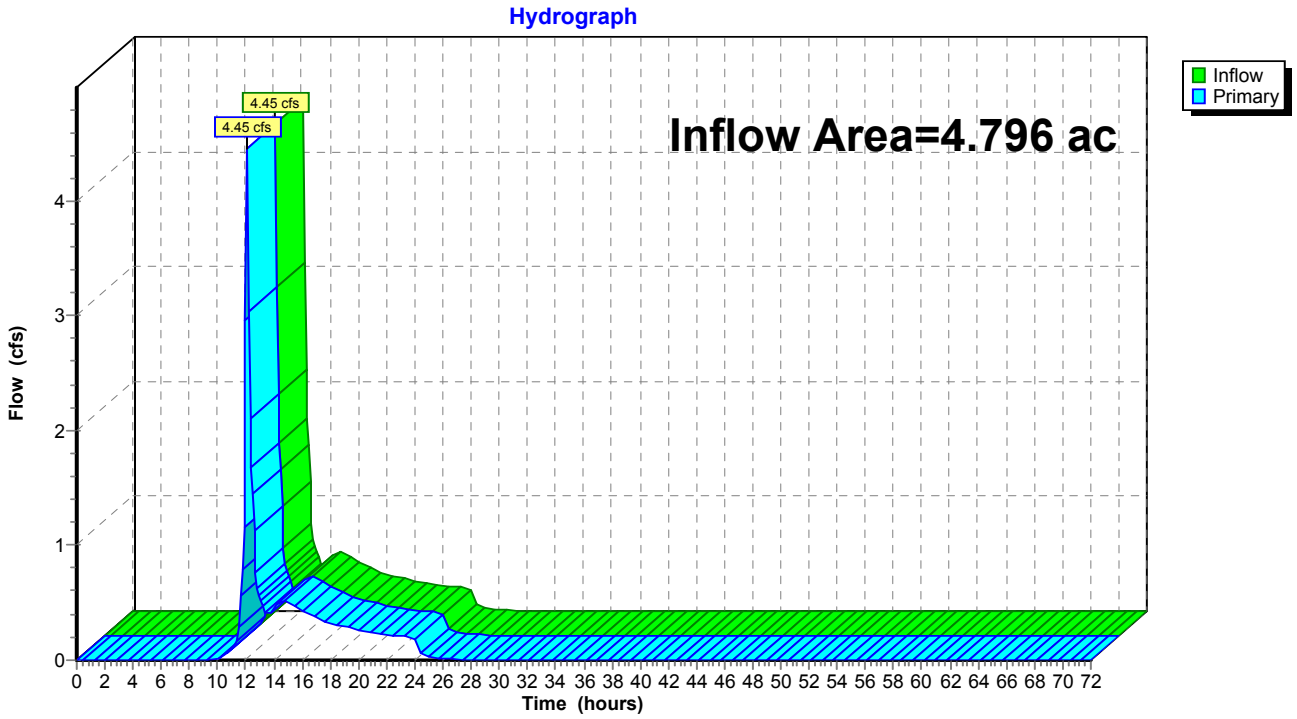


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 1.26" for 10-yr event
Inflow = 4.45 cfs @ 12.10 hrs, Volume= 0.502 af
Primary = 4.45 cfs @ 12.10 hrs, Volume= 0.502 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

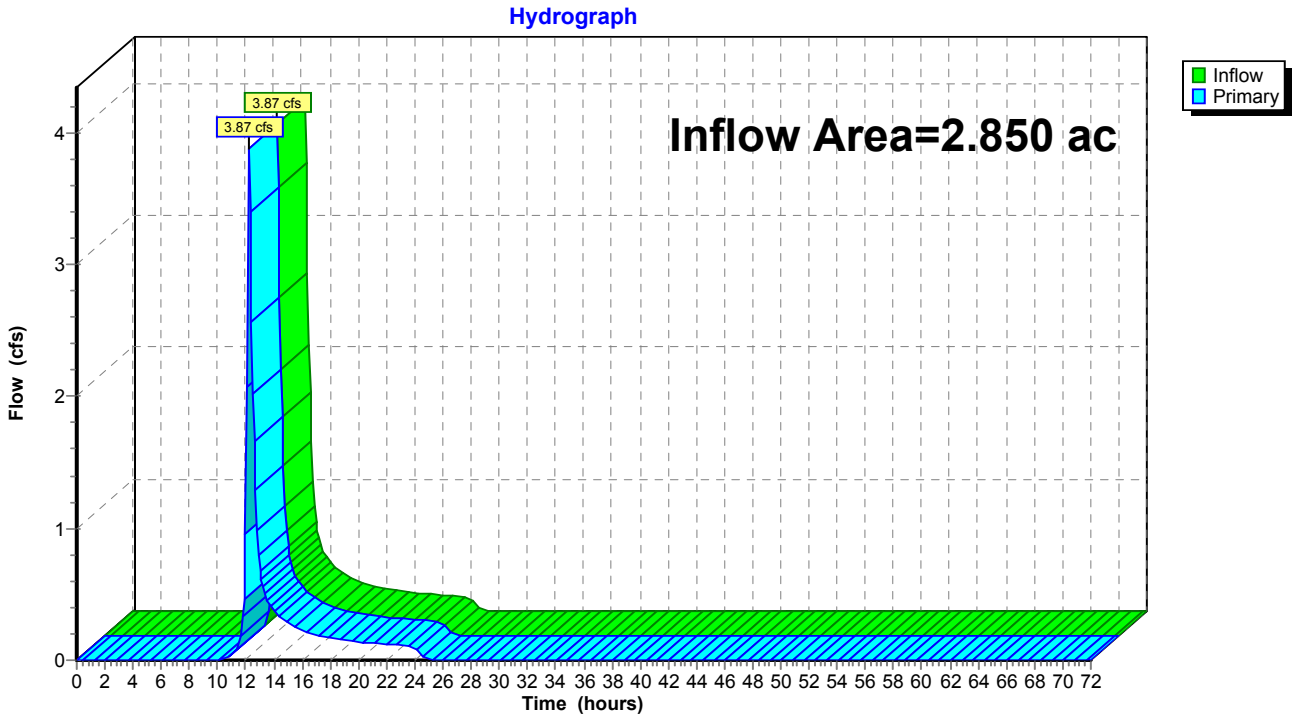


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 1.55" for 10-yr event
Inflow = 3.87 cfs @ 12.23 hrs, Volume= 0.369 af
Primary = 3.87 cfs @ 12.23 hrs, Volume= 0.369 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

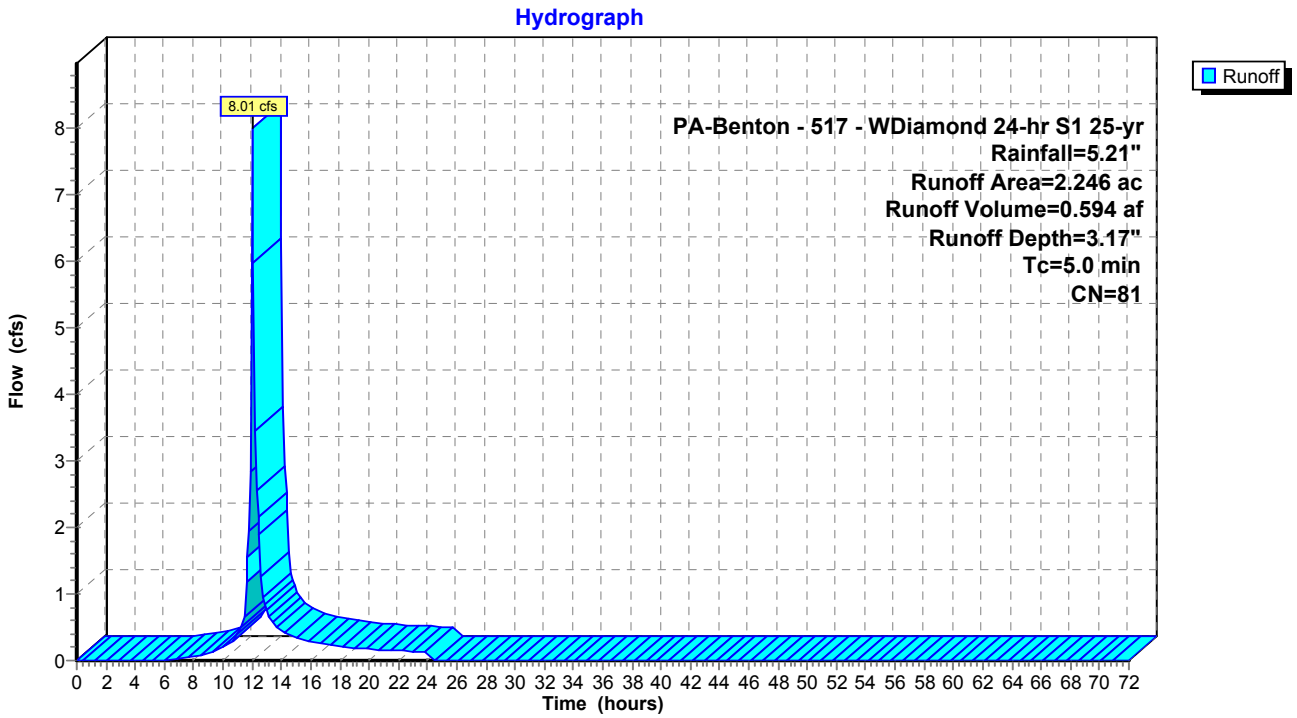
Runoff = 8.01 cfs @ 12.02 hrs, Volume= 0.594 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

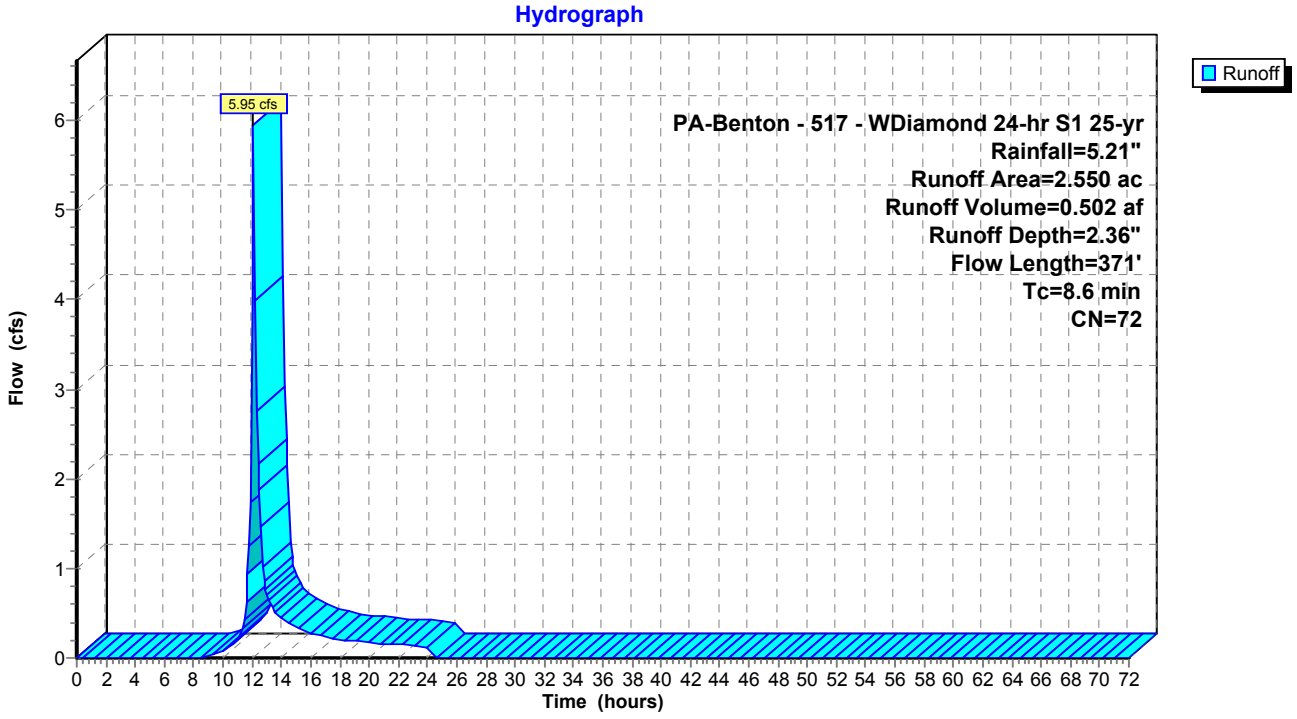
Runoff = 5.95 cfs @ 12.10 hrs, Volume= 0.502 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

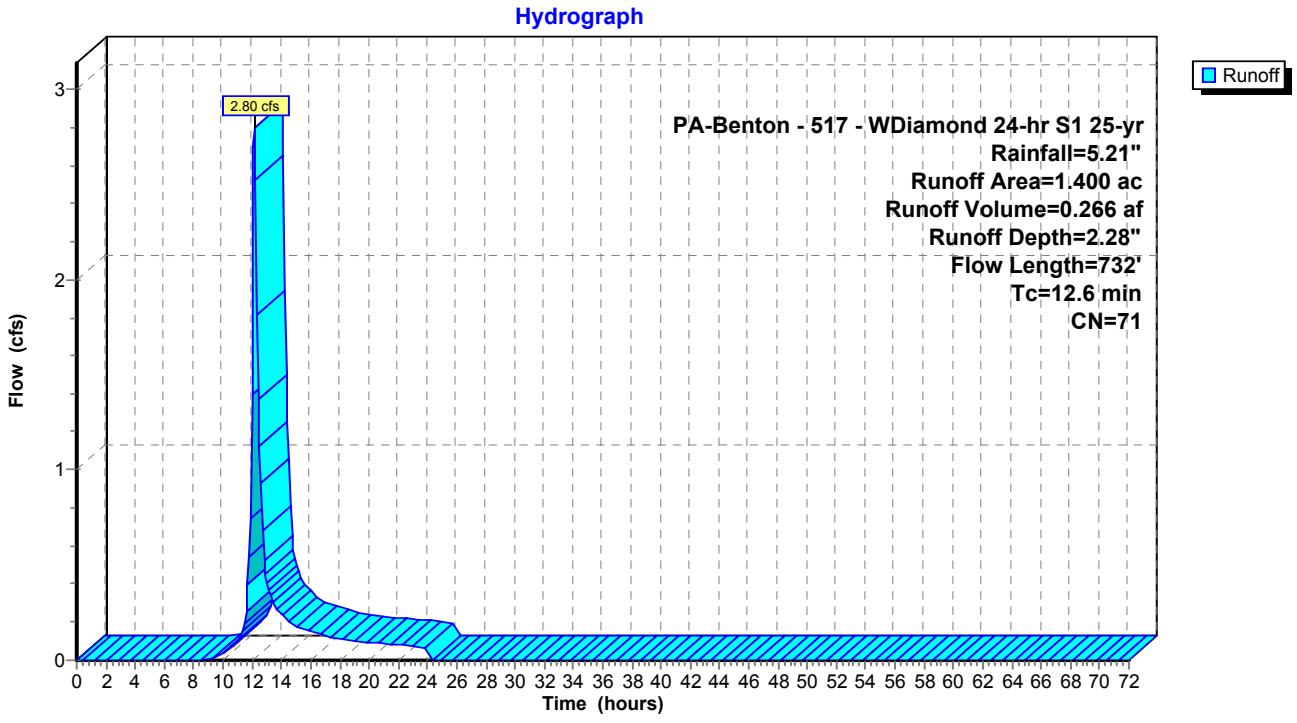
Runoff = 2.80 cfs @ 12.14 hrs, Volume= 0.266 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

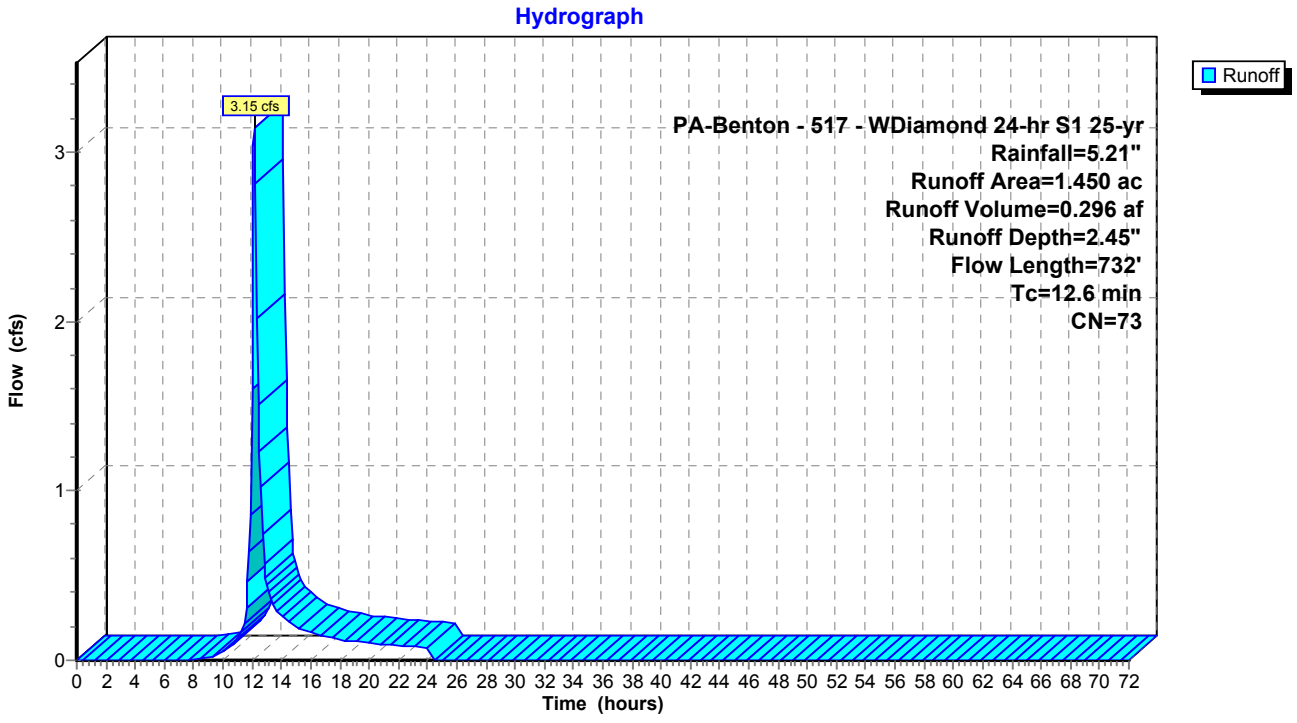
Runoff = 3.15 cfs @ 12.14 hrs, Volume= 0.296 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 25-yr Rainfall=5.21"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 3.17" for 25-yr event
Inflow = 8.01 cfs @ 12.02 hrs, Volume= 0.594 af
Outflow = 0.89 cfs @ 12.77 hrs, Volume= 0.298 af, Atten= 89%, Lag= 44.9 min
Primary = 0.89 cfs @ 12.77 hrs, Volume= 0.298 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.83' @ 12.77 hrs Surf.Area= 18,312 sf Storage= 14,328 cf

Plug-Flow detention time= 306.8 min calculated for 0.298 af (50% of inflow)
Center-of-Mass det. time= 172.7 min (1,003.1 - 830.3)

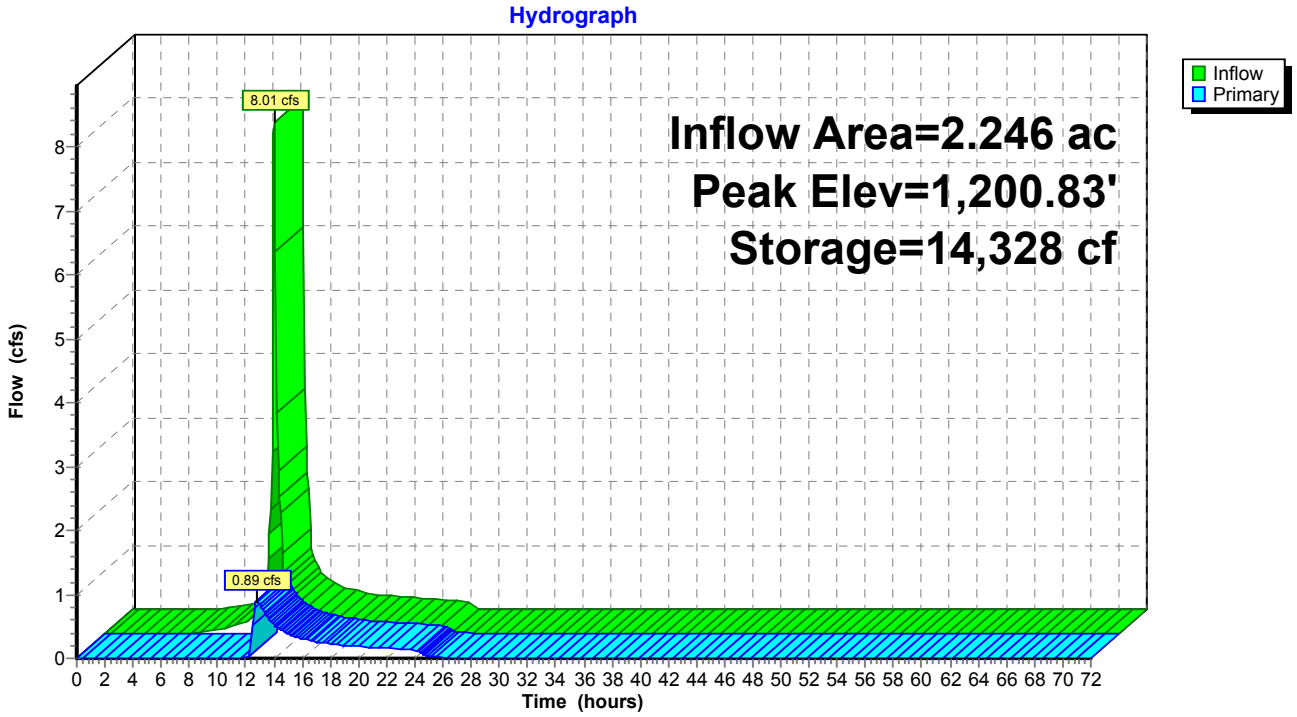
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.88 cfs @ 12.77 hrs HW=1,200.83' (Free Discharge)
- **1=Culvert** (Passes 0.88 cfs of 5.77 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 0.88 cfs @ 0.92 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 2.45" for 25-yr event
Inflow = 3.15 cfs @ 12.14 hrs, Volume= 0.296 af
Outflow = 3.02 cfs @ 12.19 hrs, Volume= 0.272 af, Atten= 4%, Lag= 3.5 min
Primary = 3.02 cfs @ 12.19 hrs, Volume= 0.272 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.27' @ 12.19 hrs Surf.Area= 0 sf Storage= 1,555 cf

Plug-Flow detention time= 65.9 min calculated for 0.272 af (92% of inflow)
Center-of-Mass det. time= 23.6 min (885.7 - 862.1)

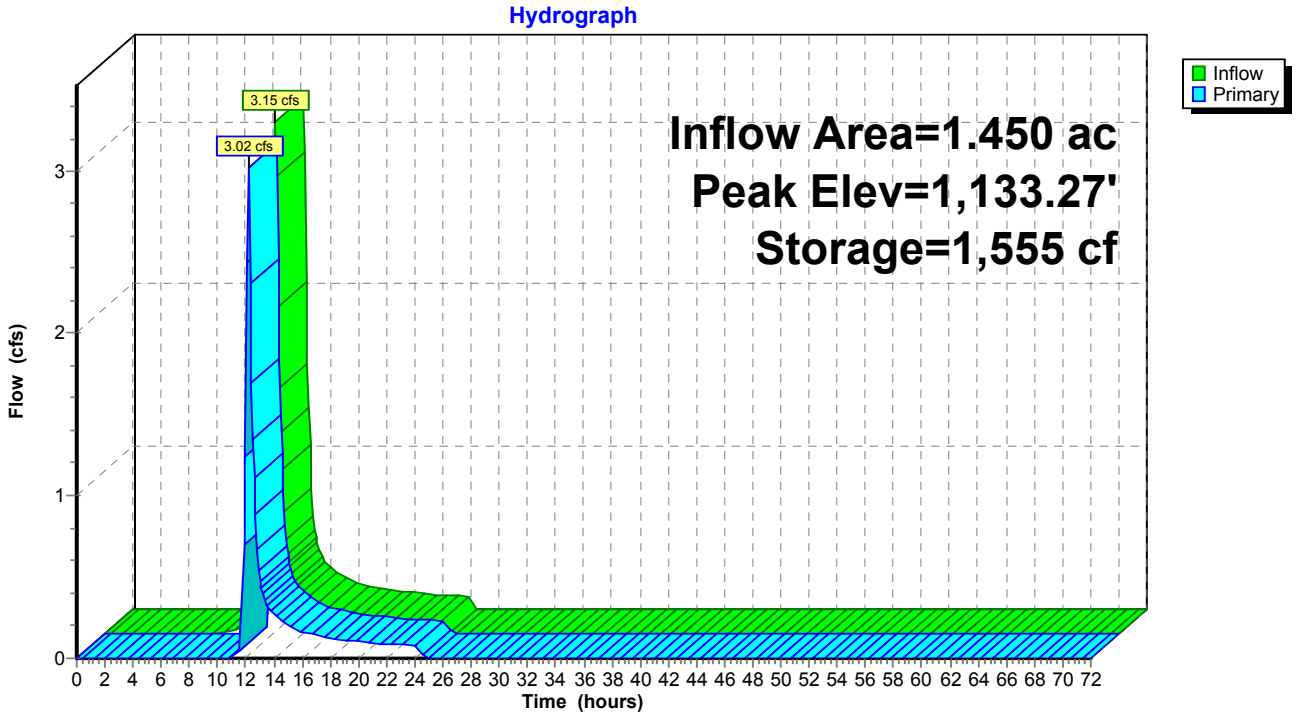
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=2.98 cfs @ 12.19 hrs HW=1,133.27' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.98 cfs @ 1.40 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 2.25" for 25-yr event
Inflow = 3.02 cfs @ 12.19 hrs, Volume= 0.272 af
Outflow = 2.78 cfs @ 12.25 hrs, Volume= 0.268 af, Atten= 8%, Lag= 3.2 min
Primary = 2.78 cfs @ 12.25 hrs, Volume= 0.268 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,131.53' @ 12.25 hrs Surf.Area= 677 sf Storage= 755 cf

Plug-Flow detention time= 18.2 min calculated for 0.268 af (98% of inflow)
Center-of-Mass det. time= 9.5 min (895.2 - 885.7)

