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Post Construction Stormwater Management/Site Restoration Plans Narrative
Atlantic Sunrise Project
Phase 2

River Road Regulator Station
Drumore Township
Lancaster County
Pennsylvania

Prepared For:

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

Issued: August 2015
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BL Project No. 14C4909

Prepared By:

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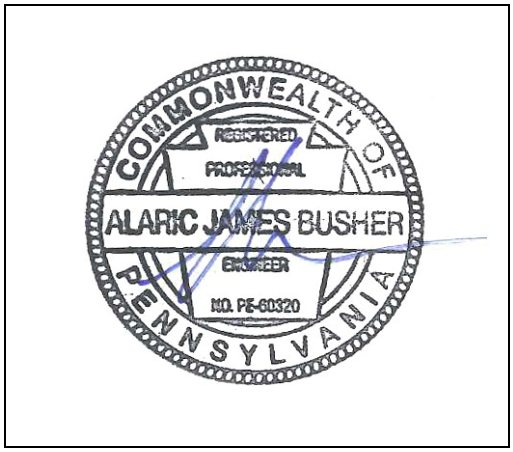

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APPENDICES

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 River Road Regulator Station ("Site") to be constructed as part of the Project, within Drumore Township, Lancaster 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 Lancaster County is the following:

Facility Name	Facility Description	Facility Coordinates
River Road Regulator Station	Regulator Station	N39°50'09.68", W76°15'14.30"

The River Road Regulator Station will include the development of approximately 2.59 acres and the addition of 40,588 square feet of gravel area and a 2,860 square foot building. The River Road Regulator Station is adjacent to the Rock Springs Expansion Project. The Rock Springs Expansion Project was designed by others and covered under a separate permit. 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 requirements of 25 Pa. Code § 102.8(b) and the standards and specifications in the Pennsylvania Department of Environmental Protection's (PADEP's) "Pennsylvania Stormwater BMP Manual," Document No. 363-0300-002, as amended and updated (PCSM 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:

1. Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream by reducing the runoff rate and runoff volume.
2. Prevent an increase in the rate of stormwater runoff by using infiltration facilities.
3. Minimize any increase in stormwater runoff volume by using infiltration facilities.
4. Minimize impervious areas by using pervious surfaces for drive access in lieu of asphalt or concrete.
5. Maximize the protection of existing drainage features and existing vegetation by identifying and installing protective features around areas to be preserved.
6. Minimize land clearing and grading by reducing the footprint of the infiltration facilities.

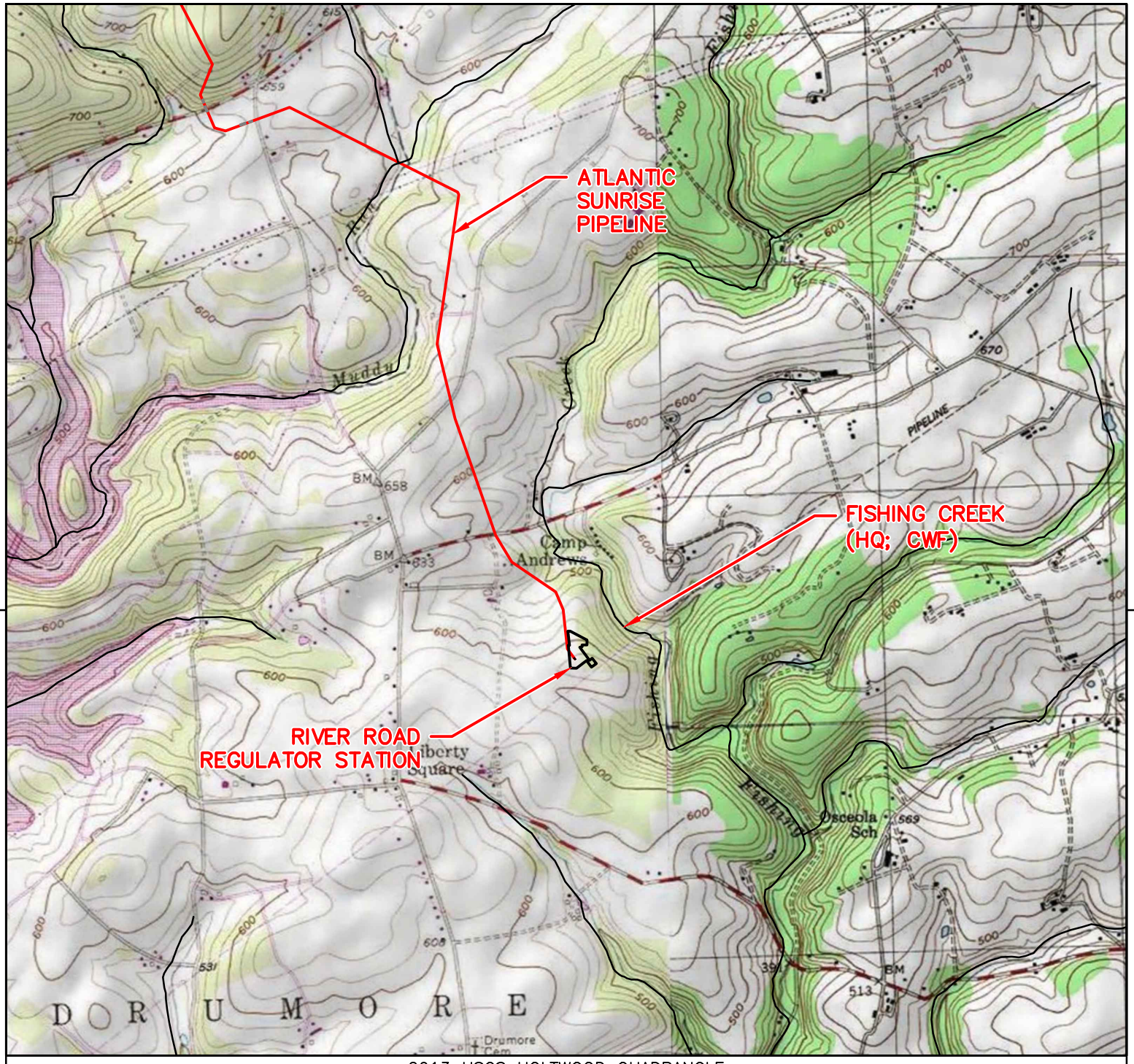
7. Minimize soil compaction by identifying areas to receive soil amendments and areas to be protected from vehicle and material storage.
8. Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff.

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 HOLTWOOD QUADRANGLE

N

GRAPHIC SCALE
2000 1000 0 2000
SCALE IN FEET

ATLANTIC SUNRISE PROJECT
RIVER ROAD REGULATOR STATION
USGS LOCATION MAP
DRUMORE TOWNSHIP
LANCASTER COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161509	SMK	
1	12-02-15	BL	ISSUED FOR PADEP RESUBMITTAL	1161509	AJB	
2	10-17-16	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	1161503	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: RIVER ROAD RS LOCATION	SHEET 1 OF 1
WO: 1161509			

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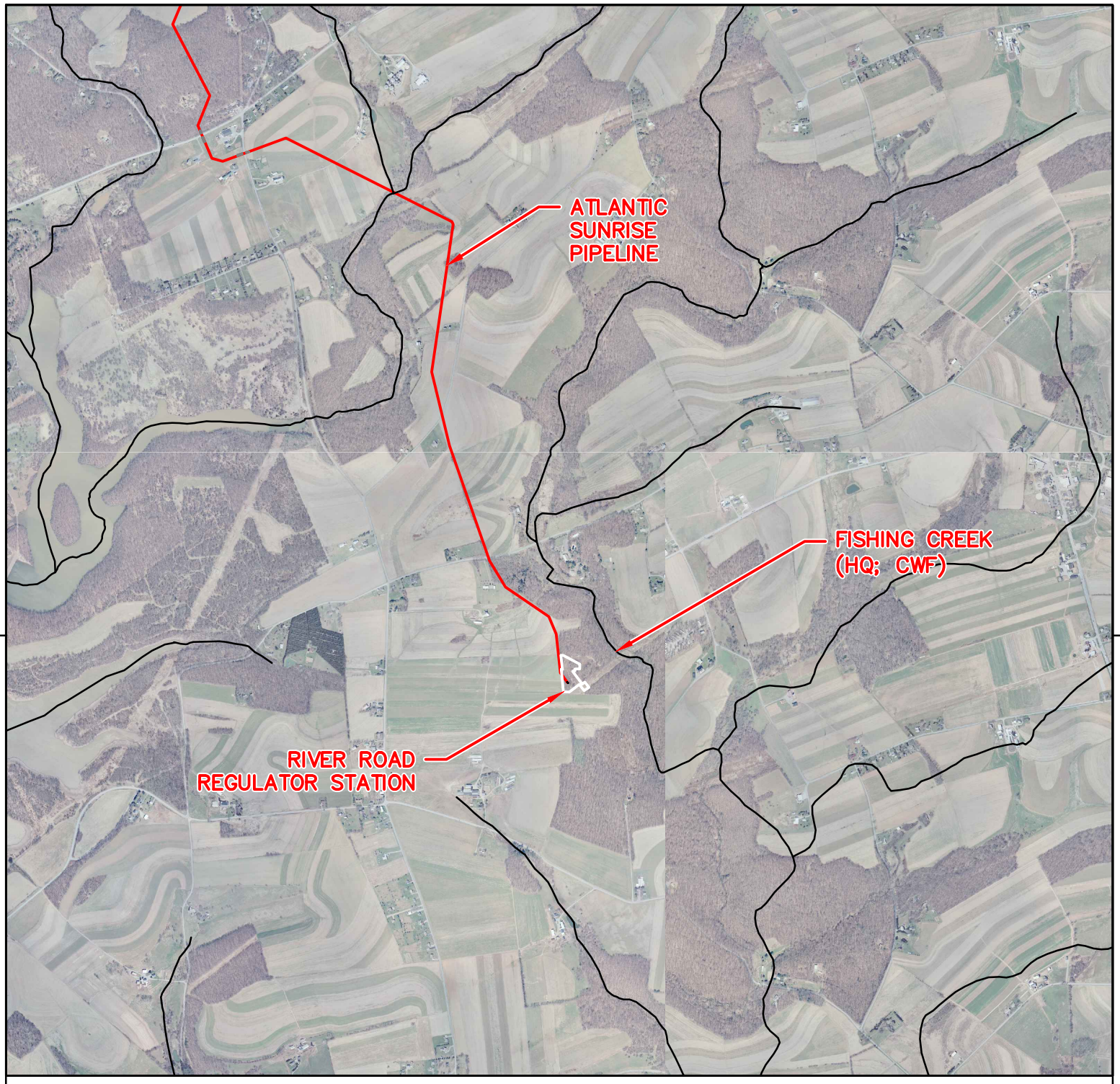

N

GRAPHIC SCALE

2000 1000 0 2000

SCALE IN FEET

ATLANTIC SUNRISE PROJECT

RIVER ROAD REGULATOR STATION

AERIAL LOCATION MAP

DRUMORE TOWNSHIP
LANCASTER COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	08-28-15	BL	ISSUED FOR PADEP PERMIT SUBMITTAL	1161509	SMK	
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WO: 1161509			

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
CbB	Chester silt loam	3-8%	X	C		X				X		X		X				
GbB	Glenelg silt loam	3-8%	X	C		X			X	X	X	X	X	X				X
GbC	Glenelg silt loam	8-15%	X	C		X			X	X	X	X	X	X				X
MbD	Manor very stony silt loam	8-25%	X	C		X				X	X	X	X	X				

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

Soil Use Limitations Resolutions

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

1.3 Earth Disturbance Activity Characterization

Proposed Improvements and Land Use

The proposed River Road Regulator Station will be constructed in Drumore Township, Lancaster County, Pennsylvania. River Road Regulator Station will include construction of a regulator station. The earthmoving activity will involve the stripping and stockpiling of top soil, Site grading, Site excavation, placement of fill, trenching and backfill, construction of 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.

Present/Past Land Use

This section identifies the land requirements for construction and operation of the proposed facility. Table 1.3.1 summarizes the land requirements for the proposed River Road Regulator Station associated with the CPL South mainline.

The present characterization of land use within the proposed facility 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. The adjacent area to the east of the proposed facility project area is occupied by the Rock Springs facility built in 2016. Previous land uses in the last 5 to 50 years within the project area have remained similar to present use. Transco classified land uses within the proposed 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 Main Line Valve sites (MLVs) will be wholly located within the permanent ROWs for the proposed CPL North and CPL South mainlines or permanent facilities. Construction will primarily occur within the proposed CPL North and CPL South construction ROWs.

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

Facility	Milepost	County	Agricultural Land (acres)		Upland Forest / Woodland (acres)		Open Land (acres)		Total (acres)	
			Cons	Op	Cons	Op	Cons	Op	Cons	Op
River Road Regulator Station with pig receiver	Transco Mainline 1683.3	Lancaster	0.0	0.0	2.1	2.1	0.3	0.3	2.4	2.4
Lancaster County Subtotal			**0.0**	**0.0**	**2.1**	**2.1**	**0.3**	**0.3**	**2.4**	**2.4**

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

Recently, the Rock Springs Expansion project constructed a facility and access road on the same parcel. This work was completed under a separate permit. The proposed River Road facility will utilize the Rock Springs Expansion access road for permanent access. This PCSM design is meant to address construction of the new River Road Regulator Station only.

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 24 hour storm events using the Soil Conservation Service's TR-55 Method. The PCSM/SR BMPs will meet the volume reduction and water quality requirements of 25 Pa. Code § 102.8 and Control Guideline 1 (CG 1). PCSM Standard Worksheet #4 was used to complete the CG 1 volume analysis for the 2-year 24 hour storm event. Stormwater models were created using the HydroCAD Version 7.10 computer program produced by HydroCAD Software Solutions, LLC. Stormwater conveyance calculations were performed using Worksheet 11 of the Pennsylvania Erosion and Sediment Pollution Control (E&S) Program Manual. (Analysis of rates and flows at each point of interest (POI) were completed to meet Act 167 study Requirements.) National Oceanic Atmospheric Administration (NOAA) Atlas 14 rainfall intensities were used in the calculations. See Appendix A for calculations and results.

POI Summary:

POI A: Downslope of existing drainage way. Common offsite areas tributary to POI A were not included in the runoff calculations.

Overall Site: Fishing Creek Watershed

Volume Summary Table

	2- YR PRE (FT^3)	2- YR POST (FT^3)	2- YR VOLUME INCREASE (FT^3)	2- YR STRUCTURAL AND NONSTRUCTURAL CREDITS (FT^3)	DIFFERENCE (FT^3)
POI	***3,401***	***8,651***	***5,250***	***6,143***	***893***

*See Appendix A for calculations.

Runoff Rate Summary Table

STORM EVENT	PRE-DEVELOPMENT PEAK FLOW (CFS)	POST-DEVELOPMENT PEAK FLOW (CFS)	REDUCTION (CFS)
1-yr	***0.20***	***0.03***	***0.17***
2-yr	***0.62***	***0.09***	***0.53***
5-yr	***1.93***	***0.33***	***1.60***
10-yr	***3.18***	***0.63***	***2.55***
25-yr	***5.06***	***1.71***	***3.35***
50-yr	***6.61***	***2.79***	***3.82***
100-yr	***8.24***	***4.22***	***4.02***

*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 was designed to meet the *Blueprints: An integrated Water Resources Plan for Lancaster County (Act 247 and 167).* This PCSM/SR narrative provides evidence that the Act 167 standards for stormwater runoff rate release, stormwater volume and water quality are met.

Plan Requirements

The watersheds within Lancaster County were modeled to assess current and future drainage patterns. Release rates were recommended for some subbasins that are more restrictive than CG 1 requirements. However, the Site is not located in such a management district and will comply with release rates and water quality guidelines described in the Pennsylvania Stormwater Best Management Practices Manual (BMP Manual).

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 24 hour storm events, as required by the Act 167 study.

Infiltration and Water Quality

The *Blueprints: An integrated Water Resources Plan for Lancaster County (Act 247 and 167* requires that water quality and volume control design be provided to meet standards in the PADEP BMP Manual. The Site was designed in accordance with the PADEP BMP manual.

Consistency Verification
The PCSM was prepared under the supervision of a Professional Engineer, licensed in Pennsylvania, with experience and training related to E&SC and PCSM/SR. The PCSM/SR Plans attached to this PCSM/SR Narrative demonstrates that the Site is consistent with the *Blueprints: An integrated Water Resources Plan for Lancaster County (Act 247 and 167)*.

1.5 Surface Water Classification

The PCSM/SR drawings in **Section 3 of the ESCGP-2 NOI** depict the locations of the streams and wetlands in and near the LOD for the Site. The Site area surface water runoff drains to Fishing Creek. The receiving water is designated as High Quality, Cold Water Fishery (HQ-CWF) under PA Code 25 Chapter 93. The Site's watershed is listed as impaired but not impaired by sediment and not requiring a TMDL in the **2016 Integrated Water Quality Report.**

1.6 BMP Description Narrative

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

Infiltration Basin: A infiltration basin will be utilized to infiltrate post construction stormwater runoff and provide runoff rate and volume control. The basin is comprised of two cells. Each cell will be filled during the 2 year-24 hour storm event to provide the required infiltration volume. Because the observed infiltration rates of the existing site soils exceed that recommended by the PADEP PCSM BMP Manual, the engineered soil compaction and resulting infiltration rate in both of the cells will be monitored and adjusted, as necessary, to maintain an infiltration rate between 0.50in/hr and 3.33in/hr to prevent excess drawdowns and also to prevent drawdowns longer than 72 hours.

Protect Sensitive and Special Value Features: Sensitive and special value features will be protected to reduce stormwater impacts. Construction activities will be conducted in a manner that avoids affecting and encroaching upon areas with important stormwater functions or stormwater impact sensitivities, wherever practical, so that the valuable functions are preserved. This BMP is not proposed to account for a portion of the required volume reduction credit, however it is used to comply with water quality nitrate requirements.

Landscape Restoration: Landscape restoration will be utilized to improve onsite soil conditions to provide for greater infiltration. This BMP is not proposed to account for a portion of the required volume reduction credit; however, it is used to comply with water quality nitrate requirements.

Vegetated Swale: A vegetated swale will be utilized to provide pollutant removal benefits. This BMP is not proposed to account for a portion of the required volume reduction credit; however, it is used to comply with water quality nitrate requirements.

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&E plan preparer, the PCSM plan preparer, the licensed professional responsible for oversight of critical stages of implementation of the PCSM plan, and a representative from the local conservation district to an on-site preconstruction meeting.
2. At least 3 days prior to starting any earth disturbance activities, or expanding into an area previously unmarked, the Pennsylvania One Call System Inc. shall be notified at 1-800-242-1776 for the location of existing underground utilities.
3. Hold pre-construction conference with the Permittee(s), Co-Permittee(s), Operators, Environmental Inspectors, local County Conservation District (CCD), PADEP, and licensed professionals or designees responsible for the earth disturbance activity, including implementation of the E&S and PCSM plans and critical stages of implementation of the approved PCSM plan.
4. Install orange construction fence around areas to be protected. Protected woodland areas shall be clearly delineated in the field prior to any construction activities. Protected areas should not be disturbed during construction except for temporary impacts for mitigation or restoration efforts.
5. Locate staging areas and access points including construction entrances. Field locate limits of disturbance.
6. Install rock construction entrances (RCEs).
7. Remove brush to effectively install perimeter controls as shown on the construction drawings.

8. The Compliance Manager shall provide PADEP and CCD at least three days' notice prior to bulk earth disturbance and upon completed installation of perimeter erosion controls.

9. ***Install the following BMPs:**

   9.1. Install infiltration basins, including clay core, antiseep collars, slope liners, inlet and outlet piping including inlet I-1, emergency spillway, vegetated swale and associated improvements. Excavate basin bottom to finished grades. Do not install engineered soil at this time.

   9.2. Install orange construction fence at perimeter of infiltration basin to prevent compaction of basin bottoms.

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

11. 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).

12. Rough grade Site.

13. Grade the regulator station pad and portion of access road to be reconstructed, including stone swale 1 as shown on the E&SC and PCSM/SR plans (**Sections 2 and 3 of the ESCGP-2 NOI**). Install inlet protection on inlet I-1 to prevent siltation of basin.

14. 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.

15. Establish final grade.

16. Surface stabilization, apply permanent stabilization measures including gravel pad, fertilizer, seed, mulch and erosion control blankets immediately to any disturbed areas where work has reached final grade. 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**). After seeding, fertilizing and mulching is complete, install erosion control blankets as required or ordered or on slopes of 3:1 or greater.

17. ***Upon stabilization of gravel pad, remove 18" of soil from basin bottom and install engineered soil in infiltration basin bottoms. Immediately seed and mulch. Complete infiltration testing on material after placement and hand compaction. Perform additional testing 60 days following placement. If infiltration rates are outside specified range of 0.50in/hr to 3.33in/hr, aerate or compact material as needed to adjust infiltration rate. Install silt sock at interior toe of slope to minimize siltation of basin bottoms. Install silt sock 5 and 10 upslope to protect infiltration basins from siltation.**

18. 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 of the E&SC BMPs.

19. After all upslope disturbed areas are stabilized, remove temporary inlet protection and allow flow to inlet I-1. Remove rock construction entrance. Restore existing gravel road.

20. 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.

21. Complete site stabilization in areas of BMP removal, including fertilizing, seed application, erosion control blanket and mulching.

22. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for a final inspection.

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

24. 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 a regular basis as specified by the individual operation and maintenance schedule described for each BMP after permit closure, by qualified personnel, trained and experienced in PCSM/SR, to ascertain that the BMPs are functioning and operating effectively to ensure River Road 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. Frequency of inspections will vary by BMP, as indicated, below.

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 the Permittee.

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. Infiltration Facility - Items removed during maintenance activities will be disposed of in a manner consistent with the ESCGP-2 requirements. Compaction of the basin bottom shall be prevented.
   - Annually - Inspect and correct problems, damage to vegetation, and inspect for sediment and debris accumulation, if found, remove debris and restore to design grades. Inspect grass along side slopes for erosion, rills, or gullies, & correct if observed. Mow and trim vegetation to ensure safety or to suppress weeds and invasive vegetation. Inspect for pools of standing water; if found dewater & discharge to an approved location, restore to design grade. Inspect for uniformity in cross-section & longitudinal slope, correct as needed. Inspect soil & repair settled areas to design grade, remove litter and debris.
   - Annually or after a rainfall event of 1" or more – Monitor drawdown. If drawdown exceeds 72 hours, contact design engineer to initiate corrective action.
   - As needed - Inspect outlet control devices after every major rainfall event (>1 in.) to ensure free flow. If outfall is blocked, remove debris.

2. Landscape Restoration
   - At all times – Restrict vehicle access. Assign responsibilities for watering, weeding, mowing and maintenance.
   - Annually – Inspect area for growth and potential problems. Mow, weed and reseed as needed for meadow establishment.

3. Vegetated Swale
   - As needed
     - Plant alternative grass species in the event of unsuccessful establishment
     - Reseed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming
     - Water during dry periods, fertilize and apply pesticide only when absolutely necessary
   - Annually and within 48 hours of a rainfall event of 1" or more
     - Inspect and correct erosion problems, damage to vegetation and sediment and debris accumulation
     - Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed
     - Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade
     - Mow and trim vegetation to ensure safety, aesthetics, proper swale operation or to suppress weeds and invasive vegetation; dispose of

cuttings in a local composting facility; mow only when swale is dry to avoid rutting.
    - Inspect for litter; remove prior to mowing
    - Inspect for uniformity in cross-section and longitudinal slope, correct as needed.
    - Inspect swale inlet and outlet for signs of erosion or blockage, correct as needed
- Annually-Spring
    - Inspect swale immediately after the spring melt, remove residuals (e.g. sand) and replace damaged vegetation without disturbing remaining vegetation
    - If roadside or parking lot runoff is directed in the swale, mulching and/or soil aeration/manipulation may be required in the spring to restore soil structure and moisture capacity and to reduce the impacts of deicing agents
    - Use nontoxic, organic deicing agents, applied either as blended, magnesium chloride-based liquid products or as pretreated salt.
    - Use salt-tolerant vegetation in swales

4. Protect Sensitive/Special Value Features
    - Biannually – Inspect and ensure protected areas remain undisturbed after construction activities cease.

5. Annual Records of Maintenance Procedures

The facility shall maintain a checklist whenever the BMPs are 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.

6. 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 including long term operation and maintenance requirements listed on sheets 4 and 6 of the PCSM plan drawings.

1.11 Material Recycling and Disposal

Transco has prepared a Spill Plan for Oil and Hazardous Materials to assist in prevention of any spills that may occur at the Site and to respond to any spills that do

occur. The Contractor will be required to become familiar with the Spill Plan for Oil and Hazardous Materials and its contents prior to commencing any construction-related activities. The Spill Plan for Oil and Hazardous Materials is included as **Attachment 9 to the ECP** provided as **Section 4 of the ESCGP-2 NOI**. The Spill plan will be available on-site as the Preparedness, Prevention, and Contingency (PPC) Plan.

During construction, 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. During site operation, the permittee will be responsible for the same. It is anticipated that all waste generated by maintenance of PCSM BMPs will fall into one of the following categories.

Soil, trash, debris or other materials removed from PCSM BMPs shall be removed from the site and recycled or disposed of in accordance with the department's solid waste management regulations at 25 PA. Code 260.1 et seq., 271.1, and 287.1 et seq. No wastes, unused building materials or other materials shall be burned, buried, dumped, or discharged at the site.

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 (list here): _____

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.

12 Sediment

Any sediment generated clean up and maintenance of the PCSM BMPs will be disposed of offsite at a location having the required permits and approvals to accept such materials.

1.12 Soil Conditions and Geologic Formations

There are no naturally occurring geologic formations or soils on-site that are expected to 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 or geologic formations 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.
- PCSM/SR BMPs incorporate the use of infiltration basins.
- 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.
- Site disturbance is approximately 550' from the nearest receiving water. Runoff will be through an existing conveyance channel or via overland flow through a wooded area. The combination of travel length and tree canopy is expected to negate any thermal impacts the site will have on the receiving waters.

1.14 Riparian Forest Buffer Management Plan

There are no regulated riparian buffers within the Site area.

1.15 Antidegradation Requirements

The Project is in a special protection watershed that is siltation impaired but has no TMDL identified. Therefore, the following non-discharge BMPs will be utilized prior to, during and after earth disturbance activities:

Alternative Siting/Alternative Location: The proposed location was chosen in an attempt to minimize impacts to wetland and streams and wooded areas. Within the limitations of landscape and landowner constraints, the facility was located in areas

where wetland and/or stream avoidance was possible. The Project is located along an existing pipeline and adjacent to a proposed facility of similar use. Minimal additional clearing of wooded areas is proposed for the Project. No regulated riparian buffers are impacted by the facility LOD.

Limited Disturbed Area: The limit of disturbance was minimized to the fullest extent practicable to avoid increased erosion and sediment issues. The Project will be located in an area already disturbed by the Rock Springs Expansion Project, thereby minimizing any tree removal or disturbance of established vegetation.

Limiting Extent & Duration of Disturbance: As construction progresses, completed areas will be final graded and permanently stabilized. In all areas where construction becomes inactive, temporary stabilization will occur immediately.

In addition to non-discharge BMP alternatives, ABACT BMPs are proposed for the site during construction. Use of ABACT erosion and sediment control BMPs will minimize sedimentation of the downstream receiving waters.

Post Construction Stormwater management (PCSM) BMPs are proposed to provide a post construction infiltration volume that exceeds the predeveloped infiltration volume of the site. Stormwater runoff rates will also be managed in the PCSM BMPs. Post developed runoff rates will not exceed predeveloped runoff rates. Post construction runoff will be via overland flow or over energy dissipating rip rap aprons to prevent physical degradation of the receiving waters.

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.