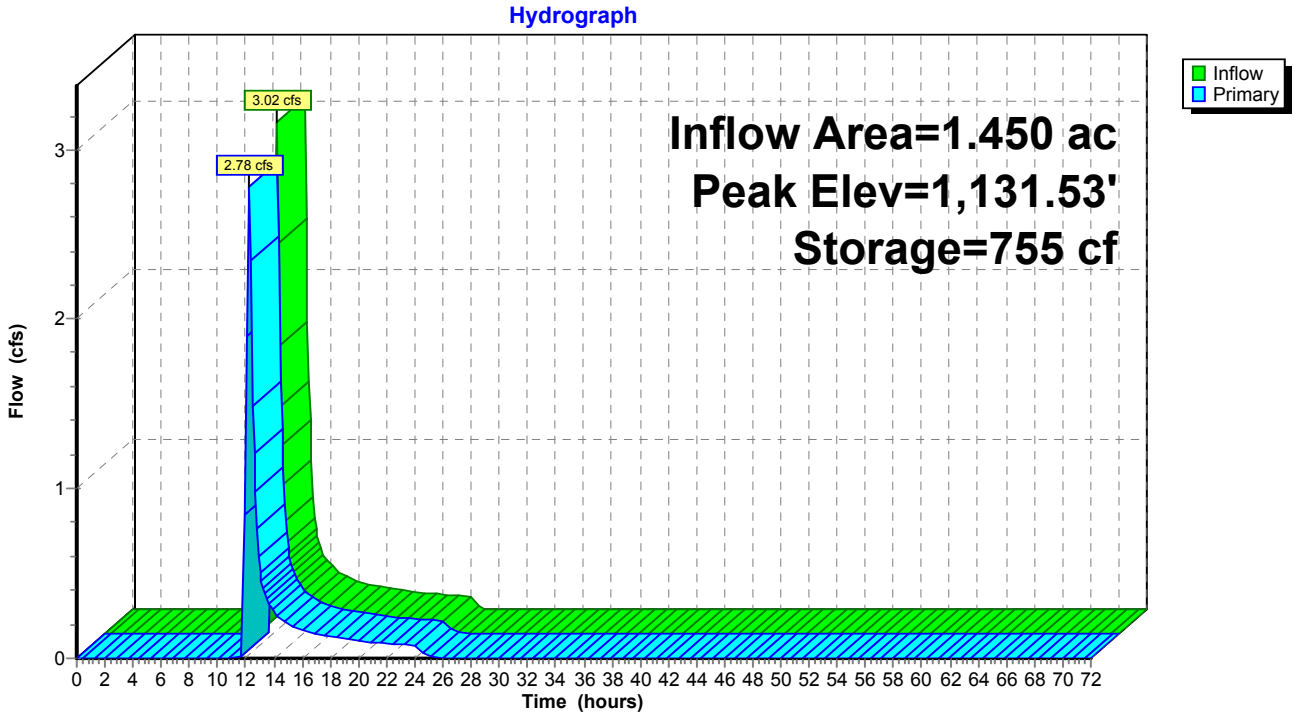
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.67 cfs @ 12.25 hrs HW=1,131.50' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 2.67 cfs @ 3.40 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

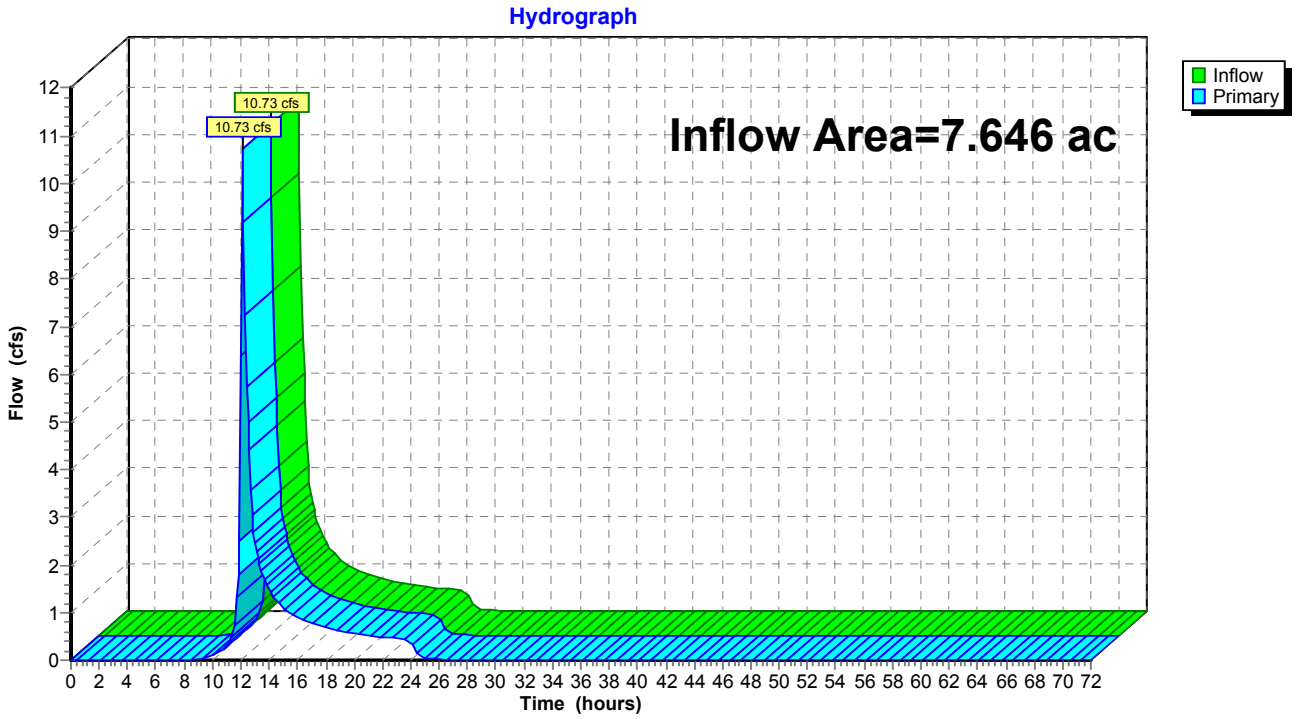
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 2.09" for 25-yr event
Inflow = 10.73 cfs @ 12.13 hrs, Volume= 1.333 af
Primary = 10.73 cfs @ 12.13 hrs, Volume= 1.333 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

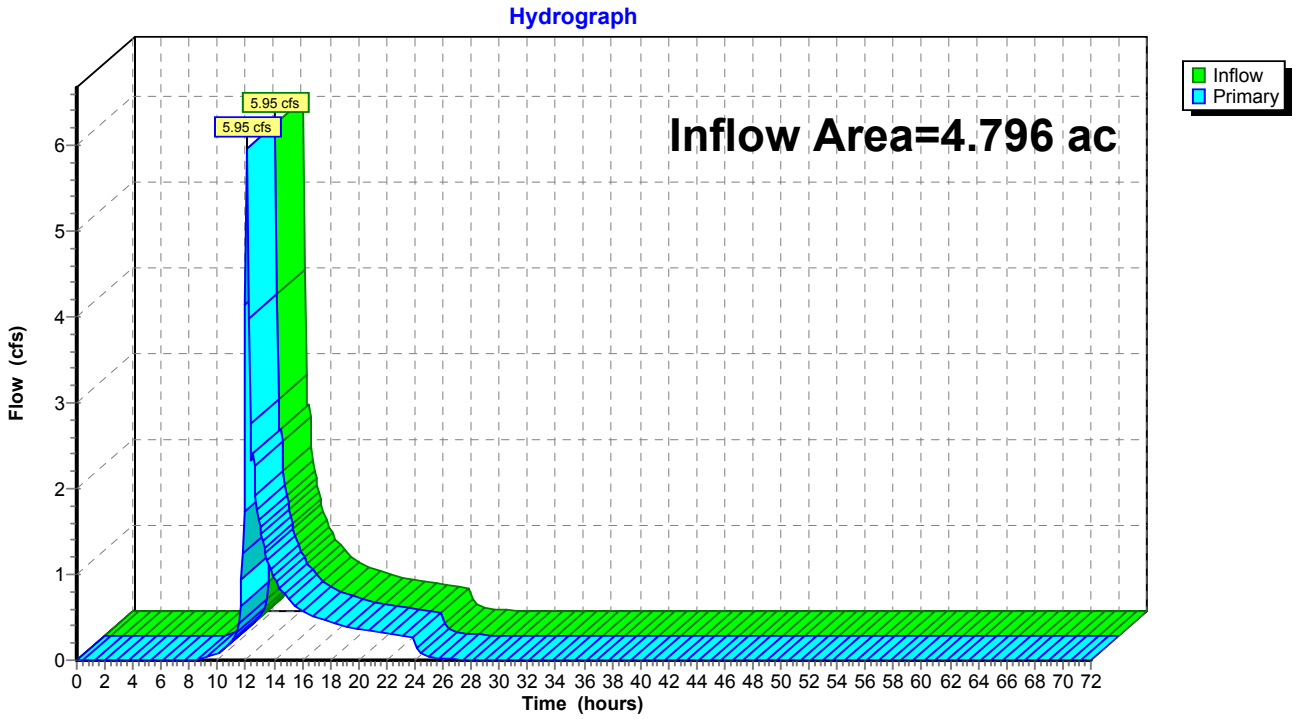


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 2.00" for 25-yr event
Inflow = 5.95 cfs @ 12.10 hrs, Volume= 0.800 af
Primary = 5.95 cfs @ 12.10 hrs, Volume= 0.800 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

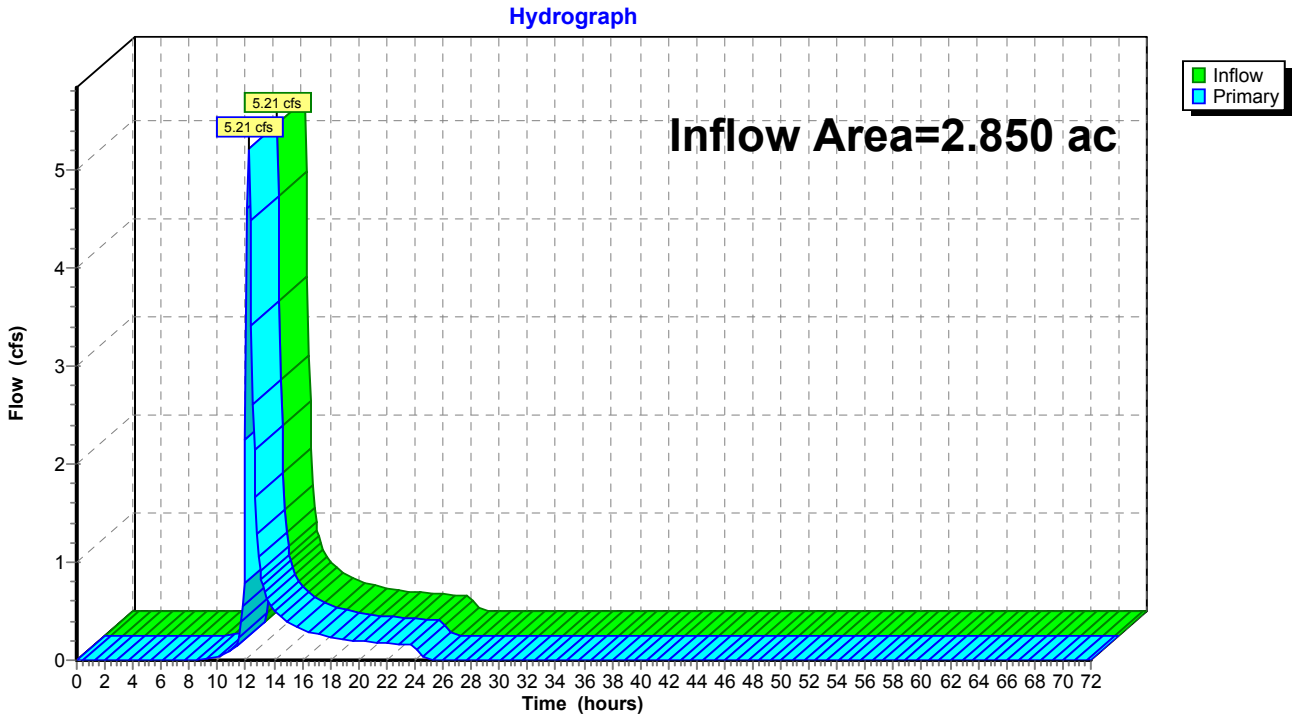


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 2.25" for 25-yr event
Inflow = 5.21 cfs @ 12.20 hrs, Volume= 0.534 af
Primary = 5.21 cfs @ 12.20 hrs, Volume= 0.534 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

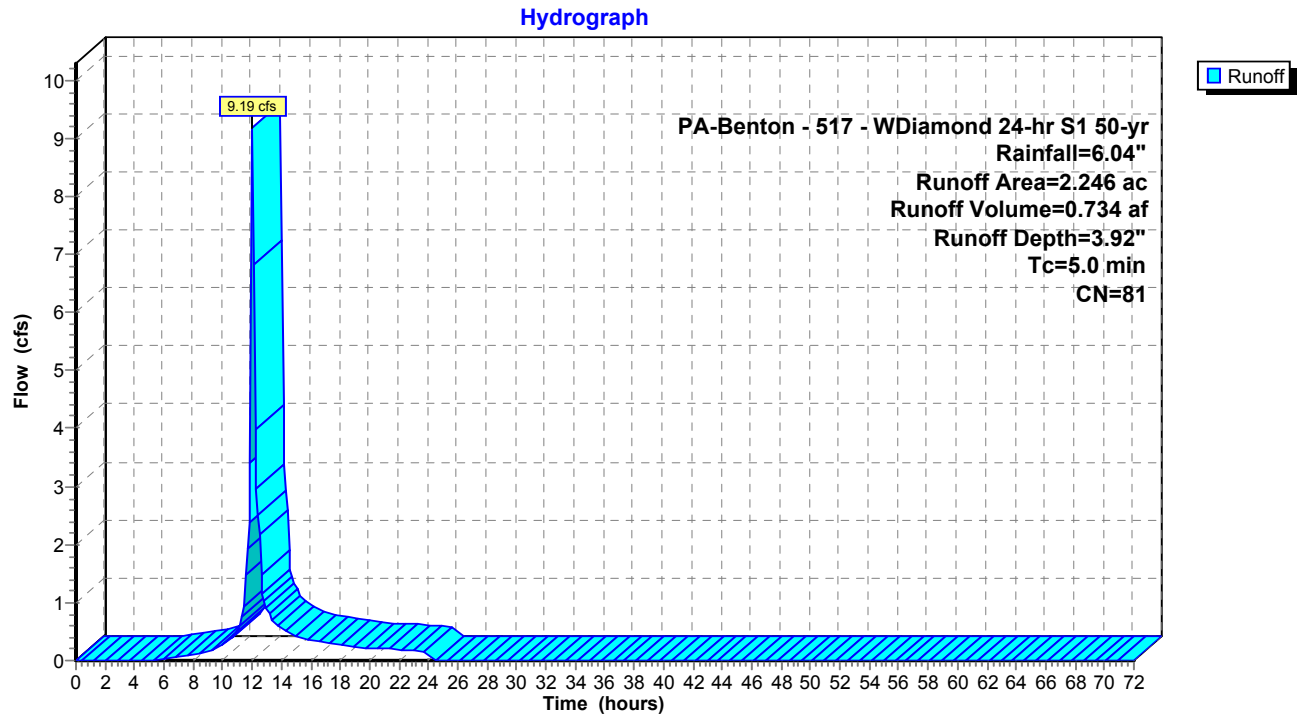
Runoff = 9.19 cfs @ 12.02 hrs, Volume= 0.734 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

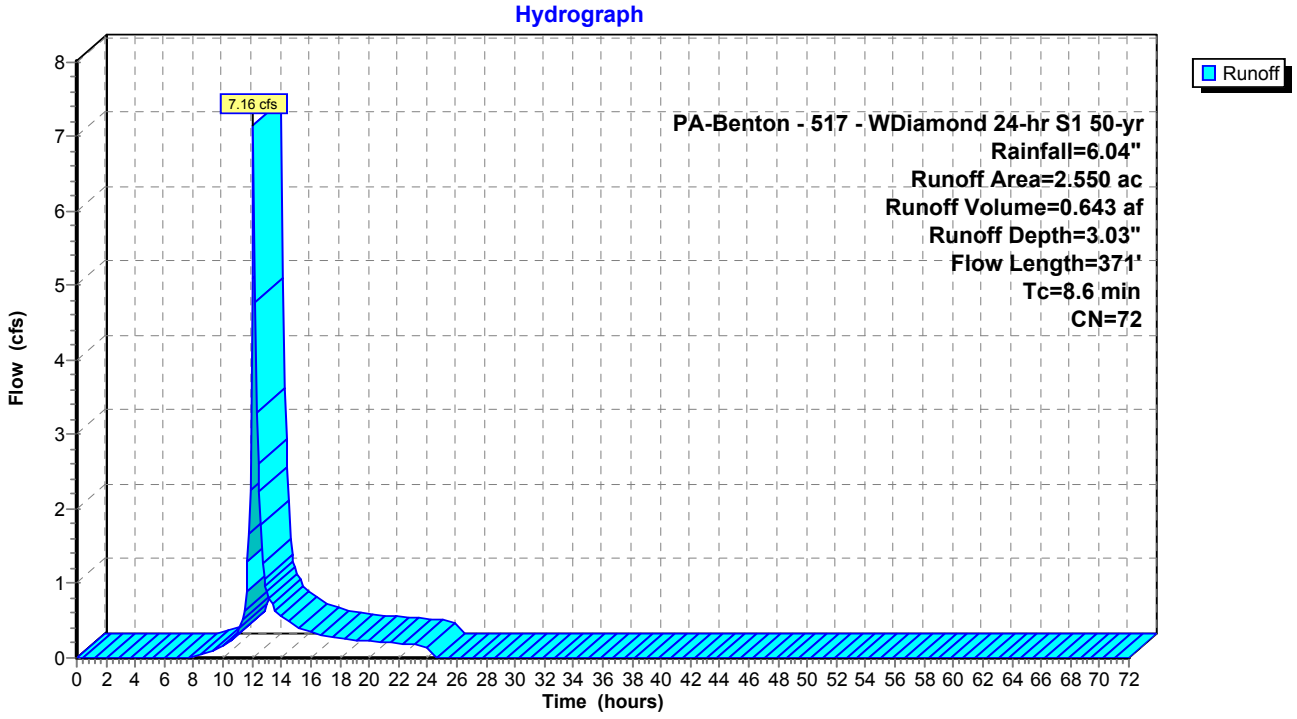
Runoff = 7.16 cfs @ 12.10 hrs, Volume= 0.643 af, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

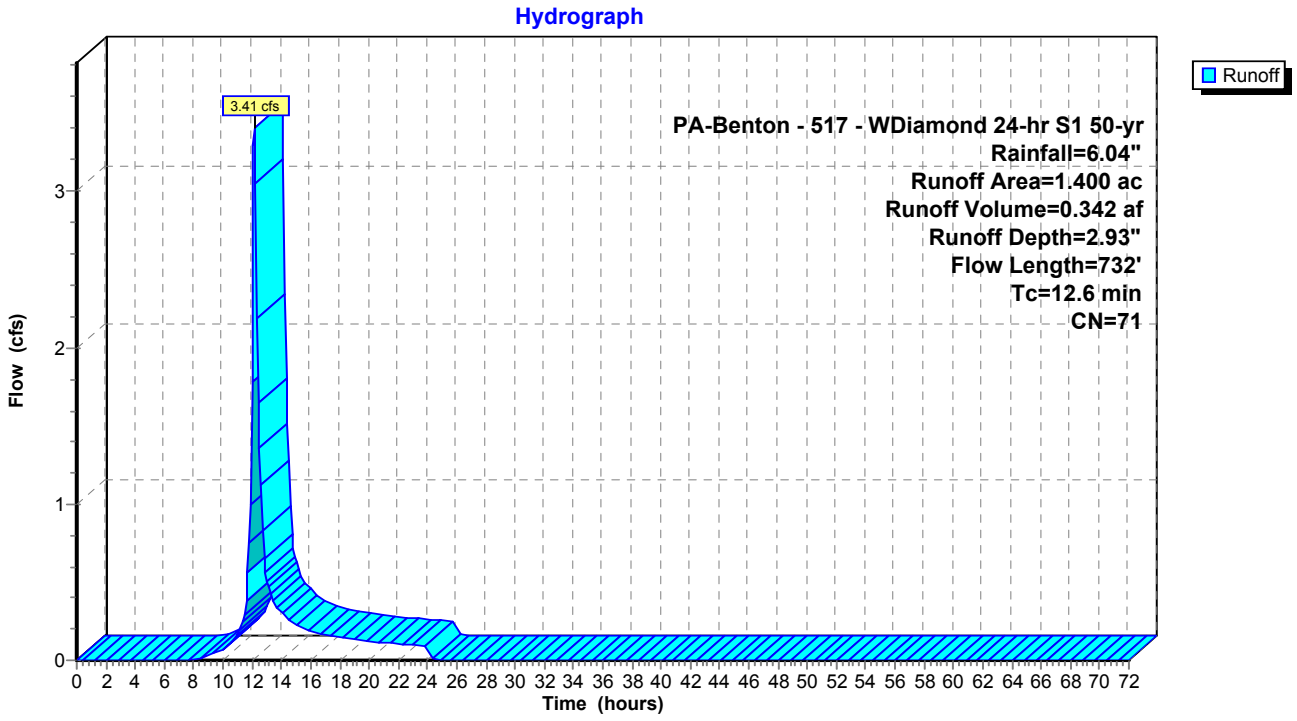
Runoff = 3.41 cfs @ 12.14 hrs, Volume= 0.342 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

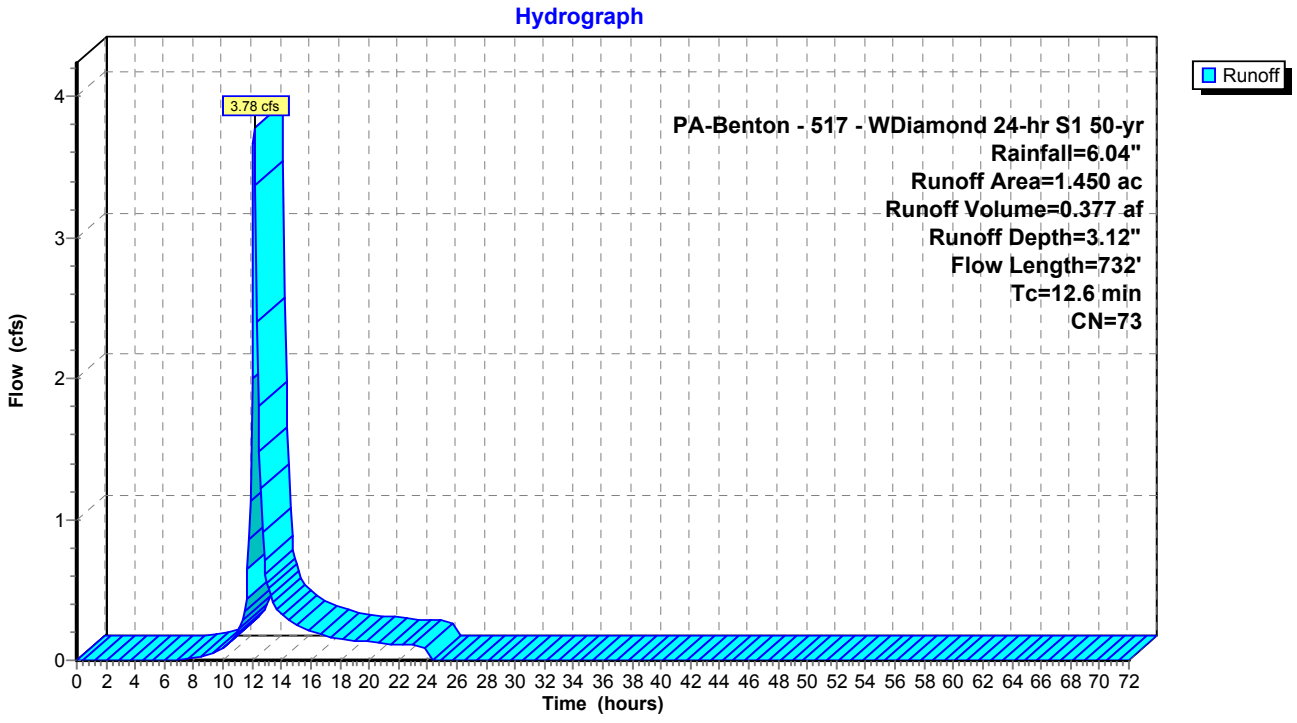
Runoff = 3.78 cfs @ 12.13 hrs, Volume= 0.377 af, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 50-yr Rainfall=6.04"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 3.92" for 50-yr event
Inflow = 9.19 cfs @ 12.02 hrs, Volume= 0.734 af
Outflow = 2.11 cfs @ 12.51 hrs, Volume= 0.438 af, Atten= 77%, Lag= 29.0 min
Primary = 2.11 cfs @ 12.51 hrs, Volume= 0.438 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.89' @ 12.51 hrs Surf.Area= 18,469 sf Storage= 15,479 cf

Plug-Flow detention time= 264.9 min calculated for 0.438 af (60% of inflow)
Center-of-Mass det. time= 136.0 min (962.1 - 826.1)

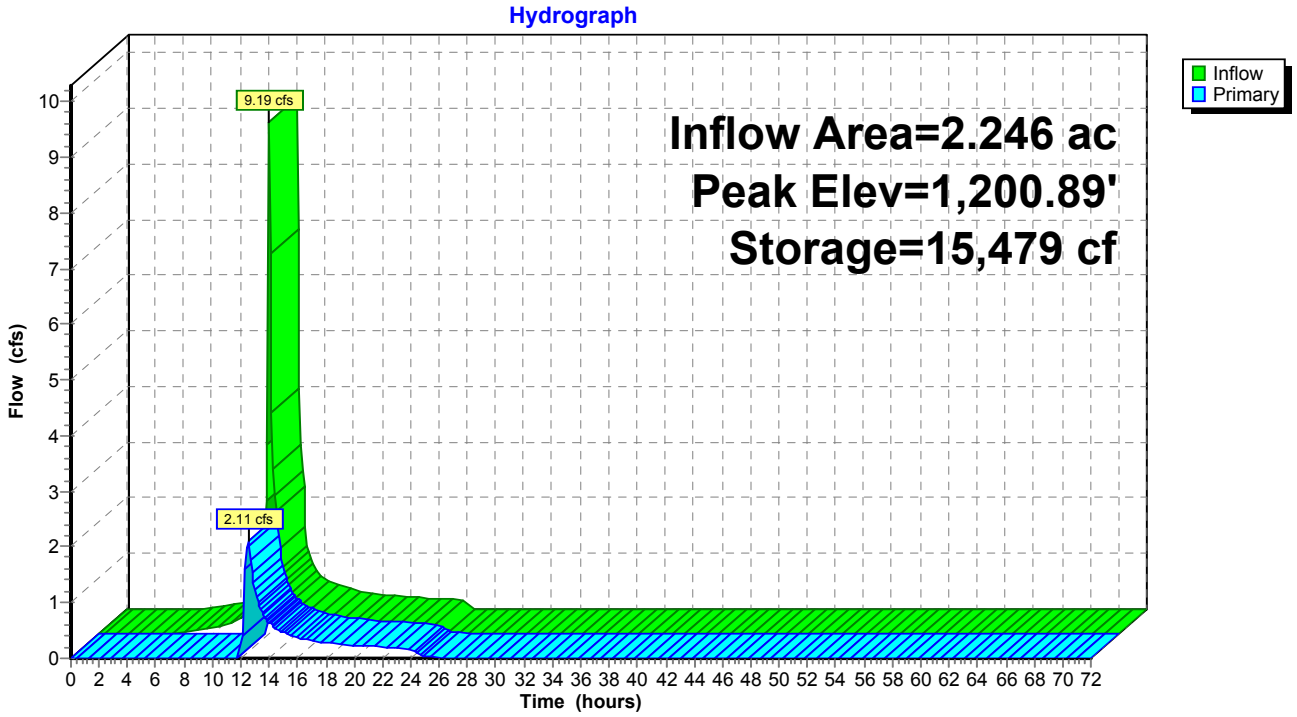
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=2.10 cfs @ 12.51 hrs HW=1,200.89' (Free Discharge)
- **1=Culvert** (Passes 2.10 cfs of 5.85 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 2.10 cfs @ 1.23 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 3.12" for 50-yr event
Inflow = 3.78 cfs @ 12.13 hrs, Volume= 0.377 af
Outflow = 3.63 cfs @ 12.19 hrs, Volume= 0.354 af, Atten= 4%, Lag= 3.3 min
Primary = 3.63 cfs @ 12.19 hrs, Volume= 0.354 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.30' @ 12.19 hrs Surf.Area= 0 sf Storage= 1,626 cf

Plug-Flow detention time= 55.6 min calculated for 0.354 af (94% of inflow)
Center-of-Mass det. time= 22.0 min (880.0 - 858.0)

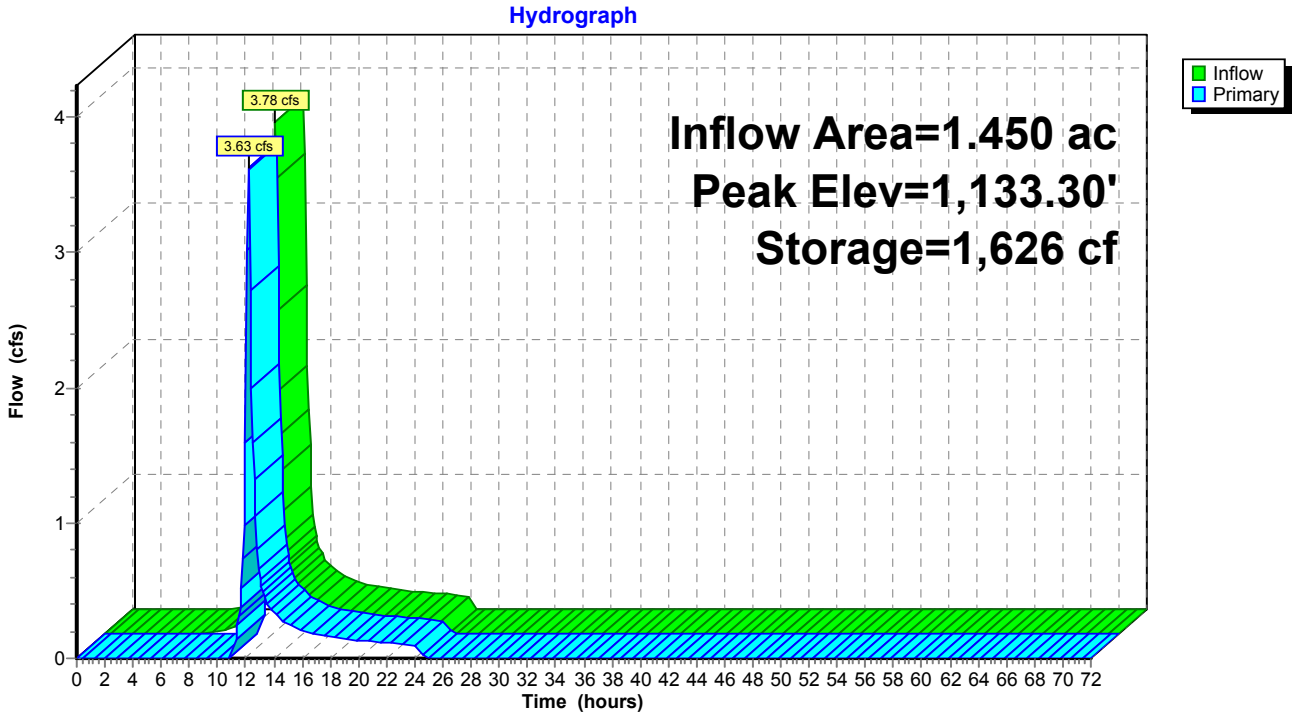
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=3.56 cfs @ 12.19 hrs HW=1,133.30' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.56 cfs @ 1.48 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 2.93" for 50-yr event
Inflow = 3.63 cfs @ 12.19 hrs, Volume= 0.354 af
Outflow = 3.23 cfs @ 12.25 hrs, Volume= 0.350 af, Atten= 11%, Lag= 3.8 min
Primary = 3.23 cfs @ 12.25 hrs, Volume= 0.350 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,131.73' @ 12.25 hrs Surf.Area= 725 sf Storage= 894 cf

Plug-Flow detention time= 15.3 min calculated for 0.349 af (99% of inflow)
Center-of-Mass det. time= 8.6 min (888.5 - 880.0)

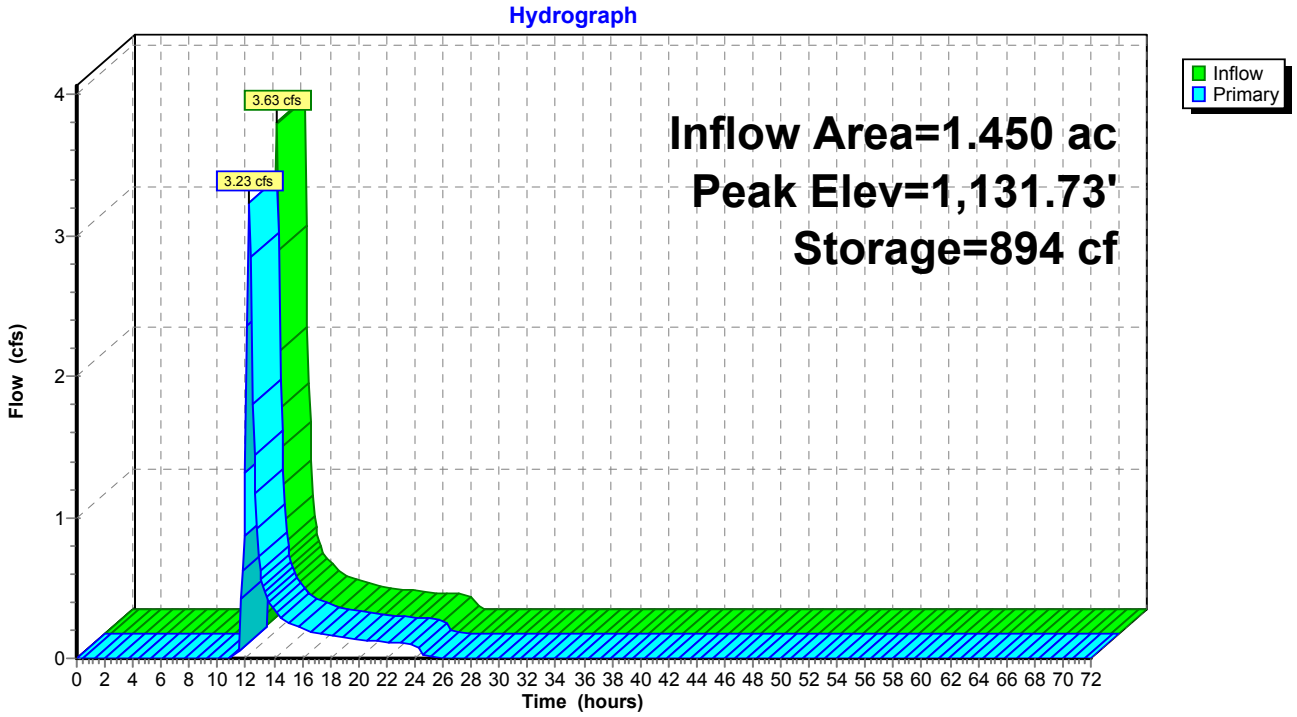
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.15 cfs @ 12.25 hrs HW=1,131.70' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 3.15 cfs @ 4.02 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

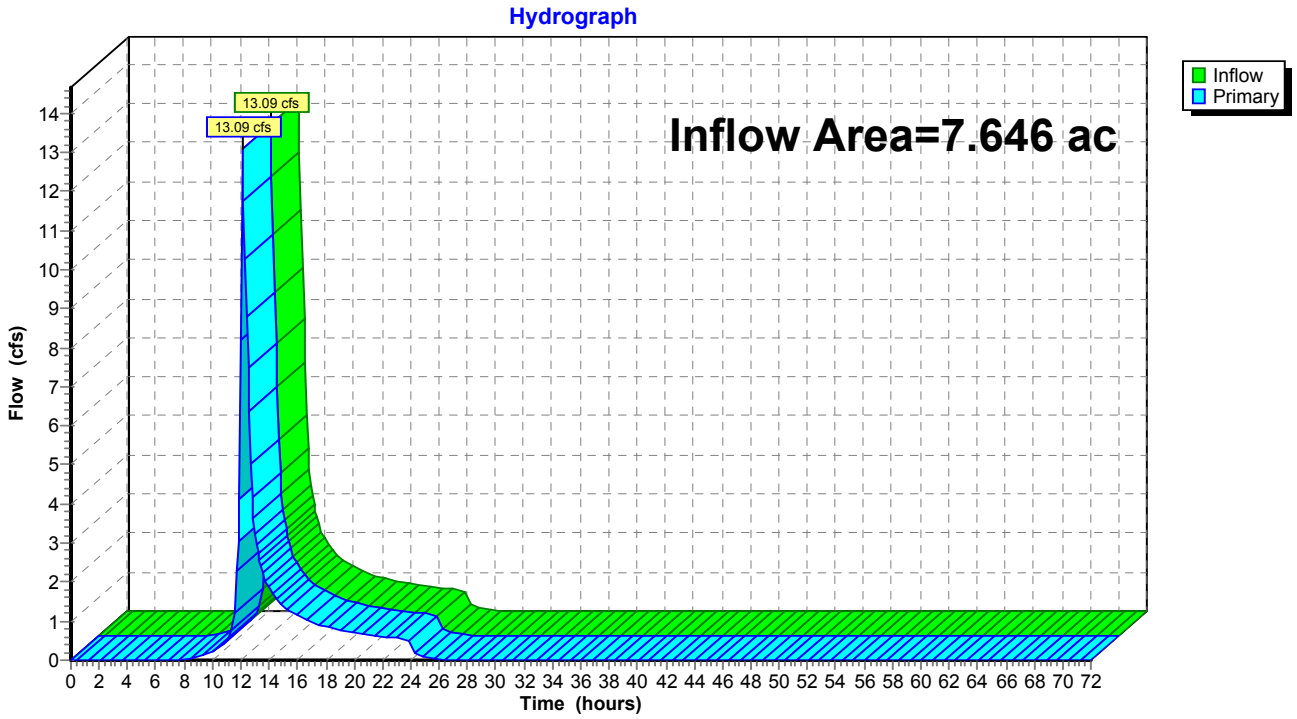
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 2.78" for 50-yr event
Inflow = 13.09 cfs @ 12.13 hrs, Volume= 1.773 af
Primary = 13.09 cfs @ 12.13 hrs, Volume= 1.773 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

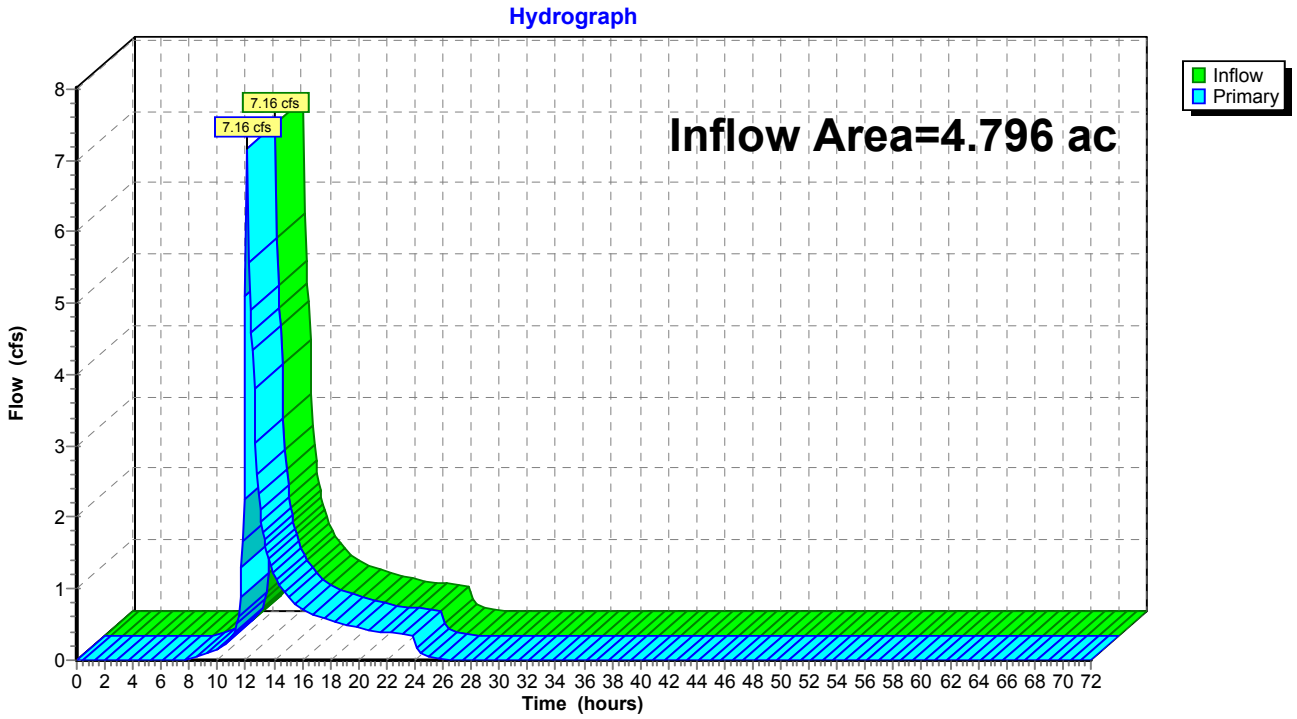


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 2.71" for 50-yr event
Inflow = 7.16 cfs @ 12.11 hrs, Volume= 1.081 af
Primary = 7.16 cfs @ 12.11 hrs, Volume= 1.081 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

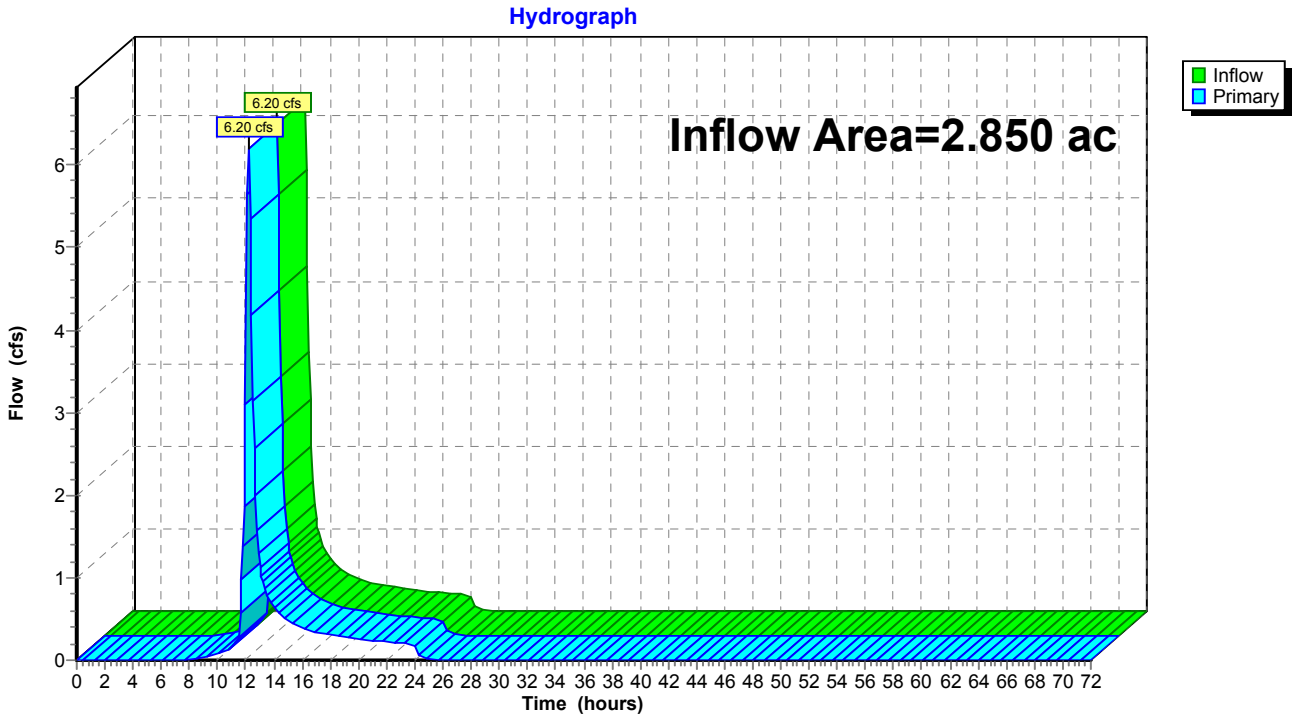


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 2.91" for 50-yr event
Inflow = 6.20 cfs @ 12.19 hrs, Volume= 0.692 af
Primary = 6.20 cfs @ 12.19 hrs, Volume= 0.692 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



Summary for Subcatchment BASIN 1: POST DEVELOPMENT

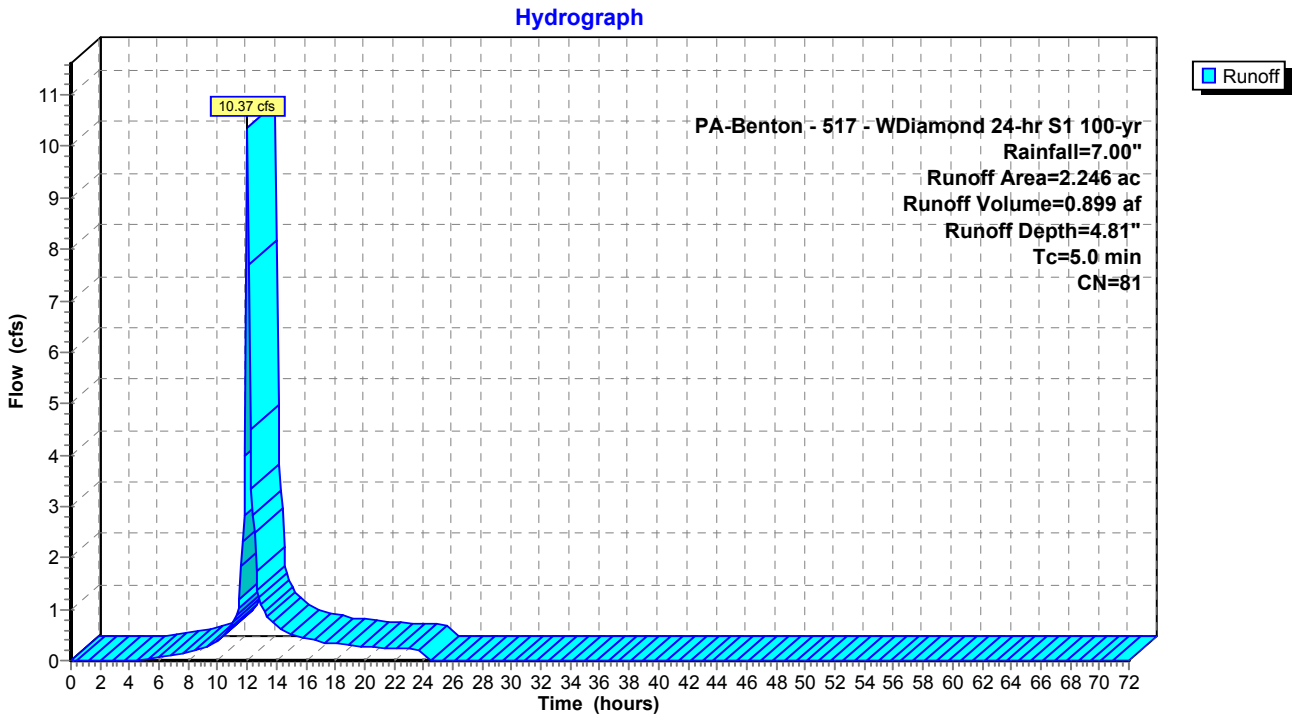
Runoff = 10.37 cfs @ 12.02 hrs, Volume= 0.899 af, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.050	71	Meadow, non-grazed, HSG C
*	1.186	89	Gravel areas, HSG C
*	0.010	98	Impervious areas, HSG C
	2.246	81	Weighted Average
	2.236		99.55% Pervious Area
	0.010		0.45% Impervious Area

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

Subcatchment BASIN 1: POST DEVELOPMENT



Summary for Subcatchment BYPASS A: POST DEVELOPMENT

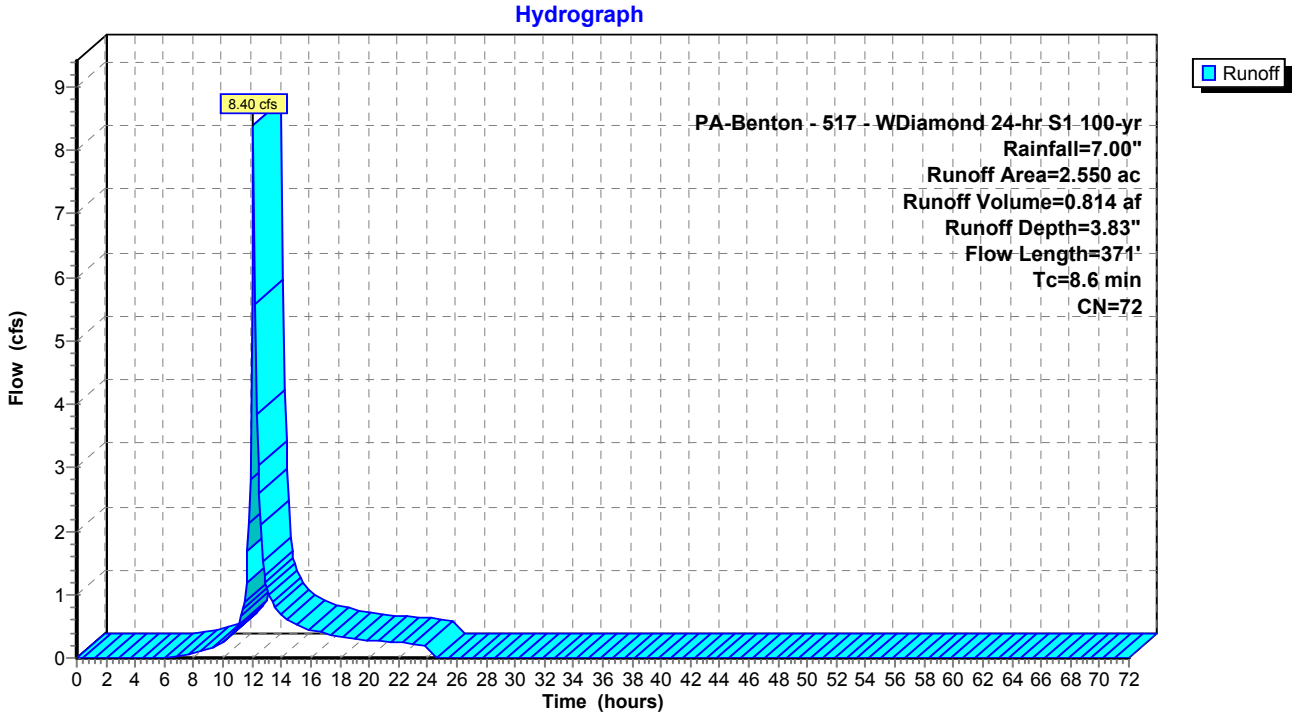
Runoff = 8.40 cfs @ 12.09 hrs, Volume= 0.814 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

	Area (ac)	CN	Description
	0.200	70	Woods, Good, HSG C
	2.235	71	Meadow, non-grazed, HSG C
*	0.115	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	2.550	72	Weighted Average
	2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0600	0.29		**Sheet Flow, SHT** Range n= 0.130 P2= 2.98"
1.1	75	0.0267	1.14		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
1.7	196	0.0714	1.87		**Shallow Concentrated Flow, SCF 2** Short Grass Pasture Kv= 7.0 fps
8.6	371	Total			

Subcatchment BYPASS A: POST DEVELOPMENT



Summary for Subcatchment BYPASS B: POST DEVELOPMENT

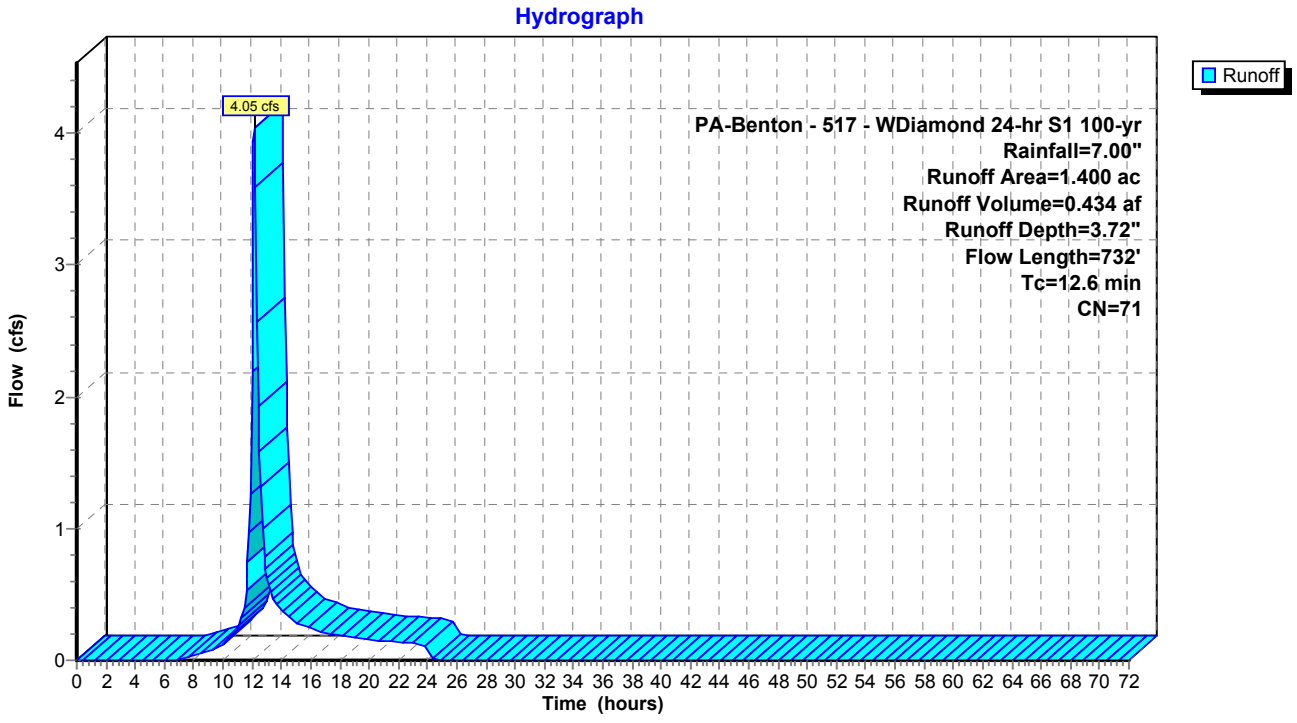
Runoff = 4.05 cfs @ 12.13 hrs, Volume= 0.434 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