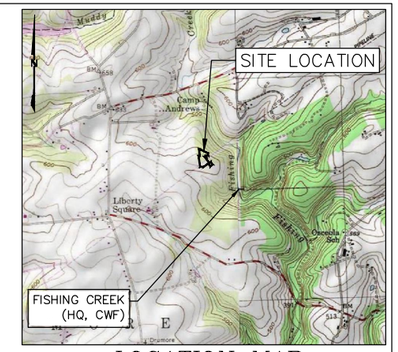
APPENDICES

Appendix A	River Road 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

River Road Regulator Station Supporting Calculations

A.1 Pre-Development Calculations



LOCATION MAP

USGS HOLTWOOD 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
- SPOT ELEVATION
- TREE OR BUSH
- UTILITY POLE AND UTILITY LINE
- GUY POLE
- GUY POLE OR ANCHOR
- POST
- SIGN
- WATER WELL
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- MONUMENT (PROPERTY BOUNDARY MARKER)
- IRON PIPE OR PIN (PROPERTY BOUNDARY MARKER)
- WsB — SOIL TYPE DESIGNATION
- ESCGP2 — ESCGP-2 PERMIT BOUNDARY
- LOD — LIMIT OF DISTURBANCE (RIVER ROAD REGULATOR STATION)
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- EXISTING ROAD
- ROW
- DRAINAGE AREA BOUNDARIES/DRAINAGE STUDY AREA
- TIME OF CONCENTRATION FLOW PATH

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

Drawing Location & Name: G:\JOBS\14\14C\14C4909\DWG\020-CPLS\FRS_PCSM14C4909(20S)_RIVER.dwg

ALARIC J. BUSHER REG NO. PE 60320

BL Companies — ARCHITECTURE, ENGINEERING, ENVIRONMENTAL, GIS, SURVEYING

REVISIONS						
NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP SUBMITTAL	W01161509	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161509	AJB	AJB
5	April 2017	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #2	W01161509	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 42" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS
FOR RIVER ROAD REGULATOR STATION
DRUMORE TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA
PRE–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: (92–3400)VF–1A–9	SHEET 1 OF 1
W.O:	1161509				

Summary for Subcatchment 3S: Study Area Predevelopment

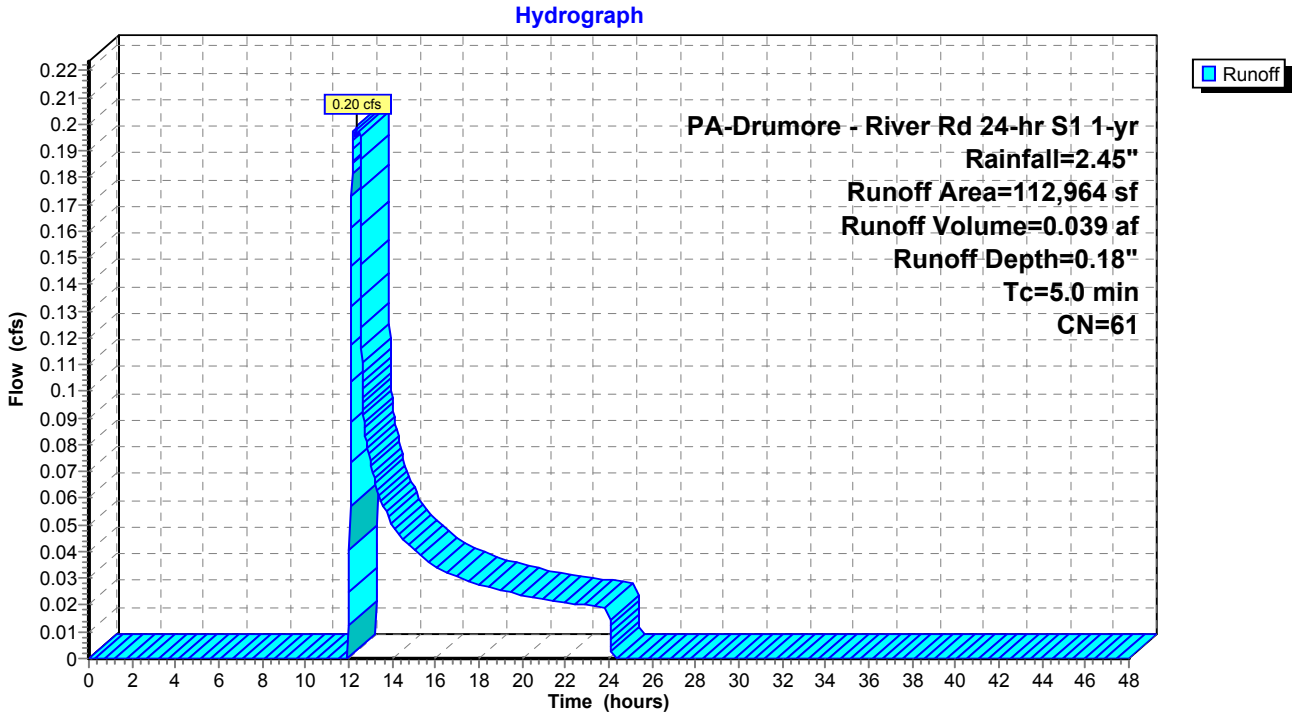
Runoff = 0.20 cfs @ 12.34 hrs, Volume= 0.039 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 1-yr Rainfall=2.45"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

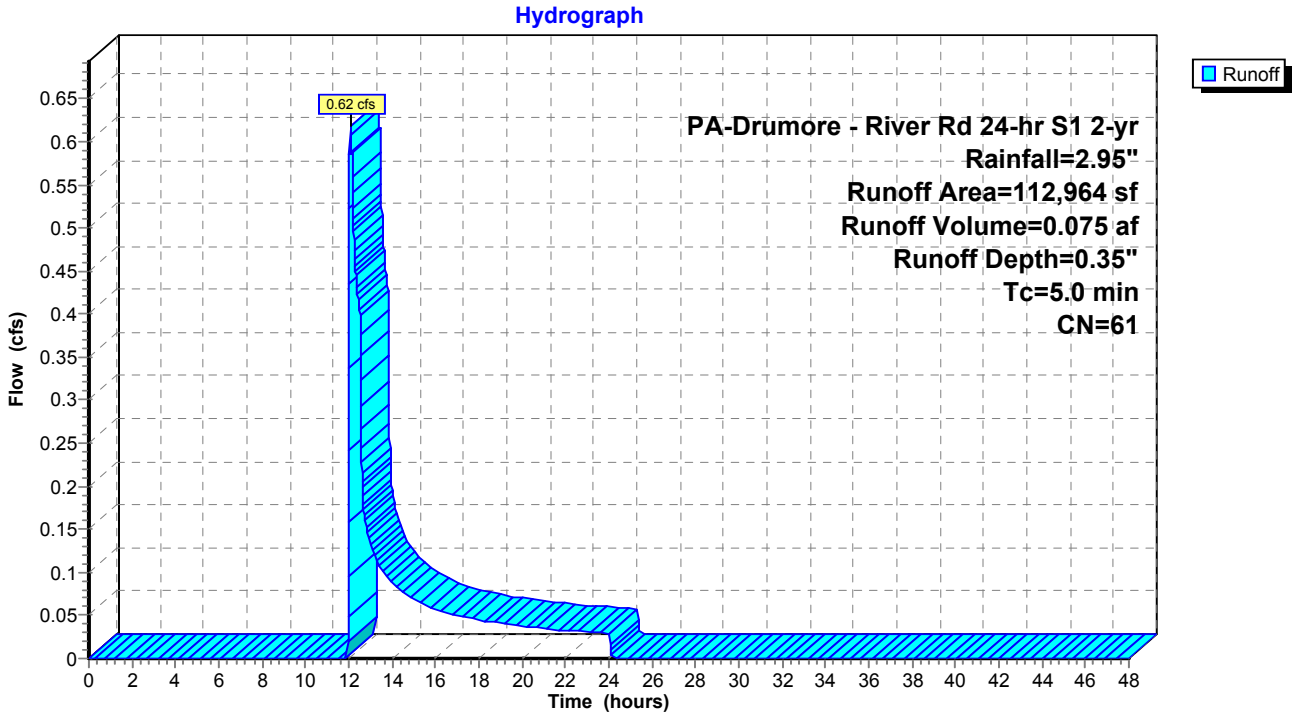
Runoff = 0.62 cfs @ 12.06 hrs, Volume= 0.075 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 2-yr Rainfall=2.95"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

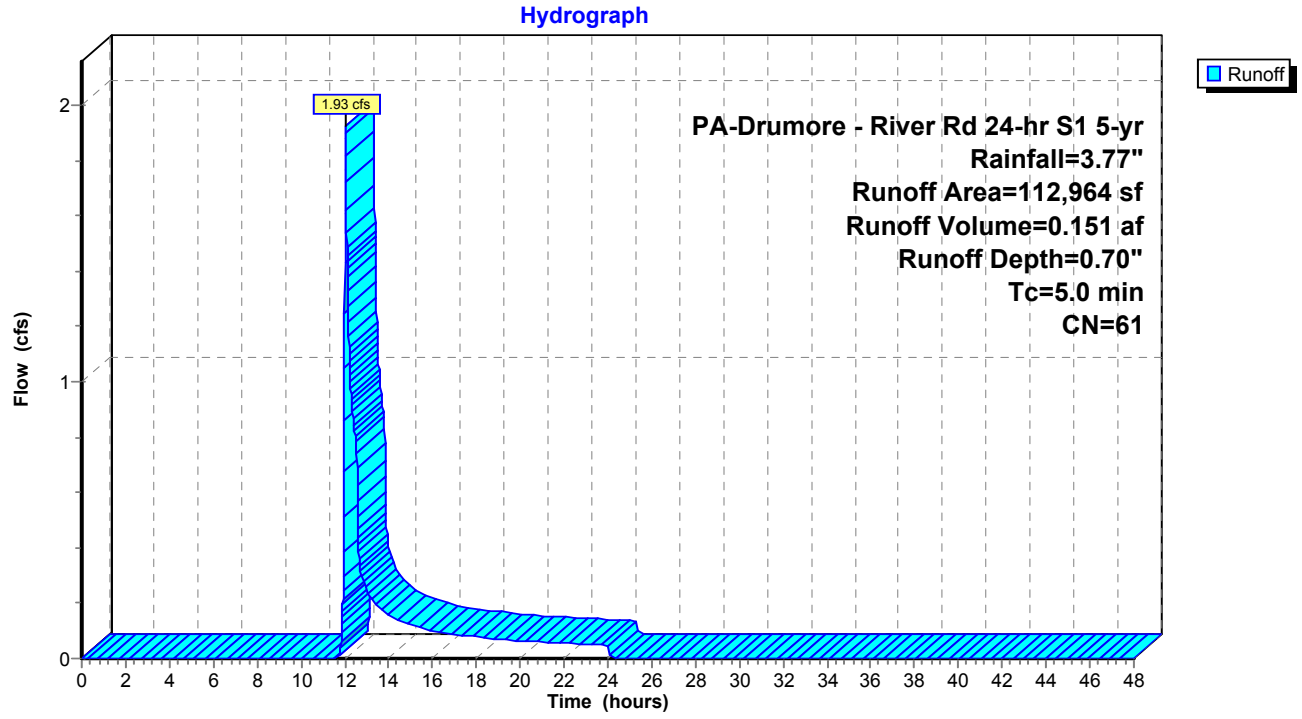
Runoff = 1.93 cfs @ 12.04 hrs, Volume= 0.151 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 5-yr Rainfall=3.77"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

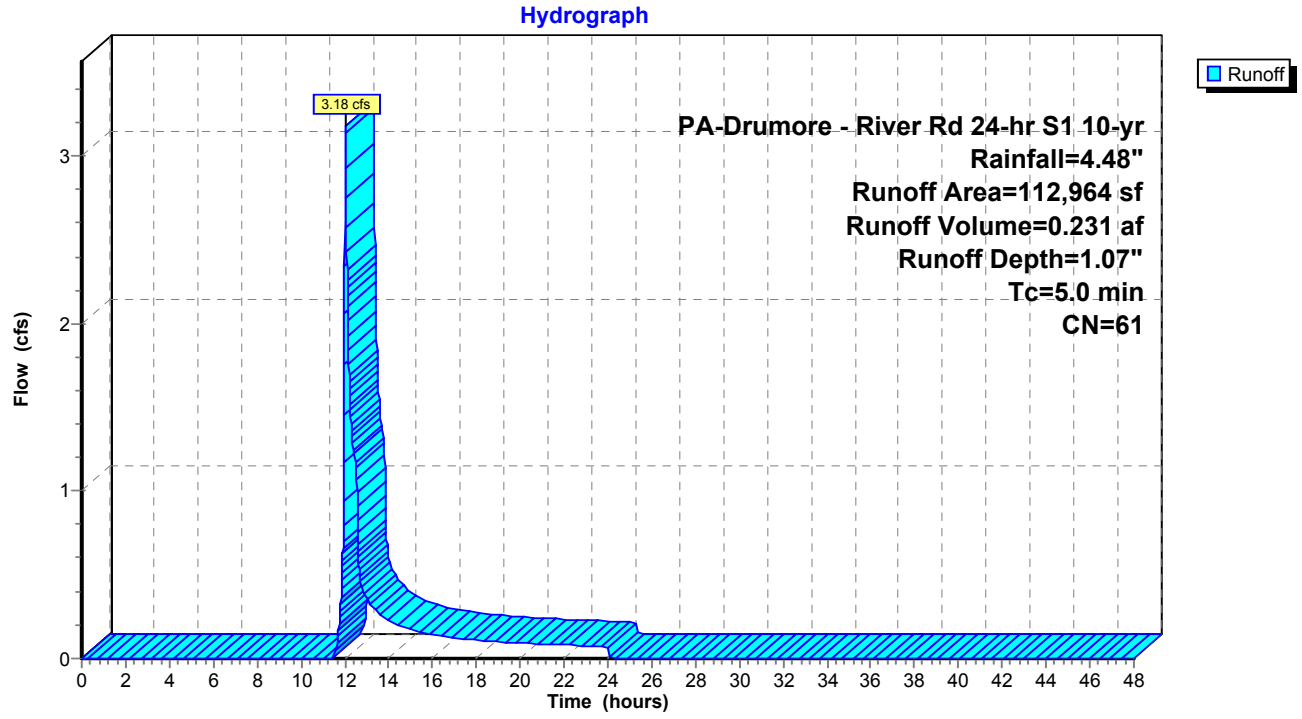
Runoff = 3.18 cfs @ 12.04 hrs, Volume= 0.231 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 10-yr Rainfall=4.48"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

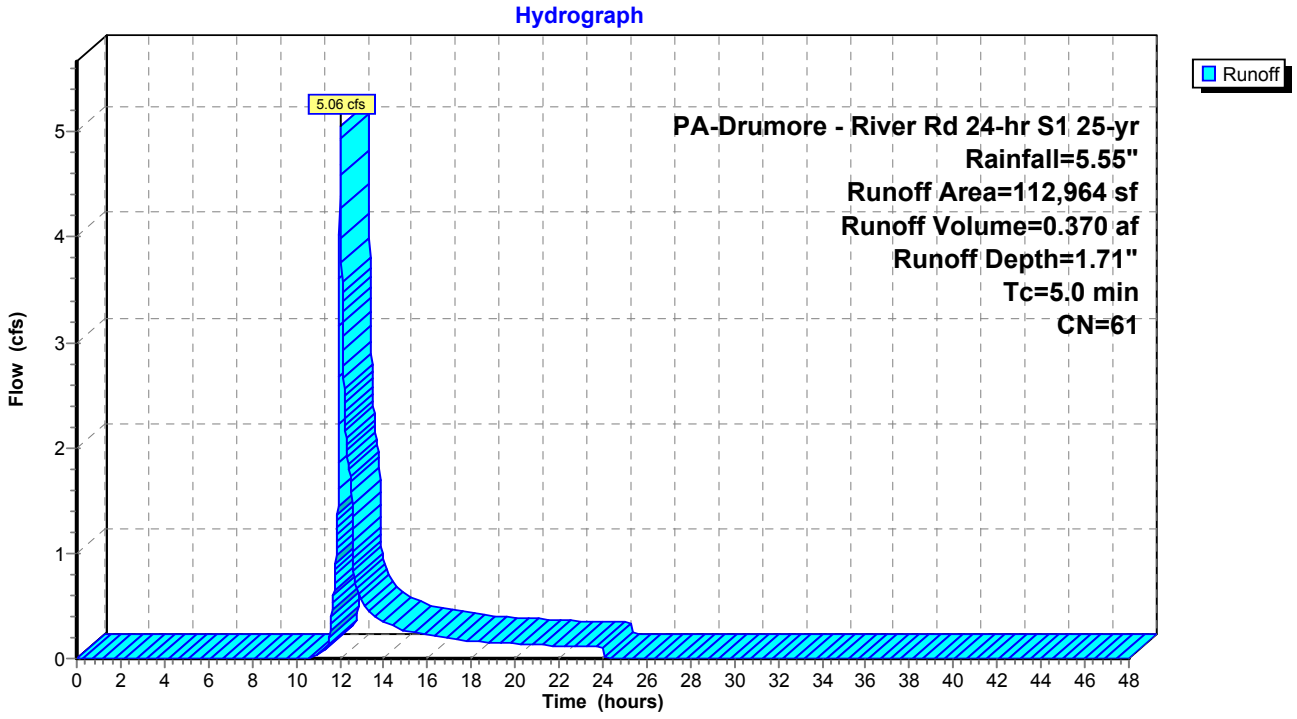
Runoff = 5.06 cfs @ 12.03 hrs, Volume= 0.370 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 25-yr Rainfall=5.55"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

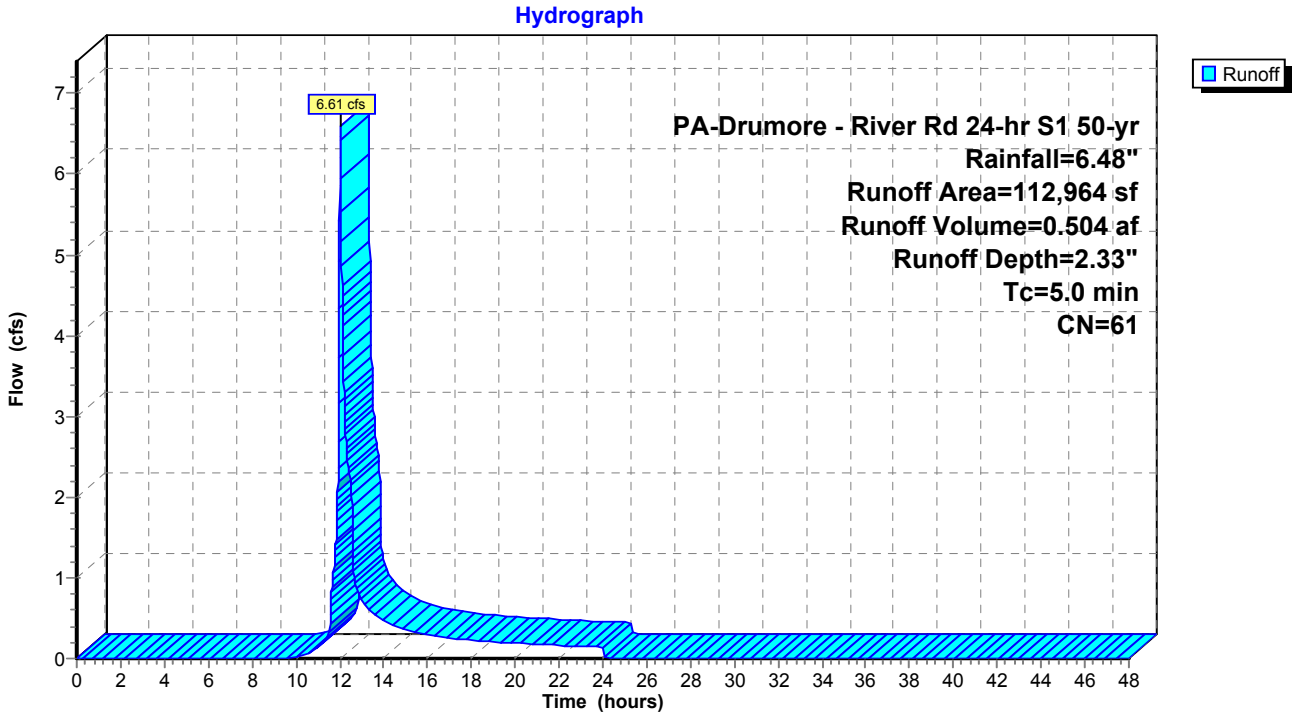
Runoff = 6.61 cfs @ 12.03 hrs, Volume= 0.504 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 50-yr Rainfall=6.48"

	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



Summary for Subcatchment 3S: Study Area Predevelopment

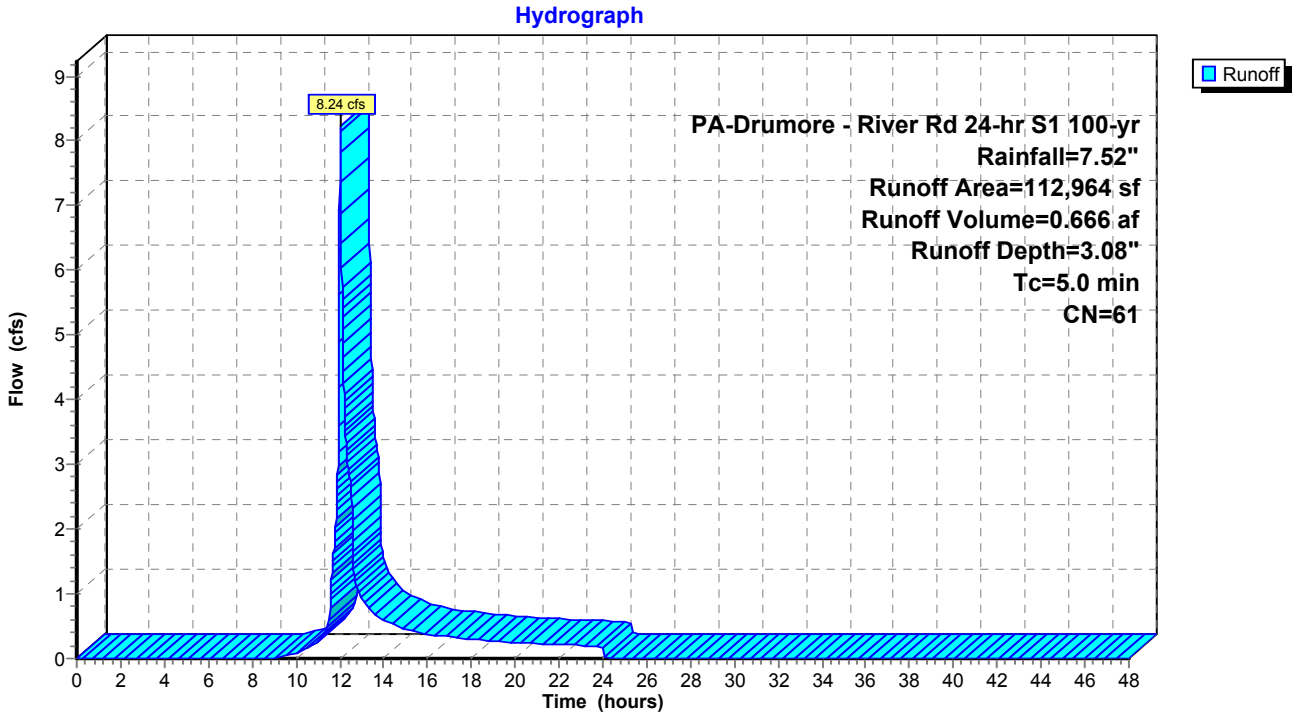
Runoff = 8.24 cfs @ 12.03 hrs, Volume= 0.666 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 100-yr Rainfall=7.52"

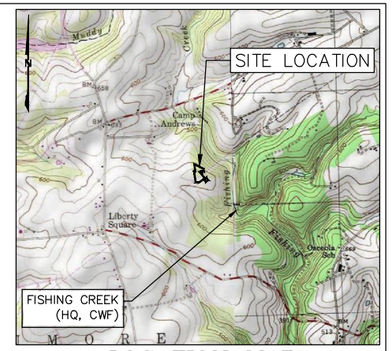
	Area (sf)	CN	Description
	77,882	58	Meadow, non-grazed, HSG B
*	4,467	89	Gravel roads, HSG B
	30,615	66	Woods, Poor, HSG B
	112,964	61	Weighted Average
	112,964		100.00% Pervious Area

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

Subcatchment 3S: Study Area Predevelopment



A.2 Post Development Calculations



LOCATION MAP

USGS HOLTWOOD 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
- 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 (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- LOD — LIMIT OF DISTURBANCE (RIVER ROAD REGULATOR STATION)
- ESCGP-2 — ESCGP-2 PERMIT BOUNDARY
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- DRAINAGE AREA BOUNDARIES/DRAINAGE STUDY AREA
- TIME OF CONCENTRATION FLOW PATH

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

COMMONWEALTH OF PENNSYLVANIA — ALARIC JAMES BUSHER

ALARIC J. BUSHER REG NO. PE 60320

BLE Companies — ARCHITECTURE ENGINEERING ENVIRONMENTAL LAND SURVEYING

REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP SUBMITTAL	W01161509	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	AJB	AJB
4	Oct. 2016	BL	PADEP TECHNICAL DEFICIENCY RESPONSE #1	W01161509	AJB	AJB

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 42" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS
FOR RIVER ROAD REGULATOR STATION
DRUMORE TOWNSHIP, LANCASTER 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: 4
APPROVED BY:	AJB	DATE:	07/17/15	DRAWING NUMBER: (92–3400)VF–1A–9	SHEET 1 OF 1
W.O.	1161509				

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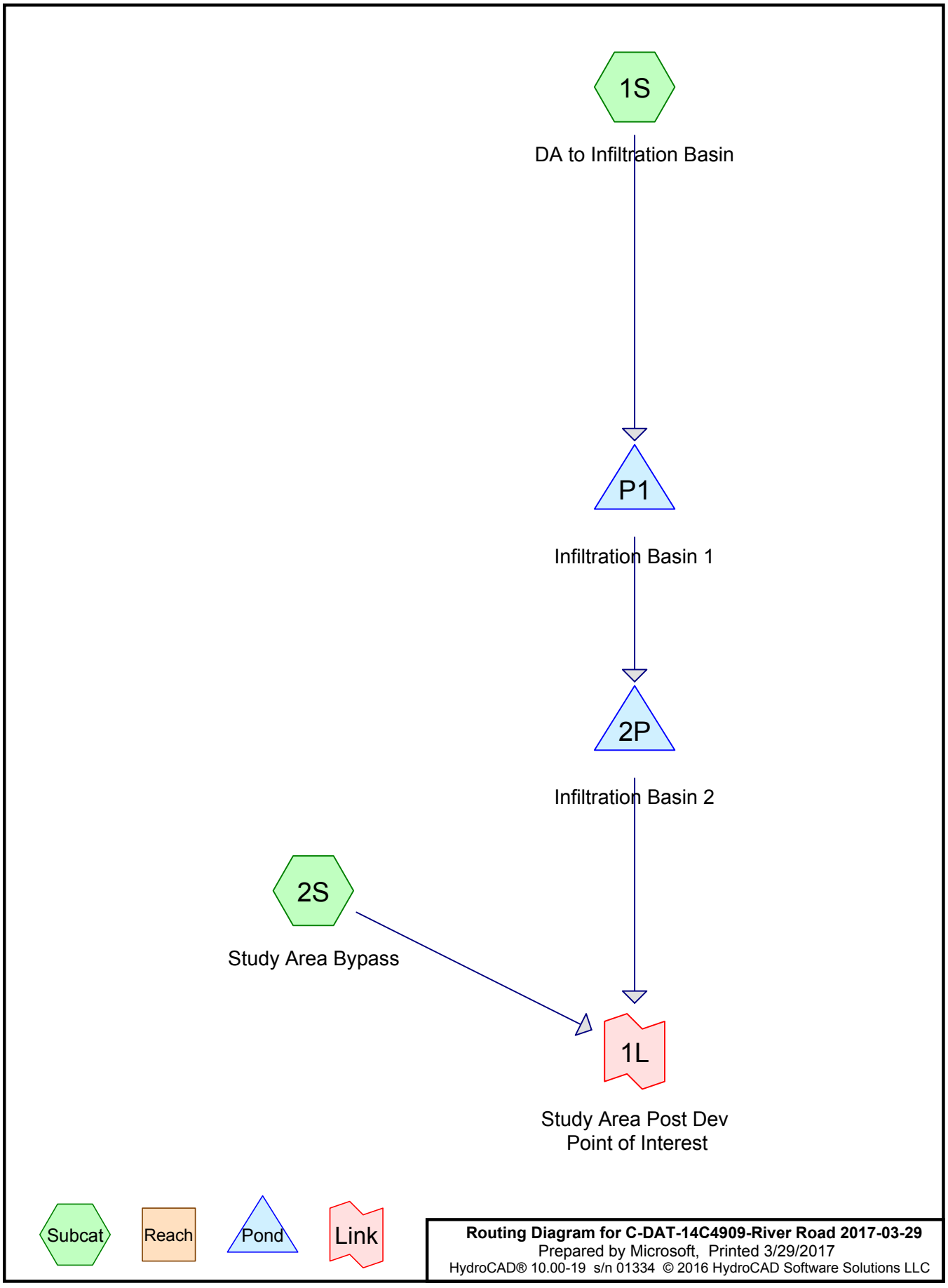


Routing Diagram for C-DAT-14C4909-River Road 2017-03-29
Prepared by Microsoft, Printed 3/29/2017

Summary for Subcatchment 1S: DA to Infiltration Basin

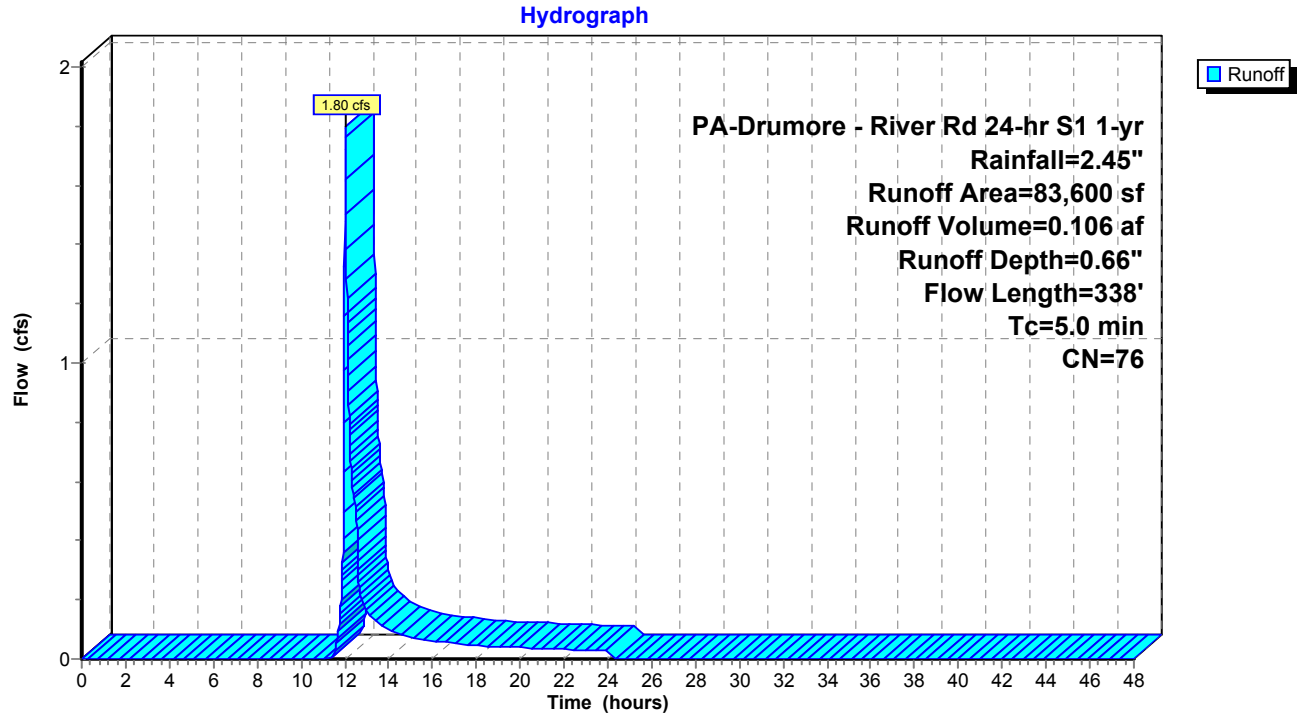
Runoff = 1.80 cfs @ 12.04 hrs, Volume= 0.106 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 1-yr Rainfall=2.45"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

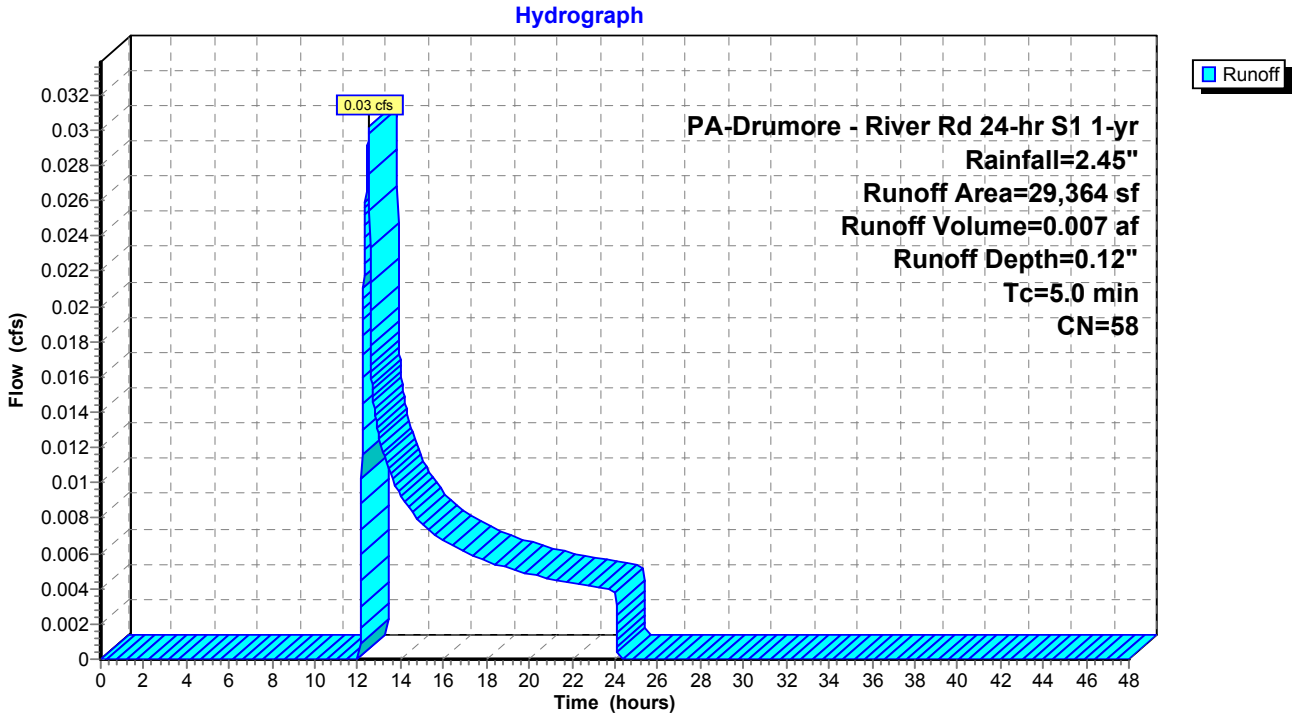
Runoff = 0.03 cfs @ 12.52 hrs, Volume= 0.007 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 1-yr Rainfall=2.45"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 0.09" for 1-yr event
Inflow = 0.40 cfs @ 12.53 hrs, Volume= 0.015 af
Outflow = 0.05 cfs @ 13.51 hrs, Volume= 0.015 af, Atten= 88%, Lag= 58.5 min
Discarded = 0.05 cfs @ 13.51 hrs, Volume= 0.015 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 596.09' @ 13.51 hrs Surf.Area= 4,081 sf Storage= 354 cf