	Area (ac)	CN	Description
	0.000	70	Woods, Good, HSG C
	1.384	71	Meadow, non-grazed, HSG C
*	0.016	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.400	71	Weighted Average
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment BYPASS B: POST DEVELOPMENT



Summary for Subcatchment POI B-POST: POST DEVELOPMENT

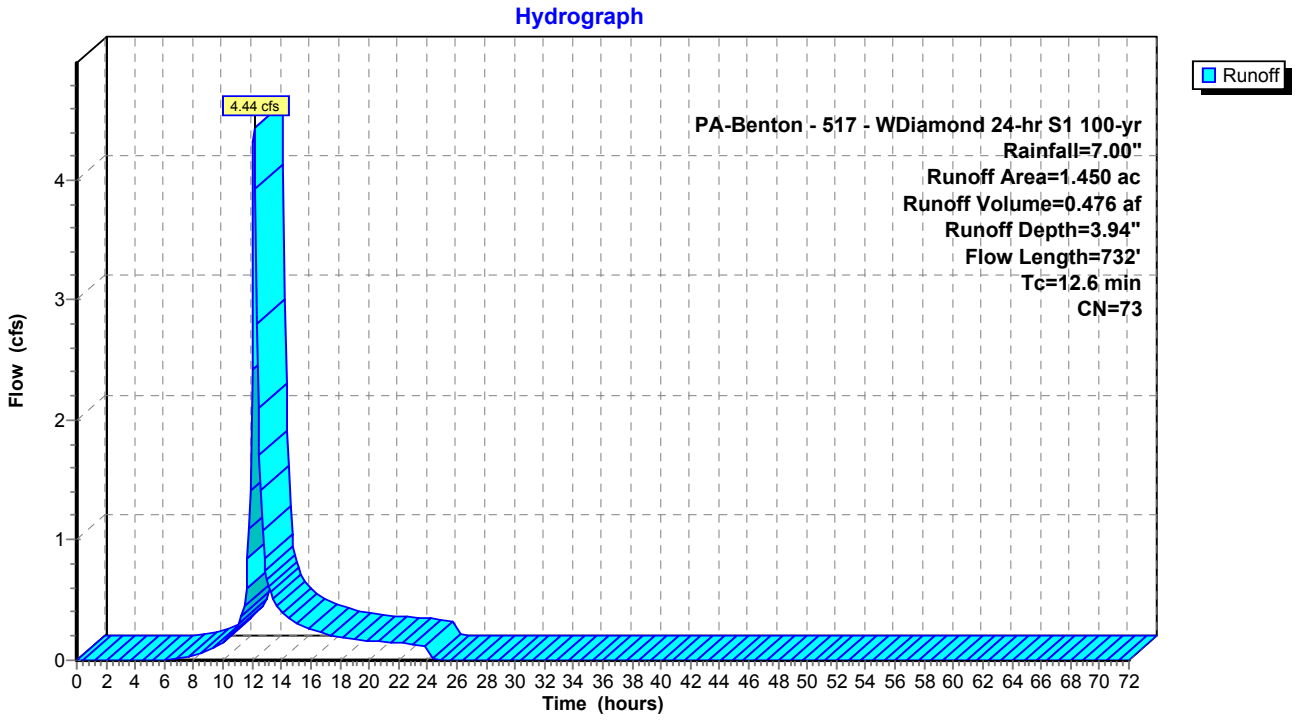
Runoff = 4.44 cfs @ 12.13 hrs, Volume= 0.476 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 100-yr Rainfall=7.00"

	Area (ac)	CN	Description
	0.460	70	Woods, Good, HSG C
	0.780	71	Meadow, non-grazed, HSG C
*	0.210	89	Gravel areas, HSG C
*	0.000	98	Impervious areas, HSG C
	1.450	73	Weighted Average
	1.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0250	0.20		**Sheet Flow, SHT 1** Range n= 0.130 P2= 2.98"
4.3	632	0.1200	2.42		**Shallow Concentrated Flow, SCF 1** Short Grass Pasture Kv= 7.0 fps
12.6	732	Total			

Subcatchment POI B-POST: POST DEVELOPMENT



Summary for Pond SWM 1: BASIN 1

Inflow Area = 2.246 ac, 0.45% Impervious, Inflow Depth = 4.81" for 100-yr event
Inflow = 10.37 cfs @ 12.02 hrs, Volume= 0.899 af
Outflow = 3.69 cfs @ 12.29 hrs, Volume= 0.604 af, Atten= 64%, Lag= 16.1 min
Primary = 3.69 cfs @ 12.29 hrs, Volume= 0.604 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,200.96' @ 12.29 hrs Surf.Area= 18,631 sf Storage= 16,670 cf

Plug-Flow detention time= 240.8 min calculated for 0.604 af (67% of inflow)
Center-of-Mass det. time= 115.8 min (937.9 - 822.0)

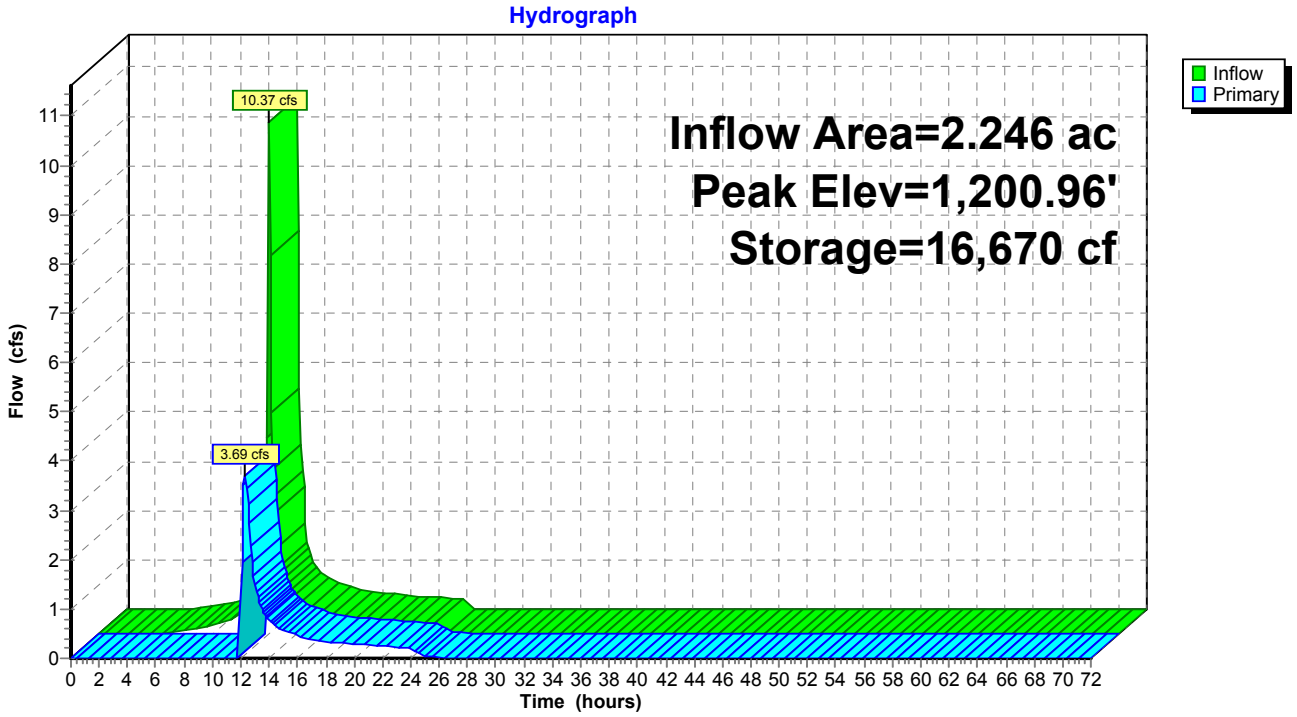
Volume	Invert	Avail.Storage	Storage Description
#1	1,200.00'	37,481 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,200.00	16,221	0	0
1,202.00	21,260	37,481	37,481

Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	**12.0" Round Culvert** L= 29.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,195.00' S= 0.1034 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	1,200.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	1,201.00'	**15.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=3.67 cfs @ 12.29 hrs HW=1,200.96' (Free Discharge)
- **1=Culvert** (Passes 3.67 cfs of 5.93 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 3.67 cfs @ 1.48 fps)
- **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 1: BASIN 1



Stage-Discharge for Pond SWM 1: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,200.00	0.00	1,200.52	0.00	1,201.04	6.34	1,201.56	23.55
1,200.01	0.00	1,200.53	0.00	1,201.05	6.48	1,201.57	24.03
1,200.02	0.00	1,200.54	0.00	1,201.06	6.63	1,201.58	24.51
1,200.03	0.00	1,200.55	0.00	1,201.07	6.80	1,201.59	24.99
1,200.04	0.00	1,200.56	0.00	1,201.08	6.97	1,201.60	25.48
1,200.05	0.00	1,200.57	0.00	1,201.09	7.16	1,201.61	25.95
1,200.06	0.00	1,200.58	0.00	1,201.10	7.35	1,201.62	26.41
1,200.07	0.00	1,200.59	0.00	1,201.11	7.55	1,201.63	26.89
1,200.08	0.00	1,200.60	0.00	1,201.12	7.77	1,201.64	27.36
1,200.09	0.00	1,200.61	0.00	1,201.13	7.99	1,201.65	27.84
1,200.10	0.00	1,200.62	0.00	1,201.14	8.22	1,201.66	28.32
1,200.11	0.00	1,200.63	0.00	1,201.15	8.46	1,201.67	28.80
1,200.12	0.00	1,200.64	0.00	1,201.16	8.70	1,201.68	29.29
1,200.13	0.00	1,200.65	0.00	1,201.17	8.95	1,201.69	29.77
1,200.14	0.00	1,200.66	0.00	1,201.18	9.22	1,201.70	30.26
1,200.15	0.00	1,200.67	0.00	1,201.19	9.48	1,201.71	30.76
1,200.16	0.00	1,200.68	0.00	1,201.20	9.76	1,201.72	31.25
1,200.17	0.00	1,200.69	0.00	1,201.21	10.04	1,201.73	31.75
1,200.18	0.00	1,200.70	0.00	1,201.22	10.33	1,201.74	32.25
1,200.19	0.00	1,200.71	0.00	1,201.23	10.62	1,201.75	32.76
1,200.20	0.00	1,200.72	0.00	1,201.24	10.93	1,201.76	33.26
1,200.21	0.00	1,200.73	0.00	1,201.25	11.24	1,201.77	33.77
1,200.22	0.00	1,200.74	0.00	1,201.26	11.55	1,201.78	34.28
1,200.23	0.00	1,200.75	0.00	1,201.27	11.87	1,201.79	34.80
1,200.24	0.00	1,200.76	0.04	1,201.28	12.20	1,201.80	35.31
1,200.25	0.00	1,200.77	0.11	1,201.29	12.53	1,201.81	35.85
1,200.26	0.00	1,200.78	0.20	1,201.30	12.87	1,201.82	36.40
1,200.27	0.00	1,200.79	0.31	1,201.31	13.22	1,201.83	36.94
1,200.28	0.00	1,200.80	0.44	1,201.32	13.57	1,201.84	37.49
1,200.29	0.00	1,200.81	0.58	1,201.33	13.92	1,201.85	38.04
1,200.30	0.00	1,200.82	0.73	1,201.34	14.29	1,201.86	38.60
1,200.31	0.00	1,200.83	0.89	1,201.35	14.65	1,201.87	39.16
1,200.32	0.00	1,200.84	1.06	1,201.36	15.03	1,201.88	39.72
1,200.33	0.00	1,200.85	1.24	1,201.37	15.41	1,201.89	40.28
1,200.34	0.00	1,200.86	1.43	1,201.38	15.79	1,201.90	40.85
1,200.35	0.00	1,200.87	1.63	1,201.39	16.18	1,201.91	41.42
1,200.36	0.00	1,200.88	1.84	1,201.40	16.57	1,201.92	41.99
1,200.37	0.00	1,200.89	2.06	1,201.41	16.97	1,201.93	42.57
1,200.38	0.00	1,200.90	2.28	1,201.42	17.38	1,201.94	43.14
1,200.39	0.00	1,200.91	2.51	1,201.43	17.79	1,201.95	43.73
1,200.40	0.00	1,200.92	2.75	1,201.44	18.20	1,201.96	44.31
1,200.41	0.00	1,200.93	3.00	1,201.45	18.62	1,201.97	44.90
1,200.42	0.00	1,200.94	3.25	1,201.46	19.04	1,201.98	45.49
1,200.43	0.00	1,200.95	3.51	1,201.47	19.47	1,201.99	46.08
1,200.44	0.00	1,200.96	3.78	1,201.48	19.91	1,202.00	**46.67**
1,200.45	0.00	1,200.97	4.05	1,201.49	20.35		
1,200.46	0.00	1,200.98	4.33	1,201.50	20.79		
1,200.47	0.00	1,200.99	4.61	1,201.51	21.24		
1,200.48	0.00	1,201.00	4.91	1,201.52	21.69		
1,200.49	0.00	1,201.01	5.24	1,201.53	22.15		
1,200.50	0.00	1,201.02	5.62	1,201.54	22.61		
1,200.51	0.00	1,201.03	6.02	1,201.55	23.08		

Summary for Pond SWM 3: SWALE 1

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 3.94" for 100-yr event
Inflow = 4.44 cfs @ 12.13 hrs, Volume= 0.476 af
Outflow = 4.26 cfs @ 12.19 hrs, Volume= 0.452 af, Atten= 4%, Lag= 3.2 min
Primary = 4.26 cfs @ 12.19 hrs, Volume= 0.452 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,133.34' @ 12.19 hrs Surf.Area= 0 sf Storage= 1,694 cf

Plug-Flow detention time= 48.3 min calculated for 0.452 af (95% of inflow)
Center-of-Mass det. time= 20.9 min (875.0 - 854.1)

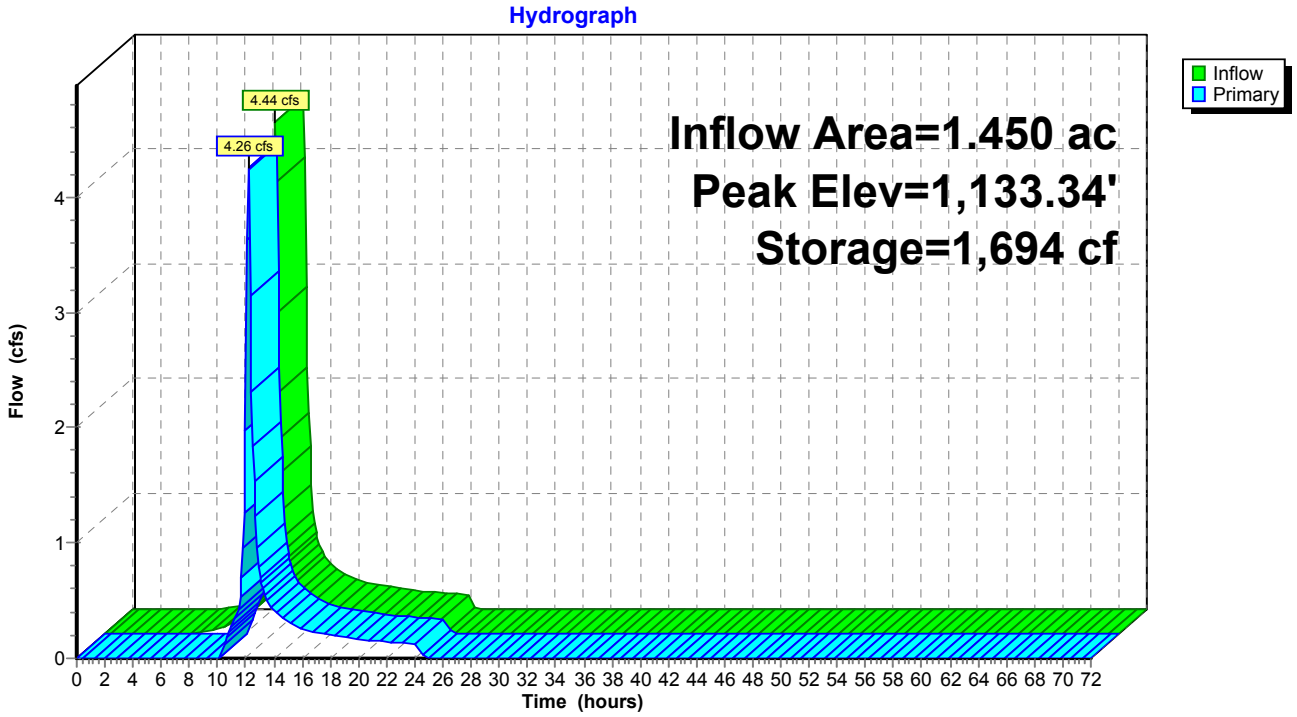
Volume	Invert	Avail.Storage	Storage Description
#1	1,132.00'	3,033 cf	**Custom Stage Data**Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,132.00	0	0
1,133.00	1,011	1,011
1,134.00	2,022	3,033

Device	Routing	Invert	Outlet Devices
#1	Primary	1,133.00'	**8.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=4.15 cfs @ 12.19 hrs HW=1,133.33' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 4.15 cfs @ 1.56 fps)

Pond SWM 3: SWALE 1



Stage-Discharge for Pond SWM 3: SWALE 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,132.00	0.00	1,132.52	0.00	1,133.04	0.17	1,133.56	9.20
1,132.01	0.00	1,132.53	0.00	1,133.05	0.24	1,133.57	9.45
1,132.02	0.00	1,132.54	0.00	1,133.06	0.32	1,133.58	9.71
1,132.03	0.00	1,132.55	0.00	1,133.07	0.40	1,133.59	9.96
1,132.04	0.00	1,132.56	0.00	1,133.08	0.49	1,133.60	10.22
1,132.05	0.00	1,132.57	0.00	1,133.09	0.58	1,133.61	10.50
1,132.06	0.00	1,132.58	0.00	1,133.10	0.68	1,133.62	10.78
1,132.07	0.00	1,132.59	0.00	1,133.11	0.79	1,133.63	11.06
1,132.08	0.00	1,132.60	0.00	1,133.12	0.89	1,133.64	11.35
1,132.09	0.00	1,132.61	0.00	1,133.13	1.01	1,133.65	11.63
1,132.10	0.00	1,132.62	0.00	1,133.14	1.13	1,133.66	11.92
1,132.11	0.00	1,132.63	0.00	1,133.15	1.25	1,133.67	12.22
1,132.12	0.00	1,132.64	0.00	1,133.16	1.38	1,133.68	12.52
1,132.13	0.00	1,132.65	0.00	1,133.17	1.51	1,133.69	12.82
1,132.14	0.00	1,132.66	0.00	1,133.18	1.64	1,133.70	13.12
1,132.15	0.00	1,132.67	0.00	1,133.19	1.78	1,133.71	13.42
1,132.16	0.00	1,132.68	0.00	1,133.20	1.92	1,133.72	13.73
1,132.17	0.00	1,132.69	0.00	1,133.21	2.07	1,133.73	14.05
1,132.18	0.00	1,132.70	0.00	1,133.22	2.22	1,133.74	14.36
1,132.19	0.00	1,132.71	0.00	1,133.23	2.38	1,133.75	14.68
1,132.20	0.00	1,132.72	0.00	1,133.24	2.54	1,133.76	15.00
1,132.21	0.00	1,132.73	0.00	1,133.25	2.70	1,133.77	15.32
1,132.22	0.00	1,132.74	0.00	1,133.26	2.86	1,133.78	15.65
1,132.23	0.00	1,132.75	0.00	1,133.27	3.03	1,133.79	15.98
1,132.24	0.00	1,132.76	0.00	1,133.28	3.20	1,133.80	16.31
1,132.25	0.00	1,132.77	0.00	1,133.29	3.38	1,133.81	16.66
1,132.26	0.00	1,132.78	0.00	1,133.30	3.56	1,133.82	17.01
1,132.27	0.00	1,132.79	0.00	1,133.31	3.74	1,133.83	17.36
1,132.28	0.00	1,132.80	0.00	1,133.32	3.92	1,133.84	17.71
1,132.29	0.00	1,132.81	0.00	1,133.33	4.11	1,133.85	18.07
1,132.30	0.00	1,132.82	0.00	1,133.34	4.30	1,133.86	18.43
1,132.31	0.00	1,132.83	0.00	1,133.35	4.49	1,133.87	18.80
1,132.32	0.00	1,132.84	0.00	1,133.36	4.69	1,133.88	19.17
1,132.33	0.00	1,132.85	0.00	1,133.37	4.89	1,133.89	19.54
1,132.34	0.00	1,132.86	0.00	1,133.38	5.09	1,133.90	19.91
1,132.35	0.00	1,132.87	0.00	1,133.39	5.30	1,133.91	20.29
1,132.36	0.00	1,132.88	0.00	1,133.40	5.50	1,133.92	20.67
1,132.37	0.00	1,132.89	0.00	1,133.41	5.72	1,133.93	21.05
1,132.38	0.00	1,132.90	0.00	1,133.42	5.93	1,133.94	21.44
1,132.39	0.00	1,132.91	0.00	1,133.43	6.15	1,133.95	21.83
1,132.40	0.00	1,132.92	0.00	1,133.44	6.36	1,133.96	22.23
1,132.41	0.00	1,132.93	0.00	1,133.45	6.59	1,133.97	22.63
1,132.42	0.00	1,132.94	0.00	1,133.46	6.81	1,133.98	23.03
1,132.43	0.00	1,132.95	0.00	1,133.47	7.04	1,133.99	23.43
1,132.44	0.00	1,132.96	0.00	1,133.48	7.27	1,134.00	**23.84**
1,132.45	0.00	1,132.97	0.00	1,133.49	7.50		
1,132.46	0.00	1,132.98	0.00	1,133.50	7.74		
1,132.47	0.00	1,132.99	0.00	1,133.51	7.97		
1,132.48	0.00	1,133.00	0.00	1,133.52	8.21		
1,132.49	0.00	1,133.01	0.02	1,133.53	8.46		
1,132.50	0.00	1,133.02	0.06	1,133.54	8.70		
1,132.51	0.00	1,133.03	0.11	1,133.55	8.95		

Summary for Pond SWM 4: Rain Garden 2

Inflow Area = 1.450 ac, 0.00% Impervious, Inflow Depth = 3.74" for 100-yr event
Inflow = 4.26 cfs @ 12.19 hrs, Volume= 0.452 af
Outflow = 3.72 cfs @ 12.26 hrs, Volume= 0.448 af, Atten= 13%, Lag= 4.3 min
Primary = 3.72 cfs @ 12.26 hrs, Volume= 0.448 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
Peak Elev= 1,131.97' @ 12.26 hrs Surf.Area= 782 sf Storage= 1,072 cf

Plug-Flow detention time= 14.8 min calculated for 0.448 af (99% of inflow)
Center-of-Mass det. time= 8.1 min (883.1 - 875.0)

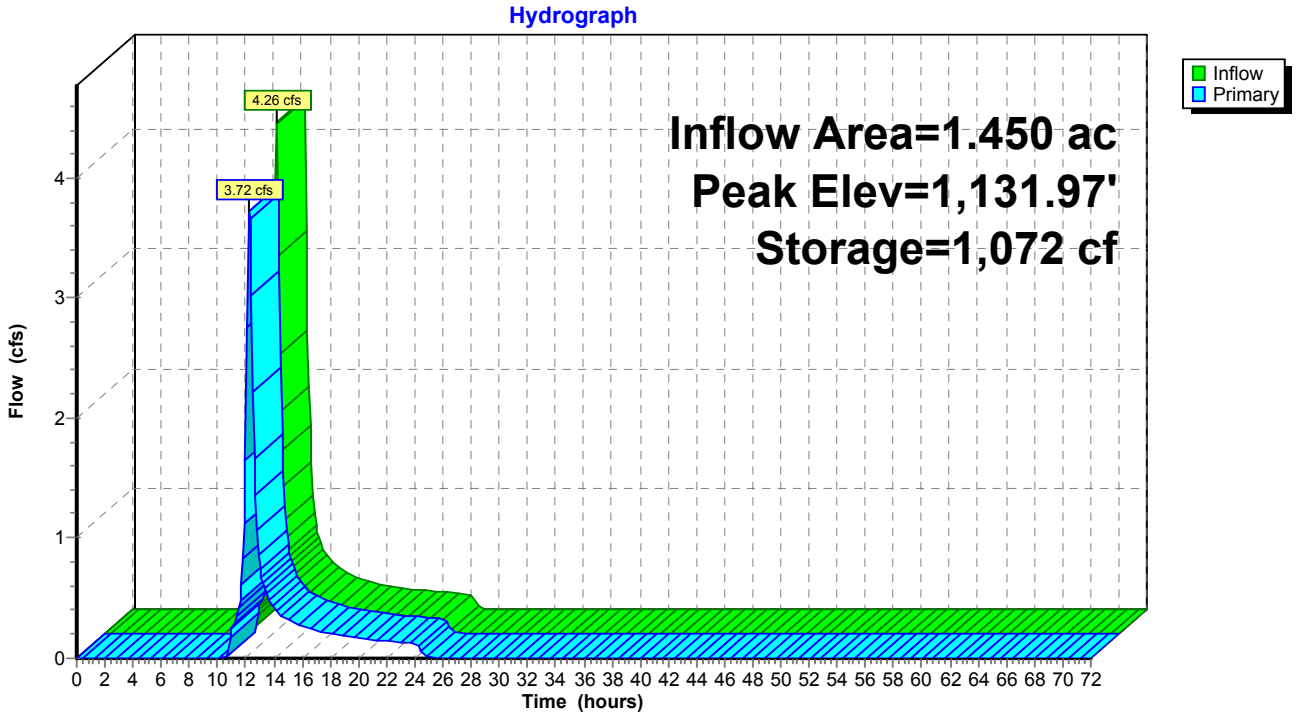
Volume	Invert	Avail.Storage	Storage Description
#1	1,130.00'	3,356 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,130.00	309	0	0
1,132.00	790	1,099	1,099
1,134.00	1,467	2,257	3,356

Device	Routing	Invert	Outlet Devices
#1	Primary	1,130.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,133.50'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.64 cfs @ 12.26 hrs HW=1,131.93' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 3.64 cfs @ 4.63 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SWM 4: Rain Garden 2



Stage-Discharge for Pond SWM 4: Rain Garden 2

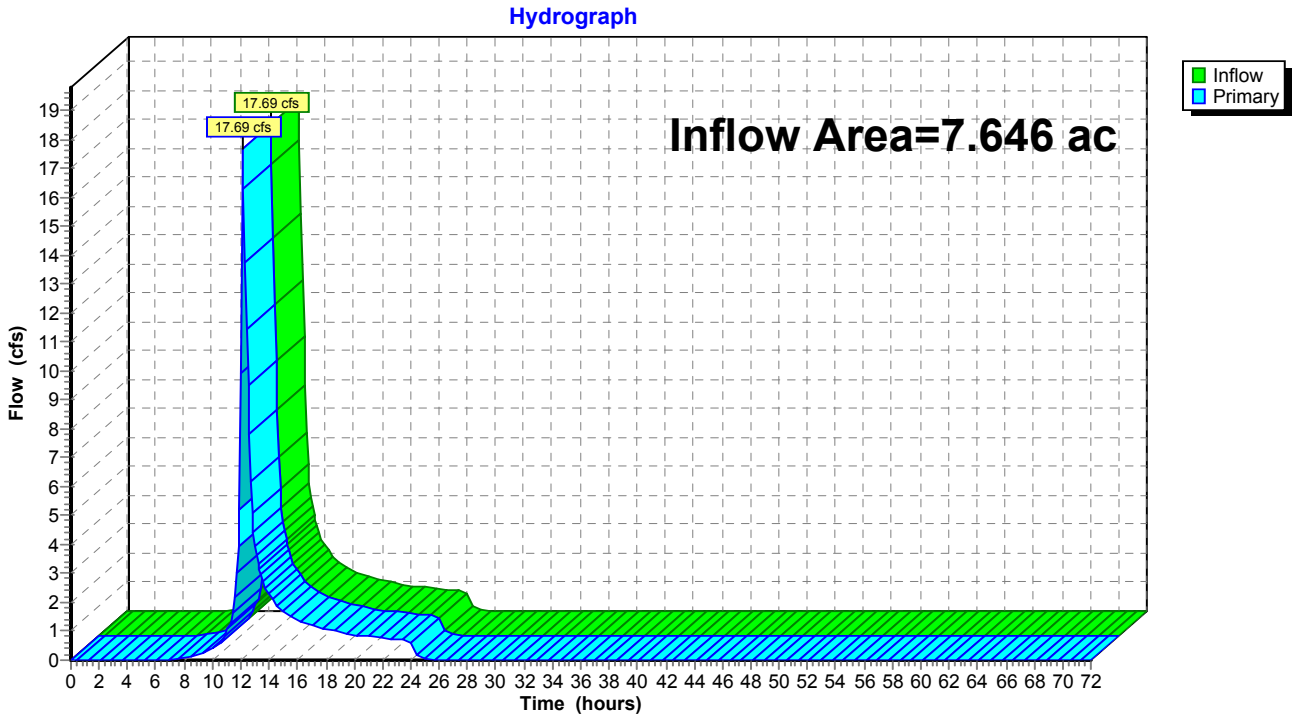
Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
1,130.00	0.00	1,131.04	1.08	1,132.08	3.93	1,133.12	5.51
1,130.02	0.00	1,131.06	1.15	1,132.10	3.97	1,133.14	5.53
1,130.04	0.00	1,131.08	1.22	1,132.12	4.00	1,133.16	5.56
1,130.06	0.00	1,131.10	1.30	1,132.14	4.04	1,133.18	5.58
1,130.08	0.00	1,131.12	1.37	1,132.16	4.07	1,133.20	5.61
1,130.10	0.00	1,131.14	1.45	1,132.18	4.11	1,133.22	5.63
1,130.12	0.00	1,131.16	1.52	1,132.20	4.14	1,133.24	5.66
1,130.14	0.00	1,131.18	1.60	1,132.22	4.18	1,133.26	5.69
1,130.16	0.00	1,131.20	1.67	1,132.24	4.21	1,133.28	5.71
1,130.18	0.00	1,131.22	1.75	1,132.26	4.24	1,133.30	5.74
1,130.20	0.00	1,131.24	1.83	1,132.28	4.28	1,133.32	5.76
1,130.22	0.00	1,131.26	1.90	1,132.30	4.31	1,133.34	5.78
1,130.24	0.00	1,131.28	1.98	1,132.32	4.34	1,133.36	5.81
1,130.26	0.00	1,131.30	2.05	1,132.34	4.38	1,133.38	5.83
1,130.28	0.00	1,131.32	2.13	1,132.36	4.41	1,133.40	5.86
1,130.30	0.00	1,131.34	2.20	1,132.38	4.44	1,133.42	5.88
1,130.32	0.00	1,131.36	2.27	1,132.40	4.47	1,133.44	5.91
1,130.34	0.00	1,131.38	2.34	1,132.42	4.51	1,133.46	5.93
1,130.36	0.00	1,131.40	2.40	1,132.44	4.54	1,133.48	5.96
1,130.38	0.00	1,131.42	2.47	1,132.46	4.57	1,133.50	5.98
1,130.40	0.00	1,131.44	2.53	1,132.48	4.60	1,133.52	6.06
1,130.42	0.00	1,131.46	2.58	1,132.50	4.63	1,133.54	6.18
1,130.44	0.00	1,131.48	2.63	1,132.52	4.66	1,133.56	6.33
1,130.46	0.00	1,131.50	2.67	1,132.54	4.69	1,133.58	6.50
1,130.48	0.00	1,131.52	2.73	1,132.56	4.72	1,133.60	6.69
1,130.50	0.00	1,131.54	2.78	1,132.58	4.75	1,133.62	6.90
1,130.52	0.00	1,131.56	2.83	1,132.60	4.78	1,133.64	7.13
1,130.54	0.01	1,131.58	2.88	1,132.62	4.81	1,133.66	7.37
1,130.56	0.02	1,131.60	2.93	1,132.64	4.84	1,133.68	7.62
1,130.58	0.03	1,131.62	2.98	1,132.66	4.87	1,133.70	7.89
1,130.60	0.04	1,131.64	3.03	1,132.68	4.90	1,133.72	8.18
1,130.62	0.06	1,131.66	3.07	1,132.70	4.93	1,133.74	8.49
1,130.64	0.09	1,131.68	3.12	1,132.72	4.96	1,133.76	8.82
1,130.66	0.11	1,131.70	3.16	1,132.74	4.99	1,133.78	9.15
1,130.68	0.14	1,131.72	3.21	1,132.76	5.02	1,133.80	9.51
1,130.70	0.17	1,131.74	3.25	1,132.78	5.05	1,133.82	9.88
1,130.72	0.20	1,131.76	3.30	1,132.80	5.07	1,133.84	10.26
1,130.74	0.24	1,131.78	3.34	1,132.82	5.10	1,133.86	10.66
1,130.76	0.28	1,131.80	3.38	1,132.84	5.13	1,133.88	11.07
1,130.78	0.32	1,131.82	3.42	1,132.86	5.16	1,133.90	11.50
1,130.80	0.37	1,131.84	3.47	1,132.88	5.19	1,133.92	11.95
1,130.82	0.42	1,131.86	3.51	1,132.90	5.21	1,133.94	12.41
1,130.84	0.47	1,131.88	3.55	1,132.92	5.24	1,133.96	12.90
1,130.86	0.52	1,131.90	3.59	1,132.94	5.27	1,133.98	13.39
1,130.88	0.57	1,131.92	3.63	1,132.96	5.29	1,134.00	**13.90**
1,130.90	0.63	1,131.94	3.67	1,132.98	5.32		
1,130.92	0.69	1,131.96	3.71	1,133.00	5.35		
1,130.94	0.75	1,131.98	3.74	1,133.02	5.37		
1,130.96	0.81	1,132.00	3.78	1,133.04	5.40		
1,130.98	0.88	1,132.02	3.82	1,133.06	5.43		
1,131.00	0.95	1,132.04	3.86	1,133.08	5.45		
1,131.02	1.01	1,132.06	3.89	1,133.10	5.48		

Summary for Link POI 1 POST: POI 1 - POST

Inflow Area = 7.646 ac, 0.13% Impervious, Inflow Depth = 3.61" for 100-yr event
Inflow = 17.69 cfs @ 12.14 hrs, Volume= 2.300 af
Primary = 17.69 cfs @ 12.14 hrs, Volume= 2.300 af, Atten= 0%, Lag= 0.0 min

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

Link POI 1 POST: POI 1 - POST

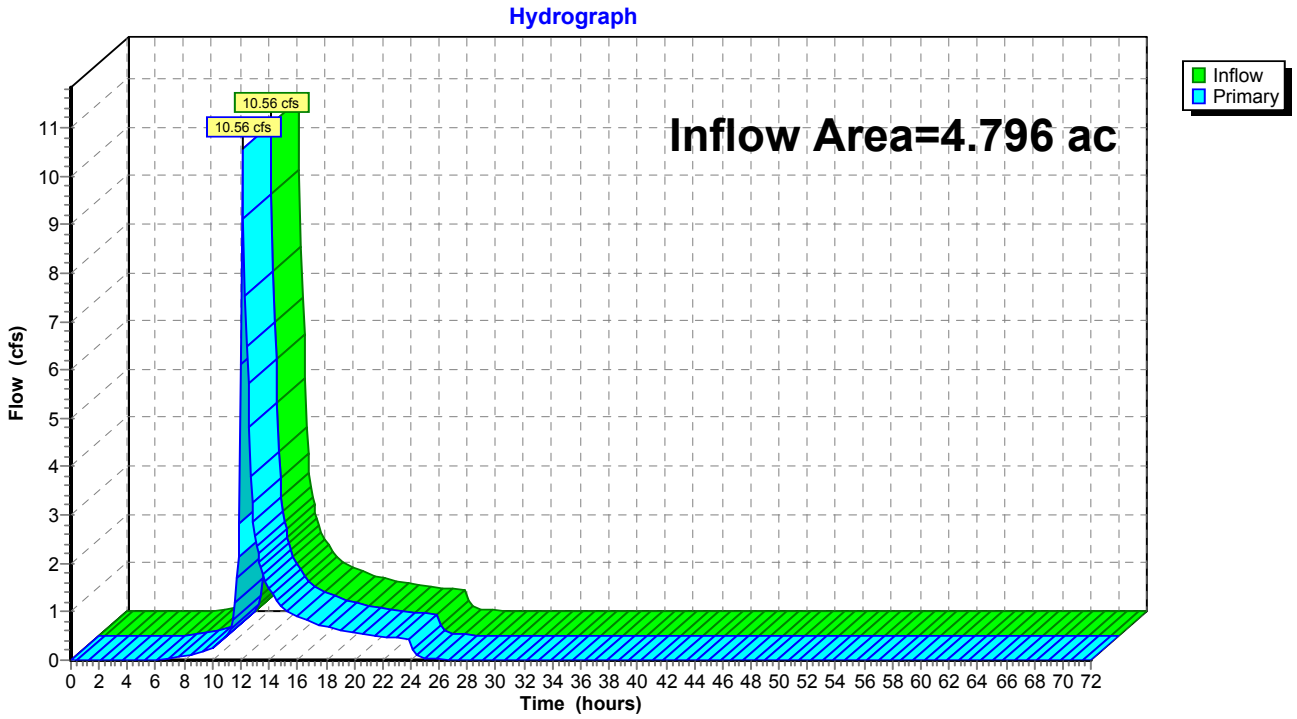


Summary for Link POI A POST: POI A - POST

Inflow Area = 4.796 ac, 0.21% Impervious, Inflow Depth = 3.55" for 100-yr event
Inflow = 10.56 cfs @ 12.13 hrs, Volume= 1.417 af
Primary = 10.56 cfs @ 12.13 hrs, Volume= 1.417 af, Atten= 0%, Lag= 0.0 min

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

Link POI A POST: POI A - POST

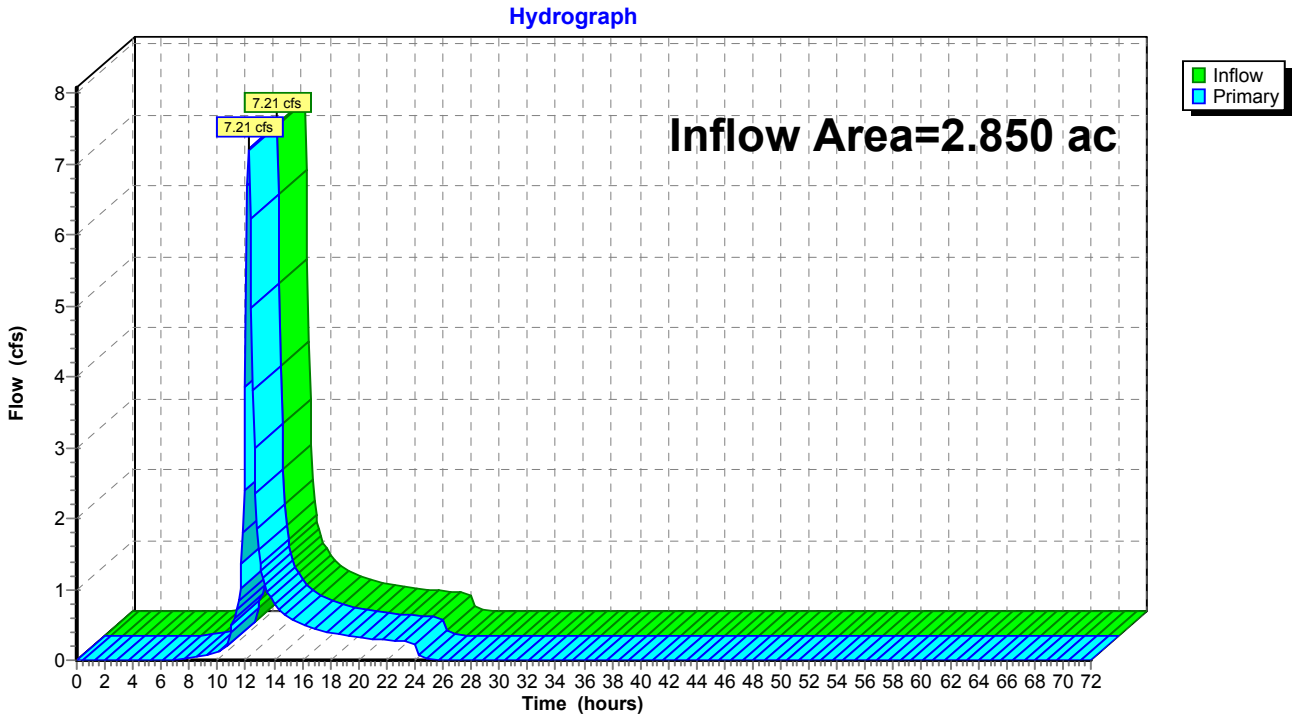


Summary for Link POI B POST: POI B - POST

Inflow Area = 2.850 ac, 0.00% Impervious, Inflow Depth = 3.72" for 100-yr event
Inflow = 7.21 cfs @ 12.18 hrs, Volume= 0.882 af
Primary = 7.21 cfs @ 12.18 hrs, Volume= 0.882 af, Atten= 0%, Lag= 0.0 min

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

Link POI B POST: POI B - POST



A.3 Conveyance Calculations

E&S WORKSHEET # 11

Channel Design Data

PROJECT NAME: ATLANTIC SUNRISE PROJECT - WEST DIAMOND REGULATOR STATION

LOCATION: JACKSON/SUGARLOAF TOWNSHIPS, COLUMBIA COUNTY, PENNSYLVANIA

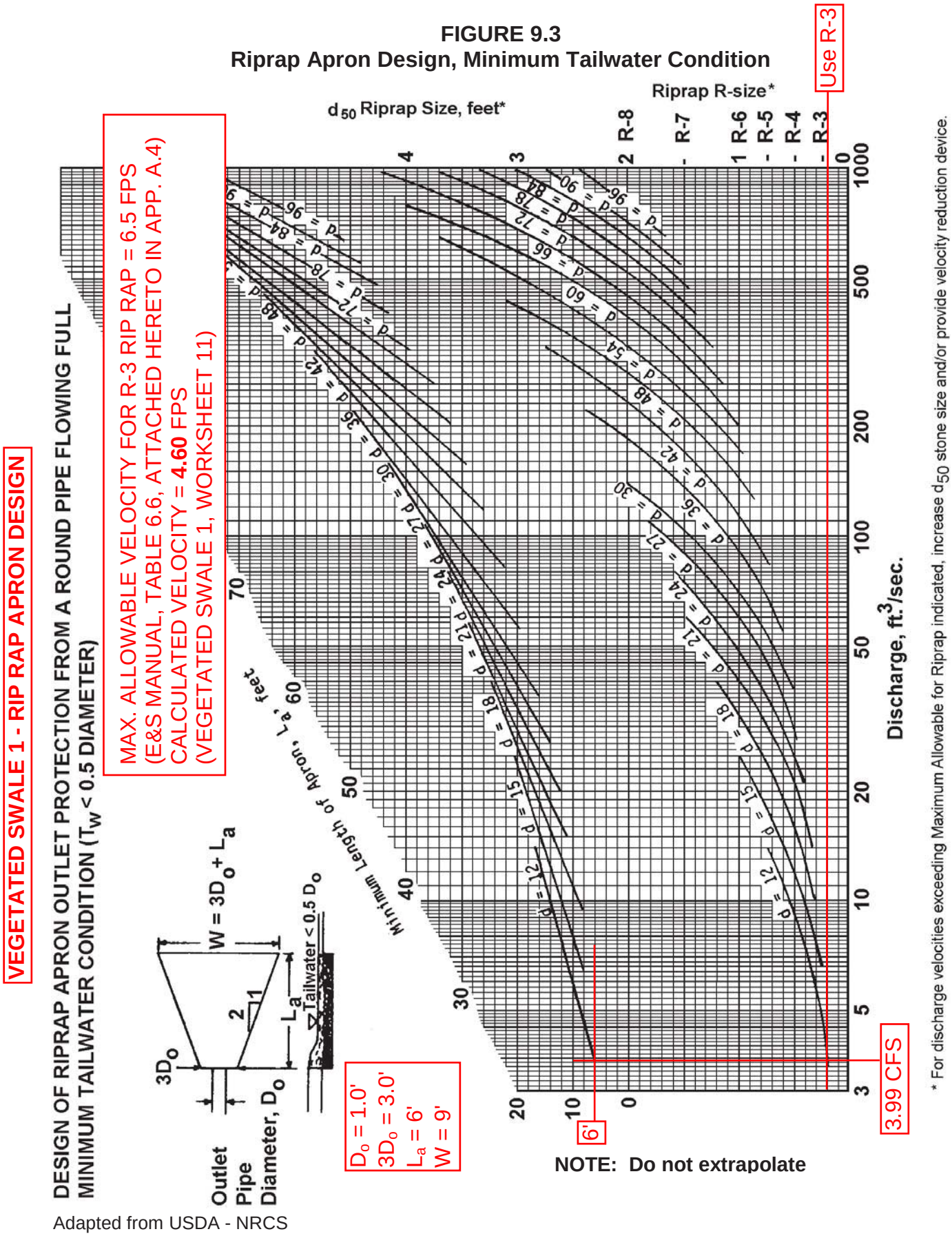
PREPARED BY: CDG DATE: 04/26/2017

CHECKED BY: AJB DATE: 04/27/2017

CHANNEL OR CHANNEL SECTION		VEGETATED SWALE 1 LINING	VEGETATED SWALE 1 GRASS		
TEMPORARY OR PERMANENT?	(T OR P)	P	P		
DESIGN STORM	(2, 5, OR 10 YR)	10	10		
ACRES	(AC)	1.45	1.45		
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	2.75	2.75		
Qr (REQUIRED CAPACITY)	(CFS)	3.99	3.99		
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	2.10	2.09		
PROTECTIVE LINING[2]		SC250	GRASS/ SC250		
n (MANNING'S COEFFICIENT)[2]		0.040	0.115		
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	4.60	2.20		
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	3.00	10.00		
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	2.25	3.99		
CHANNEL BOTTOM WIDTH	(FT)	2	2		
CHANNEL SIDE SLOPES	(H:V)	3	3		
D (TOTAL DEPTH)	(FT)	2.0	2.0		
CHANNEL TOP WIDTH @ D	(FT)	14	14		
d (CALCULATED FLOW DEPTH)	(FT)	0.18	0.32		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.08	3.92		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	11.11	6.25		
d50 STONE SIZE	(IN)	N/A	N/A		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.46	0.95		
R (HYDRAULIC RADIUS)		0.15	0.24		
S (BED SLOPE)[3]	(FT/FT)	0.2	0.2		
Sc (CRITICAL SLOPE)	(FT/FT)	0.045	0.320		
.7Sc	(FT/FT)	0.032	0.224		
1.3Sc	(FT/FT)	0.059	0.416		
STABLE FLOW?	(Y/N)	Y	Y		
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.06	0.1		
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.5		
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.5		
DESIGN METHOD FOR PROTECTIVE LINING [5] 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.

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 10 2017

Culvert 1

Invert Elev Dn (ft)	=	1130.00
Pipe Length (ft)	=	50.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	1130.50
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

Top Elevation (ft)	=	1134.00
Top Width (ft)	=	2.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.90
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1.90
Qpipe (cfs)	=	1.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.84
Veloc Up (ft/s)	=	3.97
HGL Dn (ft)	=	1130.79
HGL Up (ft)	=	1131.09
Hw Elev (ft)	=	1131.35
Hw/D (ft)	=	0.85
Flow Regime	=	Inlet Control

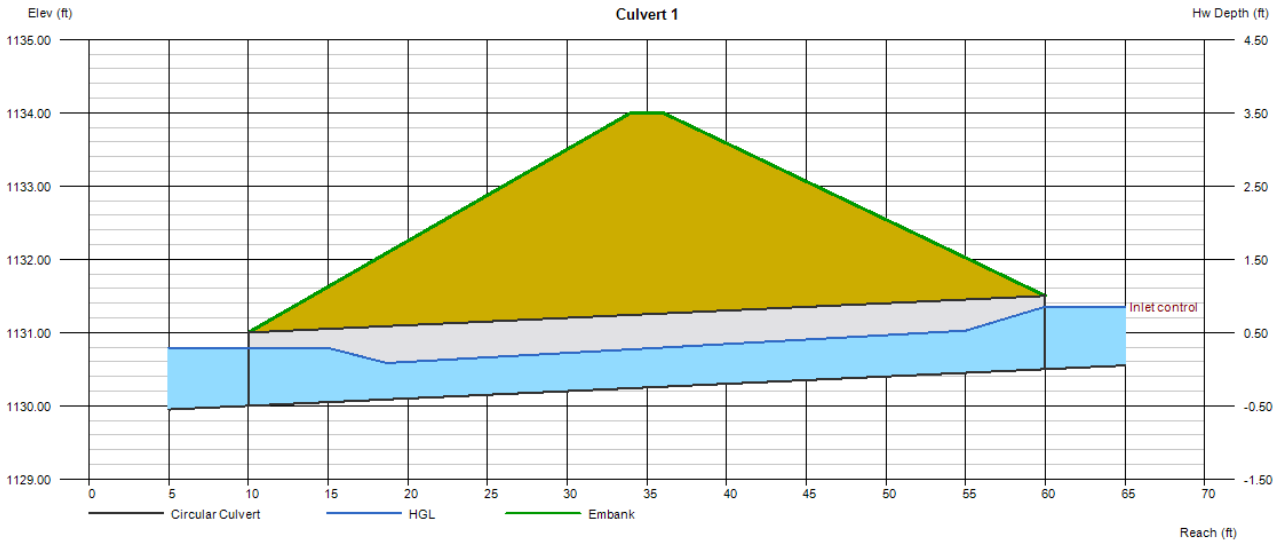
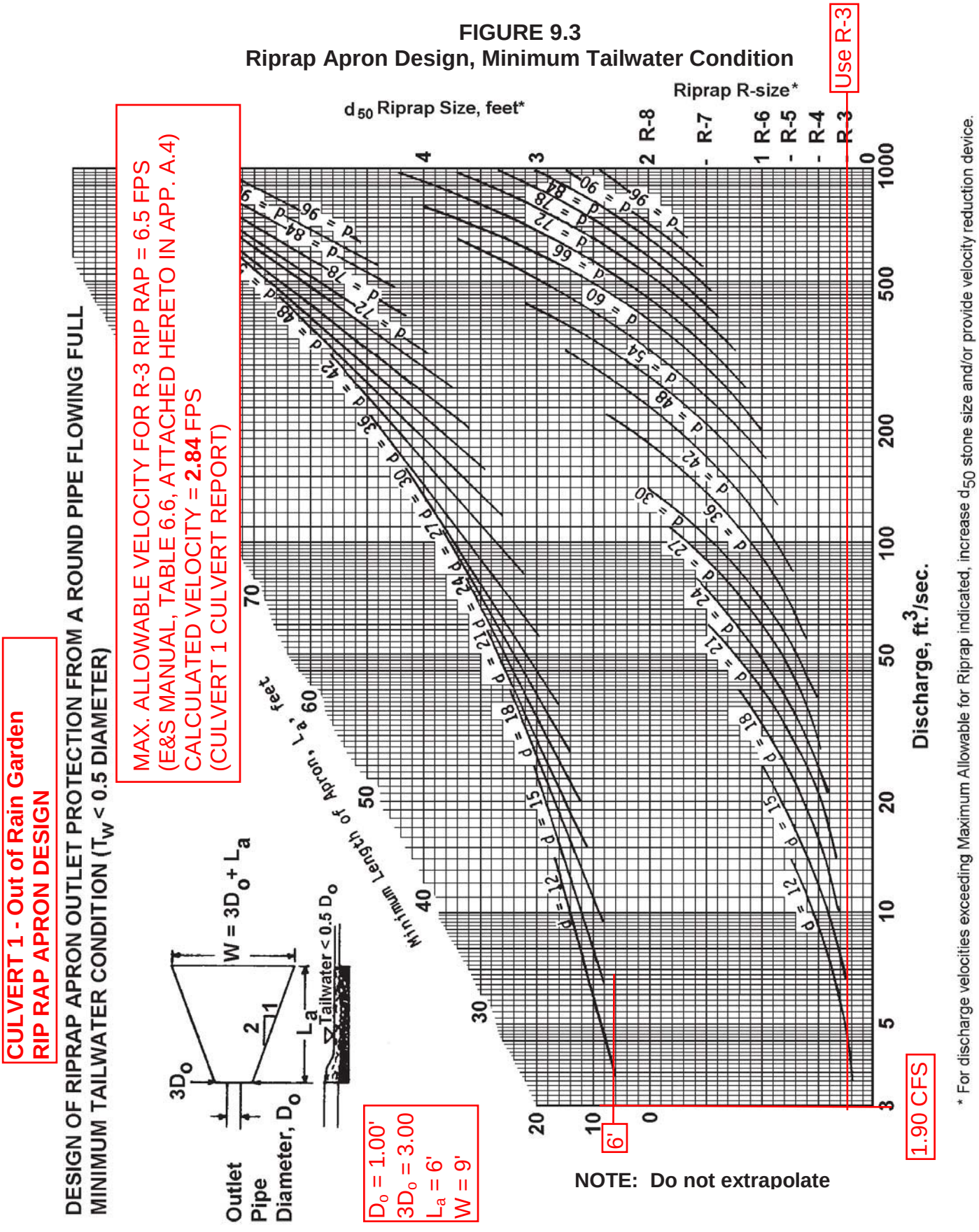


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 10 2017

Culvert 3

Invert Elev Dn (ft)	=	1129.80
Pipe Length (ft)	=	40.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	1130.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

Top Elevation (ft)	=	1132.50
Top Width (ft)	=	30.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	7.76
Qmax (cfs)	=	7.76
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	7.76
Qpipe (cfs)	=	7.76
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.80
Veloc Up (ft/s)	=	5.71
HGL Dn (ft)	=	1131.09
HGL Up (ft)	=	1131.08
Hw Elev (ft)	=	1131.67
Hw/D (ft)	=	1.11
Flow Regime	=	Inlet Control