Plug-Flow detention time= 80.7 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 80.7 min (858.5 - 777.8)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

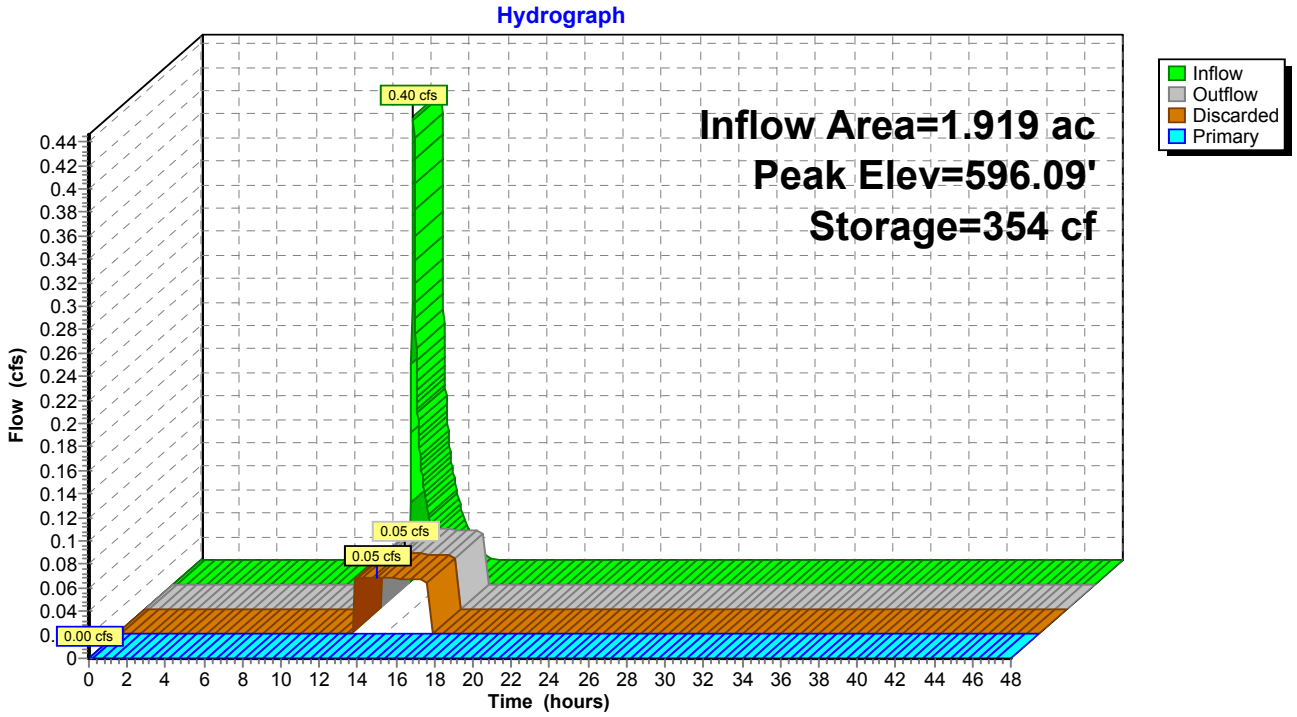
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.05 cfs @ 13.51 hrs HW=596.09' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=596.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 0.66" for 1-yr event
Inflow = 1.80 cfs @ 12.04 hrs, Volume= 0.106 af
Outflow = 0.48 cfs @ 12.53 hrs, Volume= 0.106 af, Atten= 74%, Lag= 30.0 min
Discarded = 0.08 cfs @ 12.53 hrs, Volume= 0.092 af
Primary = 0.40 cfs @ 12.53 hrs, Volume= 0.015 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.26' @ 12.53 hrs Surf.Area= 6,727 sf Storage= 1,727 cf

Plug-Flow detention time= 211.9 min calculated for 0.106 af (100% of inflow)
Center-of-Mass det. time= 211.9 min (1,084.3 - 872.4)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

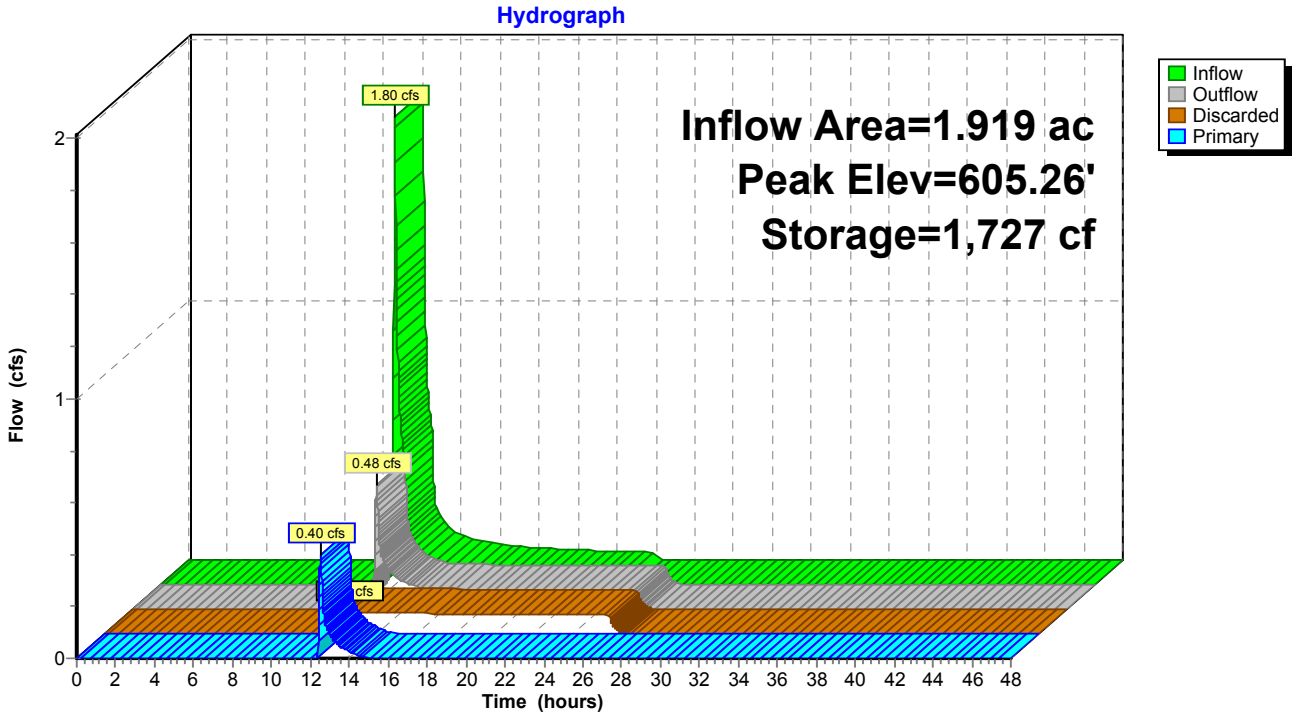
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.53 hrs HW=605.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.40 cfs @ 12.53 hrs HW=605.26' TW=596.03' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.40 cfs @ 0.27 fps)

Pond P1: Infiltration Basin 1

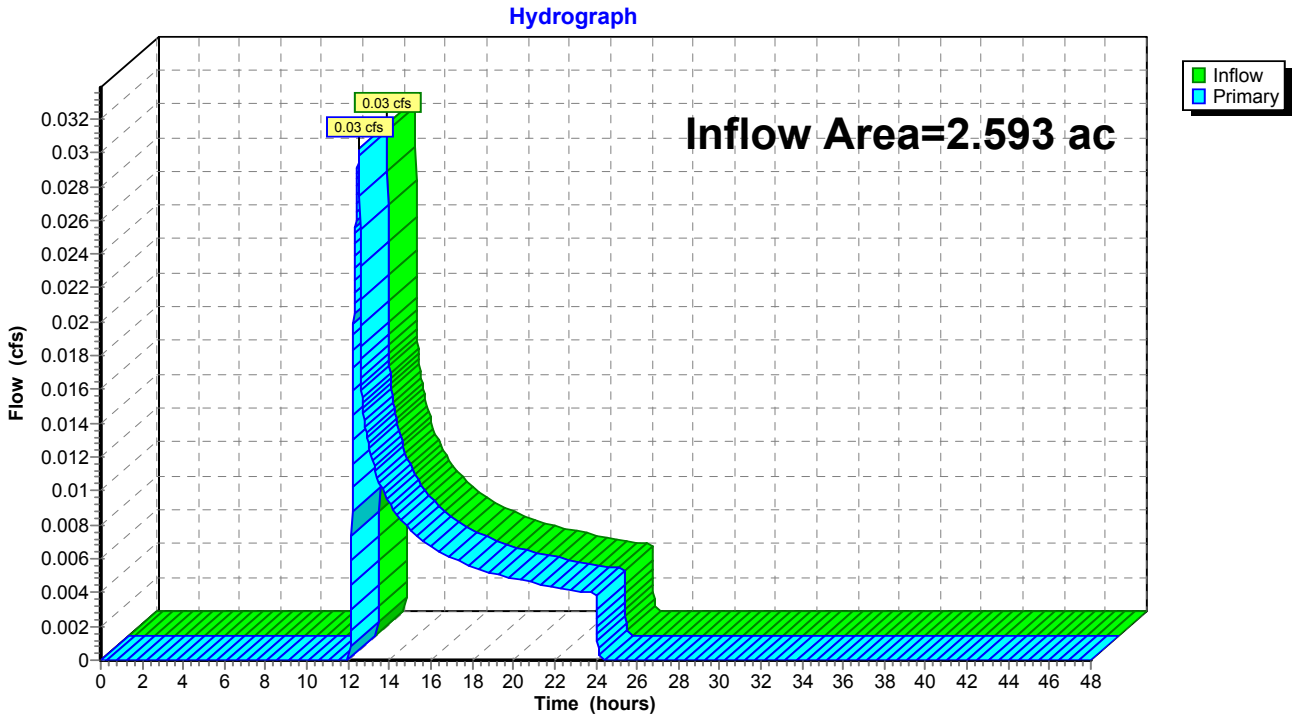


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 0.03" for 1-yr event
Inflow = 0.03 cfs @ 12.52 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 12.52 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

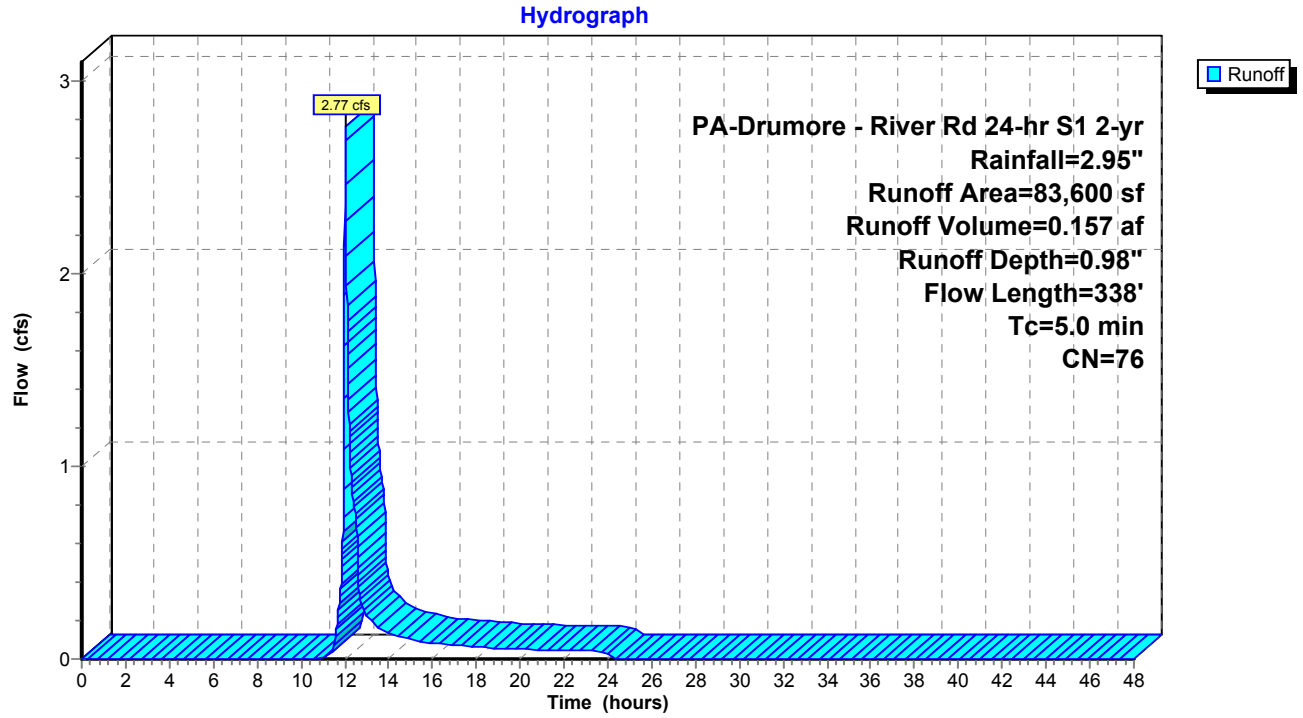
Runoff = 2.77 cfs @ 12.03 hrs, Volume= 0.157 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 2-yr Rainfall=2.95"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

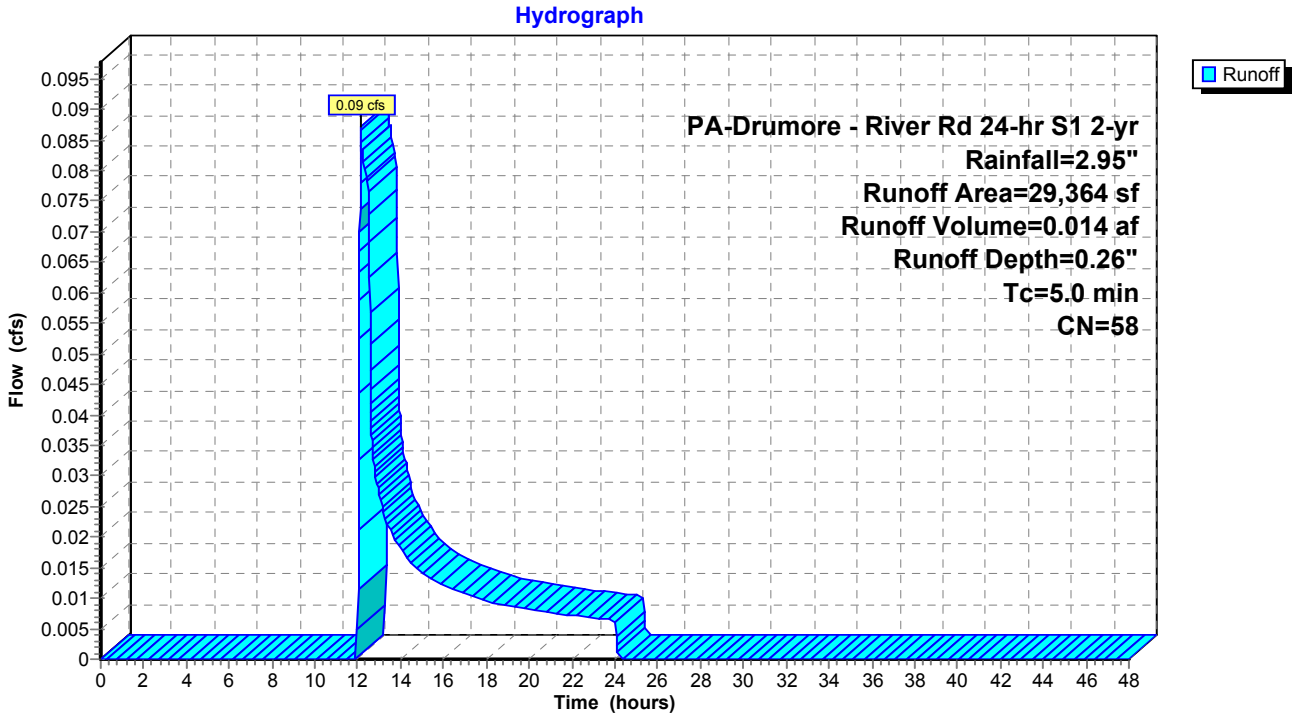
Runoff = 0.09 cfs @ 12.15 hrs, Volume= 0.014 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 2-yr Rainfall=2.95"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 0.34" for 2-yr event
Inflow = 1.19 cfs @ 12.18 hrs, Volume= 0.054 af
Outflow = 0.05 cfs @ 14.25 hrs, Volume= 0.054 af, Atten= 96%, Lag= 123.8 min
Discarded = 0.05 cfs @ 14.25 hrs, Volume= 0.054 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 596.43' @ 14.25 hrs Surf.Area= 4,418 sf Storage= 1,788 cf

Plug-Flow detention time= 351.3 min calculated for 0.054 af (100% of inflow)
Center-of-Mass det. time= 351.4 min (1,119.2 - 767.7)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

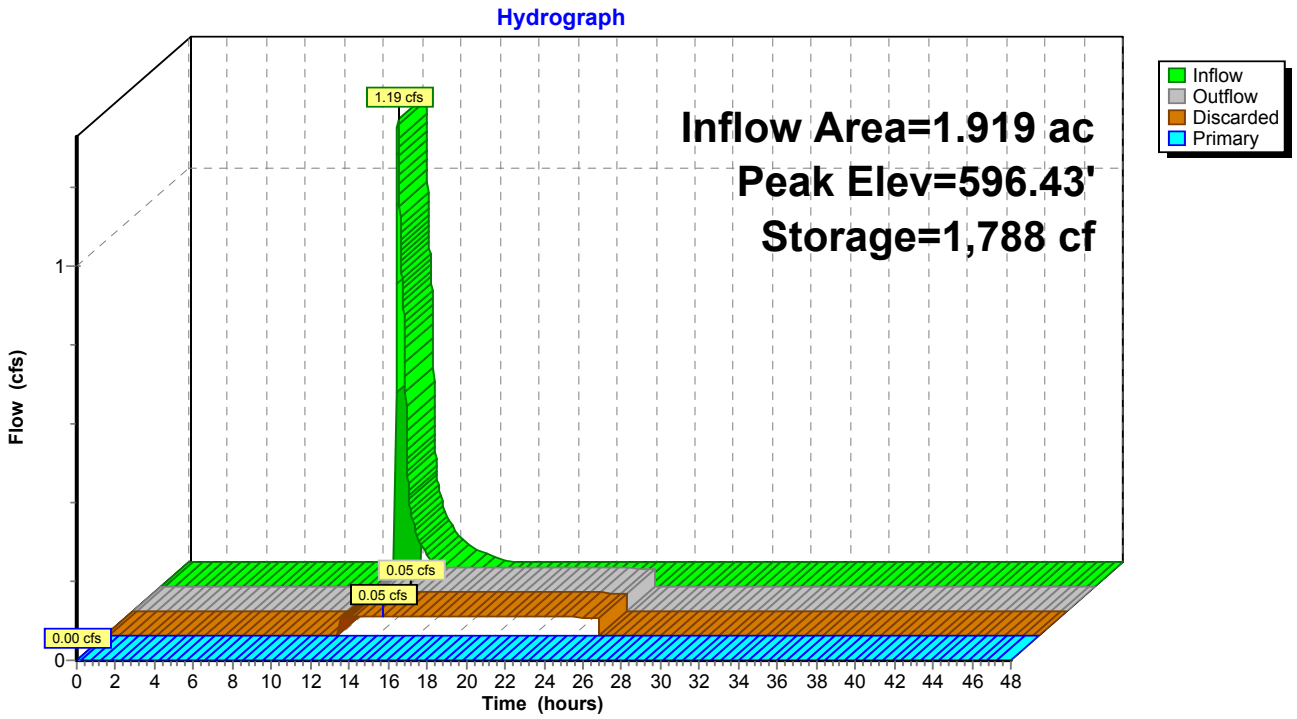
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.05 cfs @ 14.25 hrs HW=596.43' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=596.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 0.98" for 2-yr event
Inflow = 2.77 cfs @ 12.03 hrs, Volume= 0.157 af
Outflow = 1.27 cfs @ 12.18 hrs, Volume= 0.157 af, Atten= 54%, Lag= 9.0 min
Discarded = 0.08 cfs @ 12.18 hrs, Volume= 0.103 af
Primary = 1.19 cfs @ 12.18 hrs, Volume= 0.054 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.28' @ 12.18 hrs Surf.Area= 6,741 sf Storage= 1,816 cf

Plug-Flow detention time= 174.8 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 174.8 min (1,033.6 - 858.8)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

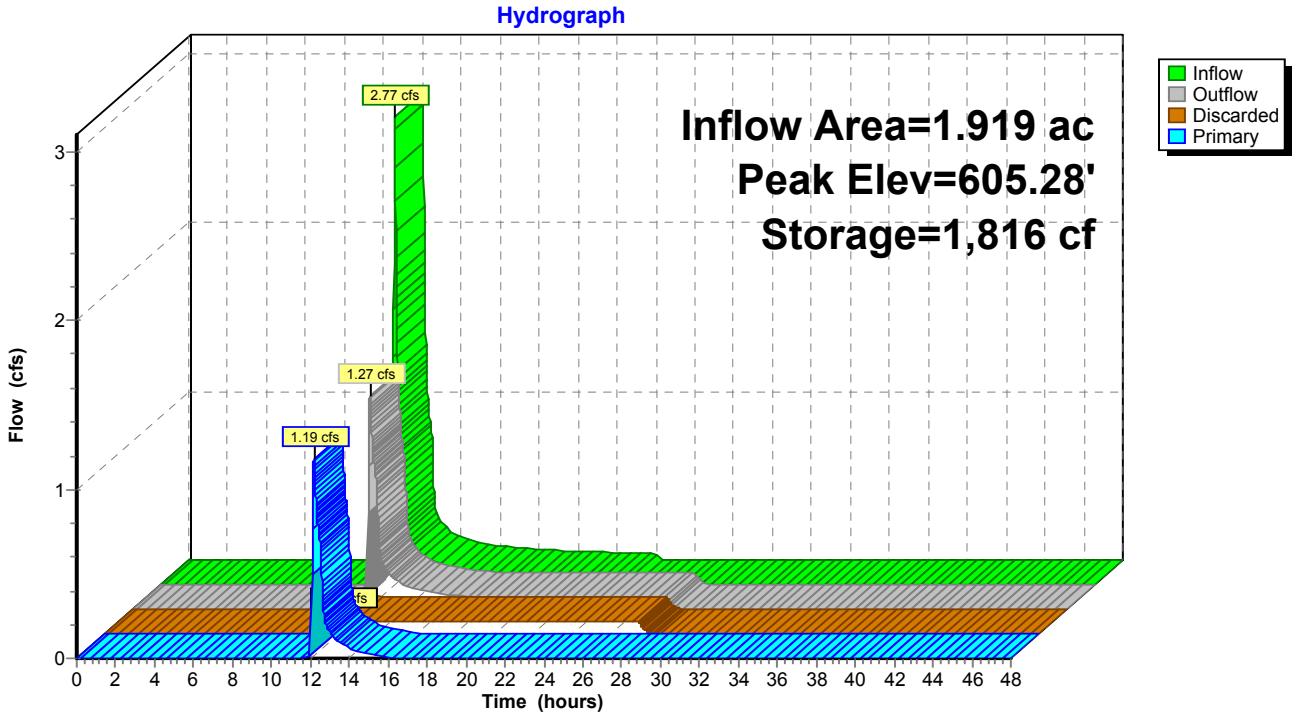
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.18 hrs HW=605.28' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=1.19 cfs @ 12.18 hrs HW=605.28' TW=596.05' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.19 cfs @ 0.39 fps)

Pond P1: Infiltration Basin 1

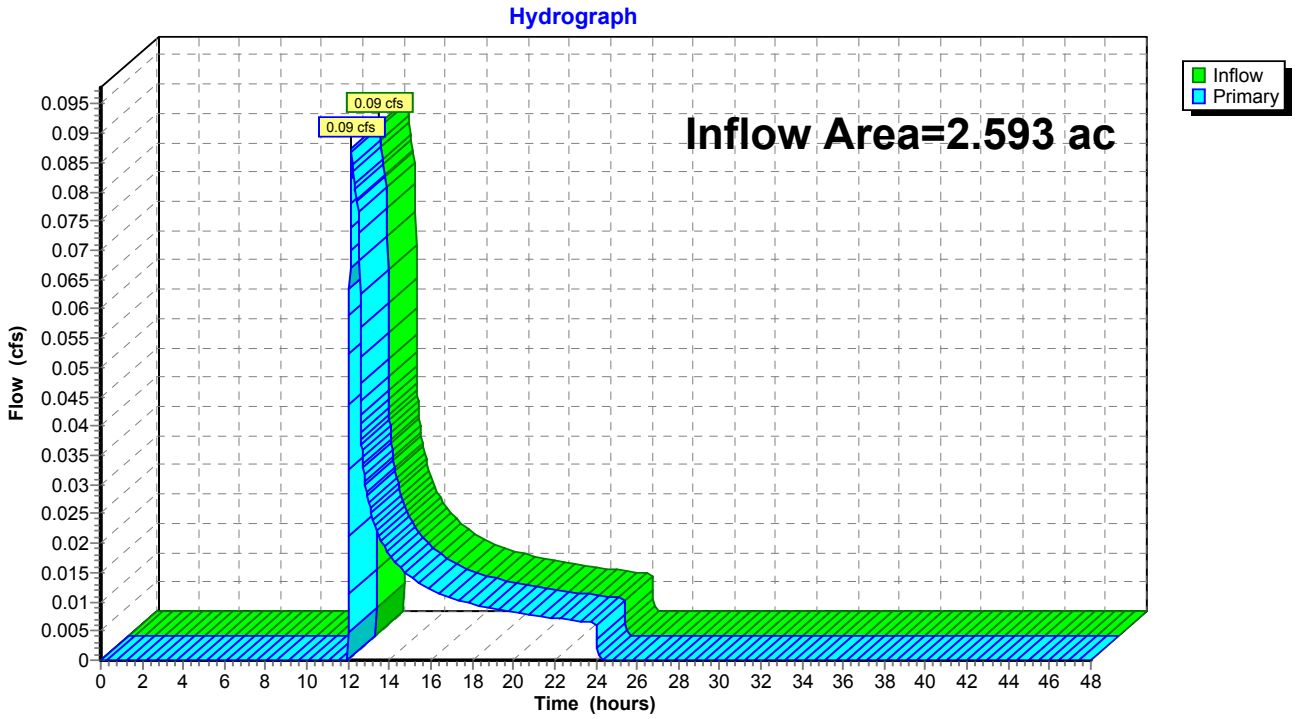


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 0.07" for 2-yr event
Inflow = 0.09 cfs @ 12.15 hrs, Volume= 0.014 af
Primary = 0.09 cfs @ 12.15 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

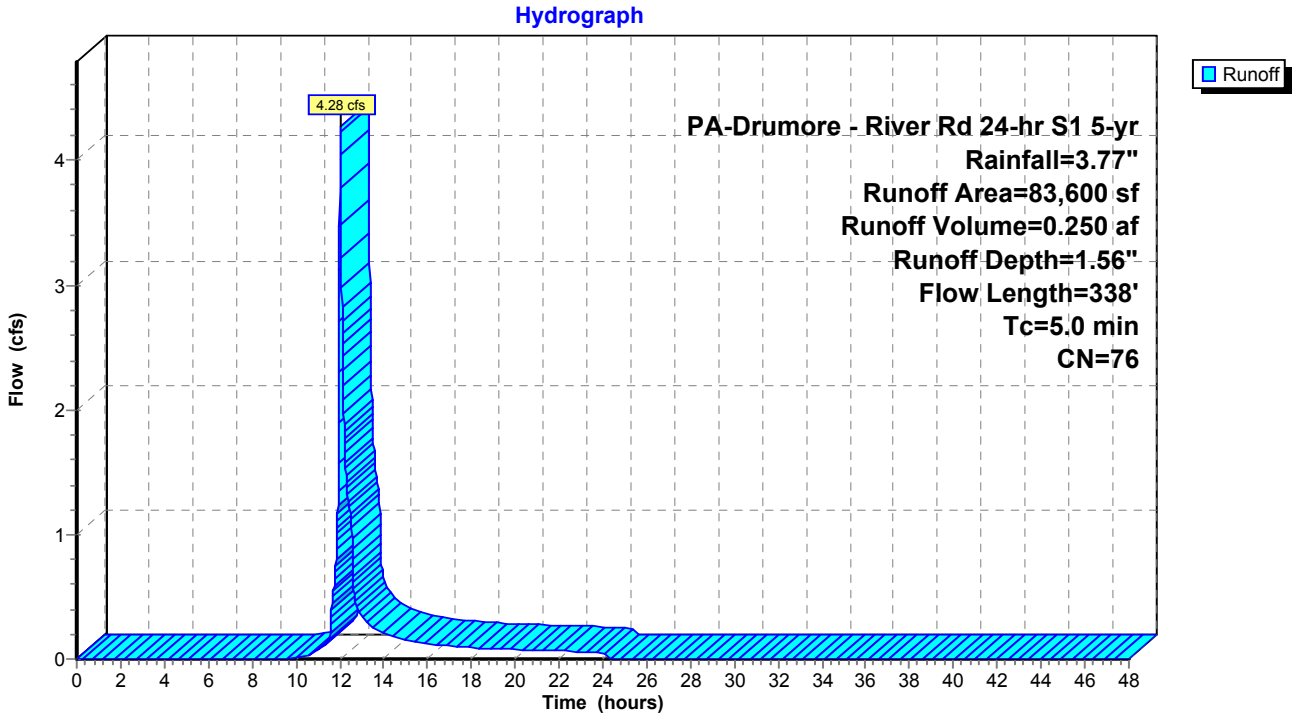
Runoff = 4.28 cfs @ 12.03 hrs, Volume= 0.250 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 5-yr Rainfall=3.77"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