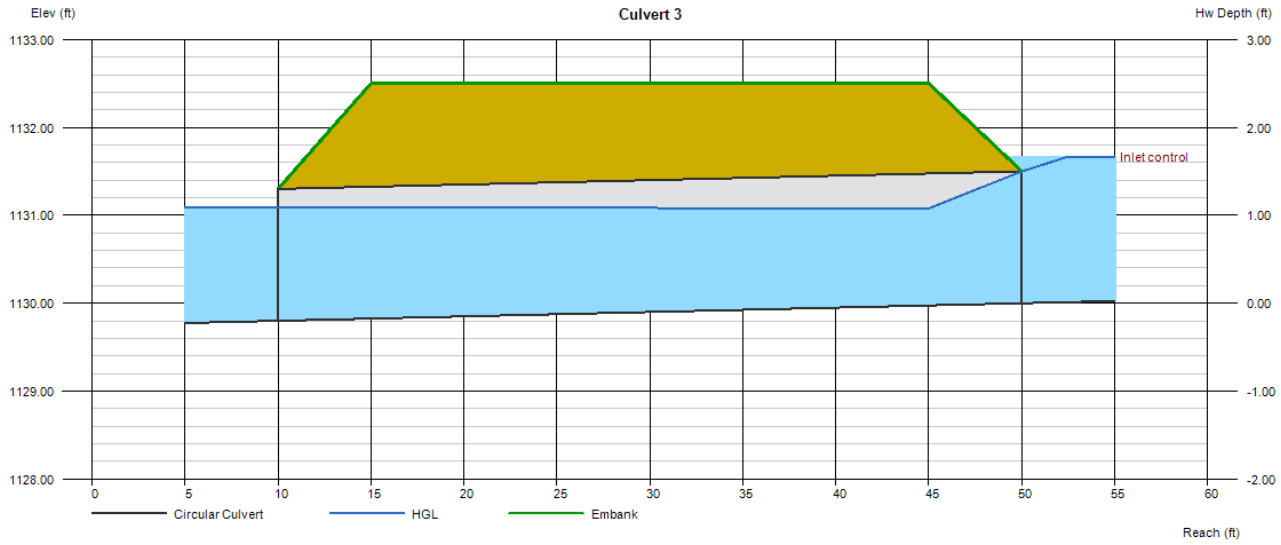
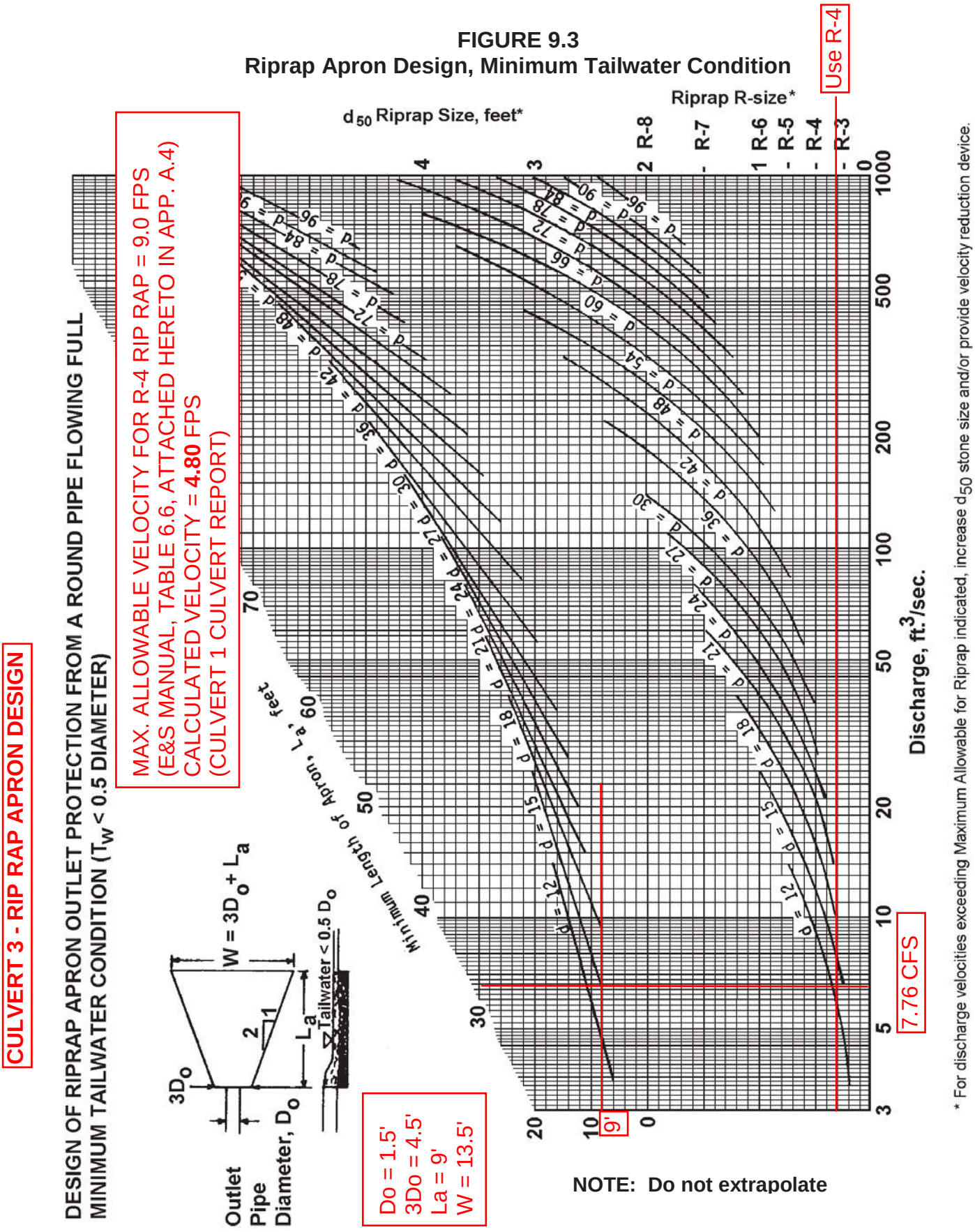


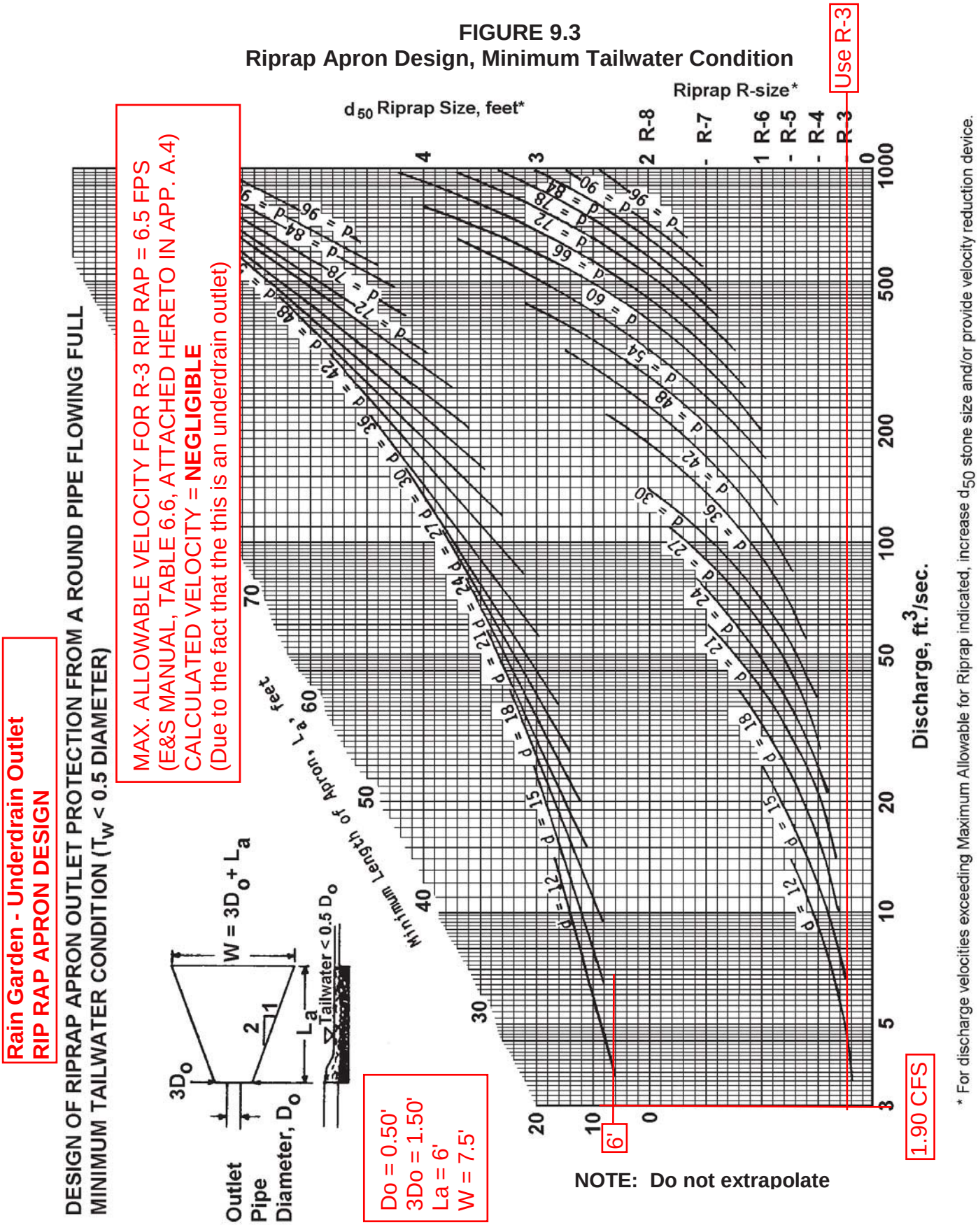
FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

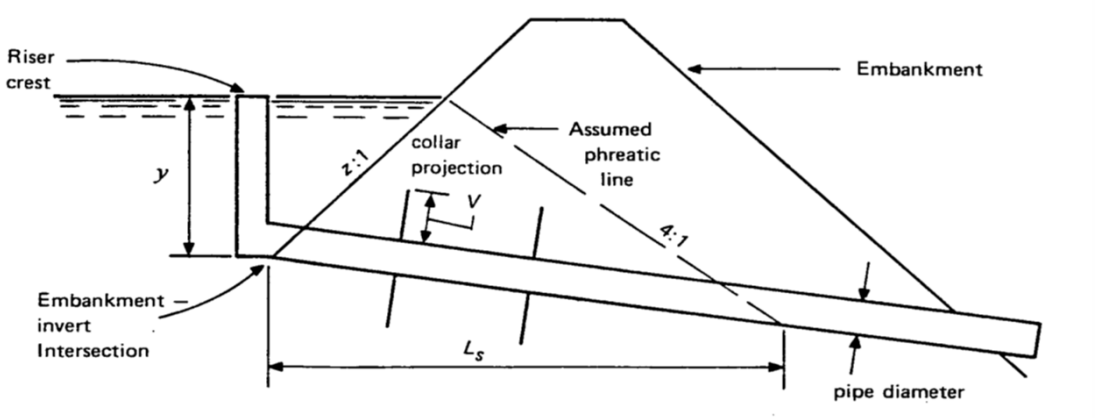


Adapted from USDA - NRCS

Not to be used for Box Culverts

A.4 PCSM BMP Calculations

STANDARD WORKSHEET #18
Anti-seep Collar Design



BASIN NO.	TEMP. OR PERM.	Y (FT)	Z	Ls (FT)	Lf (FT)	V (IN)	BARRELL DIA. (IN)	COLLAR SIZE (IN)	NO. COLLARS	COLLAR SPACING (FT)	DISTANCE TO 1ST COLLAR (FT)
1	P	2.25	3	27	31.0	24	16	60	1	NA	11

Source: 363-2134-008 / March 31, 2012 / Page 389

Architecture
Engineering
Environmental
Land Surveying
Companies

An Employee-Owned Company

WEST DIAMOND REGULATOR STATION
INFILTRATION BASIN 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

West Diamond RS outlet structure height = 2.75 ft

Weight of outlet structure = 2.75 X 525 + 750 = 2,194 lb

Buoyant force = 312 + 624 X 2.75 = 2**,028 lb**

Weight of outlet structure with 6 inches of concrete below invert:

2,194 + 10 X 150 = 3**,694 lb OK**

ATLANTIC SUNRISE PROJECT
WEST DIAMOND REGULATOR STATION LEVEL SPREADER DESIGN

9/19/2016

LEVEL SPREADER DESIGN CALCULATIONS

Required Perforated Pipe Length

Q=C*A*(2*G*H)^0.5 (Weir Equation)

where: Q = 100 year year storm, cfs
C = weir coefficient (0.60)
A = cross sectional area of orifice in sf
G = acceleration of gravity, 32.2
H = head from 100 year pond elevation to top of perforated pipe

Pipe perforation information taken from ADS Technical Note TN 1.02 for Single wall HDPE perforated patterns for 12" pipe with type C perforated pattern

100 year Q:	3.69	cfs	
Head:	4.96	ft	
Perforation Dia.:	0.313	in. per each hole	
Perforation Area:	0.0005	sq. ft	
Flow per Perforation:	0.005727	cfs	
Holes required:	644.3		
Length of pipe:	33.03	lf	(TN 1.02 lists a minimum inlet area of 1.5 sq. in./ft.)

Summary:
To pass the 100 year storm through the level spreader, 33 lf. 12" perforated HDPE pipe is needed.

ATLANTIC SUNRISE PROJECT
W. DIAMOND REGULATOR STATION VEGETATED SWALE STORAGE VOLUME

4/14/2017

TOTAL REACH VOLUME = 1011 CF Width (W_B): 2 FT. Depth (H): 1 FT.

VEGETATED SWALE 1

Input data

S =	0.110	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

L =	9	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	23	cf

No. of ***check dams*** = 6
Subreach Volume = 136 CF

Input data

S =	0.180	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

L =	6	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	14	cf

No. of ***check dams*** = 23
Subreach Volume = 319 CF

Input data

S =	0.140	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

L =	7	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	18	cf

No. of ***check dams*** = 11
Subreach Volume = 196 CF

Input data

S =	0.110	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

L =	9	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	23	cf

No. of ***check dams*** = 7
Subreach Volume = 159 CF

Input data

S =	0.050	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

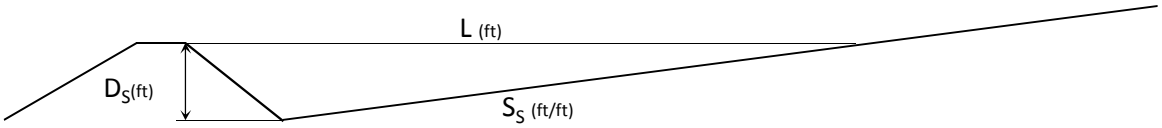
Output data

L =	20	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	50	cf

No. of ***check dams*** = 4
Subreach Volume = 200 CF

ATLANTIC SUNRISE PIPELINE PROJECT
W. DIAMOND REGULATOR STATION VEGETATED SWALE INFILTRATION VOLUME ROCK FILTER VOLUME AND SPACING

Per the Pennsylvania Stormwater BMP Manual (pg 94), the minimum spacing of check dam is determined by the length of the storage volume (L). The length of the storage volume is calculated by dividing the height of the check dam (D_S) by the slope of the channel (S_S):



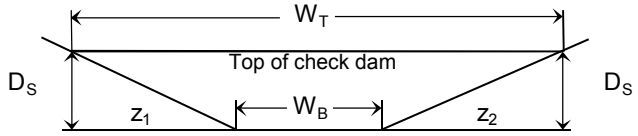
$L = D_S/S_S$

Where: L = Storage Length

S_S = Channel slope

D_S = Height of the check dam

The volume of runoff that will be stored upstream of a check dam is dependent on the height of the check dam, the slope of the upstream channel and the dimensions of the upstream channel. The storage volume (V_S) can be calculated with:



$V_S = 0.25 \times L \times D_S \times (W_T + W_B)$

Where:

L = Storage Length

D_S = Height of check dam

W_T = check dam top width

W_B = check dam bottom width

The check dam top width (W_T) is given by:

$W_T = W_B + z_1 + z_2$

Where: W_B = check dam bottom width

z_1 = side slope

z_2 = side slope

ATLANTIC SUNRISE PROJECT
WEST DIAMOND REGULATOR STATION RAIN GARDEN 1 VOLUME

9/17/2016

BASIN 1

Elevation	Surface Area (S.F.)	Inc. Storage (C.F.)	Cumulative Storage (C.F.)
1200	16221	0	0
1202	21260	37481	37481

Criteria and Credits for BMP 5.6.1 Minimize Total Disturbed Area - Grading

To receive credit, areas of Minimized Disturbance/Grading must meet the following criteria:

- ☒ Area shall not be subject to grading or movement of existing soils.
- ☒ Existing native vegetation in a healthy condition may not be removed.
- ☐ Invasive non-native vegetation may be removed. N/A
- ☐ Pruning or other required maintenance of vegetation is permitted. Additional planting is permitted. N/A
- ☒ Area shall be protected by having the limits of disturbance clearly shown on all construction drawings and delineated in the field.
- ☒ The area not subject to grading shall be clearly delineated on the Stormwater Management Plan. If future grading or disturbance of this area occurs, subsequent stormwater management must be provided to address disturbance.
- ☒ Shall be located on the development project.

CREDITS

Volume and Quality

Protected Area is not to be included in Runoff Volume calculation or Water Quality volume

Mitigation Area = (Total Area – Protected Area)

Peak Rate and Channel Protection

Runoff from the Protected Area (area not subject to grading) may be excluded from Peak Rate calculations and Channel Protection calculations for rate control, provided that the runoff from the protected area is not conveyed to and/or through stormwater management control structures. If necessary, runoff from Protected Areas should be directed around BMPs and stormwater pipes and inlets by means of vegetated swales or low berms that direct flow to natural drainage ways.

Criteria and Credits for BMP 5.8.2 Disconnection from Storm Sewers

To receive credit, the following must be met:

- ☒ Runoff from the non-rooftop impervious cover shall be directed to pervious areas where it is infiltrated into the soil.
- ☒ May include Vegetated Swales as outlined in BMP 6.8.
- ☒ May include check dams, low berms, native vegetation, and limited grading to improve natural drainage features.
- ☒ Shall be designed such that flows after development are non-erosive.
- ☒ Shall be protected from compaction or unintended disturbance during construction by having the limits of disturbance clearly shown on all construction drawings and delineated in the field.
- ☒ Shall be noted on stormwater management plans as part of stormwater management system and included in any municipal easement requirements for stormwater systems.
- ☒ Shall be located on the development project.
- ☒ Runoff cannot originate from a designated hotspot.
- ☒ The maximum contributing impervious flow path length shall be 75 feet.
- ☒ The disconnection shall drain continuously through a vegetated swale or filter strip, or planted area to the property line or BMP.
- ☒ The length of the disconnection area must be at the least the length of the contributing area.
- ☒ The entire vegetated “disconnection” area shall have a maximum slope of 5%.
- ☒ The contributing impervious area to any one discharge point shall not exceed 1000 ft^2.
- ☐ Disconnections are encouraged on relatively well-draining soils (HSG A & B). N/A
- ☒ If the site cannot meet the required disconnect length, a level-spreading device, recharge garden, infiltration trench, or other storage device may be needed for compensation.

CREDITS
Volume and Quality

Volume Reduction (ft^3) = Contributing Impervious Area (ft^2) x 1/4” / 12

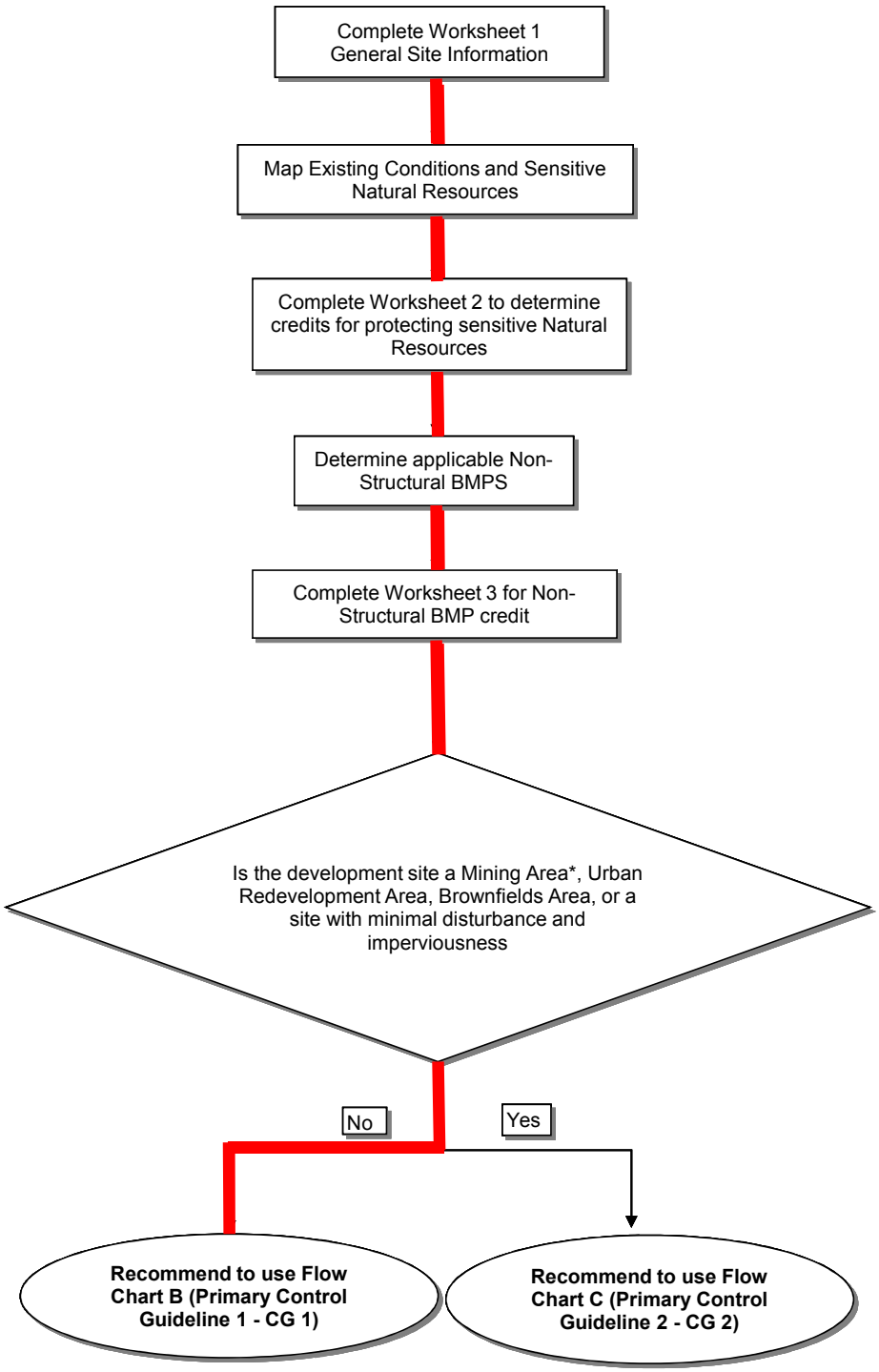
Note: A greater volume credit may be requested by the applicant if calculations support a greater numerical value to Minimizing Soil Compaction.

Peak Rate and Channel Protection

The Peak Rate for flood protection and channel protection will be reduced by the reduction in runoff volume provided above.

A.5 Water Quality Worksheets

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 13-Aug-15

Project Name: Atlantic Sunrise Project - West Diamond Regulator Station

Municipality: Jackson/Sugarloaf Township

County: Columbia County

Total Area (acres): ***7.65 (POI A = 4.80; POI B = 2.85)***

Major River Basin: Susquehanna River

http://www.dep.state.pa.us/dep/depupdate/watermgt/wc/default.htm#newtopics

Watershed: West Creek

Sub-Basin: UNT to West Creek; UNT to West Creek

Nearest Surface Water(s) to Receive Runoff: UNT; UNT

Chapter 93 - Designated Water Use: CWF; 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	X

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/StormwaterManagement/GeneralPermits/default.htm	No	X
Existing or planned drinking water supply?	Yes	
	No	X

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan?	Yes	X
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html	No	
Existing River Conservation Plan?	Yes	
http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/	No	X

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	N/A	0.00	0.00
Floodplains	N/A	0.00	0.00
Riparian Areas	N/A	0.00	0.00
Wetlands	N/A	0.00	0.00
Woodlands	N/A	3.35	0.00
Natural Drainage Ways	N/A	0.00	0.00
Steep Slopes, 15% - 25%	N/A	0.00	0.00
Steep Slopes, over 25%	N/A	0.00	0.00
Other:			
Other:			
TOTAL EXISTING:		3.35	0.00

Worksheet 3. Nonstructural BMP Credits

POI A

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) - **Ac.**

1.2 Area of Riparian Forest Buffer Protection - **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading - **Ac.**

TOTAL - **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
4.80	-	-	=	***4.80***

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn ____ ft^2 x 1/4" x 1/12 = - **ft^3**

Meadow ____ ft^2 x 1/3" x 1/12 = - **ft^3**

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area: DISCONECTED NON-ROOF

Tree Canopy ____ ft^2 x 1/2" x 1/12 = - **ft^3**

For Trees within 20 feet of impervious area:

Tree Canopy ____ x 1/12 = - **ft^3**

5.1 Disconnect Roof Leaders to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area ____ ft^2 x 1/12 = - **ft^3**

For all other disconnected roof areas

Roof Area ____ ft^2 x 1/4" x 1/12 = - **ft^3**

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 ____ ft^2 x 1/3" x 1/12 = - **ft^3**

For all other disconnected roof areas

Impervious Area ____ ft^2 x 1/4" x 1/12 = - **ft^3**

TOTAL NON-STRUCTURAL VOLUME CREDIT* - **ft^3**

** For use on Worksheet 5*

Worksheet 3. Nonstructural BMP Credits

POI B

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) - **Ac.**

1.2 Area of Riparian Forest Buffer Protection - **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading - **Ac.**

TOTAL - **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
2.84	-	-	=	***2.84***

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn ____ ft^2 x 1/4" x 1/12 = - ft^3

Meadow ____ ft^2 x 1/3" x 1/12 = - ft^3

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy ____ ft^2 x 1/2" x 1/12 = - ft^3

For Trees within 20 feet of impervious area:

Tree Canopy ____ x 1/12 = - ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area ____ ft^2 x 1/12 = - ft^3

For all other disconnected roof areas

Roof Area ____ ft^2 x 1/4" x 1/12 = - ft^3

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 ***9,183*** ft^2 x 1/3" x 1/12 = ***255*** ft^3

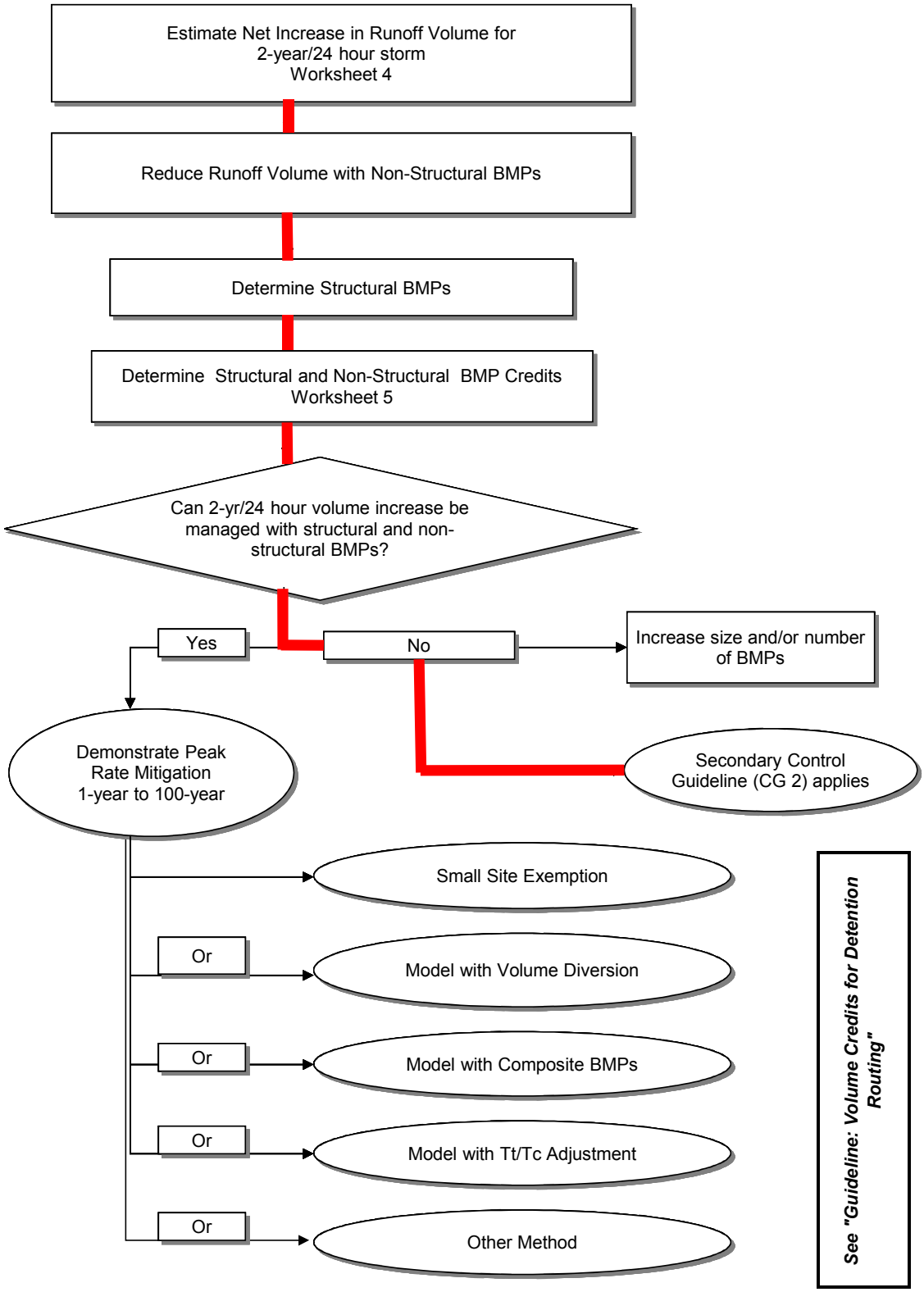
For all other disconnected roof areas

Impervious Area ____ ft^2 x 1/4" x 1/12 = - ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* ***255*** ft^3

** For use on Worksheet 5*

FLOW CHART B
Control Guideline 1 Process



WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Atlantic Sunrise Project - West Diamond Regulator Station
DA: POI A
2-Year Rainfall: 2.98 in

Total Site Area: *4.80* acres
Protected Site Area: acres
Managed Area *4.80* acres

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow	C	73,943.00	1.70	71	4.08	0.82	0.75	4,615
Woods	C	123,275.00	2.83	70	4.29	0.86	0.70	7,224
Dirt Road	C	-	0.00	87	1.49	0.30	1.72	-
TOTAL:		***197,218.00***	***4.53***					***11,839***

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow	C	143,312.00	3.29	71	4.08	0.82	0.75	8,944
Woods	C	8,712.00	0.20	70	4.29	0.86	0.70	510.52
Gravel Road	C	56,554.00	1.30	89	1.24	0.25	1.88	8,868
Impervious	C	561.00	0.01	98	0.20	0.04	2.75	128
TOTAL:		***209,139.00***	***4.80***					***18,452***

2-Year Volume Increase (ft^3)	***6,613***

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 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Atlantic Sunrise Project - West Diamond Regulator Station
DA: POI B
2-Year Rainfall: 2.98 in

Total Site Area: *2.85* acres
Protected Site Area: acres
Managed Area *2.85* acres

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow	C	46,174.00	1.06	71	4.08	0.82	0.75	2,882
Woods	C	89,873.00	2.06	70	4.29	0.86	0.70	5,267
Dirt Road	C	-	0.00	87	1.49	0.30	1.72	-
TOTAL:		***136,047.00***	***3.12***					***8,148***

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow	C	***94,090.00***	***2.16***	71	4.08	0.82	0.75	5,872
Woods	C	19,969.00	0.46	70	4.29	0.86	0.70	1,170
Gravel Road	C	9,887.00	0.23	89	1.24	0.25	1.88	1,550
TOTAL:		***123,946.00***	***2.85***					***8,593***

2-Year Volume Increase (ft^3)	***444***

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

POI A

PROJECT: Atlantic Sunrise Project - West Diamond Regulator Station

SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4*:		***6,613***
Non-structural Volume Credit (ft^3) - *from Worksheet 3*:	**-**	***0***
Structural Volume Reqmt (ft^3)		***6,613***
(Required Control Volume minus Non-structural Credit)		

	Proposed BMP	Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
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/Bioretention	16,221	-
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		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	63,162	2,632
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		

Total Structural Volume (ft^3):	***2,632***
Structural Volume Requirement (ft^3):	***6,613***
DIFFERENCE	***-3,981***

WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

POI B

PROJECT: Atlantic Sunrise Project - West Diamond Regulator Station

SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4*:		***444***
Non-structural Volume Credit (ft^3) - *from Worksheet 3*:	**-**	***111***
Structural Volume Reqmt (ft^3)		***333***

(Required Control Volume minus Non-structural Credit)

	Proposed BMP	Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
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/Bioretention		
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		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment	10,454	436
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		

Total Structural Volume (ft^3):	***436***
Structural Volume Requirement (ft^3):	***333***
DIFFERENCE	***102***

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

POI A

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area	X	
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.9.1 - Street Sweeping / Vacuuming		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention	X	
Structural BMP 6.4.8 - Vegetated Swale		
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration	X	

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

POI B

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.9.1 - Street Sweeping / Vacuuming		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention	X	
Structural BMP 6.4.8 - Vegetated Swale	X	
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration	X	

WORKSHEET 11. BMPS FOR POLLUTION PREVENTION

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 BMPs are provided across the site. "Provided across the site" is taken to mean that the specifications for that BMP set forward in Chapters 5 and 6 are satisfied.

BMPs FOR POLLUTANT PREVENTION: ***POI A***

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.4.3 - Protect / Utilize Natural Flow Pathways in Overall		
NS BMP 5.5.1 - Cluster Uses at Each Site; Build on the Smallest Area		
NS BMP 5.6.1 - Minimize Total Disturbed Area - Grading		
NS BMP 5.6.2 - Minimize Soil Compaction in Disturbed Areas		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.7.1 - Reduce Street Imperviousness	X	
NS BMP 5.7.2 - Reduce Parking Imperviousness	X	
NS BMP 5.8.1 - Rooftop Disconnection	X	
NS BMP 5.8.2 - Disconnection from Storm Sewers	X	
NS BMP 5.9.1 - Street Sweeping		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment and Restoration	X	

WORKSHEET 11. BMPS FOR POLLUTION PREVENTION

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 BMPs are provided across the site. "Provided across the site" is taken to mean that the specifications for that BMP set forward in Chapters 5 and 6 are satisfied.

BMPs FOR POLLUTANT PREVENTION: ***POI B***

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.4.3 - Protect / Utilize Natural Flow Pathways in Overall		
NS BMP 5.5.1 - Cluster Uses at Each Site; Build on the Smallest Area		
NS BMP 5.6.1 - Minimize Total Disturbed Area - Grading		
NS BMP 5.6.2 - Minimize Soil Compaction in Disturbed Areas		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		
NS BMP 5.7.1 - Reduce Street Imperviousness	X	
NS BMP 5.7.2 - Reduce Parking Imperviousness		
NS BMP 5.8.1 - Rooftop Disconnection		
NS BMP 5.8.2 - Disconnection from Storm Sewers	X	
NS BMP 5.9.1 - Street Sweeping		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment and Restoration	X	

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 12. WATER QUALITY ANALYSIS OF POLLUTANT LOADING FROM ALL DISTURBED AREAS

Total Site Area (AC)	4.8
Total Disturbed Area (AC)	4.60
Distrubed Area controlled by BMP's (AC)	3.96

Total Disturbed Areas:

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	3.29	0.79	0.22	27.41	0.11	0.17
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.01	2.27	0.00	0.11	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	1.30	1.45	0.16	24.68	0.06	0.17
							TOTAL LOAD (PROPOSED)	52.20	0.18	0.34
							REQUIRED REDUCTION	85%	85%	50%
							REQUIRED REDUCTION (LBS)	44.37	0.15	0.17

*Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
**TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI A - WQ Train No. 1: Soil Amendments to Landscape restoration to Rain Garden

DISTURBED AREA CONTROLLED BY BMP	0.18 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.18	0.79	0.01	1.50	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	1.50	0.01	0.01
							REMOVAL EFFICIENCIES	99.66%	99.66%	82.50%
							POLLUTANT REDUCTION (LBS)	1.49	0.01	0.01

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.7.2	85%	85%	50%
3	6.4.5	85%	85%	30%
Equivalent Series Efficiency		99.66%	99.66%	82.50%

Removal Efficiency TSS = 1- (1-.85) * (1-.85) *(1-.85)= 99.66%
Removal Efficiency TP = 1- (1-.85) * (1-.85)*(1-.85)= 99.66%
Removal Efficiency NO3 = 1- (1-.50) * (1-.50)*(1-.30)= 82.50%

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI A - WQ Train No. 2 To Landscape restoation then Rain Garden

DISTURBED AREA CONTROLLED BY BMP	1.64 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.43	0.79	0.03	3.58	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.01	2.27	0.00	0.11	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	1.20	1.45	0.15	22.78	0.06	0.15
							TOTAL LOAD	26.47	0.07	0.18
							REMOVAL EFFICIENCIES	97.75%	97.75%	65.00%
							POLLUTANT REDUCTION (LBS)	25.88	0.07	0.12

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.2	85%	85%	50%
2	6.4.5	85%	85%	30%
Equivalent Series Efficiency		97.75%	97.75%	65.00%

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI A - WQ Train No.3 Amended Soils

DISTURBED AREA CONTROLLED BY BMP	1.27 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	1.27	0.79	0.08	10.58	0.04	0.07
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	10.58	0.04	0.07
							REMOVAL EFFICIENCIES	85.00%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	8.99	0.04	0.03

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI A - WQ Train No. 4 Rain Garden

DISTURBED AREA CONTROLLED BY BMP	0.37 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.37	0.79	0.02	3.08	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	3.08	0.01	0.02
							REMOVAL EFFICIENCIES	85.00%	85.00%	30.00%
							POLLUTANT REDUCTION (LBS)	2.62	0.01	0.01

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.4.5	85%	85%	30%
Equivalent Series Efficiency		85.00%	85.00%	30.00%

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI A - WQ Train No. 5 Landscape Restoration

DISTURBED AREA CONTROLLED BY BMP	0.50 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE	COVER (AC.)	Runoff (in)	RUNOFF VOLUME	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.39	0.79	0.03	3.25	0.01	0.02
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.11	2.27	0.02	3.26	0.01	0.02
							TOTAL LOAD	6.51	0.02	0.04
							REMOVAL EFFICIENCIES	85.00%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	5.53	0.02	0.02

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.2	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: West Diamond RS POI - A
BL Project No.: 14C4909
Date: 4/26/2017

	TSS (LBS)	TP (LBS)	NO3 (LBS)
TOTAL POLLUTANT REDUCTION PROVIDED (LBS)	44.52	0.15	0.18
TOTAL POLLUTANT REDUCTION REQUIRED (LBS)	44.37	0.15	0.17
Δ	0.15	0.0	0.01

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 12. WATER QUALITY ANALYSIS OF POLLUTANT LOADING FROM ALL DISTURBED AREAS

Total Site Area (AC)	2.85
Total Disturbed Area (AC)	2.39
Distrubed Area controlled by BMP's (AC)	2.33

Total Disturbed Areas:

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	2.16	0.79	0.14	18.03	0.07	0.12
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.23	1.45	0.03	4.37	0.01	0.03
							TOTAL LOAD (PROPOSED)	22.40	0.08	0.14
							REQUIRED REDUCTION	85%	85%	50%
							REQUIRED REDUCTION (LBS)	19.04	0.07	0.07

*Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
**TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI B - WQ Train No. 1 Soil Amendments To Vegetated Swale to Rain Garden

DISTURBED AREA CONTROLLED BY BMP	0.41 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.20	0.79	0.01	1.67	0.01	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.21	1.45	0.03	3.99	0.01	0.03
							TOTAL LOAD	5.65	0.02	0.04
							REMOVAL EFFICIENCIES	98.31%	98.31%	68.50%
							POLLUTANT REDUCTION (LBS)	5.56	0.02	0.03

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2*	6.4.8	25%	25%	10%
3	6.4.5	85%	85%	30%
Equivalent Series Efficiency		98.31%	98.31%	68.50%

NOTE: * Half credit taken for vegetated swale due to slope of swale. Check dams are provided to extend interaction time between runoff and vegetation and to provide uptake by vegetation in channel.

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI B - WQ Train No. 2 vegetated swale to rain garden

DISTURBED AREA CONTROLLED BY BMP	1.01 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.46	0.74	0.03	2.99	0.01	0.01
	MEADOW	47	0.19	0.30	0.55	0.79	0.04	4.58	0.02	0.03
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	7.57	0.03	0.04
							REMOVAL EFFICIENCIES	88.75%	88.75%	37.00%
							POLLUTANT REDUCTION (LBS)	6.72	0.03	0.02

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.4.8	25%	25%	10%
2	6.4.5	85%	85%	30%
Equivalent Series Efficiency		88.75%	88.75%	37.00%

NOTE: * Half credit taken for vegetated swale due to slope of swale. Check dams are provided to extend interaction time between runoff and vegetation and to provide uptake by vegetation in channel.

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI B - WQ Train No. 3 soil amendment to landscape restoration

DISTURBED AREA CONTROLLED BY BMP	0.10 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.10	0.79	0.01	0.83	0.00	0.01
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	0.83	0.00	0.01
							REMOVAL EFFICIENCIES	97.75%	97.75%	75.00%
							POLLUTANT REDUCTION (LBS)	0.81	0.00	0.00

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.7.2	85%	85%	50%
Equivalent Series Efficiency		97.75%	97.75%	75.00%

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI B - WQ Train No. 4 soil Amendment to Rain Garden

DISTURBED AREA CONTROLLED BY BMP	0.08 AC.

		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE EMC	COVER (AC.)	Runoff (in)	RUNOFF VOLUME (AF)	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.06	0.79	0.00	0.50	0.00	0.00
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.02	1.45	0.00	0.38	0.00	0.00
							TOTAL LOAD	0.88	0.00	0.01
							REMOVAL EFFICIENCIES	97.75%	97.75%	65.00%
							POLLUTANT REDUCTION (LBS)	0.86	0.00	0.00

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.3	85%	85%	50%
2	6.4.5	85%	85%	30%
Equivalent Series Efficiency		97.75%	97.75%	65.00%

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS

BMP type:	POI B - WQ Train No. 5 Landscape Restoration

DISTURBED AREA CONTROLLED BY BMP	0.73 AC.

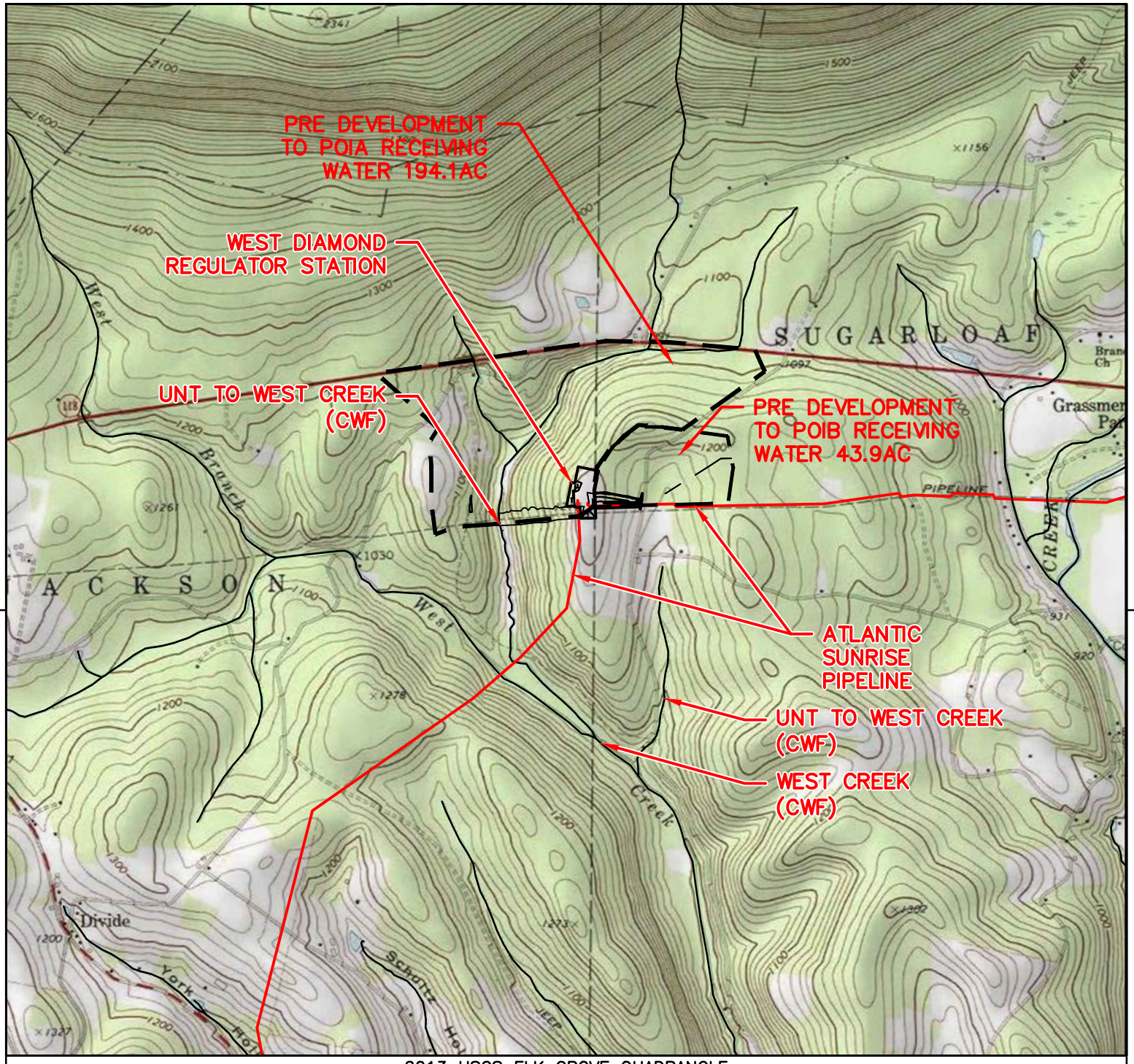
		POLLUTANT						POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	TSS EMC	TP EMC	NITRATE NITRITE	COVER (AC.)	Runoff (in)	RUNOFF VOLUME	TSS (LBS)	TP (LBS)	NO3 (LBS)
PERVIOUS SURFACES	FOREST	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	MEADOW	47	0.19	0.30	0.73	0.79	0.05	6.08	0.02	0.04
	FERTILIZED PLANTING AREA	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	NATIVE PLANTING AREA	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, LOW INPUT	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00
	LAWN, HIGH INPUT	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00	0.00
	GOLF COURSE FAIRWAY/GREEN	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00	0.00
	GRASSED ATHLETIC FIELD	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00
IMPERVIOUS SURFACES	ROOFTOP	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC STREET/HIGHWAY	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	MEDIUM TRAFFIC STREET	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC STREET	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	DRIVEWAY	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00	0.00
	HIGH TRAFFIC PARKING	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00	0.00
	LOW TRAFFIC PARKING	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00	0.00
							TOTAL LOAD	6.08	0.02	0.04
							REMOVAL EFFICIENCIES	85.00%	85.00%	50.00%
							POLLUTANT REDUCTION (LBS)	5.17	0.02	0.02

		REMOVAL EFFICIENCIES		
Series	BMP No.	TSS	TP	NO3
1	6.7.2	85%	85%	50%
Equivalent Series Efficiency		85.00%	85.00%	50.00%

Project Name: West Diamond RS POI - B
BL Project No.: 14C4909
Date: 4/26/2017

	TSS (LBS)	TP (LBS)	NO3 (LBS)
TOTAL POLLUTANT REDUCTION PROVIDED (LBS)	19.12	0.07	0.07
TOTAL POLLUTANT REDUCTION REQUIRED (LBS)	19.04	0.07	0.07
Δ	0.08	0.00	0.00

1.1 Topographic Features



2013 USGS ELK GROVE QUADRANGLE

N

GRAPHIC SCALE

2000 1000 0 2000

SCALE IN FEET

ATLANTIC SUNRISE PROJECT

WEST DIAMOND REGULATOR STATION

PRE DEVELOPMENT DRAINAGE AREA MAP

JACKSON/SUGARLOAF TOWNSHIP
COLUMBIA COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161501	SMK	
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	1161501	AJB	
2	09-01-16	BL	MOD 1 ISSUED FOR PADEP SUBMITTAL	1161481	AJB	
3	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	1161481	AJB	
4	Apr. 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	1161481	AJB	

DRAWN BY: JEC	DATE: 04/03/15	ISSUED FOR BID:	SCALE: 1"=2,000'		
CHECKED BY: AOE	DATE: 04/03/15	ISSUED FOR CONSTRUCTION:			
APPROVED BY: AJB	DATE: 04/03/15	DRAWING NUMBER:	WEST DIAMOND RS LOCATION	SHEET	1 OF 1
WO: 1161501					

Summary for Subcatchment 4S: PRE to POI B Wetlands

Runoff = 18.19 cfs @ 12.45 hrs, Volume= 2.573 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

Area (ac)	CN	Description
43.900	70	Woods, Good, HSG C
43.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	150	0.0660	0.13		**Sheet Flow, Sheeet flow** Woods: Light underbrush n= 0.400 P2= 2.98"
1.5	175	0.1600	2.00		**Shallow Concentrated Flow, 175 Shallow Conc** Woodland Kv= 5.0 fps
10.3	760	0.0600	1.22		**Shallow Concentrated Flow, 760 Shallow Conc** Woodland Kv= 5.0 fps
30.9	1,085	Total			

2.573 af = 112,080 cf of runoff volume from 2 year storm event
1% allowable volume increase as a result of the development: 1120.8 cf

Summary for Subcatchment 6S: PRE to POI A Reg.Stream

Runoff = 70.89 cfs @ 12.58 hrs, Volume= 11.374 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.10 hrs
PA-Benton - 517 - WDiamond 24-hr S1 2-yr Rainfall=2.98"

Area (ac)	CN	Description
182.000	70	Woods, Good, HSG C
12.100	71	Meadow, non-grazed, HSG C
194.100	70	Weighted Average
194.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	150	0.1000	0.15		**Sheet Flow, Sheeet flow** Woods: Light underbrush n= 0.400 P2= 2.98"
10.6	930	0.0860	1.47		**Shallow Concentrated Flow, 930 Shallow Conc** Woodland Kv= 5.0 fps
12.6	3,750	0.0200	4.95	59.39	**Channel Flow,** Area= 12.0 sf Perim= 11.0' r= 1.09' n= 0.045 Winding stream, pools & shoals
39.4	4,830	Total			

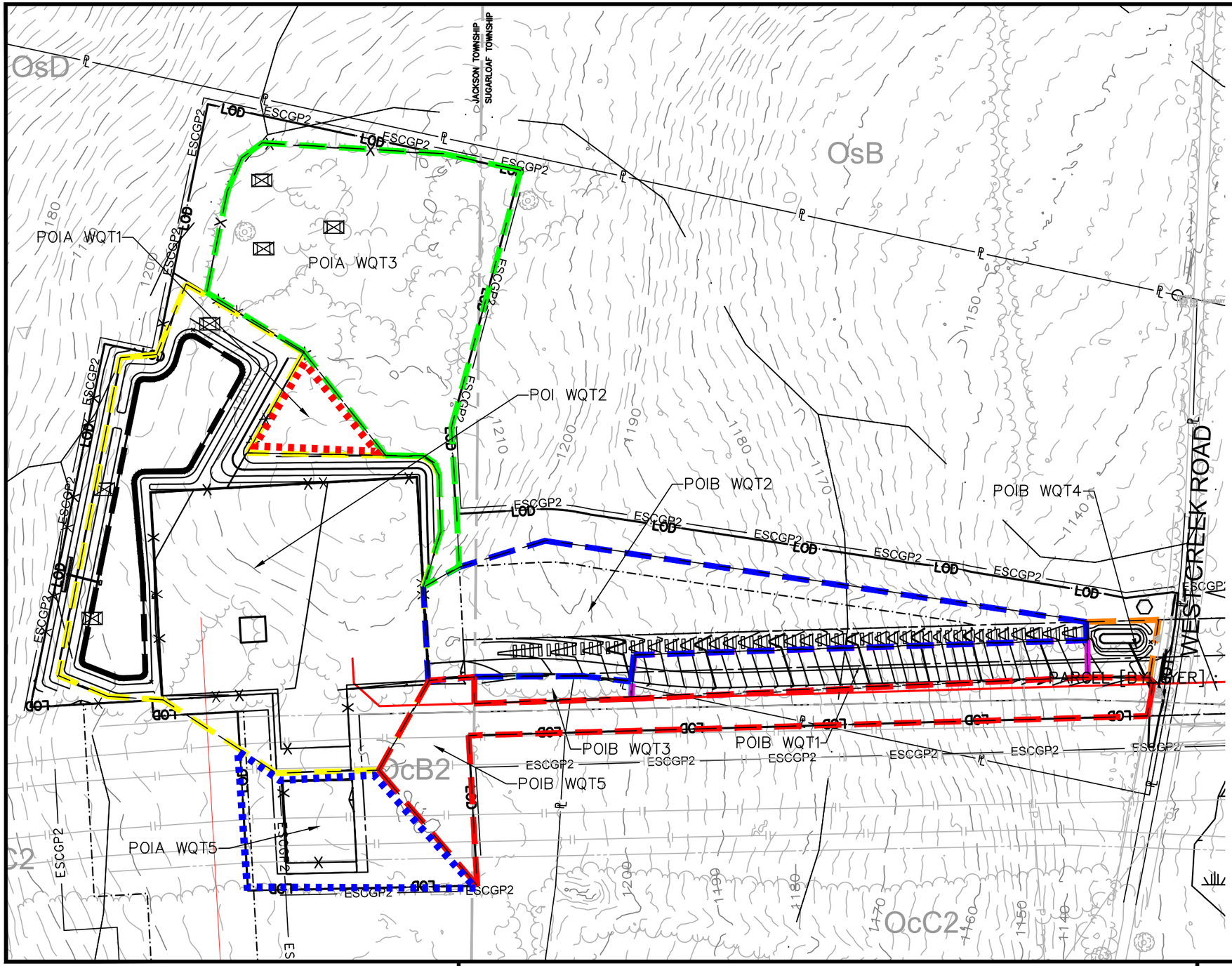
11.374 af = 495,451 cf of runoff volume from 2 year storm event
1% allowable volume increase as a result of the development: 4,954.5 cf

PROJECT:	Atlantic Sunrise Project - West Diamond Regulator Station
SUB-BASIN:	**POI A - To UNT to West Creek**
Municipality:	Jackson/Sugarloaf Township
County:	Columbia County

Existing 2-Year Stream Volume Run-off:	11.374	acre-feet
	495,451	Cubic Feet
Volume Increase Per Worksheet 5:	3,306	Cubic Feet
Percent Increase:	0.67%	

PROJECT:	Atlantic Sunrise Project - West Diamond Regulator Station
SUB-BASIN:	**POI B - To Wetlands east of West Creek Road**
Municipality:	Jackson/Sugarloaf Township
County:	Columbia County

Existing 2-Year Stream Volume Run-off:	2.573	acre-feet
	112,080	Cubic Feet
Volume Increase Per Worksheet 5:	327	Cubic Feet
Percent Increase:	0.29%	



LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- FENCE
- STONE ROW
- SOIL BOUNDARY
- TREELINE
- CENTERLINE STREAM/EDGE WATERBODY
- DELINEATED WETLANDS
- WsB — SOIL TYPE DESIGNATION
- EXISTING ROAD
- ROW
- LIMITS OF FLOODWAY/ FLOODPLAN
- PROPOSED MAJOR CONTOUR (10' INTERVAL)
- PROPOSED MINOR CONTOUR (2' INTERVAL)
- LOD — LIMIT OF DISTURBANCE (WEST DIAMOND REGULATOR STATION)
- ESCGP2 — ESCGP-2 PERMIT BOUNDARY
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREAS SPECIFIED ON WATER QUALITY WORKSHEET 13

N

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET
1 inch = 100 ft.