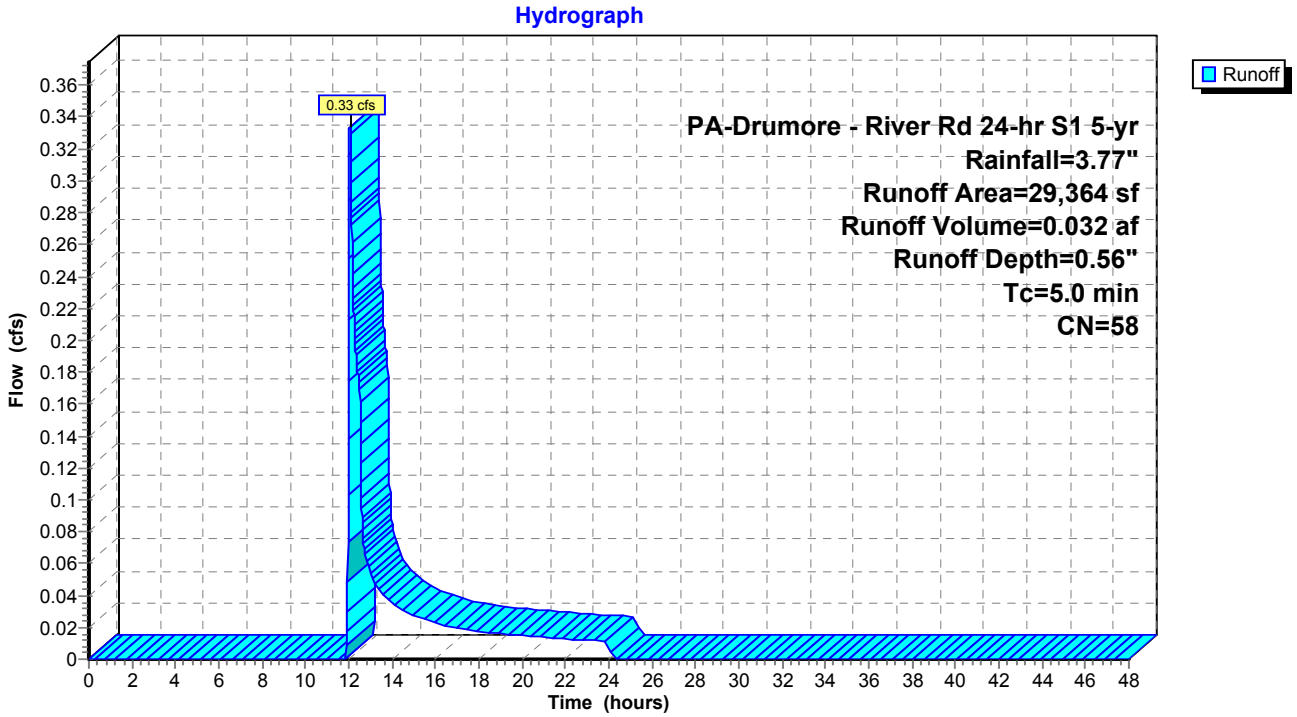
Runoff = 0.33 cfs @ 12.05 hrs, Volume= 0.032 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 5-yr Rainfall=3.77"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 0.82" for 5-yr event
Inflow = 3.61 cfs @ 12.06 hrs, Volume= 0.131 af
Outflow = 0.06 cfs @ 15.49 hrs, Volume= 0.131 af, Atten= 98%, Lag= 205.3 min
Discarded = 0.06 cfs @ 15.49 hrs, Volume= 0.131 af
Primary = 0.00 cfs @ 15.49 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 597.02' @ 15.49 hrs Surf.Area= 5,047 sf Storage= 4,620 cf

Plug-Flow detention time= 801.4 min calculated for 0.131 af (100% of inflow)
Center-of-Mass det. time= 801.5 min (1,578.0 - 776.5)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

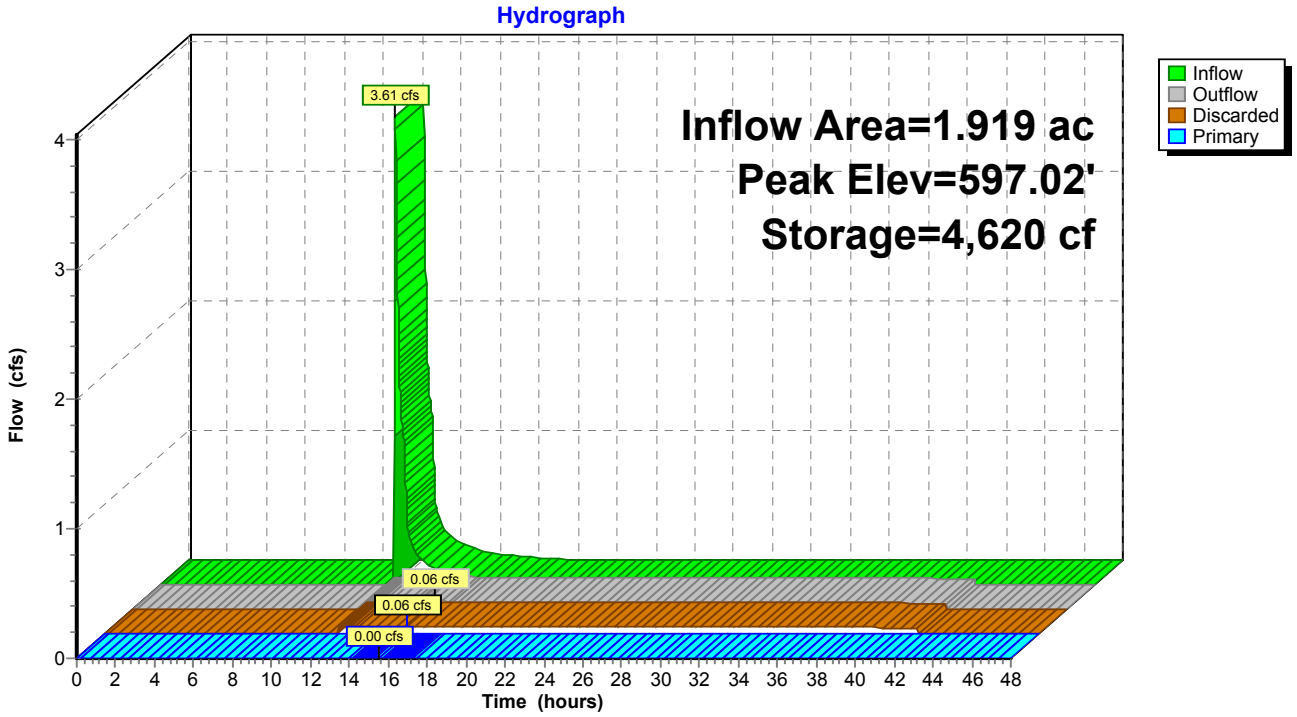
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.06 cfs @ 15.49 hrs HW=597.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 15.49 hrs HW=597.02' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.00 cfs @ 0.53 fps)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 1.56" for 5-yr event
Inflow = 4.28 cfs @ 12.03 hrs, Volume= 0.250 af
Outflow = 3.68 cfs @ 12.06 hrs, Volume= 0.250 af, Atten= 14%, Lag= 2.0 min
Discarded = 0.08 cfs @ 12.06 hrs, Volume= 0.119 af
Primary = 3.61 cfs @ 12.06 hrs, Volume= 0.131 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.30' @ 12.06 hrs Surf.Area= 6,772 sf Storage= 2,004 cf

Plug-Flow detention time= 132.9 min calculated for 0.250 af (100% of inflow)
Center-of-Mass det. time= 133.0 min (980.3 - 847.3)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

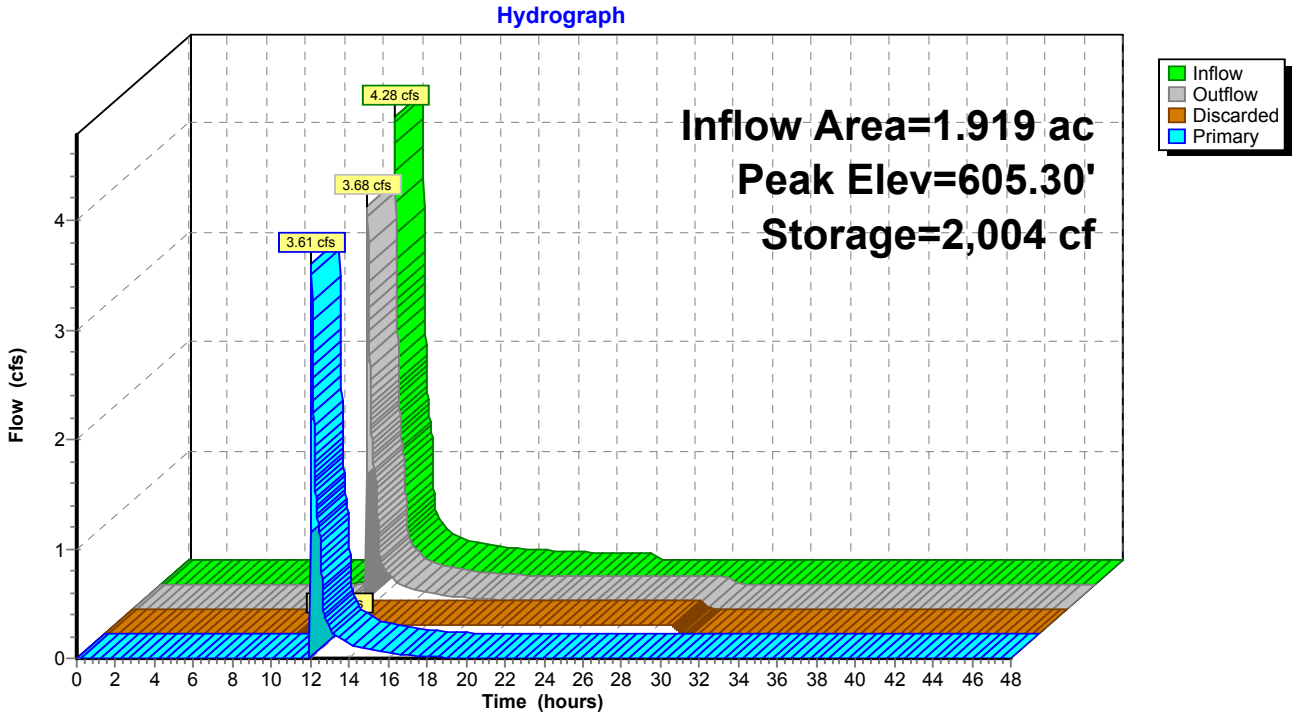
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.06 hrs HW=605.30' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=3.58 cfs @ 12.06 hrs HW=605.30' TW=596.11' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.58 cfs @ 0.56 fps)

Pond P1: Infiltration Basin 1

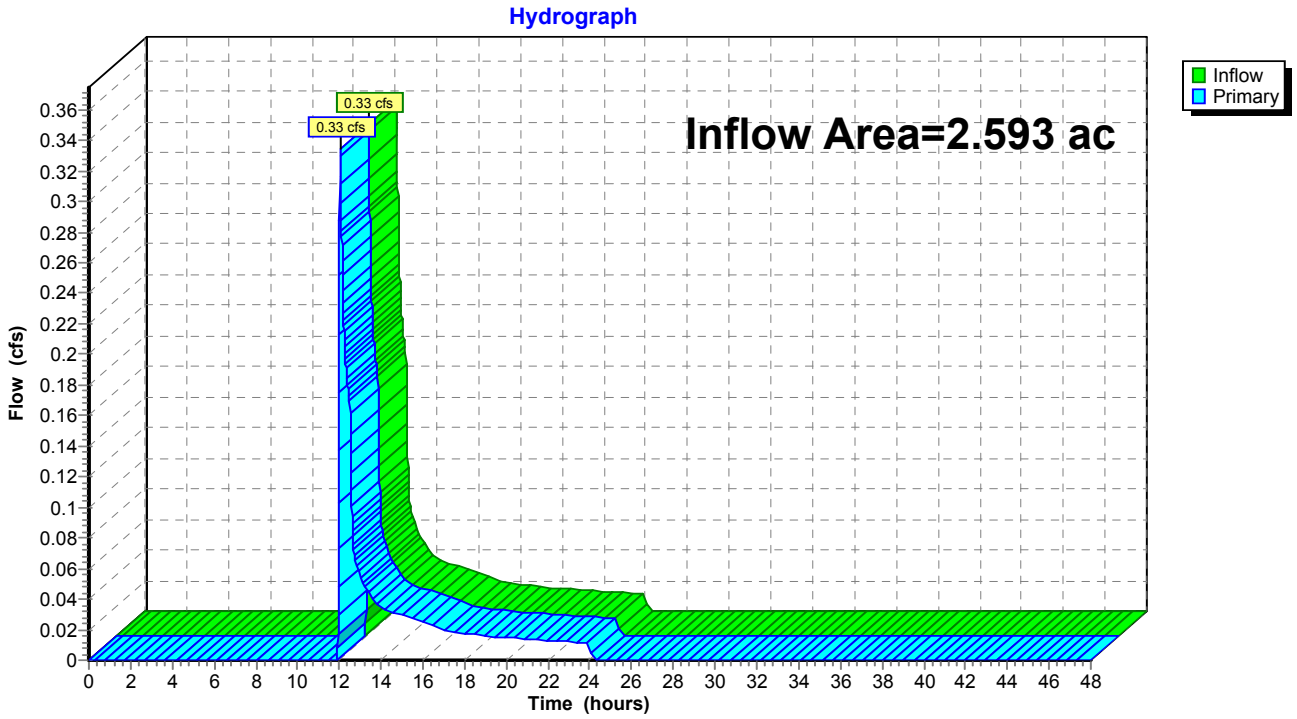


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 0.15" for 5-yr event
Inflow = 0.33 cfs @ 12.05 hrs, Volume= 0.032 af
Primary = 0.33 cfs @ 12.05 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

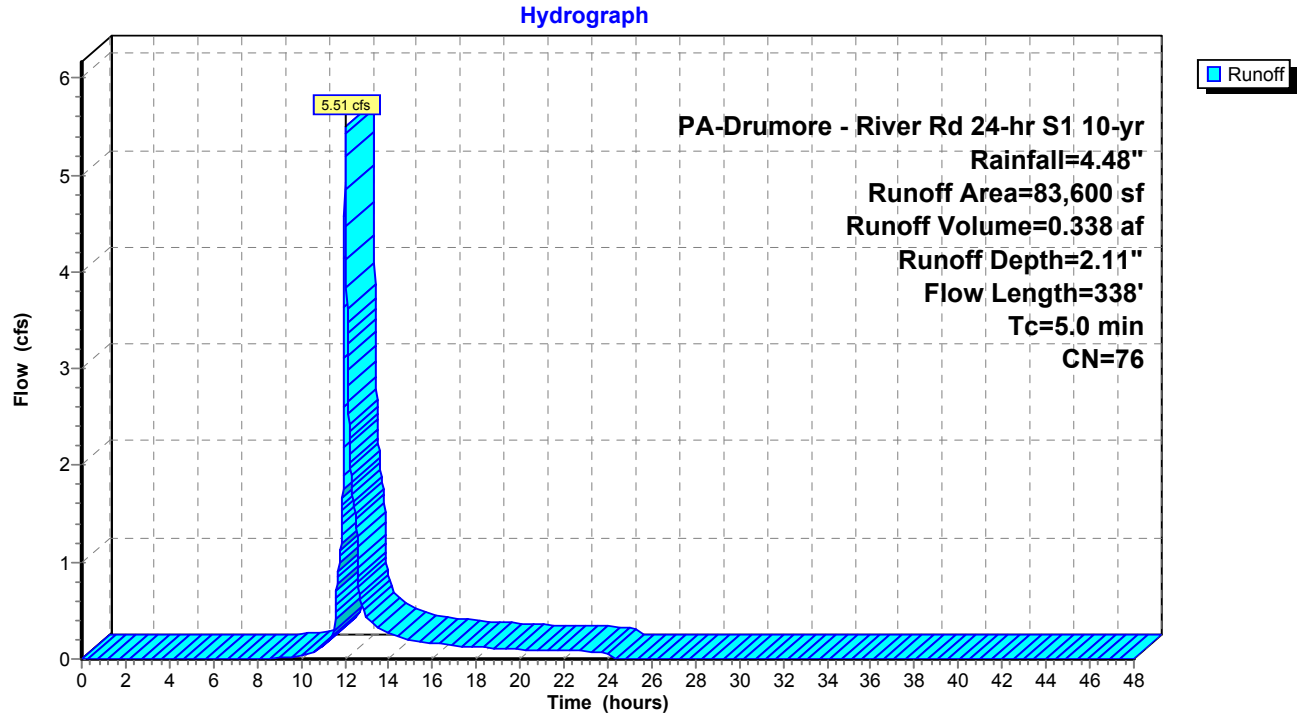
Runoff = 5.51 cfs @ 12.03 hrs, Volume= 0.338 af, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 10-yr Rainfall=4.48"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

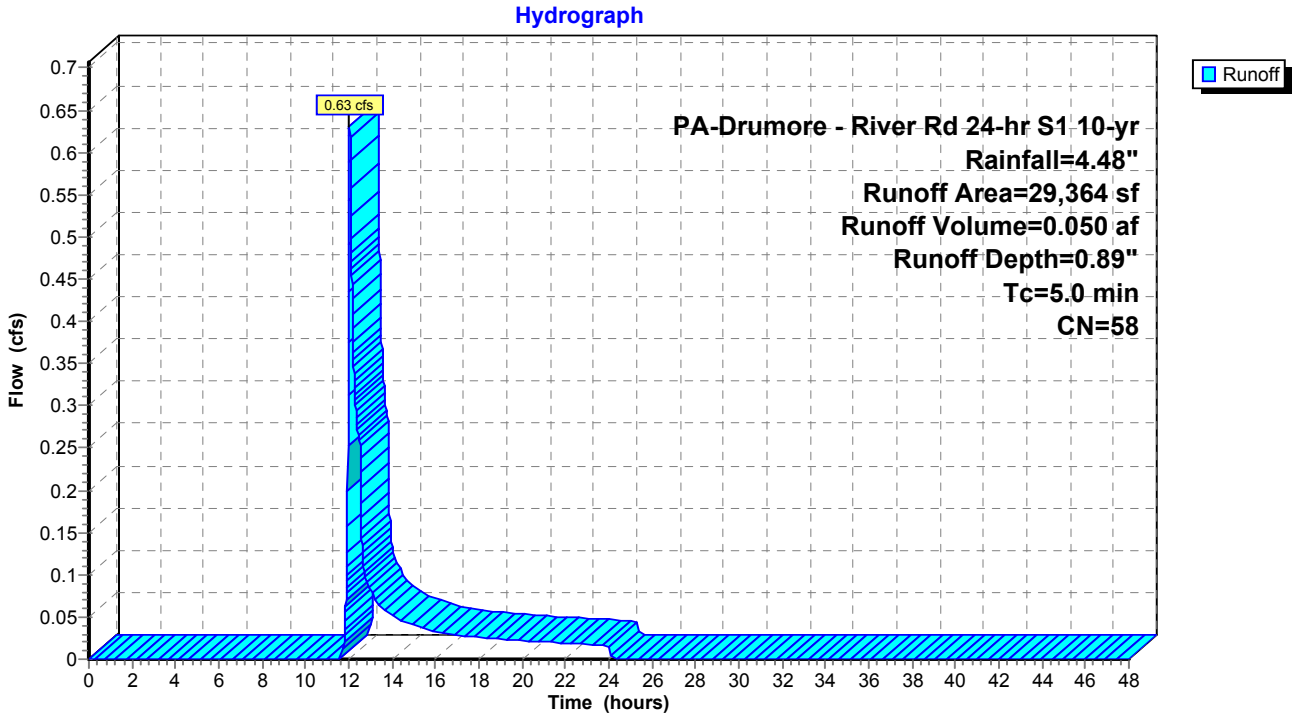
Runoff = 0.63 cfs @ 12.04 hrs, Volume= 0.050 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 10-yr Rainfall=4.48"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 1.32" for 10-yr event
Inflow = 5.23 cfs @ 12.05 hrs, Volume= 0.211 af
Outflow = 0.36 cfs @ 13.04 hrs, Volume= 0.211 af, Atten= 93%, Lag= 59.6 min
Discarded = 0.06 cfs @ 13.04 hrs, Volume= 0.148 af
Primary = 0.30 cfs @ 13.04 hrs, Volume= 0.063 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 597.24' @ 13.04 hrs Surf.Area= 5,272 sf Storage= 5,733 cf

Plug-Flow detention time= 632.1 min calculated for 0.211 af (100% of inflow)
Center-of-Mass det. time= 632.3 min (1,425.2 - 793.0)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

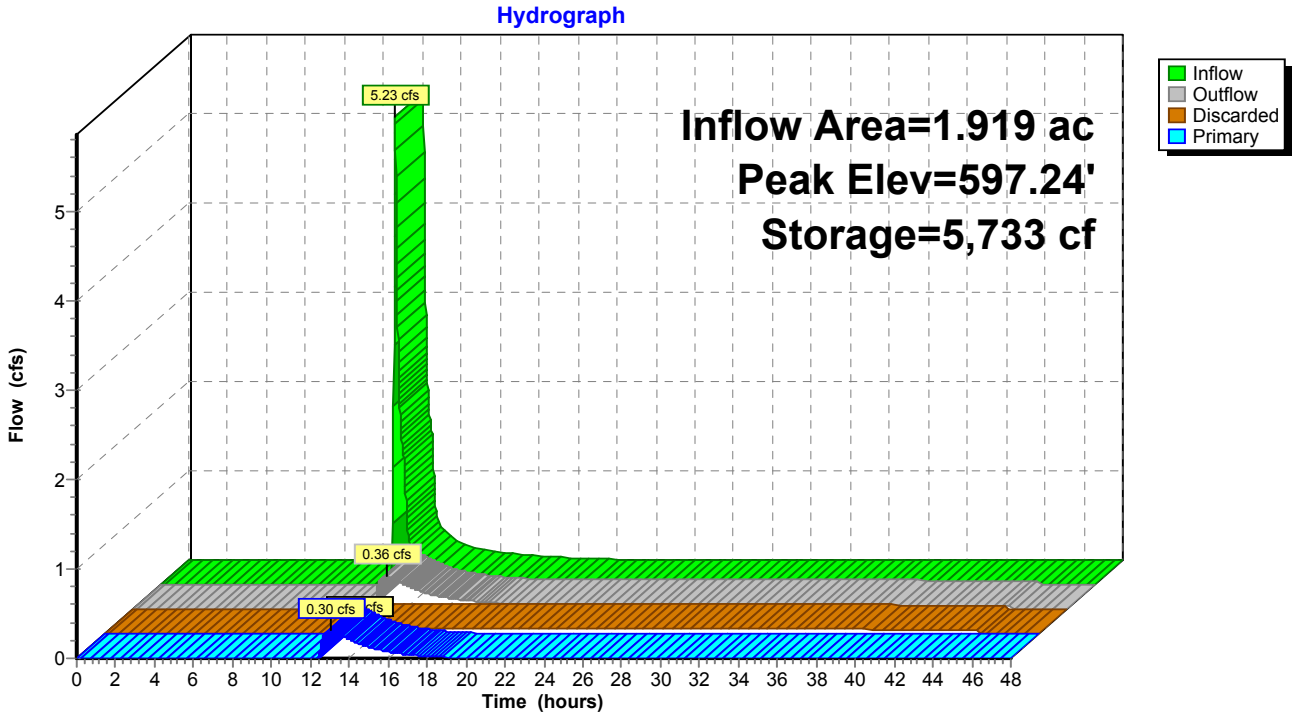
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.06 cfs @ 13.04 hrs HW=597.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.30 cfs @ 13.04 hrs HW=597.24' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.30 cfs @ 1.67 fps)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 2.11" for 10-yr event
Inflow = 5.51 cfs @ 12.03 hrs, Volume= 0.338 af
Outflow = 5.31 cfs @ 12.05 hrs, Volume= 0.338 af, Atten= 4%, Lag= 0.9 min
Discarded = 0.08 cfs @ 12.05 hrs, Volume= 0.128 af
Primary = 5.23 cfs @ 12.05 hrs, Volume= 0.211 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.32' @ 12.05 hrs Surf.Area= 6,789 sf Storage= 2,106 cf

Plug-Flow detention time= 105.2 min calculated for 0.338 af (100% of inflow)
Center-of-Mass det. time= 105.2 min (947.1 - 841.9)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

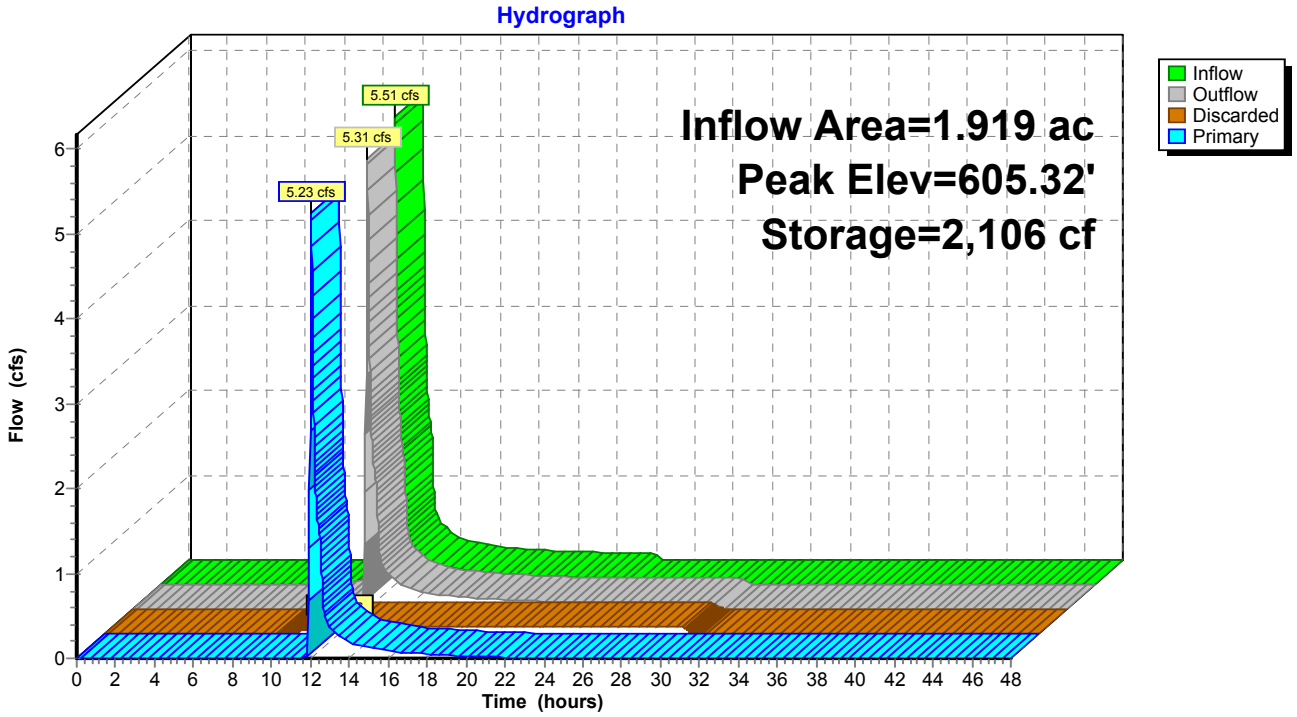
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.05 hrs HW=605.32' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=5.21 cfs @ 12.05 hrs HW=605.32' TW=596.29' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 5.21 cfs @ 0.64 fps)

Pond P1: Infiltration Basin 1

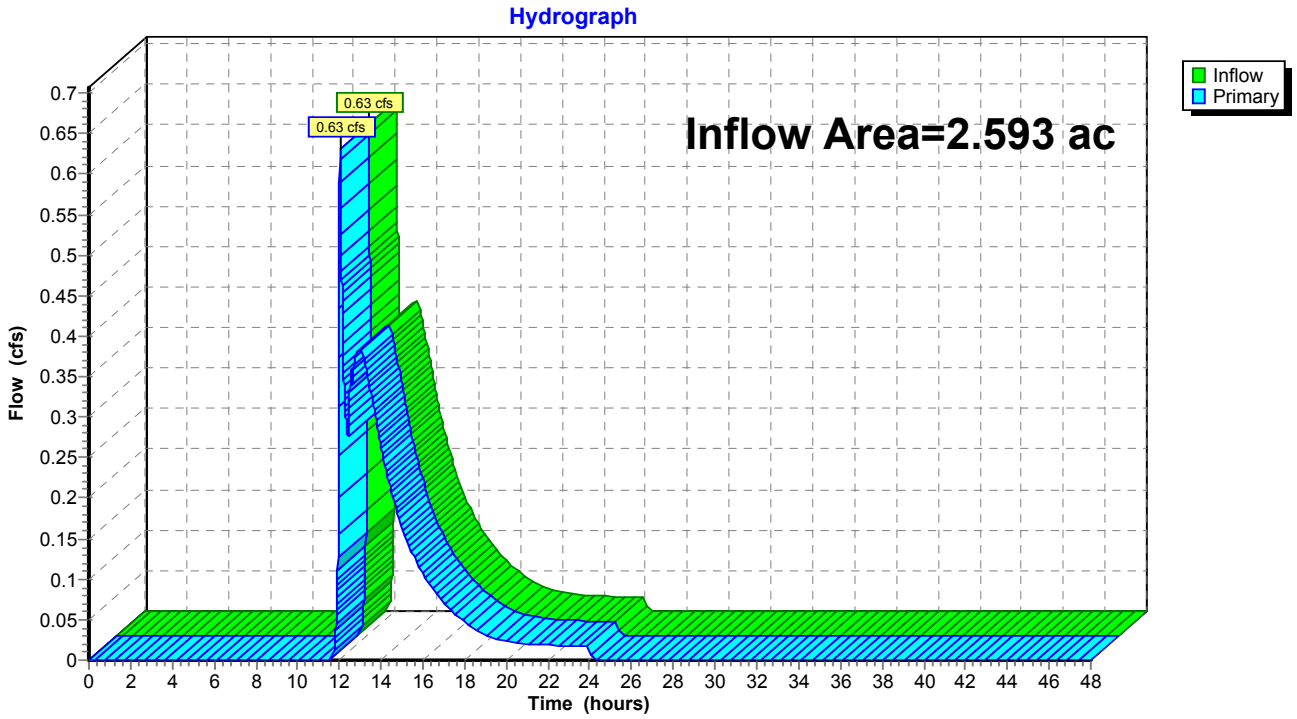


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 0.52" for 10-yr event
Inflow = 0.63 cfs @ 12.04 hrs, Volume= 0.113 af
Primary = 0.63 cfs @ 12.04 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

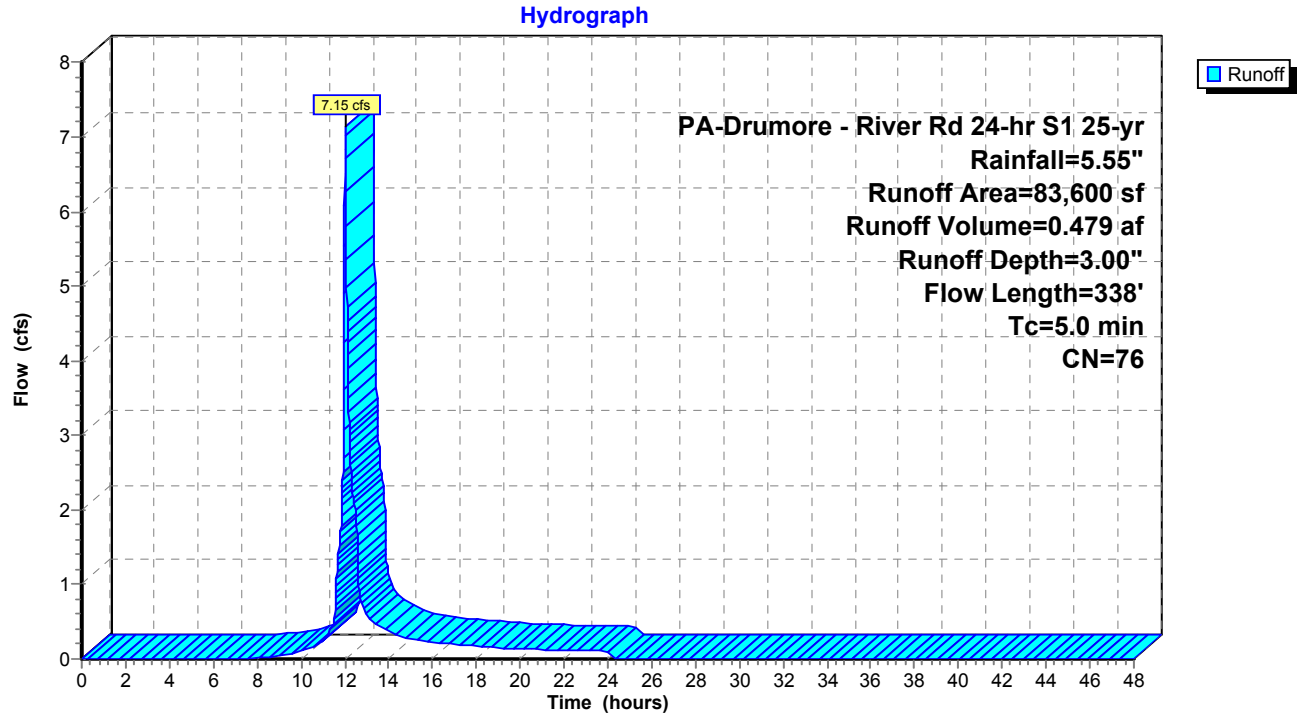
Runoff = 7.15 cfs @ 12.03 hrs, Volume= 0.479 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 25-yr Rainfall=5.55"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

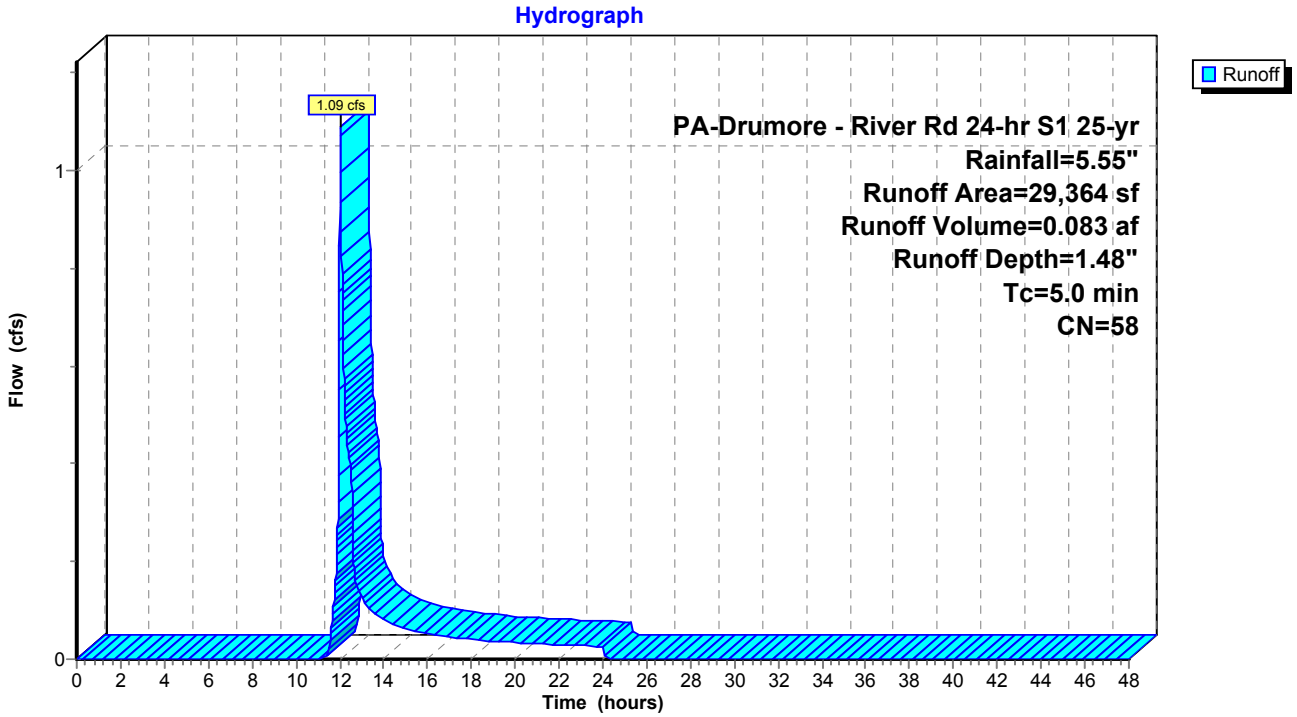
Runoff = 1.09 cfs @ 12.04 hrs, Volume= 0.083 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 25-yr Rainfall=5.55"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 2.15" for 25-yr event
Inflow = 6.88 cfs @ 12.04 hrs, Volume= 0.344 af
Outflow = 1.44 cfs @ 12.58 hrs, Volume= 0.343 af, Atten= 79%, Lag= 32.4 min
Discarded = 0.06 cfs @ 12.58 hrs, Volume= 0.164 af
Primary = 1.37 cfs @ 12.58 hrs, Volume= 0.179 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 597.53' @ 12.58 hrs Surf.Area= 5,581 sf Storage= 7,294 cf

Plug-Flow detention time= 460.9 min calculated for 0.343 af (100% of inflow)
Center-of-Mass det. time= 460.2 min (1,273.3 - 813.1)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

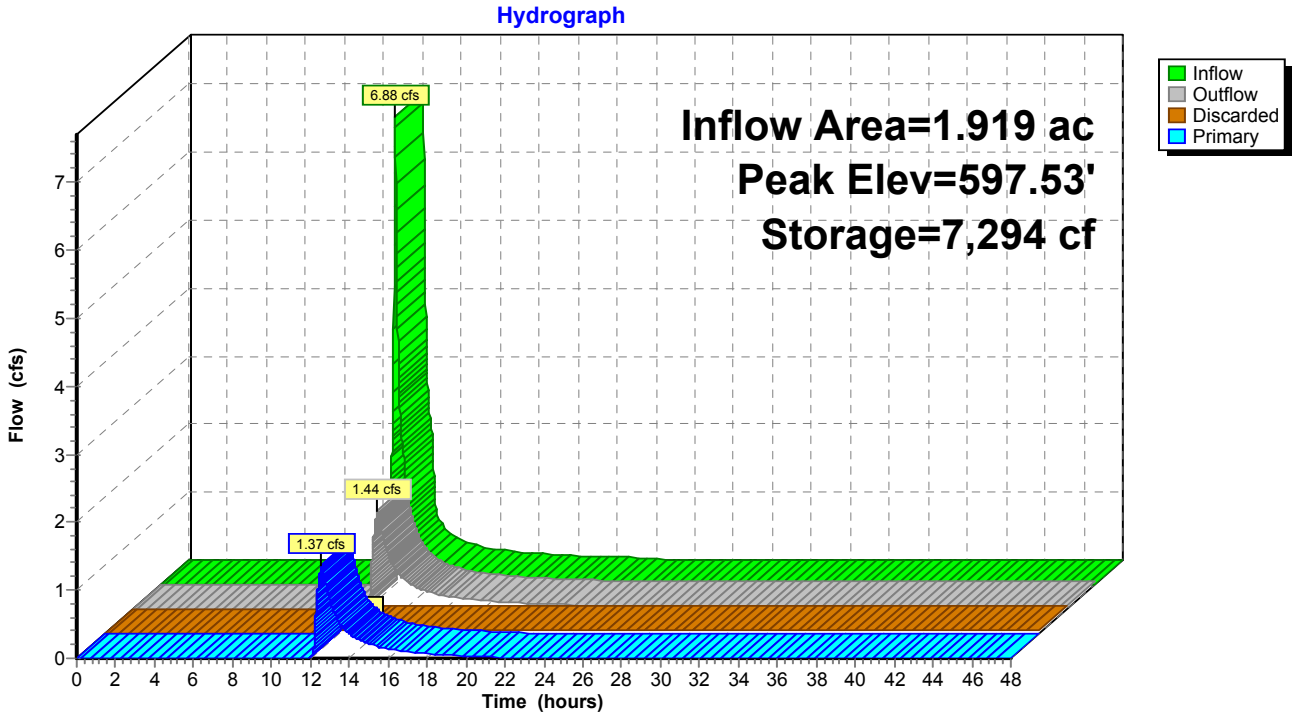
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.06 cfs @ 12.58 hrs HW=597.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.37 cfs @ 12.58 hrs HW=597.53' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 1.37 cfs @ 2.47 fps)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 3.00" for 25-yr event
Inflow = 7.15 cfs @ 12.03 hrs, Volume= 0.479 af
Outflow = 6.96 cfs @ 12.04 hrs, Volume= 0.479 af, Atten= 3%, Lag= 0.8 min
Discarded = 0.08 cfs @ 12.04 hrs, Volume= 0.135 af
Primary = 6.88 cfs @ 12.04 hrs, Volume= 0.344 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.33' @ 12.04 hrs Surf.Area= 6,804 sf Storage= 2,200 cf

Plug-Flow detention time= 77.1 min calculated for 0.479 af (100% of inflow)
Center-of-Mass det. time= 77.2 min (913.4 - 836.2)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

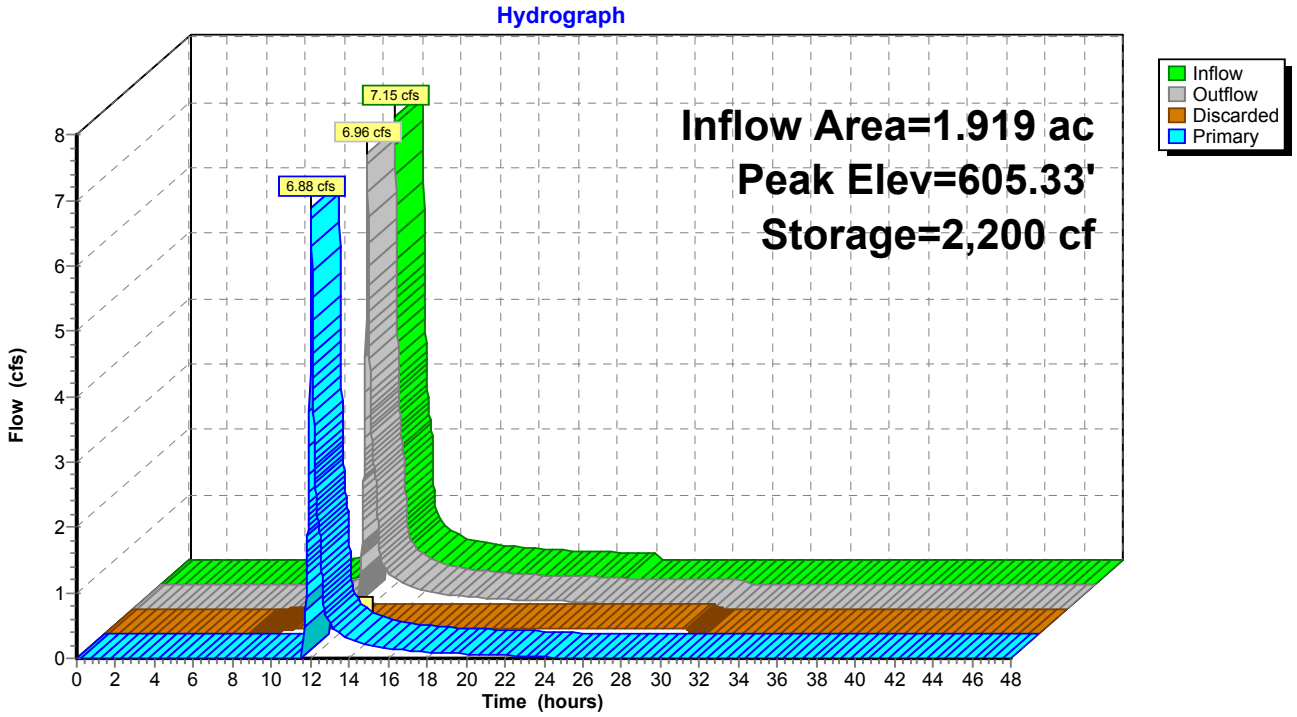
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.04 hrs HW=605.33' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=6.86 cfs @ 12.04 hrs HW=605.33' TW=596.67' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 6.86 cfs @ 0.70 fps)

Pond P1: Infiltration Basin 1

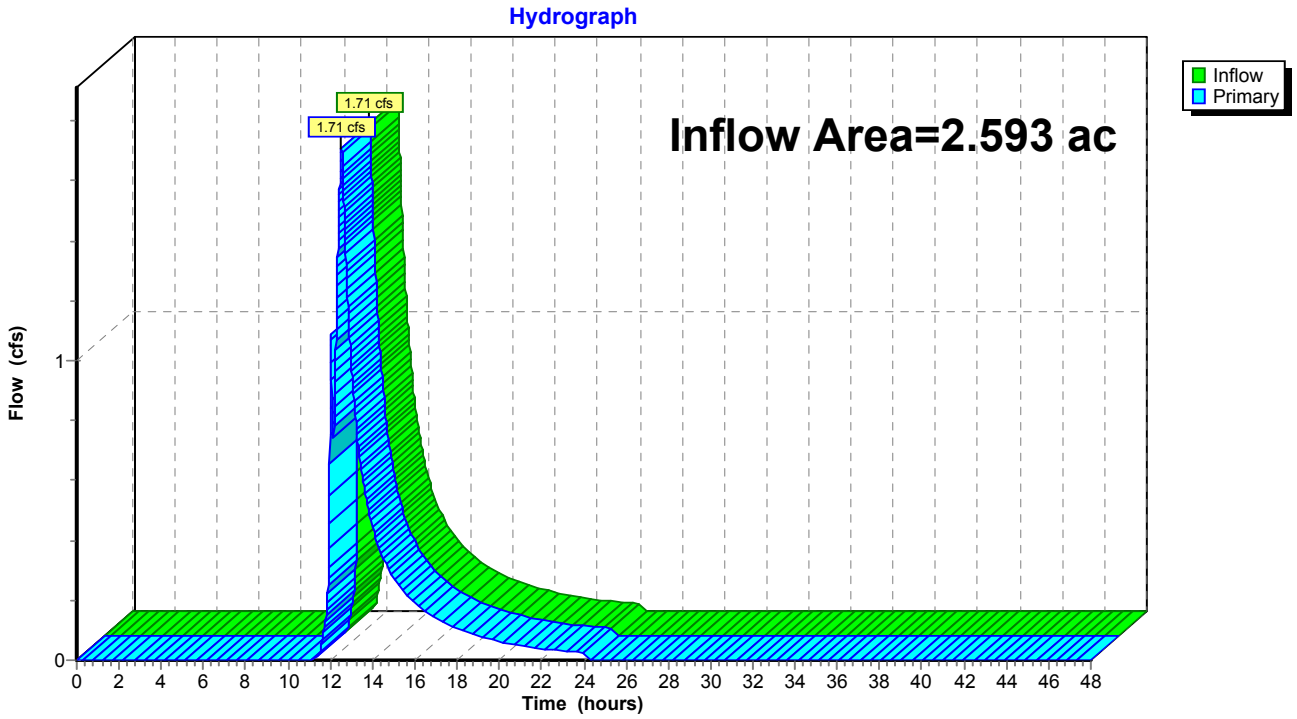


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 1.21" for 25-yr event
Inflow = 1.71 cfs @ 12.53 hrs, Volume= 0.263 af
Primary = 1.71 cfs @ 12.53 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

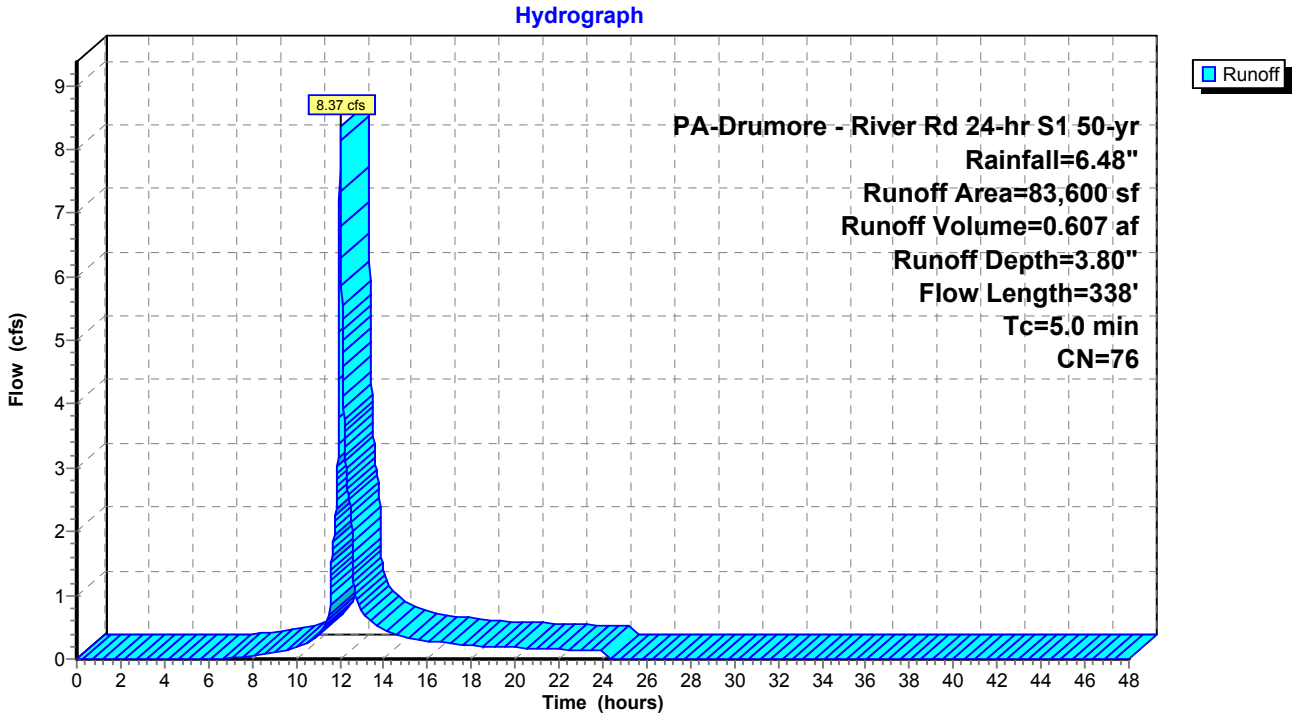
Runoff = 8.37 cfs @ 12.03 hrs, Volume= 0.607 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 50-yr Rainfall=6.48"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

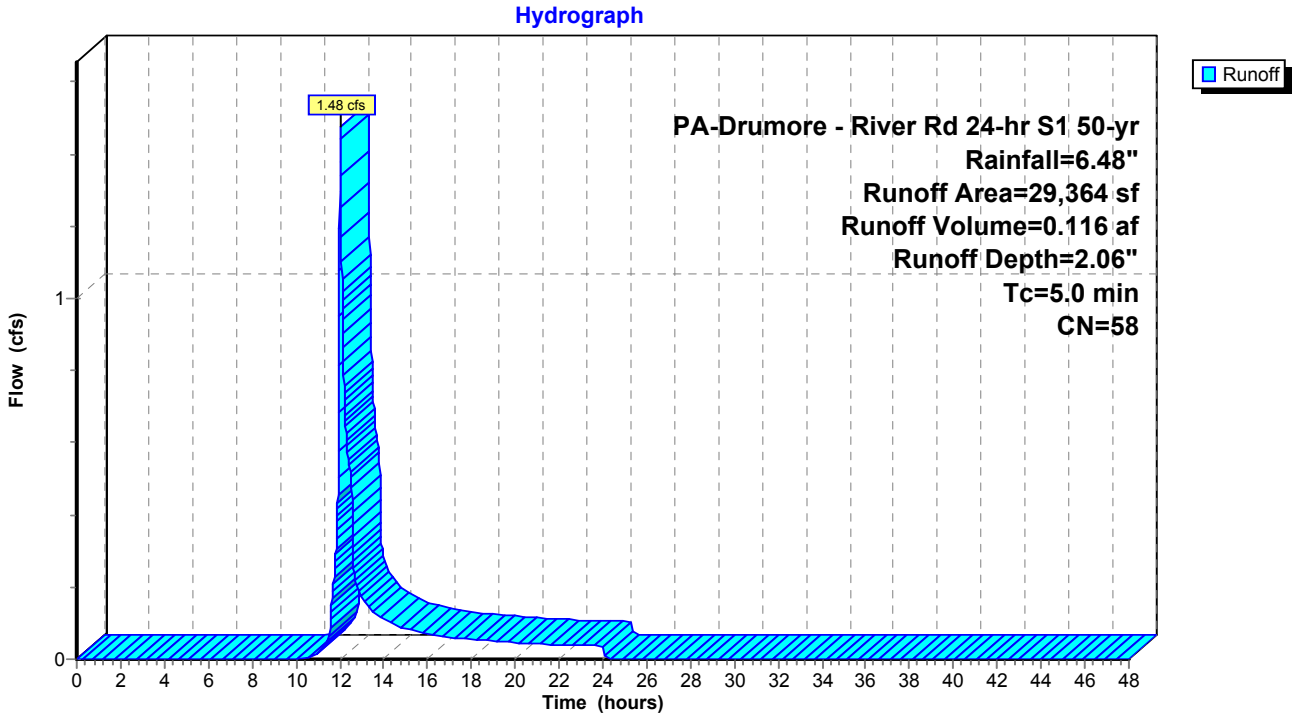
Runoff = 1.48 cfs @ 12.03 hrs, Volume= 0.116 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 50-yr Rainfall=6.48"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 2.91" for 50-yr event
Inflow = 8.10 cfs @ 12.04 hrs, Volume= 0.465 af
Outflow = 2.33 cfs @ 12.48 hrs, Volume= 0.460 af, Atten= 71%, Lag= 26.4 min
Discarded = 0.07 cfs @ 12.48 hrs, Volume= 0.167 af
Primary = 2.26 cfs @ 12.48 hrs, Volume= 0.294 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 597.69' @ 12.48 hrs Surf.Area= 5,762 sf Storage= 8,233 cf

Plug-Flow detention time= 356.2 min calculated for 0.460 af (99% of inflow)
Center-of-Mass det. time= 349.7 min (1,171.4 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

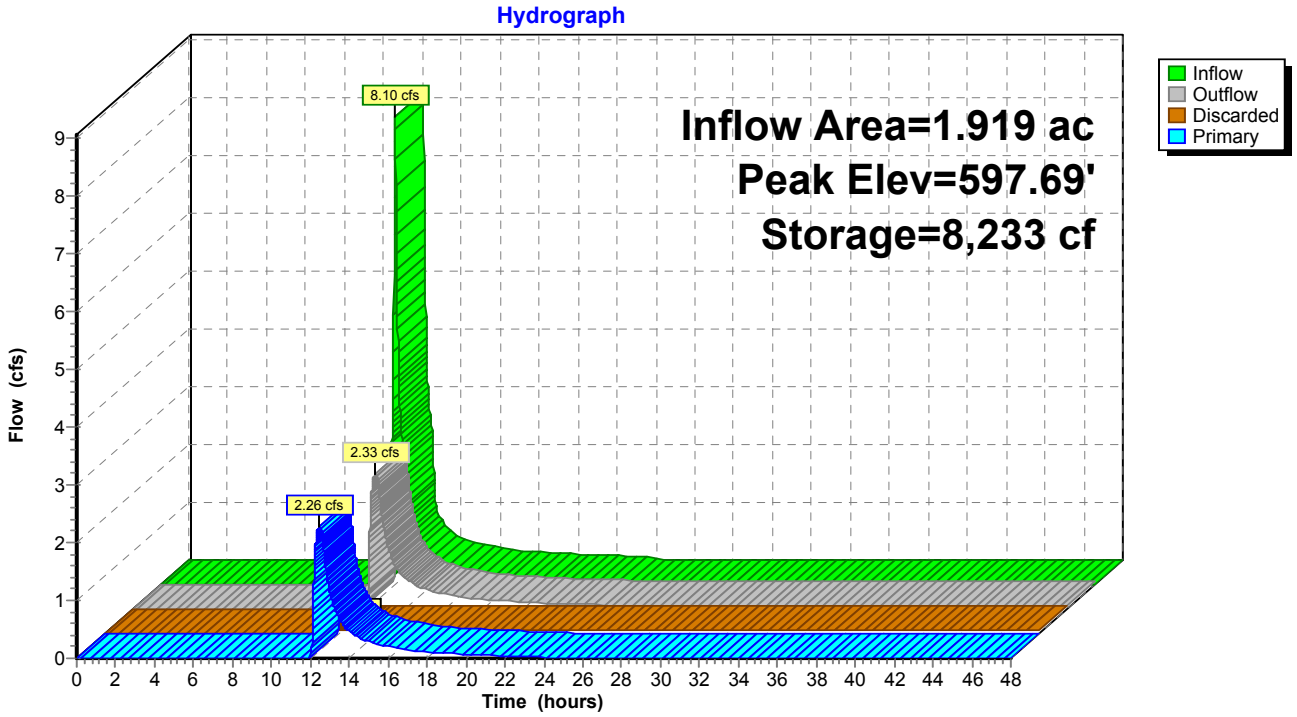
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.07 cfs @ 12.48 hrs HW=597.69' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=2.26 cfs @ 12.48 hrs HW=597.69' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 2.26 cfs @ 2.83 fps)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 3.80" for 50-yr event
Inflow = 8.37 cfs @ 12.03 hrs, Volume= 0.607 af
Outflow = 8.18 cfs @ 12.04 hrs, Volume= 0.607 af, Atten= 2%, Lag= 0.8 min
Discarded = 0.08 cfs @ 12.04 hrs, Volume= 0.142 af
Primary = 8.10 cfs @ 12.04 hrs, Volume= 0.465 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.34' @ 12.04 hrs Surf.Area= 6,814 sf Storage= 2,264 cf

Plug-Flow detention time= 63.5 min calculated for 0.607 af (100% of inflow)
Center-of-Mass det. time= 63.5 min (895.7 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

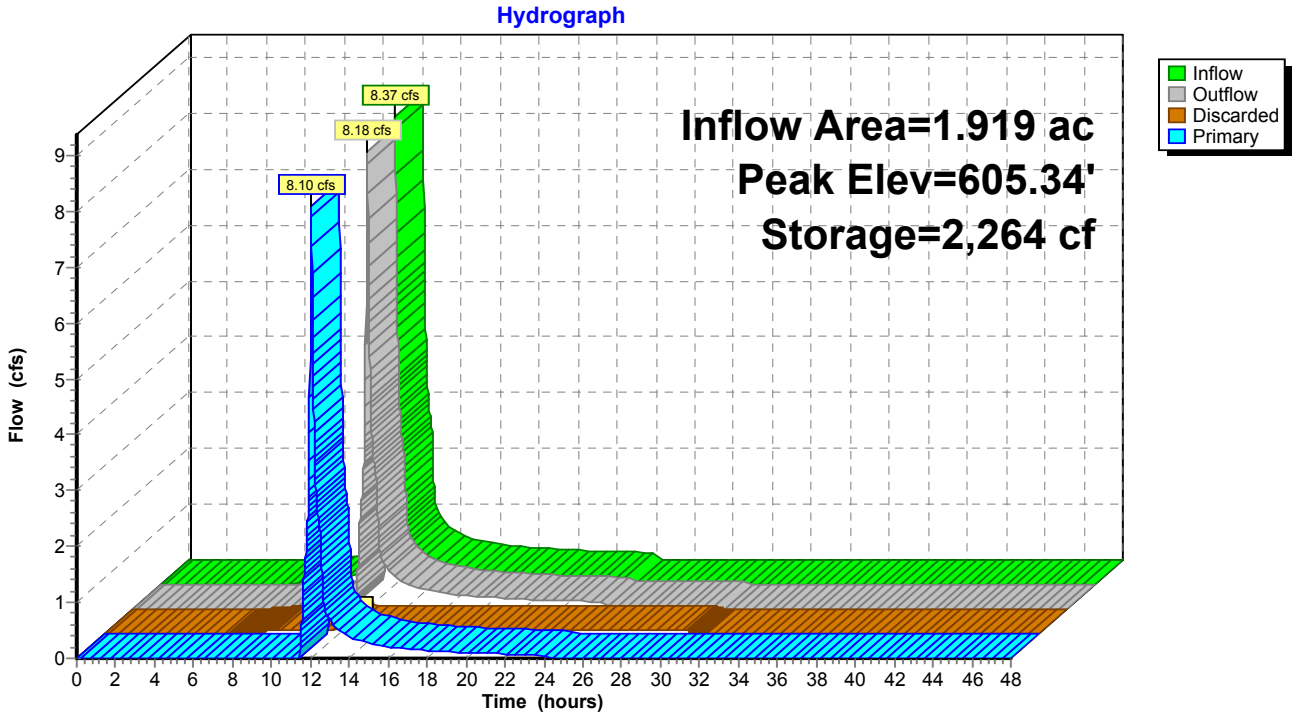
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.04 hrs HW=605.34' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=8.09 cfs @ 12.04 hrs HW=605.34' TW=597.03' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 8.09 cfs @ 0.74 fps)

Pond P1: Infiltration Basin 1

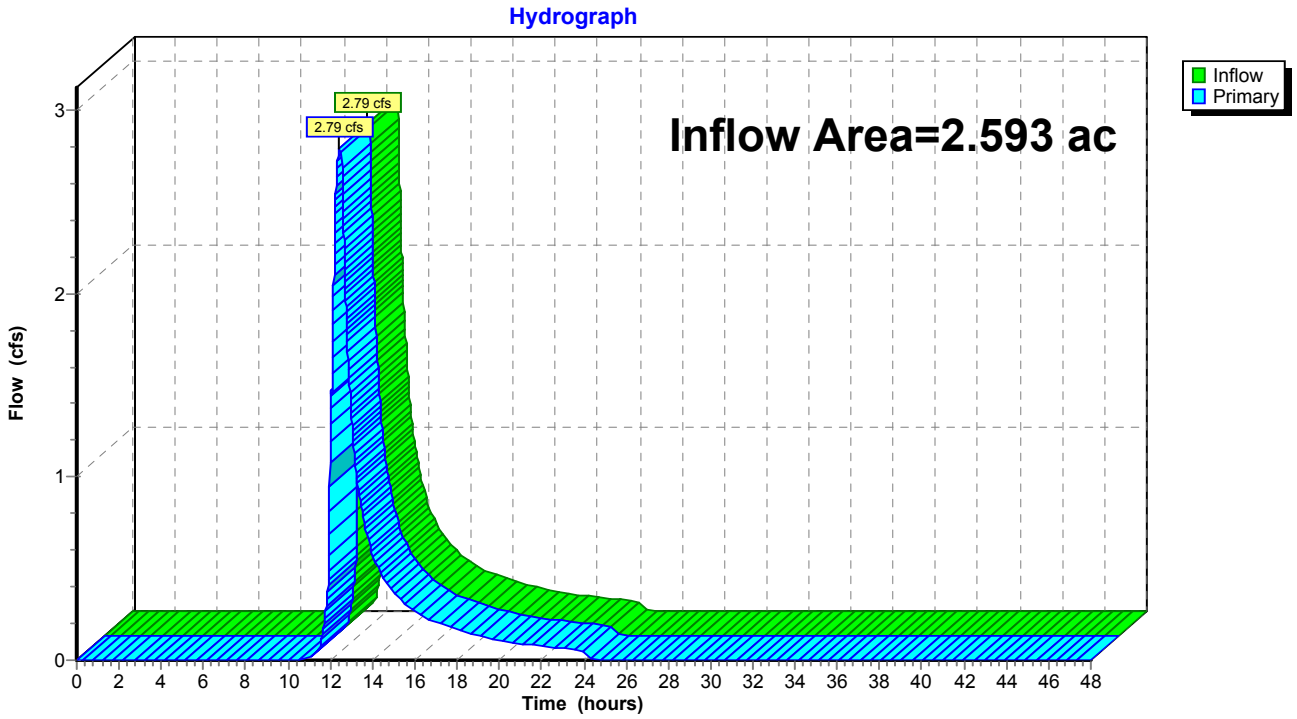


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 1.90" for 50-yr event
Inflow = 2.79 cfs @ 12.44 hrs, Volume= 0.410 af
Primary = 2.79 cfs @ 12.44 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



Summary for Subcatchment 1S: DA to Infiltration Basin

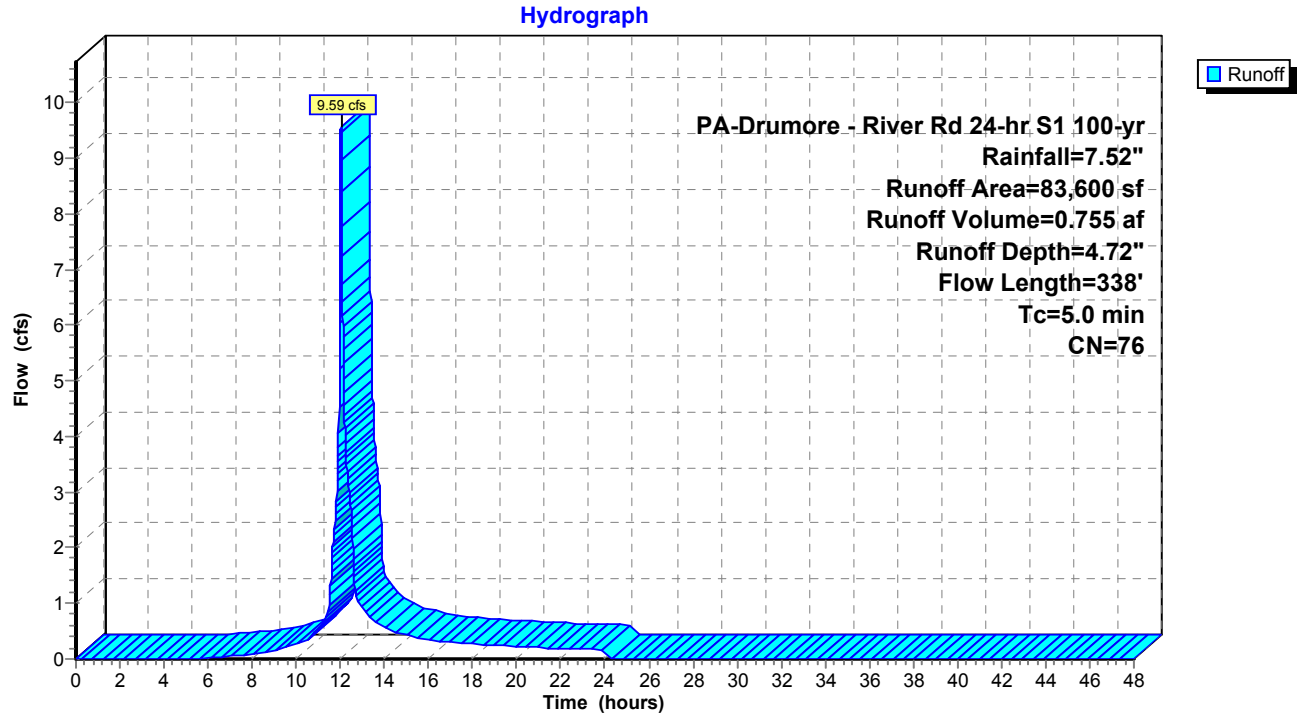
Runoff = 9.59 cfs @ 12.03 hrs, Volume= 0.755 af, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 100-yr Rainfall=7.52"

	Area (sf)	CN	Description
	36,336	58	Meadow, non-grazed, HSG B
*	44,404	89	Gravel
	2,860	98	Roofs, HSG B
	83,600	76	Weighted Average
	80,740		96.58% Pervious Area
	2,860		3.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0128	1.10		**Sheet Flow, Gravel** Smooth surfaces n= 0.011 P2= 2.90"
1.3	181	0.0128	2.30		**Shallow Concentrated Flow, Gravel Pad-Concentrated** Paved Kv= 20.3 fps
0.1	57	0.0700	10.40	8.17	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.015 Concrete sewer w/manholes & inlets
2.1					**Direct Entry, Time added to meet 5 minute min.**
5.0	338	Total			

Subcatchment 1S: DA to Infiltration Basin



Summary for Subcatchment 2S: Study Area Bypass

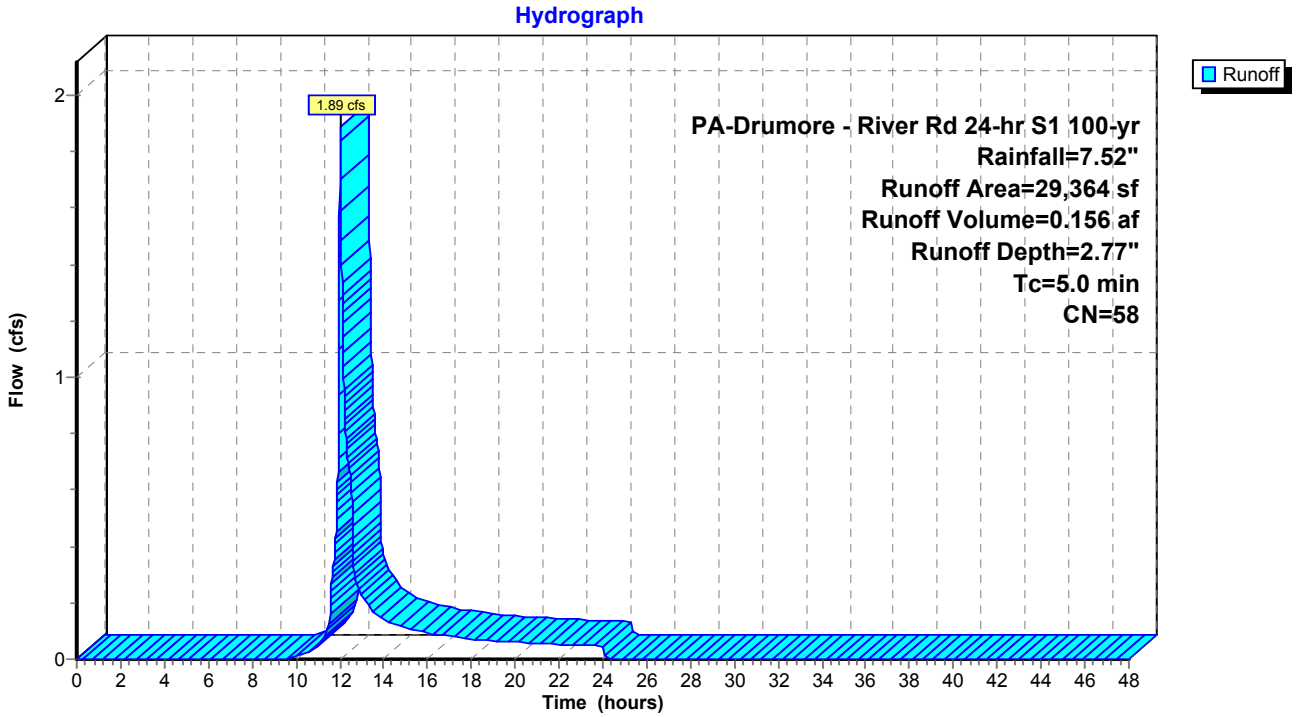
Runoff = 1.89 cfs @ 12.03 hrs, Volume= 0.156 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
PA-Drumore - River Rd 24-hr S1 100-yr Rainfall=7.52"

Area (sf)	CN	Description
29,364	58	Meadow, non-grazed, HSG B
29,364		100.00% Pervious Area

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

Subcatchment 2S: Study Area Bypass



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 3.79" for 100-yr event
Inflow = 9.31 cfs @ 12.04 hrs, Volume= 0.607 af
Outflow = 3.48 cfs @ 12.30 hrs, Volume= 0.599 af, Atten= 63%, Lag= 15.4 min
Discarded = 0.07 cfs @ 12.30 hrs, Volume= 0.170 af
Primary = 3.41 cfs @ 12.30 hrs, Volume= 0.429 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 597.88' @ 12.30 hrs Surf.Area= 5,965 sf Storage= 9,303 cf

Plug-Flow detention time= 283.1 min calculated for 0.599 af (99% of inflow)
Center-of-Mass det. time= 276.0 min (1,102.6 - 826.6)

Volume	Invert	Avail.Storage	Storage Description
#1	596.00'	16,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

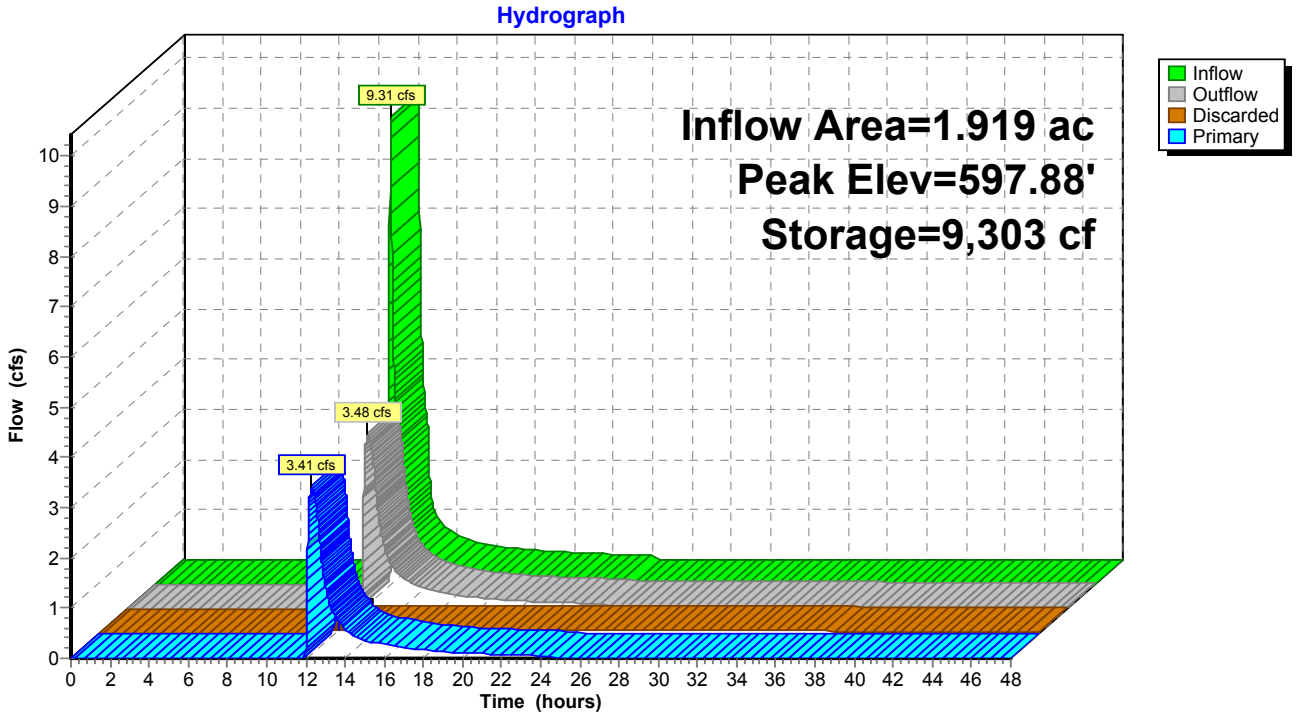
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
596.00	3,996	332.0	0	0	3,996
597.00	5,022	351.0	4,499	4,499	5,084
598.00	6,106	370.0	5,555	10,054	6,232
599.00	7,245	389.0	6,667	16,722	7,441

Device	Routing	Invert	Outlet Devices
#1	Discarded	596.00'	**0.500 in/hr Exfiltration over Surface area**
#2	Primary	597.00'	**18.0" Round Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 597.00' / 593.00' S= 0.1250 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.07 cfs @ 12.30 hrs HW=597.88' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=3.41 cfs @ 12.30 hrs HW=597.88' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 3.41 cfs @ 3.19 fps)

Pond 2P: Infiltration Basin 2



Summary for Pond P1: Infiltration Basin 1

Inflow Area = 1.919 ac, 3.42% Impervious, Inflow Depth = 4.72" for 100-yr event
Inflow = 9.59 cfs @ 12.03 hrs, Volume= 0.755 af
Outflow = 9.39 cfs @ 12.04 hrs, Volume= 0.755 af, Atten= 2%, Lag= 0.7 min
Discarded = 0.08 cfs @ 12.04 hrs, Volume= 0.149 af
Primary = 9.31 cfs @ 12.04 hrs, Volume= 0.607 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 605.35' @ 12.04 hrs Surf.Area= 6,824 sf Storage= 2,325 cf

Plug-Flow detention time= 53.9 min calculated for 0.755 af (100% of inflow)
Center-of-Mass det. time= 53.8 min (882.1 - 828.2)

Volume	Invert	Avail.Storage	Storage Description
#1	605.00'	3,357 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

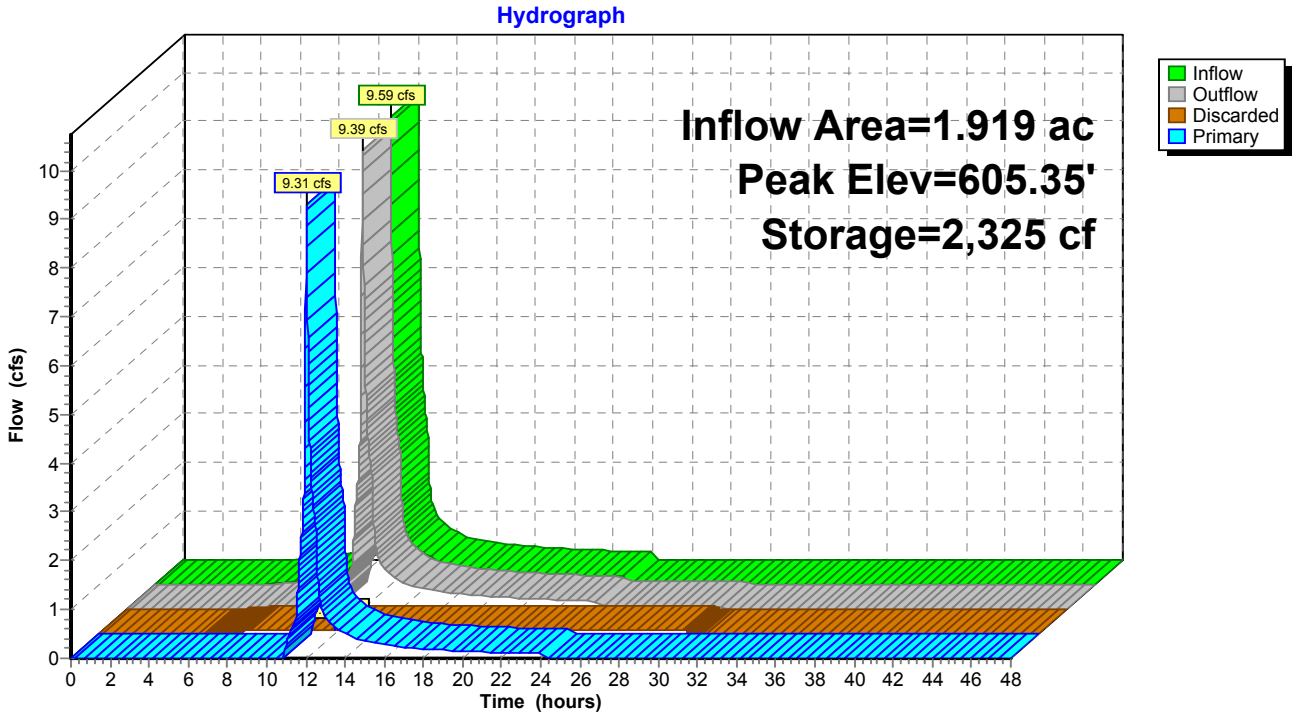
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
605.00	6,439	363.0	0	0	6,439
605.25	6,713	368.0	1,644	1,644	6,744
605.50	6,991	372.0	1,713	3,357	6,997

Device	Routing	Invert	Outlet Devices
#1	Discarded	605.00'	**0.500 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	605.25'	**120.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.08 cfs @ 12.04 hrs HW=605.35' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=9.31 cfs @ 12.04 hrs HW=605.35' TW=597.42' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 9.31 cfs @ 0.77 fps)

Pond P1: Infiltration Basin 1

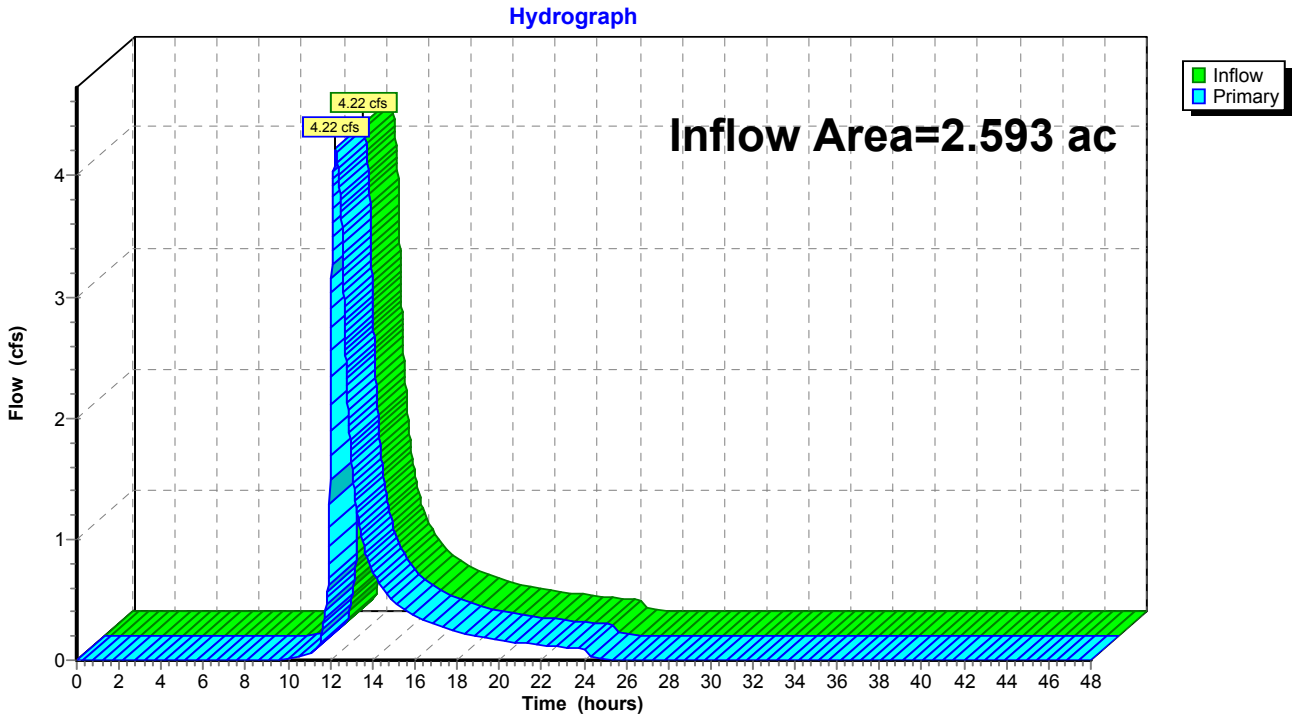


Summary for Link 1L: Study Area Post Dev Point of Interest

Inflow Area = 2.593 ac, 2.53% Impervious, Inflow Depth = 2.71" for 100-yr event
Inflow = 4.22 cfs @ 12.25 hrs, Volume= 0.585 af
Primary = 4.22 cfs @ 12.25 hrs, Volume= 0.585 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Study Area Post Dev Point of Interest



A.3 Conveyance Calculations

E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: ATLANTIC SUNRISE PROJECT - RIVER ROAD REGULATOR STATION

LOCATION: DRUMORE TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA

PREPARED BY: JEC DATE: 07/21/2016

CHECKED BY: AJB DATE: 07/21/2016

CHANNEL OR CHANNEL SECTION		STONE SWALE 1 LINING	VEG SWALE		
TEMPORARY OR PERMANENT?	(T OR P)	P	P		
DESIGN STORM	(2, 5, OR 10 YR)	10	10		
ACRES	(AC)	0.86	1.99		
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	2.75	2.75		
Qr (REQUIRED CAPACITY)	(CFS)	2.37	3.41	Use 100 year from HydroCAD	
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	2.31	3.42		
PROTECTIVE LINING[2]		R-3	SC150/GRASS		
n (MANNING'S COEFFICIENT)[2]		0.032	0.049		
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A		
V (CALCULATED AT FLOW DEPTH d)	(FPS)	2.06	1.70		
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	1.00	1.00		
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.25	0.41		
CHANNEL BOTTOM WIDTH	(FT)	2	2		
CHANNEL SIDE SLOPES	(H:V)	2	3		
D (TOTAL DEPTH)	(FT)	1.0	1.0		
CHANNEL TOP WIDTH @ D	(FT)	6	8		
d (CALCULATED FLOW DEPTH)	(FT)	0.40	0.55		
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.60	5.30		
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	5.00	3.64		
d50 STONE SIZE	(IN)	N/A	N/A		
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	1.12	2.01		
R (HYDRAULIC RADIUS)		0.30	0.37		
S (BED SLOPE)[3]	(FT/FT)	0.01	0.012		
Sc (CRITICAL SLOPE)	(FT/FT)	0.024	0.050		
.7Sc	(FT/FT)	0.016	0.035		
1.3Sc	(FT/FT)	0.031	0.066		
STABLE FLOW?	(Y/N)	Y	Y		
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.06	0.07		
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.50		
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.50		
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.

Source: 363-2134-008 / March 31, 2012 / Page 382

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 27 2016

ES-1 Storm Sewer

Circular

Diameter (ft)	= 1.00
Invert Elev (ft)	= 609.00
Slope (%)	= 7.00
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.37

Highlighted

Depth (ft)	= 0.37
Q (cfs)	= 2.370
Area (sqft)	= 0.27
Velocity (ft/s)	= 8.94
Wetted Perim (ft)	= 1.31
Crit Depth, Yc (ft)	= 0.66
Top Width (ft)	= 0.97
EGL (ft)	= 1.61

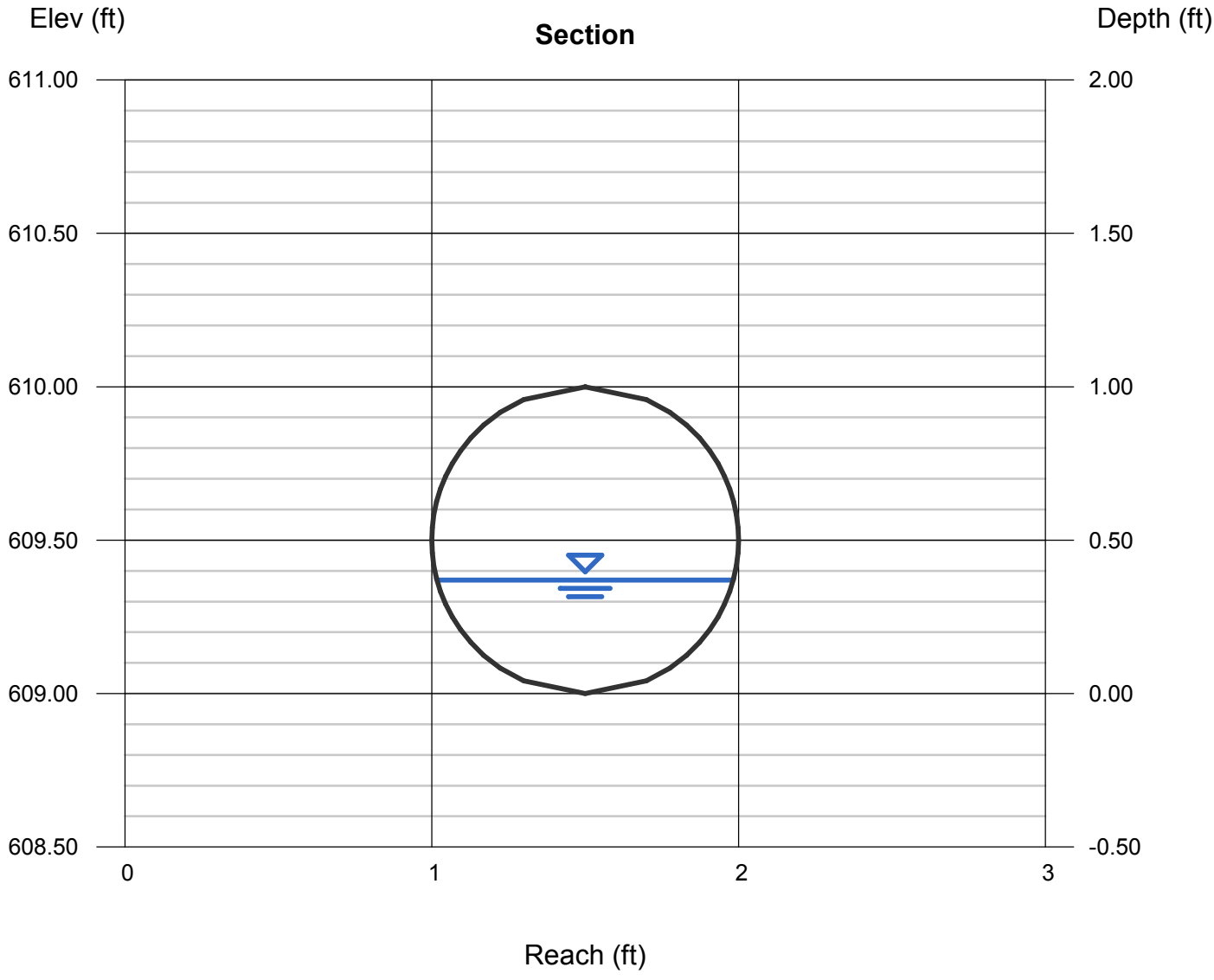
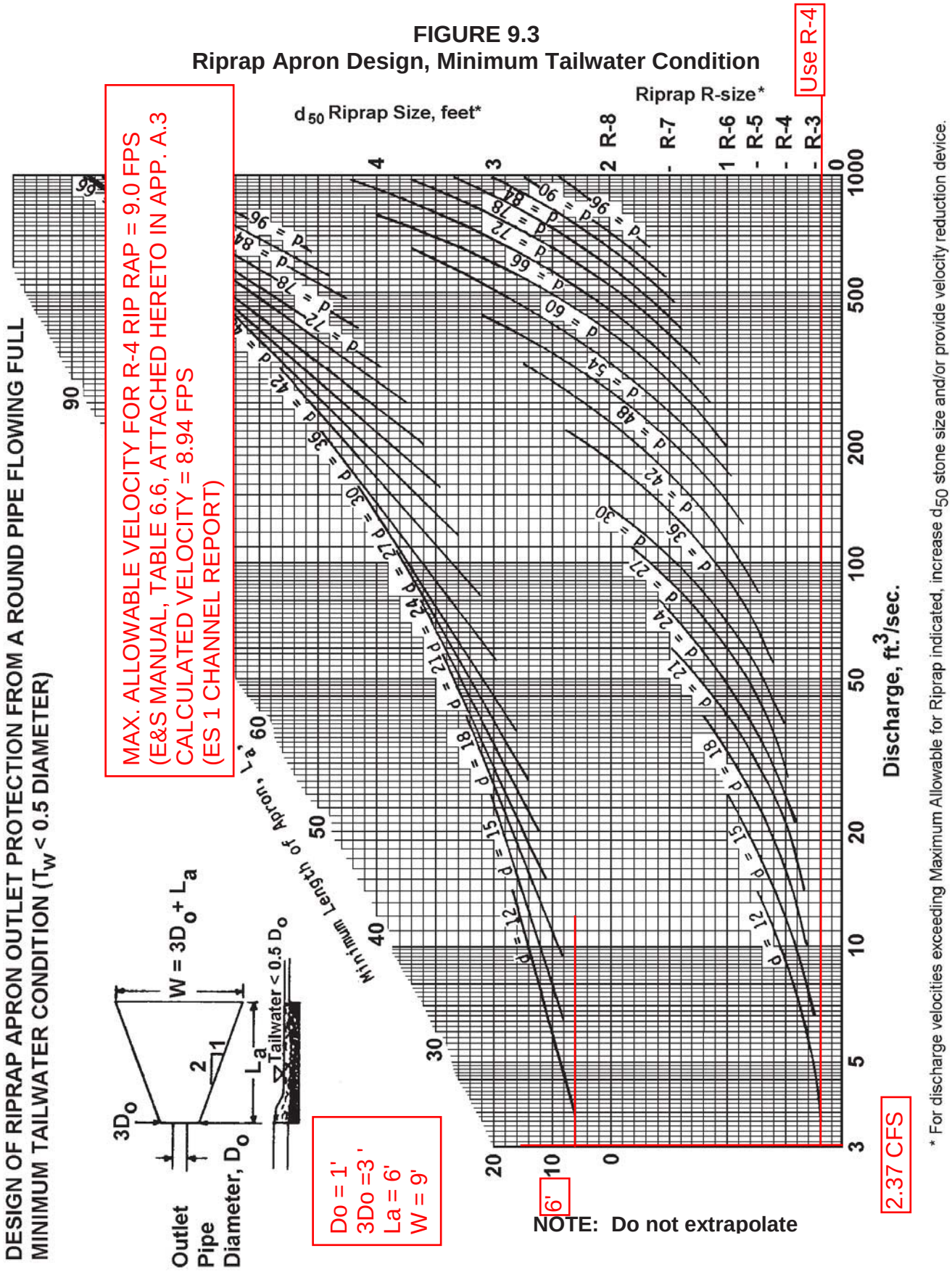


FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

END SECTION 1 (ES-1) - RIP RAP APRON DESIGN

MAX. ALLOWABLE VELOCITY FOR R-4 RIP RAP = 9.0 FPS
(E&S MANUAL, TABLE 6.6, ATTACHED HERETO IN APP. A.3
CALCULATED VELOCITY = 8.94 FPS
(ES 1 CHANNEL REPORT)

Use R-4

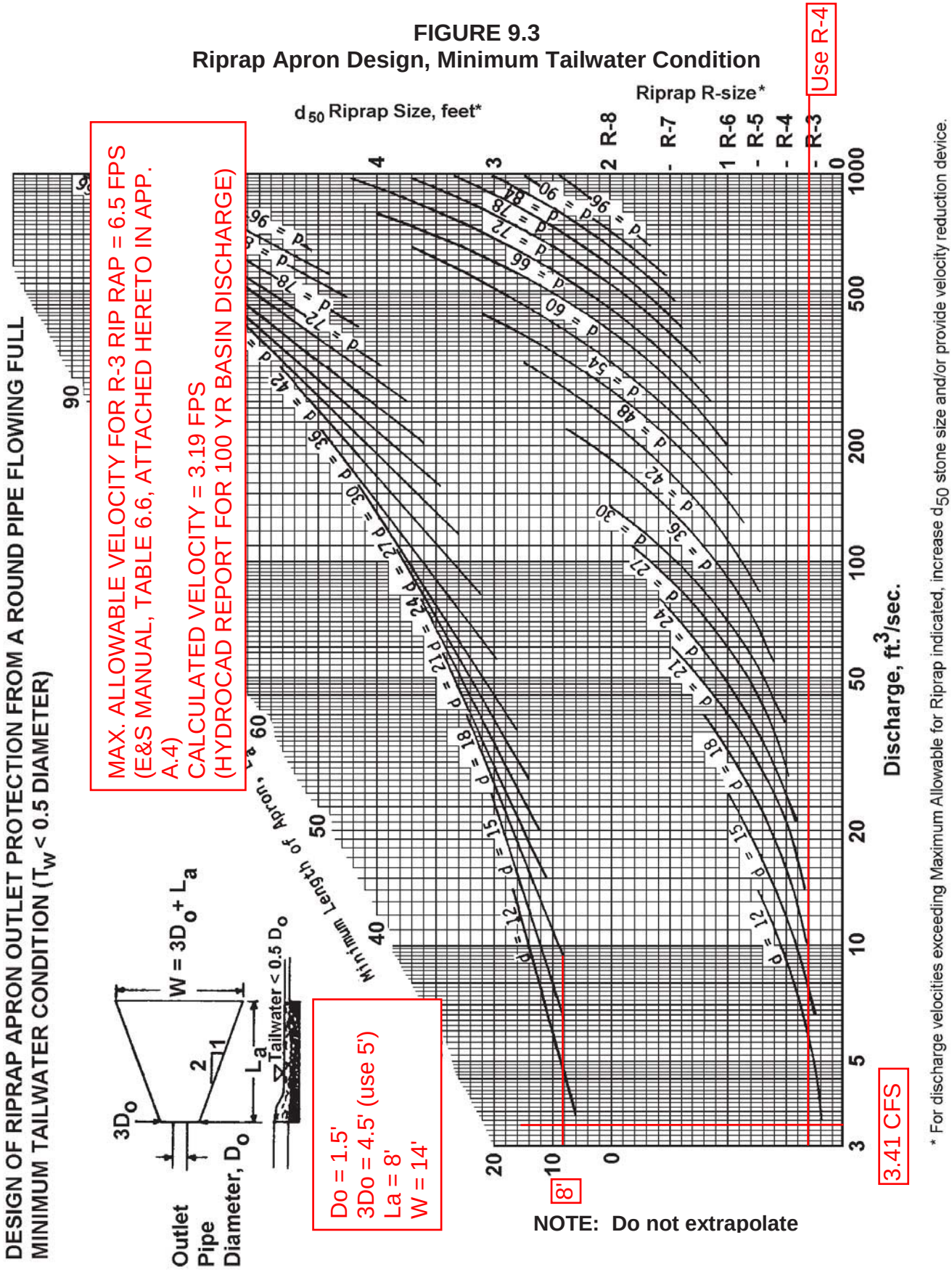


* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

Adapted from USDA - NRCS

Not to be used for Box Culverts

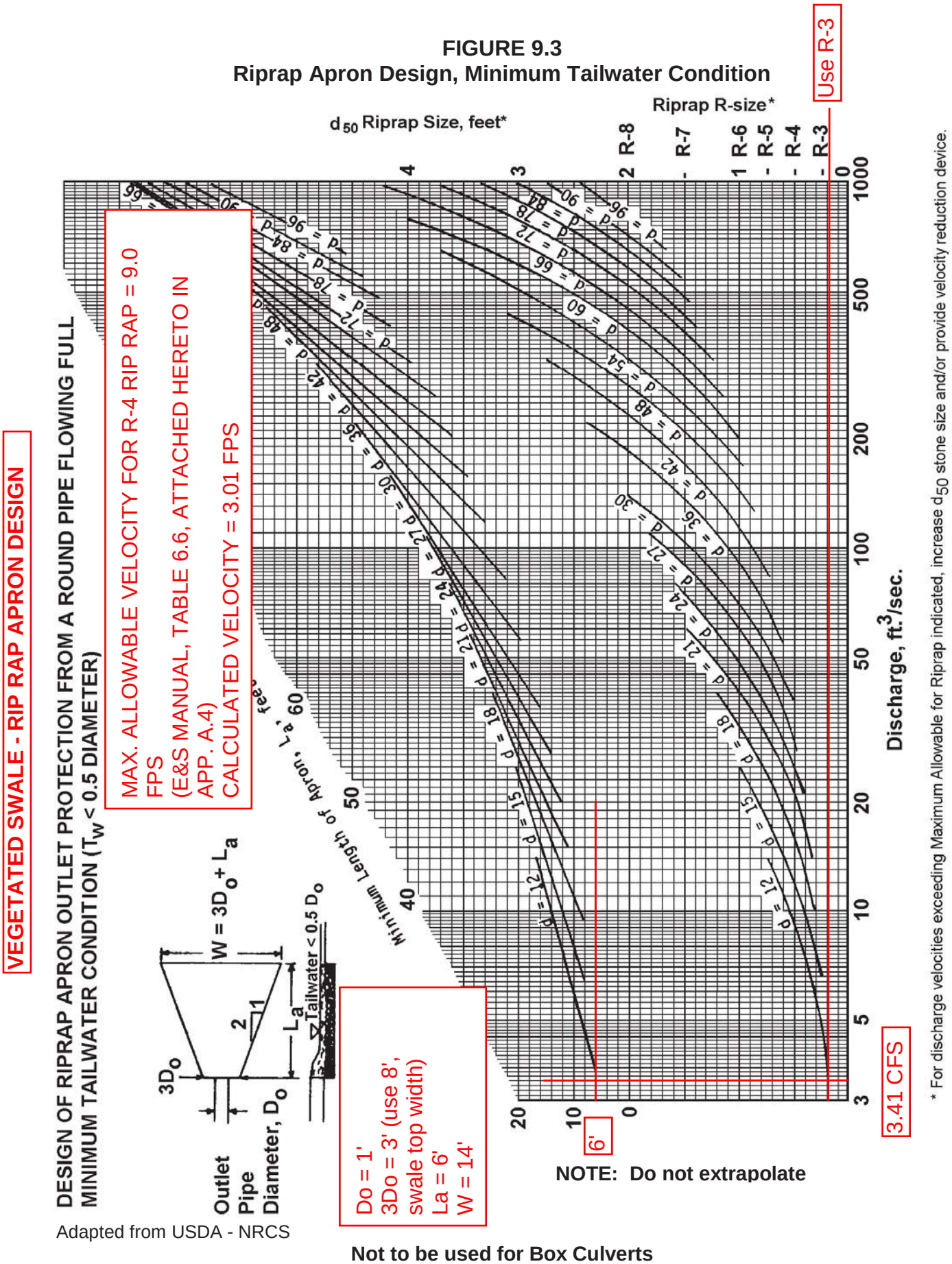
FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

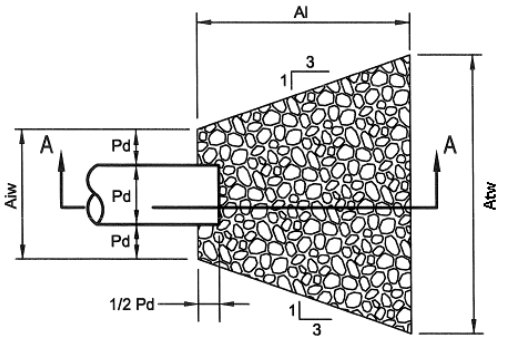


Adapted from USDA - NRCS

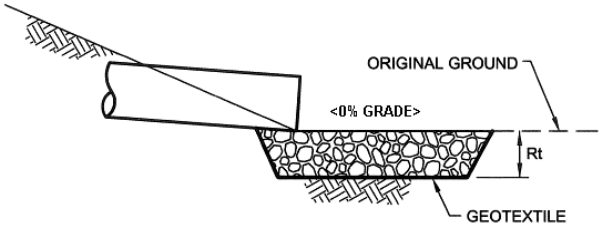
Not to be used for Box Culverts

STANDARD E&S WORKSHEET # 20
Riprap Apron Outlet Protection

PROJECT NAME: ATLANTIC SUNRISE PROJECT - RIVER ROAD REGULATOR STATION
LOCATION: DRUMORE TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA
PREPARED BY: HFT DATE: 8/24/2016
CHECKED BY: AJB DATE: 8/24/2016



PLAN VIEW



SECTION A - A

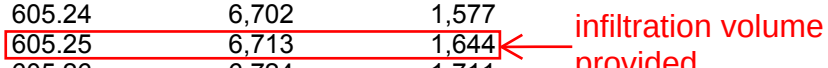
NO.	PIPE DIA. Do (in.)	TAIL WATER COND. (Max or Min)	MAN. "n" FOR PIPE	PIPE SLOPE (FT/FT)	Q (CFS)	V* (FPS)	RIPRAP SIZE	Rt (in)	Al (ft)	Aiw (ft)	Atw (ft)
ES-1	12	MIN	0.015	0.07	2.37	8.94	R-4	18	6	3	9
ES-2	18	MIN	0.015	0.0125	3.41	3.19	R-4	18	8	5	14

***:The anticipated velocity (V) should not exceed the maximum permissible shown in Table 6.6 for the proposed riprap protection. Adjust for less than full pipe flow. Use Manning's equation to calculate velocity for pipe slopes ≥ 0.05 ft/ft.**

A.4 PCSM BMP Calculations

Stage-Area-Storage for Pond P1: Infiltration Basin 1

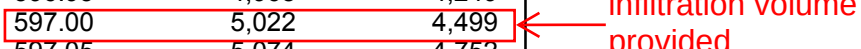
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
605.00	6,439	0
605.01	6,450	64
605.02	6,461	129
605.03	6,472	194
605.04	6,482	258
605.05	6,493	323
605.06	6,504	388
605.07	6,515	453
605.08	6,526	519
605.09	6,537	584
605.10	6,548	649
605.11	6,559	715
605.12	6,570	781
605.13	6,581	846
605.14	6,592	912
605.15	6,603	978
605.16	6,614	1,044
605.17	6,625	1,110
605.18	6,636	1,177
605.19	6,647	1,243
605.20	6,658	1,310
605.21	6,669	1,376
605.22	6,680	1,443
605.23	6,691	1,510
605.24	6,702	1,577
605.25	6,713	1,644
605.26	6,724	1,711
605.27	6,735	1,778
605.28	6,746	1,846
605.29	6,757	1,913
605.30	6,768	1,981
605.31	6,779	2,049
605.32	6,790	2,116
605.33	6,801	2,184
605.34	6,812	2,253
605.35	6,824	2,321
605.36	6,835	2,389
605.37	6,846	2,457
605.38	6,857	2,526
605.39	6,868	2,595
605.40	6,879	2,663
605.41	6,890	2,732
605.42	6,901	2,801
605.43	6,913	2,870
605.44	6,924	2,939
605.45	6,935	3,009
605.46	6,946	3,078
605.47	6,957	3,148
605.48	6,969	3,217
605.49	6,980	3,287
605.50	**6,991**	**3,357**



Stage-Area-Storage for Pond 2P: Infiltration Basin 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
596.00	3,996	0
596.05	4,045	201
596.10	4,093	404
596.15	4,142	610
596.20	4,192	819
596.25	4,242	1,030
596.30	4,292	1,243
596.35	4,342	1,459
596.40	4,392	1,677
596.45	4,443	1,898
596.50	4,494	2,121
596.55	4,546	2,347
596.60	4,598	2,576
596.65	4,650	2,807
596.70	4,702	3,041
596.75	4,755	3,277
596.80	4,807	3,516
596.85	4,861	3,758
596.90	4,914	4,002
596.95	4,968	4,249
597.00	5,022	4,499
597.05	5,074	4,752
597.10	5,126	5,007
597.15	5,178	5,264
597.20	5,230	5,524
597.25	5,283	5,787
597.30	5,336	6,053
597.35	5,389	6,321
597.40	5,443	6,592
597.45	5,497	6,865
597.50	5,551	7,141
597.55	5,605	7,420
597.60	5,660	7,702
597.65	5,715	7,986
597.70	5,770	8,273
597.75	5,825	8,563
597.80	5,881	8,856
597.85	5,937	9,151
597.90	5,993	9,449
597.95	6,049	9,751
598.00	6,106	10,054
598.05	6,161	10,361
598.10	6,216	10,670
598.15	6,271	10,983
598.20	6,326	11,298
598.25	6,382	11,615
598.30	6,437	11,936
598.35	6,494	12,259
598.40	6,550	12,585
598.45	6,607	12,914
598.50	6,663	13,246
598.55	6,720	13,580

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
598.60	6,778	13,918
598.65	6,835	14,258
598.70	6,893	14,601
598.75	6,951	14,947
598.80	7,009	15,296
598.85	7,068	15,648
598.90	7,127	16,003
598.95	7,186	16,361
599.00	**7,245**	**16,722**



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BL Companies

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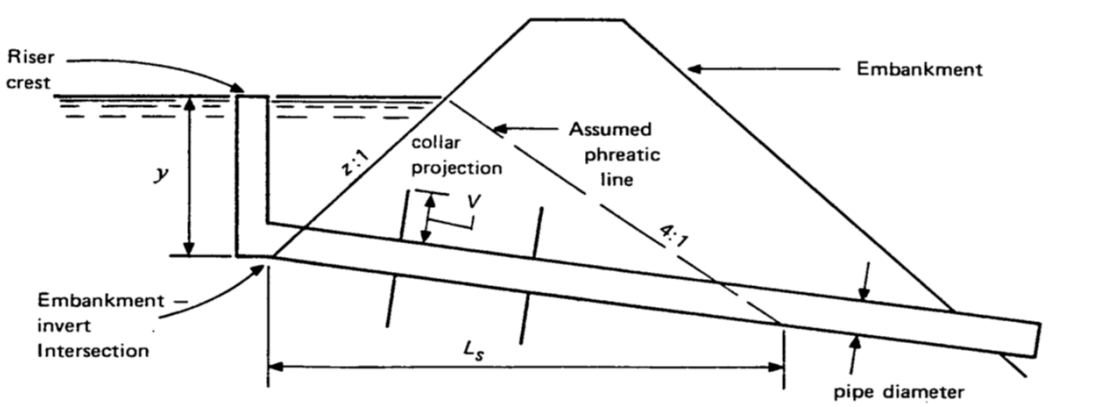
RIVER ROAD REGULATOR STATION
INFILTRATION LOADING RATIO

Total drainage area to infiltration basins:			
	83,600	sf.	Infiltration Facilities
Impervious area to infiltration basins =			
	47,915	sf.	Infiltration Facilities
Infiltration area provided =			
	10,435	sf.	Total
Impervious loading Ratio =	4.6	:	1
Total DA loading Ratio =	8.0	:	1

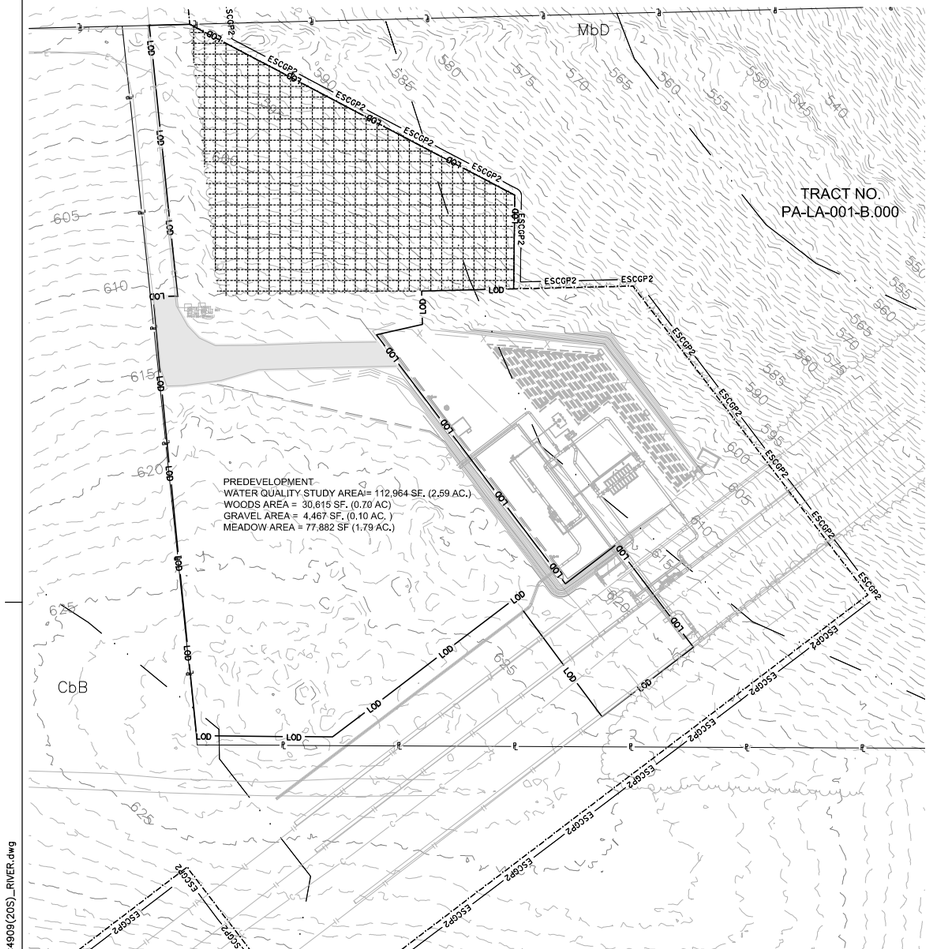
STANDARD WORKSHEET #18
Anti-seep Collar Design



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	PERM.	2	3	14.74	16.21	9	22 (OD)	40	1	N/A	10

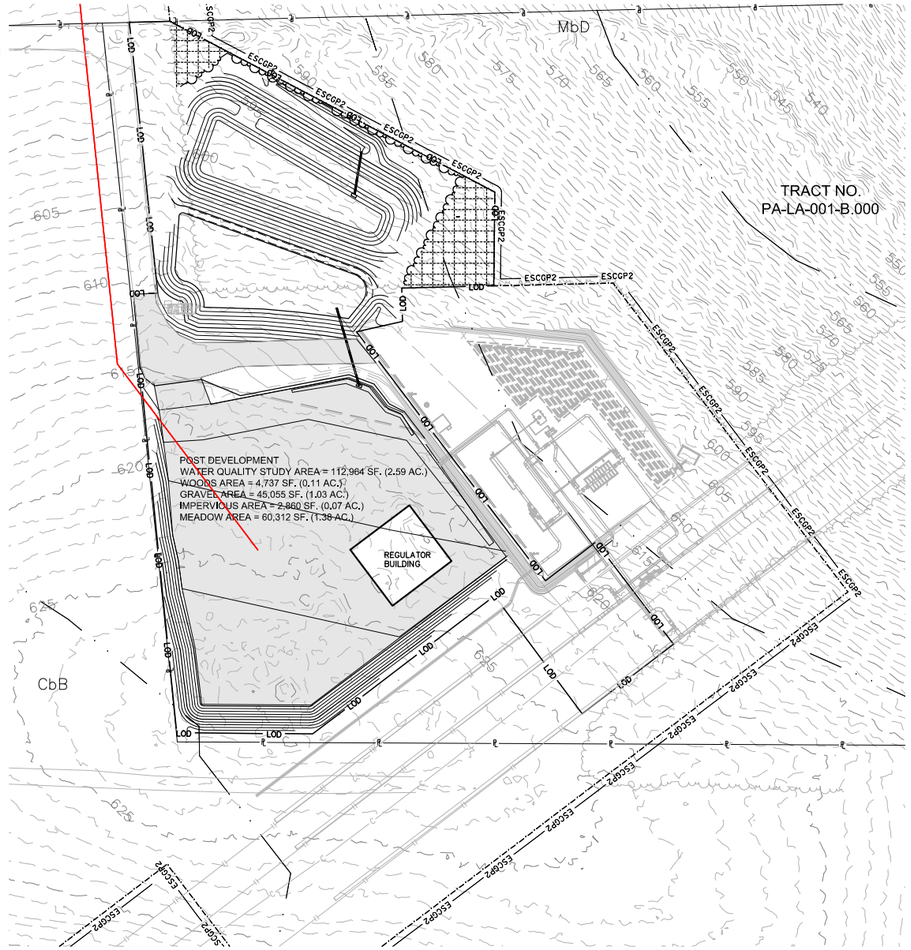
Source: 363-2134-008 / March 31, 2012 / Page 389

A.5 Water Quality Worksheets



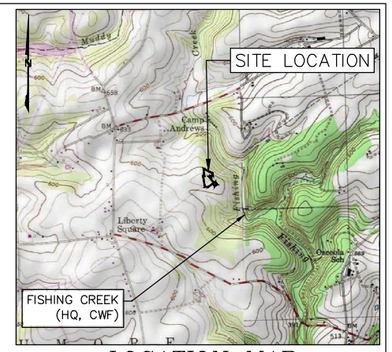
PREDEVELOPMENT WATER QUALITY SURFACES

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



POST DEVELOPMENT WATER QUALITY SURFACES

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



LOCATION MAP

USGS HOLTWOOD QUADRANGLE
SCALE: 1"=2,000'

LEGEND

- PROPERTY BOUNDARY LINE (APPROXIMATE)
- 1460 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
- EXISTING ROAD
- ROW
- 1460 PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- LOD LIMIT OF DISTURBANCE (RIVER ROAD REGULATOR STATION)
- ESCGP-2 ESCGP-2 PERMIT BOUNDARY
- CENTERLINE GAS PIPELINE
- LIMIT OF WORKSPACE (OVERALL PIPELINE PROJECT)
- PROPOSED ACCESS ROAD
- GRAVEL AREA
- WOODED AREA

COMMONWEALTH OF PENNSYLVANIA
ALARIC JAMES BUSHER
ENGINEER
ALARIC J. BUSHER REG NO. PE 60320
BLE Companies

REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O. NO.	CHK.	APP.
0	08/28/2015	BL	ISSUED FOR PADEP SUBMITTAL	W01161509	DAK	AJB
1	12/02/2015	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	DAK	AJB
3	03/28/2016	BL	ISSUED FOR PADEP RESUBMITTAL	W01161509	AJB	AJB
4	*Oct. 2016*	*BL*	*PADEP TECHNICAL DEFICIENCY RESPONSE #1*	*W01161509*	*AJB*	*AJB*

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
ATLANTIC SUNRISE PROJECT– PROPOSED 42" NATURAL GAS PIPELINE
POST CONSTRUCTION STORMWATER MANAGEMENT PLANS
FOR RIVER ROAD REGULATOR STATION
DRUMORE TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA

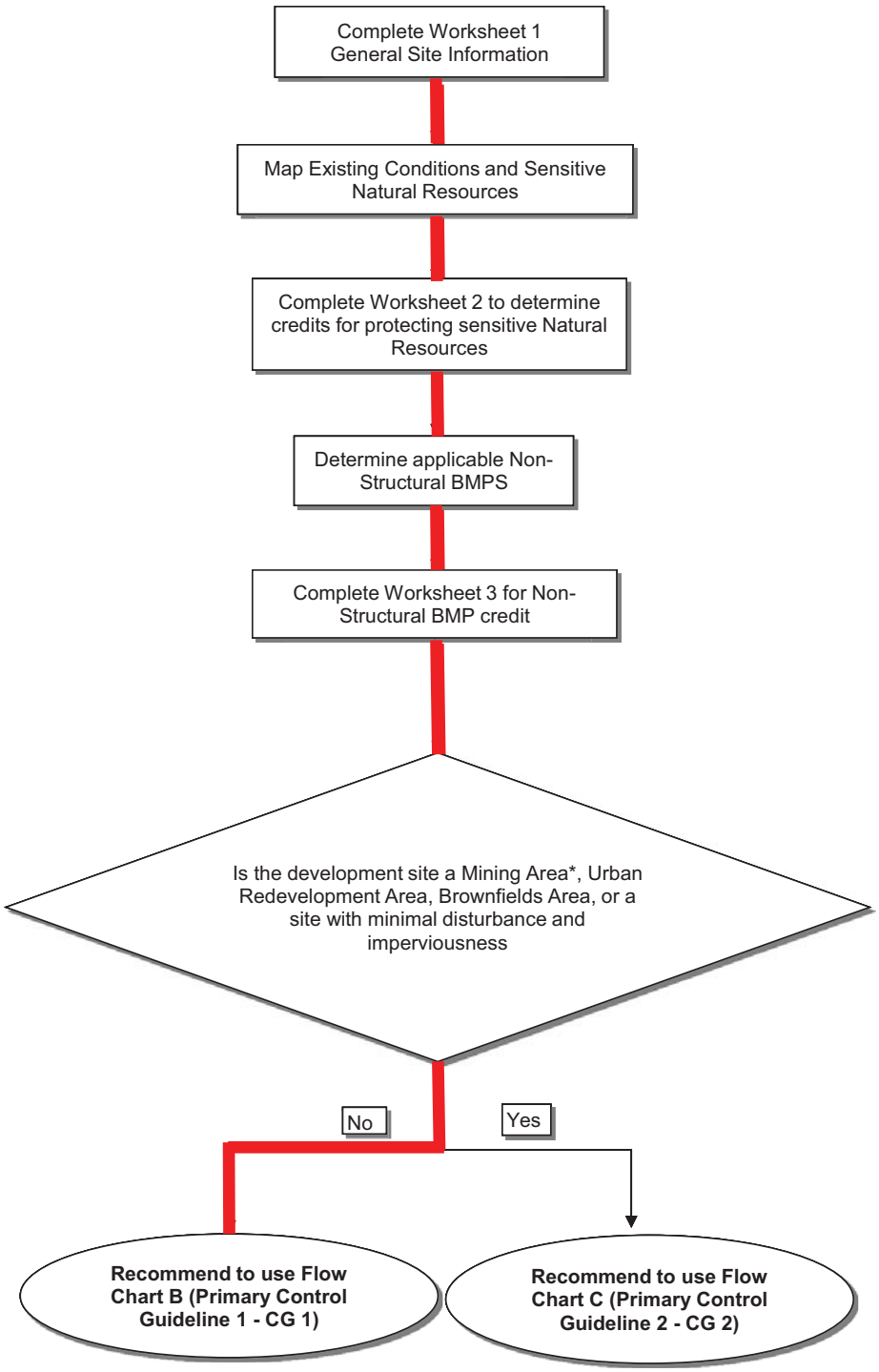
WATER QUALITY STUDY AREA MAP

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: 4
APPROVED BY:	AJB	DATE:	07/17/15	DRAWING NUMBER: (92–3400)VF–1A–9	SHEET 1 OF 1
W.O.	1161509				

Drawing Location & Name: G:\JOBS14\14C\14C4909\DWG\020-CPLS\FRS_PCSM14C4909(20S)_RIVER.dwg

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 22-Oct-15

Project Name: Atlantic Sunrise Project - River Road Regulator Station

Municipality: Drumore Township

County: Lancaster

Total Area (acres): 2.59

Major River Basin: Susquehanna River

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

Watershed: Fishing Creek

Sub-Basin: None

Nearest Surface Water(s) to Receive Runoff: Fishing Creek

Chapter 93 - Designated Water Use: HQ; CWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Chapter 303(d) List?

http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm

Yes	x
No	

List Causes of Impairment: Other Habitat Alterations

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements?

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

Yes	
No	X

Existing or planned drinking water supply?

Yes	
No	X

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan?

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html

Yes	
No	X

Existing River Conservation Plan?

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/

Yes	X
No	

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	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	0.70	0.11
Natural Drainage Ways	n/a	0.00	0.00
Steep Slopes, 15% - 25%	n/a	0.17	0.00
Steep Slopes, over 25%	n/a	0.68	0.00
Other:			
Other:			
TOTAL EXISTING:		1.55	0.11

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0.11	**Ac.**
1.2 Area of Riparian Forest Buffer Protection	-	**Ac.**
3.1 Area of Minimum Disturbance/Reduced Grading	0.11	**Ac.**
TOTAL	0.11	**Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
2.59	-	0.11	=	2.48

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	0	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	0	ft^2	x 1/3"	x 1/12	=	- **ft^3**

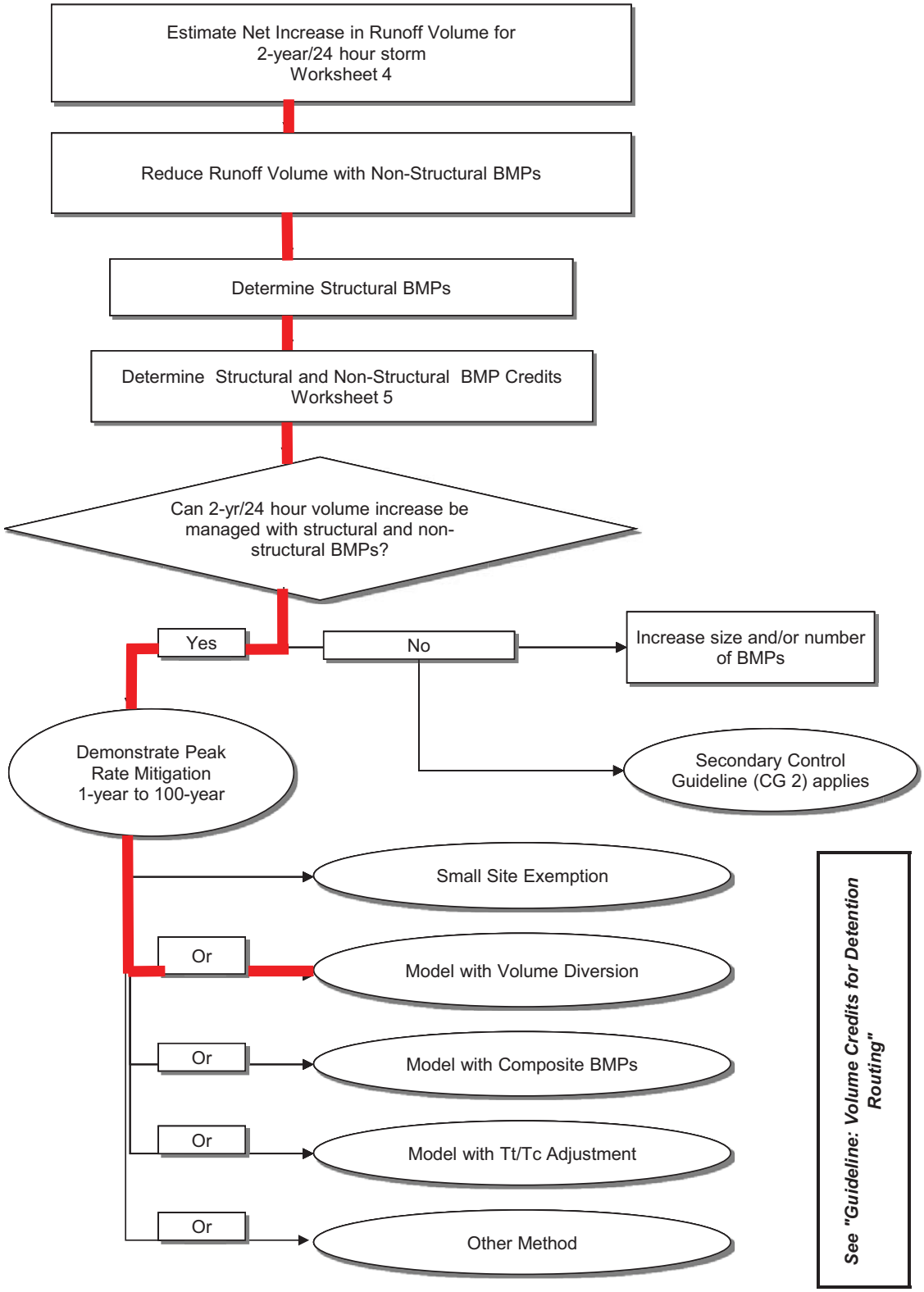
For all other disconnected roof areas

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

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

** For use on Worksheet 5*

FLOW CHART B
Control Guideline 1 Process



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

PROJECT: Atlantic Sunrise Project - River Road Regulator Station
DA: 2.59
2-Year Rainfall: 2.9 in

Total Site Area: 2.59 acres
Protected Site Area: 0.11 acres
Managed Area 2.49 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	B	77,882.00	1.79	58	7.24	1.45	0.24	1,573.44
Meadow*	B	893.00	0.02	58	7.24	1.45	0.24	18.04
Woods	B	30,615.00	0.70	66	5.15	1.03	0.50	1,270
Impervious**	B	3,574.00	0.08	89	1.24	0.25	1.81	539
TOTAL:		112,964.00	2.59					3,401

* 20% of existing gravel area
** 80% of existing gravel area

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	B	61,805.00	1.42	58	7.24	1.45	0.24	1,249
Woods	B	4,737.00	0.11	66	5.15	1.03	0.50	196.54
Gravel	B	43,562.00	1.00	89	1.24	0.25	1.81	6,569.42
Impervious	B	2,860.00	0.07	98	0.20	0.04	2.67	636
TOTAL:		112,964.00	2.59				5.22	8,651

2-Year Volume Increase (ft^3)	**5,250**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where

   P = 2-Year Rainfall (in)

   S = (1000/ CN)-10

2. Runoff Volume (CF) = Q x Area x 1/12

   Q = Runoff (in)

   Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

PROJECT: Atlantic Sunrise Project - River Road Regulator Station
SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4*: 5,250
Non-structural Volume Credit (ft^3) - *from Worksheet 3*: - 0

Structural Volume Reqmt (ft^3) 5,250
(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	10,435	6,143
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 Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation	7,841	-
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales	-	-

Total Structural Volume (ft^3): 6,143
Structural Volume Requirement (ft^3): 5,250

DIFFERENCE 893

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
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	X	

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	X	
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		
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		

A.6 Site Characterization Assessment

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RIVER ROAD REGULATOR STATION
INFILTRATION RATE/DEWATERING TIME/TESTING METHODS

Infiltration testing data for the River Road Regulator Station site was provided by AECOM (TP-1 through TP-8) and BL Companies (BL-1 through BL-5). The test numbers correspond to the test pit locations shown on the Post Construction Stormwater Management Plan. Tests performed by BL Companies used the double ring infiltrometer method. Tests performed by AECOM used the falling head procedure. The bentonite soak referred to by AECOM is to set the bentonite; the pre-soak is to establish saturated conditions at the test site. (See Appendices)

The adjusted infiltration rate exceeds the allowable 10 in/hr. To compensate for this, the drawdown time in the infiltration basins will be monitored and the soils within the basin will be amended if dewatering exceeds 72 hours (0.50 in/hr) or if the dewatering is greater than 3.33 in/hr. The minimum/design infiltration rate of 0.50 in/hr was derived by multiplying the minimum infiltration rate of 0.16 in/hr by a safety factor of 3. The 0.16 in/hr infiltration rate was calculated using the greatest ponding depth (12" in infiltration basin #2) and a maximum 72 hours dewatering time. The maximum dewatering time was calculated by dividing the maximum allowable infiltartion rate of 10 in/hr (per PA Stormwater BMP Manual,Appendix C) by a safety factor of 3.

Average/Stabilized reading

TP-1A	7.13	in/10 min. time interval
TP-1B	3.88	in/10 min. time interval
TP-2A-A	8.00	in/10 min. time interval
TP-2A-B	8.00	in/10 min. time interval
TP-3A-A	8.00	in/10 min. time interval
TP-3A-B	8.00	in/10 min. time interval
TP-8A	7.13	in/10 min. time interval
TP-8B	3.88	in/10 min. time interval
BL-1	0.94	in/10 min. time interval
BL-2	0.06	in/10 min. time interval
BL-3	1.75	in/10 min. time interval
BL-4	5.75	in/10 min. time interval
BL-5	5.75	in/10 min. time interval
Average drop	5.25	in/10 min. time interval

Adjusted Infiltration Rate

Average Infiltration Rate	31.50	in/hr	
Safety factor	3.00		
Adjusted infiltration rate	10.50	in/hr	(Exceeds allowable 10 in/hr per Appendix C)

The limiting layer depths range from 72 inches to 88 inches across the infiltration areas except for BL-1 through BL-5 in which no limiting layer was encountered. Bedrock was identified as the limiting layer. Most of the proposed infiltration elevations provide the recommended 24 inches of clearance to the limiting layer. In any area where bedock is encountered within 2 feet of the final infiltration elevation, the bedrock will be removed and amended soil will be placed to provide the recommended buffer between the bedrock and infiltration suface. This will provide the recommended clearance to the limiting layer. As a result, it is our belief that the proposed design will meet the standards recommended in the PCSM Manual.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - River Road Regulator Station
Test Pit # 1 (BL1 ON PLAN SHEETS)
Name Krystal Bealing, CPSS
Date June 17, 2016
Weather Sunny, 66-80°F
Equipment Mini Excavator

Elevation 597.88 AMSL
Soil Type GbB - Glenelg silt loam, 3-8% slopes
Geology Octoraro Formation
Landscape Position/Slope Summit, 0-1% slope
Land Use Disturbed woods
Additional Notes Edge of woods and gravel road

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure/Grade	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
A	0-4	Silt Loam	-	7.5YR 3/4	-	-	Granular, 2	Very Friable	Diffuse and Smooth	>20% roots	-	-
Bt1	4-18	Silt Clay Loam	15% Channery	7.5YR 4/6	-	-	Subangular Blocky, 1	Very Friable	Gradual and Wavy	>20% roots	-	-
Bt2	18-27	Silt Clay Loam	35% Channery	7.5YR 5/6	7.5YR 3/1	-	Platy, 1 parting to Subangular Blocky, 2	Very Friable	Diffuse and Smooth	2-20% roots	-	-
BC	27-41	Silt Clay Loam	50% Channery	7.5YR 3/4	-	-	Platy, 2 parting to Subangular Blocky, 1	Very Friable	Clear and Smooth	<2% roots	-	-
C	41-60+	Silt Clay Loam	60% Channery	7.5YR 4/4	-	-	Platy, 1	Very Friable	-	-	-	-

Comments: No limiting layer observed.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - River Road Regulator Station
Test Pit # 2 (BL2 ON PLAN SHEETS)
Name Krystal Bealing, CPSS
Date June 17, 2016
Weather Sunny, 66-80°F
Equipment Mini Excavator

Elevation 608-14 AMSL
Soil Type GbB - Glenelg silt loam, 3-8% slopes
Geology Octoraro Formation
Landscape Position/Slope Summit, 0-1% slope
Land Use Disturbed woods
Additional Notes Edge of woods and gravel road

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure/Grade	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
A	0-8	Silt Loam	5% Channery	7.5YR 3/4+	-	-	Granular, 1	Very Friable	Diffuse and Smooth	>20% roots	-	-
Bt	8-24	Silt Clay Loam	15% Channery	7.5YR 5/8	-	-	Subangular Blocky, 1	Very Friable	Clear and Smooth	>20% roots	-	-
BC	24-42	Silt Clay Loam	50% Channery	5YR 4/6	-	-	Platy, 2 parting to Subangular Blocky, 1	Very Friable	Clear and Smooth	2-20% roots	-	-
C	42-60+	Silt Clay Loam	60% Channery	7.5YR 4/6	-	-	Platy, 1	Very Friable	-	<2% roots	-	-

Comments: No limiting layer observed.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - River Road Regulator Station
Test Pit # 3 (BL3 ON PLAN SHEETS)
Name Krystal Bealing, CPSS
Date June 17, 2016
Weather Sunny, 66-80°F
Equipment Mini Excavator

Elevation 598.8 AMSL
Soil Type GbB - Glenelg silt loam, 3-8% slopes
Geology Octoraro Formation
Landscape Position/Slope Summit, 0-1% slope
Land Use Disturbed woods
Additional Notes Edge of woods and gravel road

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure/Grade	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
A	0-8	Silt Loam	10% Channery	7.5YR 3/4	-	-	Granular, 2	Very Friable	Clear and Smooth	>20% roots	-	-
Bt	8-18	Silt Clay Loam	25% Channery	7.5YR 4/6	-	-	Subangular Blocky, 1	Very Friable	Gradual and Wavy	>20% roots	-	-
BC	18-32	Silt Clay Loam	40% Channery	7.5YR 4/4	-	-	Platy, 2 parting to Subangular Blocky, 1	Very Friable	Clear and Smooth	2-20% roots	-	-
C	32-60	Silt Clay Loam	65% Channery	7.5YR 4/3	-	-	Platy, 1	Very Friable	-	<2% roots	-	-

Comments: No limiting layer observed.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - River Road Regulator Station
Test Pit # 4 (BL4 ON PLAN SHEETS)
Name Krystal Bealing, CPSS
Date June 17, 2016
Weather Sunny, 66-80°F
Equipment Mini Excavator

Elevation 599.52 AMSL
Soil Type GbB - Glenelg silt loam, 3-8% slopes
Geology Octoraro Formation
Landscape Position/Slope Summit, 0-1% slope
Land Use Disturbed woods
Additional Notes Edge of woods and gravel road

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure/Grade	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
A	0-6	Silt Loam	10% Channery	7.5YR 3/4	-	-	Granular, 2	Very Friable	Clear and Smooth	>20% roots	-	-
Bt	6-21	Silt Clay Loam	25% Channery	7.5YR 4/6	-	-	Subangular Blocky, 1	Very Friable	Gradual and Wavy	>20% roots	-	-
BC	21-42	Silt Clay Loam	40% Channery	7.5YR 4/4	-	-	Platy, 2 parting to Subangular Blocky, 1	Very Friable	Clear and Smooth	2-20% roots	-	-
C	42-60+	Silt Clay Loam	65% Channery	7.5YR 4/3	-	-	Platy, 1	Very Friable	-	<2% roots	-	-

Comments: No limiting layer observed.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - River Road Regulator Station
Test Pit # 5 (BL5 ON PLAN SHEETS)
Name Krystal Bealing, CPSS
Date June 17, 2016
Weather Sunny, 66-80°F
Equipment Mini Excavator

Elevation 607.84 AMSL
Soil Type GbB - Glenelg silt loam, 3-8% slopes
Geology Octoraro Formation
Landscape Position/Slope Summit, 0-1% slope
Land Use Disturbed woods
Additional Notes Edge of woods and gravel road

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure/Grade	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
A	0-10	Silt Loam	10% Channery	7.5YR 3/3	-	-	Granular, 2	Very Friable	Gradual and Smooth	>20% roots	-	-
Bt	10-28	Silt Clay Loam	15% Channery	7.5YR 5/8	-	-	Subangular Blocky, 2	Very Friable	Gradual and Smooth	>20% roots	-	-
BC	28-48	Silt Clay Loam	35% Channery	7.5YR 5/6	-	-	Platy, 2 parting to Subangular Blocky, 1	Very Friable	Gradual and Wavy	>20% roots	-	-
C	48-60+	Silt Clay Loam	50% Channery	7.5YR 5/6	-	-	Platy, 2	Very Friable	-	<2% roots	-	-

Comments: No limiting layer observed.

ATLANTIC SUNRISE PROJECT - RIVER ROAD 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
BL1	Yes	10	0.938	0.938	1.125	1.000					1.000	6.000	66-80°F, sunny. Test done at 36 inches below the surface.
BL2	No	30	0.125	0.375	0.375	0.375					0.313	0.625	66-80°F, sunny. Test done at 36 inches below the surface.
BL3	Yes	10	4.750	1.750	5.750	2.750	5.750	3.250	3.000	4.375	3.922	23.531	66-80°F, sunny. Test done at 60 inches below the surface. Note: Readings 3 and 5 exceeded the limits of the infiltrometer and were empty of water within the 10 minute timeframe.
BL4	Yes	10	5.750	5.750	5.750	5.750					5.750	34.500	66-80°F, sunny. Test done at 60 inches below the surface. Note: All readings exceeded the limits of the infiltrometer and were empty of water within the 10 minute timeframe.
BL5	Yes	10	5.750	5.750	5.750	5.750					5.750	34.500	66-80°F, sunny. Test done at 36 inches below the surface. Note: All readings exceeded the limits of the infiltrometer and were empty of water within the 10 minute timeframe.

[1]Inches of drop greater than 2 inches after the 2nd 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, or an overall average in the case of eight unstabilized readings.

[3]Calculated as the average stabilized reading x 2 for 30 minute intervals; x 6 for 10 minute intervals.

Soil Profile Log

Project Williams- Rock Springs
Test Pit # 1
Name Logan Dunn
Date February 25, 2015
Weather High 20s degrees F, ~5 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments No Redox Features Noted.

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	10	L	Gravelly	7.5 YR 5/6	-	Few Roots Fine Pores Weak, Granular-Subangular blocky	-	-	Frozen, Friable
Bw1	10	19	CL	Gravelly	7.5 YR 5/8	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
Bw2	19	34	CL	Cobbly	7.5 YR 5/6	-	Few Roots Fine Pores Weak-moderate, Subangular blocky	-	-	Friable
C	34	72	L	Channery	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky	-	-	Friable

Note: 1. Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

APPLICANT	Williams	PROJECT NO.		DATE	2-25-15
LOCATION	Rock Springs	PROBE NO.	TP-1	PREPARER	Logan Dunn

Hole Number	Time Interval (min)	Test Depth	Initial Water Depth inches	Presoak		Readings								
				1	2	1	2	3	4	5	6	7	8	9
				Time 1120 1150	1050 1220	Time 1220 1230	1240	1250	1300	1310	1320	1330	1340	—
TP-1A	10	4.0'	8"	8" drop	8"	7⅞"	7⅞"	7⅞"	7¼"					Amount of fill in hole
TP-1B	10	4.0'	8"	8" drop	8"	4½"	4½"	4¼"	4"	4"	3⅞"	3⅞"		

Bentonite Sock @ 1050

* If presoak drop is< 6" take readings every 30 minutes. If it is >6" take readings every 10 minutes

* 30 minute intervals: Minimum 2 hours of readings. Maximum of 4 hours

*10 minute intervals: Minimum of 80 minutes of readings, maximum of 80 mins

The test shall continue at the interval determined until a minimum of eight readings are completed or until stabilized rate drop is obtained. Test is considered stable when 4 consecutive readings are with into 1/4".

#13"
#31"

Soil Profile Log

Project Williams- Rock Springs
Test Pit # 2
Name Logan Dunn
Date February 25, 2015
Weather High 20s degrees F, ~5 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments No Infiltration Test Conducted- Rock (Schist) @ 82"
No Redox Features Noted.

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	5	L	Gravelly	7.5 YR 4/4	-	Few Roots Medium Pores Weak, Granular	-	-	Friable
Bw1	5	11	CL	Gravelly-Cobbly	7.5 YR 5/8	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
Bw2	11	29	CL	Cobbly	7.5 YR 5/6	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
BE	29	62	L	Channery	7.5 YR 5/6	-	Few Roots Medium Pores Moderate, subangular blocky	-	-	Friable
C	62	82	L	Flaggy-Stony	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky-Platy	-	-	Friable-Firm
R	82	104	Bedrock	-	-	-	-	82	-	Bedrock (Schist)

Note: 1. 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 Williams- Rock Springs
Test Pit # 2A
Name Logan Dunn
Date February 27, 2015
Weather Mid 20s degrees F, ~7 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments Rock Limiting Zone @ 84", Infiltration Test conducted @ 60"
No Redox Features Noted.

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	6	L	Gravelly	7.5 YR 4/4	-	Weak, Granular	-	-	Friable
Bw1	6	17	CL	Gravelly	7.5 YR 5/8	-	Moderate, Subangular blocky	-	-	Friable
Bw2	17	34	CL	Cobbly	7.5 YR 5/6	-	Moderate, Subangular blocky	-	-	Friable
BE	34	64	L	Cobbly	7.5 YR 5/6	-	Moderate, subangular blocky	-	-	Friable
C	64	84	L	Channery	7.5 YR 5/6	-	Moderate, subangular blocky-Platy	-	-	Friable-Firm
R	84	-	Bedrock	-	-	-	-	84	-	Bedrock

Note: 1. Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

APPLICANT	Williams	PROJECT NO.		DATE	2-27-15
LOCATION	Rock Springs	PROBE NO.	TP-2A	PREPARER	Logan Dunn

Hole Number	Time Interval (min)	Test Depth	Initial Water Depth	Presoak		Readings								
				1	2	1	2	3	4	5	6	7	8	9
				Time 1140	1210	Time 1240								
				1210	1240	1250	1300	1310	1320	1330	1340	1350	1400	
TP-2A-A	10	5'	8"	8"	8"	8"	8"	8"	8"					Amount of Drop
TP-2A-B	10	5'	8"	8"	8"	8"	8"	8"	8"					

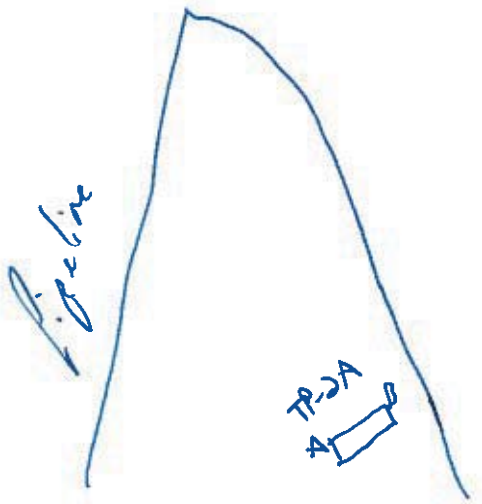
Bentonite Present @ 1110

* If presoak drop is< 6" take readings every 30 minutes. If it is >6" take readings every 10 minutes

* 30 minute intervals: Minimum 2 hours of readings. Maximum of 4 hours

*10 minute intervals: Minimum of 80 minutes of readings, maximum of 80 mins

The test shall continue at the interval determined until a minimum of eight readings are completed or until stabilized rate drop is obtained. Test is considered stable when 4 consecutive readings are with into 1/4".



Soil Profile Log

Project Williams- Rock Springs
Test Pit # 3
Name Logan Dunn
Date February 25, 2015
Weather High 20s degrees F, ~5 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments No Infiltration Test Conducted- Rock (Schist) @ 117"
No Redox Features Noted.

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	6	L	Gravelly	7.5 YR 4/4	-	Few Roots Medium Pores Weak, Granular	-	-	Frozen, Friable
Bw1	6	13	CL	Gravelly	7.5 YR 5/8	-	Few Roots Medium Pores Moderate, Granular-Subangular blocky	-	-	Friable
Bw2	13	24	CL	Cobbly	7.5 YR 5/6	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
BE	24	73	L	Channery	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky	-	-	Friable
C	73	117	L	Flaggy	7.5 YR 5/6	-	Few Roots Fine Pores Strong, subangular blocky-Platy	-	-	Friable
R	117	-	Bedrock	-	-	-	-	117	-	Bedrock (Schist)

Note: 1. 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 Williams- Rock Springs
Test Pit # 3A
Name Logan Dunn
Date February 27, 2015
Weather Mid 20s degrees F, ~7 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments Competent Rock @ 88", Infiltration Test conducted @ 64"
No Redox Features Noted.

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	L	Gravelly	7.5 YR 4/4	-	Few Roots Medium Pores Weak, Granular	-	-	Frozen, Friable
Bw1	7	18	CL	Gravelly	7.5 YR 5/8	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
Bw2	18	32	CL	Cobbly	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, Subangular blocky	-	-	Friable
BE	32	45	L	Cobbly-Channery	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky	-	-	Friable
C	45	88	L	Channery	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky-Platy	-	-	Friable-Firm
R	88	-	Bedrock	-	-	-	-	88	-	Bedrock (Schist)

Note: 1. Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

APPLICANT	Williams	PROJECT NO.		DATE	2-27-15
LOCATION	Rock Springs	PROBE NO.	TP-3A	PREPARER	Logan Dunn

Hole Number	Time Interval (min)	Test Depth	Initial Water Depth	Presoak		Readings								
				1	2	1	2	3	4	5	6	7	8	9
				1125 Time 1155		1225 Time								
				1155	1225	1235	1245	1255	1305	1315	1325	1335	1345	
TP3A-A	10	64"	8"	8"	8"	8"	8"	8"	8"					Amount of Drop
TP3A-B	10	64"	8"	8"	8"	8"	8"	8"	8"					

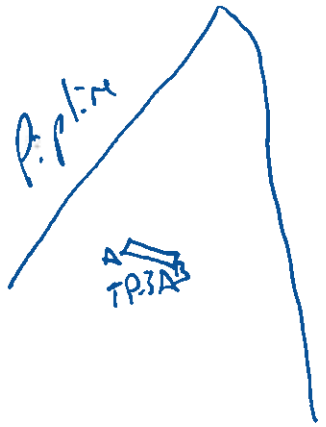
Bentonite presoak @ 1055

* If presoak drop is< 6" take readings every 30 minutes. If it is >6" take readings every 10 minutes

* 30 minute intervals: Minimum 2 hours of readings. Maximum of 4 hours

*10 minute intervals: Minimum of 80 minutes of readings, maximum of 80 mins

The test shall continue at the interval determined until a minimum of eight readings are completed or until stabilized rate drop is obtained. Test is considered stable when 4 consecutive readings are with into 1/4".



Soil Profile Log

Project Williams- Rock Springs
Test Pit # 8
Name Logan Dunn
Date February 27, 2015
Weather Mid 20s degrees F, ~7 MPH winds
Equipment CAT Excavator

Elevation Approx. 620 AMSL
Soil Type Glenelg Silt Loam, 3-8% slopes
Geology Wissahickon Formation
Landscape Position/Slope Hilltop, 3-12%
Land Use Agriculture
Additional Comments Competent Rock @ 72", Infiltration Test conducted @ 48"
No Redox Features Noted.

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	L	Gravelly	7.5 YR 4/4	-	Few Roots Medium Pores Weak, Granular	-	-	Frozen, Friable
Bw1	7	17	CL	Gravelly	7.5 YR 5/8	-	Few Roots Medium Pores Moderate, Subangular blocky	-	-	Friable
Bw2	17	31	CL	Cobbly	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, Subangular blocky	-	-	Friable
C	31	72	L	Cobbly-Channery	7.5 YR 5/6	-	Few Roots Fine Pores Moderate, subangular blocky-platy	-	-	Friable-Firm
R	72	-	Bedrock	-	-	-	-	72	-	Bedrock

Note: 1. Unless stated otherwise, horizon strike and dip was not observed to have a significant impact on water flow within the profile.

APPLICANT	Williams	PROJECT NO.		DATE	2-27-15
LOCATION	Rock Springs	PROBE NO.	TP-8	PREPARER	Logan Dunn

Hole Number	Time Interval (min)	Test Depth	Initial Water Depth	Presoak		Readings								
				1	2	1	2	3	4	5	6	7	8	9
				1148 Time 1218	1248 Time 1248	1248 Time 1258	1308	1318	1328	1338	1348	1358	1408	
TP-8A	10	4'	8"	8"	8"	8"	8"	8"	8"					Amount of Drop
TP-8B	10	4'	8"	8"	8"	8"	8"	8"	8"					

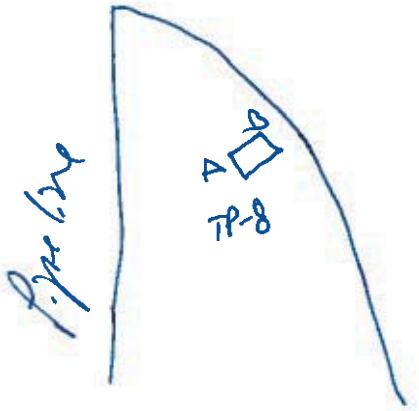
Both Presoak @ 1118

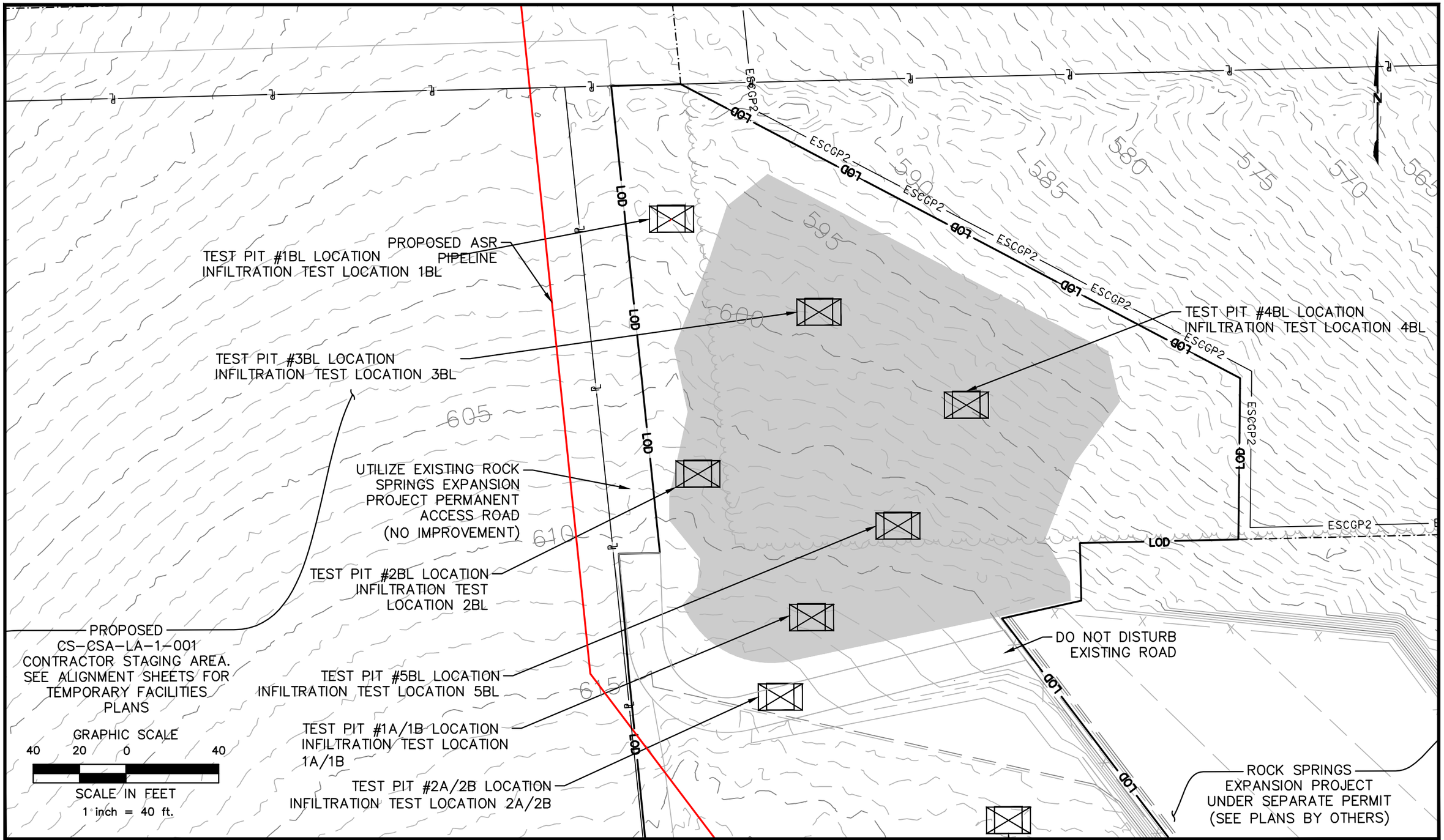
* If presoak drop is< 6" take readings every 30 minutes. If it is >6" take readings every 10 minutes

* 30 minute intervals: Minimum 2 hours of readings. Maximum of 4 hours

*10 minute intervals: Minimum of 80 minutes of readings, maximum of 80 mins

The test shall continue at the interval determined until a minimum of eight readings are completed or until stabilized rate drop is obtained. Test is considered stable when 4 consecutive readings are with into 1/4".





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Camp Hill, PA 17011
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(717) 651-9858 Fax

INFILTRATION TEST LOCATIONS

TRANSCONTINENTAL GAS PIPELINE COMPANY LLC
RIVER ROAD REGULATOR STATION
DRUMORE TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA

Designed	A.M.L.
Drawn	A.M.L.
Checked	A.J.B.
Approved	
Scale	1"=40'
Project No.	14C4909
Date	06/27/16
CAD File	FRS_PCSM1-C4909(20S)_RIVER

INF-01

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: Drumore, Pennsylvania, US*
Latitude: 39.8360°, Longitude: -76.2540°
Elevation: 623 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	**0.326** (0.290-0.367)	**0.388** (0.346-0.437)	**0.459** (0.408-0.516)	**0.509** (0.452-0.571)	**0.570** (0.504-0.639)	**0.613** (0.540-0.687)	**0.654** (0.574-0.733)	**0.692** (0.604-0.777)	**0.736** (0.638-0.828)	**0.770** (0.663-0.867)
10-min	**0.521** (0.464-0.586)	**0.620** (0.553-0.699)	**0.734** (0.653-0.826)	**0.814** (0.723-0.914)	**0.908** (0.803-1.02)	**0.976** (0.860-1.09)	**1.04** (0.912-1.17)	**1.10** (0.957-1.23)	**1.17** (1.01-1.31)	**1.21** (1.04-1.36)
15-min	**0.651** (0.580-0.733)	**0.780** (0.695-0.879)	**0.929** (0.826-1.04)	**1.03** (0.914-1.16)	**1.15** (1.02-1.29)	**1.24** (1.09-1.39)	**1.31** (1.15-1.47)	**1.38** (1.21-1.55)	**1.47** (1.27-1.65)	**1.52** (1.31-1.71)
30-min	**0.893** (0.795-1.00)	**1.08** (0.960-1.21)	**1.32** (1.17-1.48)	**1.49** (1.32-1.68)	**1.71** (1.51-1.91)	**1.86** (1.64-2.09)	**2.01** (1.76-2.26)	**2.15** (1.88-2.42)	**2.33** (2.02-2.62)	**2.46** (2.12-2.77)
60-min	**1.11** (0.991-1.25)	**1.35** (1.20-1.52)	**1.69** (1.50-1.90)	**1.94** (1.73-2.18)	**2.27** (2.01-2.55)	**2.52** (2.22-2.83)	**2.77** (2.43-3.11)	**3.02** (2.64-3.39)	**3.35** (2.90-3.76)	**3.60** (3.10-4.05)
2-hr	**1.33** (1.19-1.49)	**1.61** (1.44-1.81)	**2.04** (1.82-2.29)	**2.38** (2.11-2.66)	**2.84** (2.52-3.17)	**3.22** (2.84-3.59)	**3.62** (3.17-4.03)	**4.03** (3.50-4.50)	**4.61** (3.96-5.15)	**5.08** (4.33-5.68)
3-hr	**1.44** (1.29-1.61)	**1.75** (1.57-1.96)	**2.22** (1.99-2.48)	**2.58** (2.31-2.88)	**3.09** (2.75-3.43)	**3.50** (3.10-3.89)	**3.94** (3.46-4.38)	**4.39** (3.83-4.88)	**5.03** (4.33-5.60)	**5.54** (4.73-6.17)
6-hr	**1.77** (1.60-1.99)	**2.15** (1.94-2.41)	**2.71** (2.44-3.03)	**3.18** (2.85-3.54)	**3.85** (3.43-4.28)	**4.41** (3.90-4.89)	**5.02** (4.40-5.56)	**5.67** (4.92-6.27)	**6.62** (5.67-7.33)	**7.41** (6.26-8.22)
12-hr	**2.13** (1.92-2.40)	**2.58** (2.32-2.90)	**3.27** (2.94-3.68)	**3.87** (3.45-4.33)	**4.75** (4.20-5.30)	**5.51** (4.83-6.14)	**6.35** (5.52-7.06)	**7.28** (6.24-8.09)	**8.68** (7.30-9.64)	**9.87** (8.18-11.0)
24-hr	**2.45** (2.26-2.67)	**2.95** (2.73-