BL Companies
ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

4242 Carlisle Pike, Suite 260
Camp Hill, PA 17011
(717) 651-9850
(717) 651-9858 Fax

WATER QUALITY CALCULATION DRAINAGE AREA MAP

WEST DIAMOND STATION – TRANS CONTINENTAL GAS PIPELINE COMPANY
ATLANTIC SUNRISE PROJECT – PROPOSED 30" NATURAL GAS PIPELINE
JACKSON/SUGARLOAF TOWNSHIP, COLUMBIA COUNTY, PENNSYLVANIA

Designed	J.A.
Drawn	J.A.
Checked	C.G.
Approved	A.B.
Scale	1"=100'
Project No.	14C4909
Date	04/24/17

BMP DA

CAD File FRS_PCSM14C4909(10)_WDIAMOND

A.6 Site Characterization Assessment

Field Observation Report

Project Number: 14C4909

Project Name: Atlantic Sunrise Project – West Diamond Regulator Station

Date of Field Visit: March 11, 2015

Weather Conditions: Sunny Temperature: Approximately 40-52°F

Prepared By: Krystal Bealing, APSS and Joseph Kempf

Copies of Report Have Been Sent To: ☒ Client ☐ Contractor ☐ Other

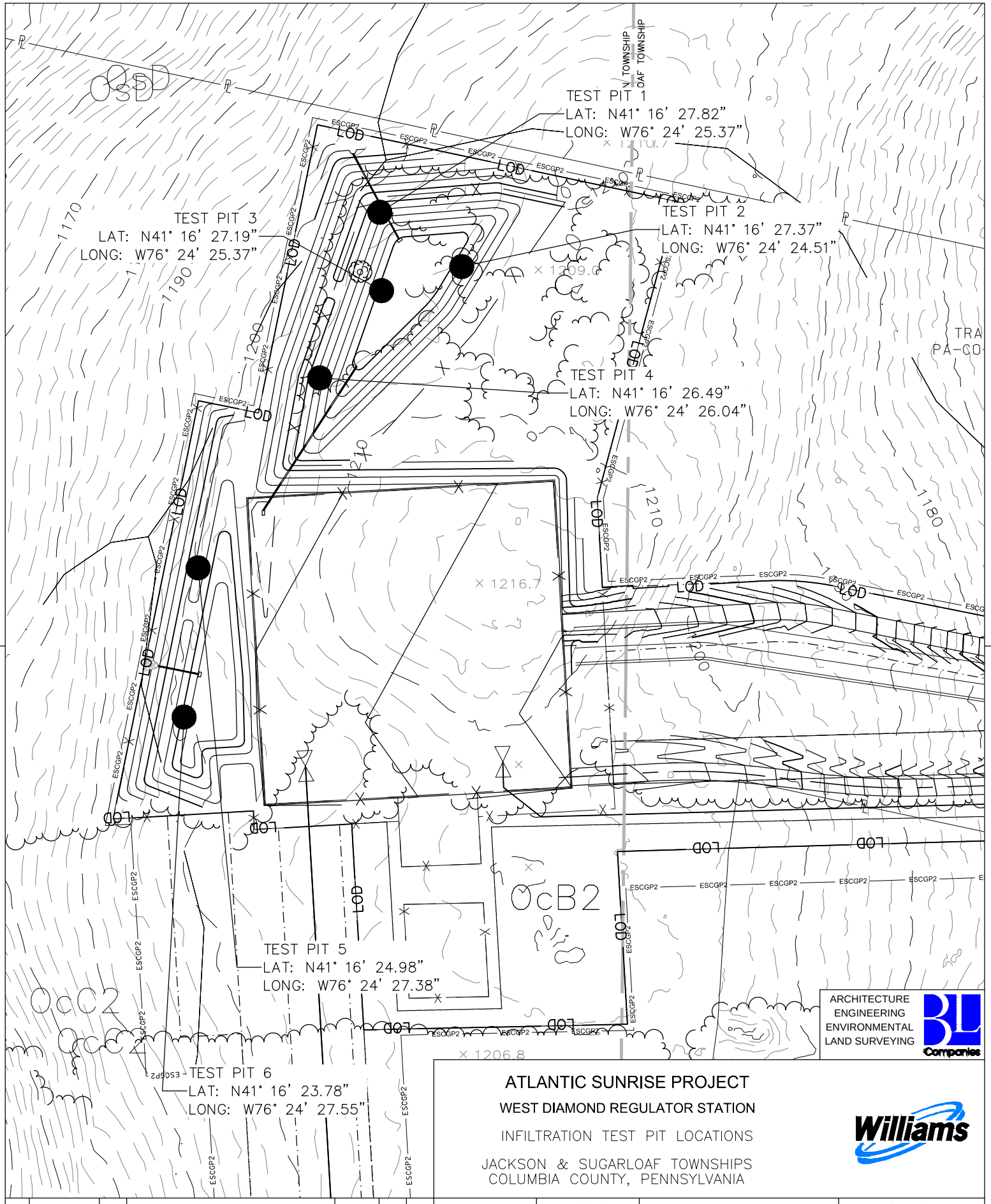
Client:
Transcontinental Gas Pipe Line
Company, LLC
2800 Post Oak Blvd
Houston, TX 77251

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

Six soil pits were excavated by backhoe and described to varying depths. Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at depths ranging from the surface to 22 inches.

The test pit location map, soil profile descriptions, infiltration worksheet and photographs are attached. Determined limiting layer depths are listed below:

Pit #1: 17 inches deep, Limiting Layer observed at 17 inches
Infiltration conducted at the surface, Infiltration Rate = 3.321 inches/hour
Pit #2: 12 inches deep, Limiting Layer observed at 12 inches
Infiltration conducted at the surface, Infiltration Rate = 0.094 inches/hour
Pit #3: 59 inches deep, Limiting Layer observed at 22 inches
Infiltration conducted at 22 inches, Infiltration Rate = 1.000 inches/hour
Pit #4: 43 inches deep, Limiting Layer observed at 18 inches
Infiltration conducted at 18 inches, Infiltration Rate = 1.250 inches/hour
Pit #5: 40 inches deep, Limiting Layer observed at 40 inches
Infiltration conducted at 16 inches, Infiltration Rate = 2.250 inches/hour
Pit #6: 17 inches deep, Limiting Layer observed at 17 inches
Infiltration conducted at the surface, Infiltration Rate = 0.000 inches/hour



ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING
BL Companies

ATLANTIC SUNRISE PROJECT

WEST DIAMOND REGULATOR STATION

INFILTRATION TEST PIT LOCATIONS

JACKSON & SUGARLOAF TOWNSHIPS
COLUMBIA COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.

DRAWN BY: AOE	DATE: 3/27/15	ISSUED FOR BID:	SCALE: 1"=100'
CHECKED BY: AJB	DATE: 3/27/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: AJB	DATE: 3/27/15	DRAWING NUMBER: WEST DIAMOND RS TEST PITS	SHEET 1 OF 1
WO:			

Soil Profile Log

Project	14C4909-A Atlantic Sunrise Project -West Diamond Regulator Station	**Elevation**	1201 AMSL
Test Pit #	1	**Soil Type**	Oquaga channery silt loam, 3-12% slopes
Name	Krystal Beaing, APSS	**Geology**	Catskill Formation
Date	March 11, 2015	**Landscape Position/Slope**	Summit, 2-5%
Weather	40-52°F; Sunny	**Land Use**	Wooded
Equipment	Mini Excavator	**Additional Comments**	Approximately 12" snow

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
A	0	9	SiL	15-35% Channery	5YR 3/3	-	Weak, Granular	-	-	-
Bw	9	17	SiL	35-60% Channery	5YR 4/3	-	Weak, Subangular Blocky	17	-	Limiting Layer - Bedrock

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 -West Diamond Regulator Station	**Elevation**	1208 AMSL
Test Pit #	2	**Soil Type**	Oquaga channery silt loam, 3-12% slopes
Name	Krystal Beaing, APSS	**Geology**	Catskill Formation
Date	March 11, 2015	**Landscape Position/Slope**	Summit, 2-5%
Weather	40-52°F; Sunny	**Land Use**	Wooded
Equipment	Mini Excavator	**Additional Comments**	Approximately 12" snow

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
A	0	9	SiL	15-35% Channery	5YR 3/3	-	Weak, Granular	-	-	-
Bw	9	12	SiL	35-60% Channery	5YR 4/3	-	Weak, Subangular Blocky	12	-	Limiting Layer - Bedrock

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 -West Diamond Regulator Station
Test Pit # 3
Name Krystal Beaing, APSS
Date March 11, 2015
Weather 40-52°F; Sunny
Equipment Mini Excavator

Elevation 1205 AMSL
Soil Type Oquaga channery silt loam, 3-12% slopes
Geology Catskill Formation
Landscape Position/Slope Summit, 2-5%
Land Use Wooded
Additional Comments Approximately 12" snow

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
A	0	9	SiL	15-35% Channery	5YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	9	22	SiL	15-35% Channery	5YR 4/3	-	Weak, Granular	-	-	-
Bw2	22	28	SiL	15-35% Channery	5YR 4/4	15% 5YR 5/8	Weak, Granular	-	-	Limiting Layer - Season High Water Table
Bw3	28	44	SiL	15-35% Channery	5YR 5/2	40% 5YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Season High Water Table
BC	44	56	L	35-60% Channery	2.5YR 4/4	10% 5YR 4/6	Weak, Subangular Blocky	-	-	Limiting Layer - Season High Water Table
C	56	59+	SL	35-60% Channery	5YR 3/4	5% 5YR 5/6	Weak, Granular	-	-	Limiting Layer - Season 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 -West Diamond Regulator Station
Test Pit # 4
Name Krystal Beaing, APSS
Date March 11, 2015
Weather 40-52°F; Sunny
Equipment Mini Excavator

Elevation 1206 AMSL
Soil Type Oquaga channery silt loam, 3-12% slopes
Geology Catskill Formation
Landscape Position/Slope Summit, 2-5%
Land Use Wooded
Additional Comments Approximately 12" snow

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
A	0	7	SiL	15-35% Channery	5YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw1	7	18	SiL	15-35% Channery	5YR 4/3	-	Weak, Subangular Blocky	-	-	-
Bw2	18	24	SiL	15-35% Channery	5YR 4/4	10% 5YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
Bw3	24	34	SiL	15-35% Channery	5YR 5/2	40% 5YR 5/8	Weak, Subangular Blocky	-	-	Limiting Layer - Seasonal High Water Table
BC	34	43	L	35-60% Channery	2.5YR 4/4	15% 5YR 4/6	Weak, Subangular Blocky	43	-	Limiting Layer - Seasonal High Water Table; Bedrock

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 -West Diamond Regulator Station
Test Pit # 5
Name Krystal Beaing, APSS
Date March 11, 2015
Weather 40-52°F; Sunny
Equipment Mini Excavator

Elevation 1202 AMSL
Soil Type Oquaga channery silt loam, 3-12% slopes
Geology Catskill Formation
Landscape Position/Slope Summit, 2-5%
Land Use Wooded
Additional Comments Approximately 12" snow

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
A	0	11	SiL	15-35% Channery	5YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw	11	40	SiL	15-35% Channery	5YR 4/4	-	Weak, Subangular Blocky	40	-	Limiting Layer - Bedrock

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 -West Diamond Regulator Station	**Elevation**	1203 AMSL
Test Pit #	6	**Soil Type**	Oquaga channery silt loam, 3-12% slopes
Name	Krystal Beaing, APSS	**Geology**	Catskill Formation
Date	March 11, 2015	**Landscape Position/Slope**	Summit, 2-5%
Weather	40-52°F; Sunny	**Land Use**	Wooded
Equipment	Mini Excavator	**Additional Comments**	Approximately 12" snow

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
A	0	11	SiL	15-35% Channery	5YR 3/3	-	Roots present; Weak, Granular	-	-	-
Bw	11	17	SiL	15-35% Channery	5YR 4/4	-	Weak, Subangular Blocky	17	-	Limiting Layer - Bedrock

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 - WEST DIAMOND REGULATOR STATION													
SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD													
Hole Number	Drop >2 inches after 30 minute presoak?[1]	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[2] (Inches of Drop)	Infiltration Rate[3] (in/hr)	Comments
1	Yes	10	0.625	0.563	0.526	0.500					0.553	3.321	40-52 degrees, sunny, approx. 12" snow cover. Test done at the surface.
2	No	30	0.063	0.000	0.063	0.063					0.047	0.094	40-52 degrees, sunny, approx. 12" snow cover. Test done at the surface.
3	No	30	0.563	0.438	0.500	0.500					0.500	1.000	40-52 degrees, sunny, approx. 12" snow cover. Test done 22" below the surface.
4	No	30	0.750	0.625	0.625	0.500					0.625	1.250	40-52 degrees, sunny, approx. 12" snow cover. Test done 18" below the surface.
5	Yes	10	0.250	0.250	0.500	0.500					0.375	2.250	40-52 degrees, sunny, approx. 12" snow cover. Test done 16" below the surface.
6	No	30	0.000	0.000	0.000	0.000					0.000	0.000	40-52 degrees, sunny, approx. 12" snow cover. Test done at the surface.

[1]Inches of drop greater than 2 inches after the 30 minute presoak? Yes, use 10 minute interval; No, use 30 minute interval.

[2]Calculated as the average of the last four stabilized (less than 0.25-inch difference overall) readings.

[3]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 #4.

View of Pit #5.

View of Pit #6.

WEST DIAMOND REGULATOR STATION
INFILTRATION RATE/DEWATERING TIME

Note: the infiltration tests were performed with a double ring infiltrometer. Therefore, no reduction factors were applied.

The limiting layer was found to be approximately 17 inches to 40 inches below exising grade (± 1200.00). Therefore, the infiltration areas would be shallow or at existing grade. Therefore, infiltration facilities are not feasible for this site

BASIN 1

Infiltration Rate

Test pit 4	1.25	in/hr
Test pit 5	2.25	in/hr
Test pit 6	0.00	in/hr
Average	1.75	in/hr
Safety factor	3.00	
Adjusted rate	0.58	in/hr

A.7 Supporting Documentation

TABLE 6.6
Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

Percent Passing (Square Openings)						
Class, Size NO. / **Rock Size (Inches)**	**R-8**	**R-7**	**R-6**	**R-5**	**R-4**	**R-3**
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[1]	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V_{max} (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"**	**3/4 "**	**1/2"**	**3/8"**	**#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.

NOAA Atlas 14, Volume 2, Version 3
Location name: Benton, Pennsylvania, US*
Latitude: 41.2734°, Longitude: -76.4070°
Elevation: 1210 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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.336** (0.305-0.371)	**0.400** (0.362-0.441)	**0.464** (0.420-0.512)	**0.509** (0.461-0.561)	**0.564** (0.508-0.621)	**0.605** (0.544-0.667)	**0.644** (0.576-0.711)	**0.685** (0.609-0.757)	**0.740** (0.653-0.822)	**0.781** (0.684-0.871)
10-min	**0.523** (0.473-0.576)	**0.624** (0.566-0.688)	**0.721** (0.652-0.795)	**0.786** (0.712-0.866)	**0.862** (0.777-0.950)	**0.917** (0.824-1.01)	**0.970** (0.867-1.07)	**1.02** (0.909-1.13)	**1.09** (0.960-1.21)	**1.14** (0.996-1.27)
15-min	**0.641** (0.580-0.706)	**0.764** (0.692-0.842)	**0.885** (0.801-0.977)	**0.967** (0.876-1.07)	**1.06** (0.960-1.17)	**1.14** (1.02-1.25)	**1.21** (1.08-1.33)	**1.27** (1.13-1.41)	**1.36** (1.20-1.51)	**1.42** (1.25-1.59)
30-min	**0.848** (0.767-0.934)	**1.02** (0.926-1.13)	**1.21** (1.10-1.34)	**1.34** (1.22-1.48)	**1.50** (1.36-1.66)	**1.62** (1.46-1.79)	**1.74** (1.56-1.92)	**1.86** (1.65-2.05)	**2.01** (1.77-2.24)	**2.13** (1.87-2.38)
60-min	**1.03** (0.937-1.14)	**1.25** (1.14-1.38)	**1.52** (1.38-1.68)	**1.71** (1.55-1.88)	**1.95** (1.76-2.15)	**2.14** (1.92-2.36)	**2.33** (2.08-2.57)	**2.52** (2.24-2.78)	**2.78** (2.45-3.09)	**2.99** (2.62-3.34)
2-hr	**1.20** (1.08-1.33)	**1.44** (1.30-1.60)	**1.76** (1.59-1.96)	**2.02** (1.81-2.24)	**2.38** (2.13-2.64)	**2.68** (2.38-2.97)	**3.01** (2.66-3.35)	**3.37** (2.96-3.75)	**3.91** (3.38-4.38)	**4.37** (3.74-4.92)
3-hr	**1.30** (1.17-1.45)	**1.56** (1.41-1.75)	**1.92** (1.73-2.15)	**2.21** (1.98-2.46)	**2.63** (2.34-2.93)	**2.99** (2.65-3.34)	**3.39** (2.97-3.79)	**3.83** (3.32-4.29)	**4.50** (3.85-5.07)	**5.09** (4.30-5.76)
6-hr	**1.63** (1.46-1.84)	**1.96** (1.76-2.22)	**2.40** (2.15-2.70)	**2.76** (2.46-3.10)	**3.28** (2.90-3.68)	**3.73** (3.28-4.19)	**4.22** (3.68-4.75)	**4.78** (4.12-5.38)	**5.63** (4.77-6.37)	**6.37** (5.33-7.24)
12-hr	**2.03** (1.82-2.29)	**2.44** (2.19-2.74)	**2.99** (2.68-3.36)	**3.45** (3.08-3.87)	**4.13** (3.66-4.62)	**4.72** (4.16-5.29)	**5.38** (4.69-6.03)	**6.13** (5.28-6.89)	**7.28** (6.16-8.22)	**8.31** (6.92-9.43)
24-hr	**2.45** (2.24-2.71)	**2.94** (2.69-3.25)	**3.63** (3.31-4.01)	**4.22** (3.84-4.66)	**5.13** (4.63-5.64)	**5.95** (5.33-6.51)	**6.89** (6.12-7.53)	**8.00** (7.04-8.71)	**9.75** (8.45-10.6)	**11.4** (9.70-12.3)
2-day	**2.88** (2.61-3.23)	**3.45** (3.13-3.87)	**4.26** (3.85-4.77)	**4.95** (4.46-5.54)	**6.02** (5.38-6.70)	**6.98** (6.20-7.76)	**8.10** (7.13-8.98)	**9.39** (8.19-10.4)	**11.5** (9.84-12.7)	**13.4** (11.3-14.7)
3-day	**3.06** (2.78-3.41)	**3.65** (3.33-4.08)	**4.48** (4.07-4.99)	**5.19** (4.70-5.77)	**6.28** (5.65-6.96)	**7.26** (6.49-8.03)	**8.39** (7.44-9.26)	**9.71** (8.53-10.7)	**11.8** (10.2-13.0)	**13.7** (11.7-15.0)
4-day	**3.23** (2.95-3.58)	**3.85** (3.52-4.28)	**4.70** (4.29-5.22)	**5.43** (4.94-6.01)	**6.54** (5.92-7.22)	**7.54** (6.78-8.30)	**8.69** (7.76-9.54)	**10.0** (8.87-11.0)	**12.1** (10.6-13.3)	**14.0** (12.1-15.3)
7-day	**3.82** (3.52-4.20)	**4.55** (4.19-5.01)	**5.49** (5.04-6.04)	**6.29** (5.75-6.90)	**7.49** (6.82-8.21)	**8.56** (7.75-9.36)	**9.77** (8.79-10.7)	**11.2** (9.97-12.2)	**13.4** (11.8-14.5)	**15.3** (13.3-16.7)
10-day	**4.40** (4.07-4.81)	**5.22** (4.83-5.71)	**6.24** (5.76-6.82)	**7.10** (6.53-7.75)	**8.38** (7.67-9.12)	**9.49** (8.65-10.3)	**10.7** (9.73-11.7)	**12.2** (10.9-13.2)	**14.4** (12.8-15.6)	**16.3** (14.4-17.6)
20-day	**5.98** (5.60-6.41)	**7.04** (6.60-7.55)	**8.20** (7.67-8.78)	**9.17** (8.56-9.82)	**10.6** (9.85-11.3)	**11.8** (10.9-12.6)	**13.1** (12.1-14.0)	**14.6** (13.4-15.6)	**16.8** (15.3-17.9)	**18.7** (16.9-19.9)
30-day	**7.44** (7.00-7.96)	**8.72** (8.21-9.32)	**10.0** (9.41-10.7)	**11.1** (10.4-11.8)	**12.6** (11.8-13.5)	**13.9** (13.0-14.8)	**15.3** (14.2-16.3)	**16.7** (15.5-17.9)	**18.9** (17.4-20.2)	**20.8** (19.0-22.2)
45-day	**9.40** (8.88-9.99)	**11.0** (10.4-11.7)	**12.4** (11.7-13.2)	**13.6** (12.8-14.4)	**15.2** (14.4-16.2)	**16.6** (15.6-17.6)	**18.0** (16.9-19.2)	**19.6** (18.3-20.8)	**21.7** (20.2-23.1)	**23.5** (21.8-25.0)
60-day	**11.3** (10.8-12.0)	**13.2** (12.5-13.9)	**14.8** (14.0-15.7)	**16.1** (15.3-17.1)	**18.0** (17.0-19.0)	**19.5** (18.4-20.6)	**21.1** (19.9-22.3)	**22.8** (21.4-24.1)	**25.2** (23.6-26.7)	**27.2** (25.3-28.8)

[1] 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

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:

Name of Training:	Annual Oil and Gas Training	Chapter 102 Update Training for the Regulated Community
Presented By:	PADEP	PADEP
Date:	7/10/2013	11/12/2010

EMPLOYMENT HISTORY:

Current Employer: BL Companies

Telephone: 717-651-9850

Former Employer: N/A

Telephone:

RECENT E&S PLANS PREPARED:

Name of Project:	Constitution Pipeline, Access Roads and Meter Station (ES, PCSM)	Reynolds Alford Pipeline (E&S, PCSM)	Annville Medical Office (E&S, PCSM)
County:	Susquehanna	Susquehanna	Lebanon
Municipality:	Multiple	Brooklyn, Harford	Annville Twp
Permit Number:	ESG0011540002	ESX13-115-0152(01)	PAG-02-0038-15-010
Approving Agency:	Susquehanna CCD	PADEP (O&G)	Lebanon CCD

Architecture
Engineering
Environmental
Land Surveying
Companies

An Employee-Owned Company

APPENDIX C

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

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Columbia County, Pennsylvania

West Diamond Regulator Station

July 6, 2015

Preface

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (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).

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

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

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

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

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

Contents

How Soil Surveys Are Made

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

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

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

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

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

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,910 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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: Columbia County, Pennsylvania
Survey Area Data: Version 7, Sep 15, 2014

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

Date(s) aerial images were photographed: Apr 14, 2011—Sep 18, 2011

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

Map Unit Legend

Columbia County, Pennsylvania (PA037)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
OcB2	Oquaga channery silt loam, 3 to 12 percent slopes, moderately eroded	6.6	84.7%
OcC2	Oquaga channery silt loam, 12 to 20 percent slopes, moderately eroded	1.1	13.6%
OsB	Oquaga very stony silt loam, 0 to 12 percent slopes	0.0	0.2%
OsD	Oquaga very stony silt loam, 12 to 35 percent slopes	0.1	1.6%
Totals for Area of Interest		**7.8**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Columbia County, Pennsylvania

OcB2—Oquaga channery silt loam, 3 to 12 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: l3fk
Elevation: 600 to 1,800 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Oquaga

Setting

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

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 22 inches: very channery loam
H3 - 22 to 26 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 12 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 2.1 inches)

Interpretive groups

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

OcC2—Oquaga channery silt loam, 12 to 20 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: l3fl
Elevation: 600 to 1,800 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Oquaga

Setting

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

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 22 inches: very channery loam
H3 - 22 to 26 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 20 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 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

OsB—Oquaga very stony silt loam, 0 to 12 percent slopes

Map Unit Setting

National map unit symbol: l3fn
Elevation: 700 to 1,800 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Oquaga

Setting

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

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 22 inches: very channery silt loam
H3 - 22 to 26 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 12 percent
Percent of area covered with surface fragments: 1.6 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 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C

OsD—Oquaga very stony silt loam, 12 to 35 percent slopes

Map Unit Setting

National map unit symbol: l3fp
Elevation: 700 to 1,800 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Oquaga

Setting

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

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 22 inches: very channery silt loam
H3 - 22 to 26 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 35 percent
Percent of area covered with surface fragments: 1.6 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 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf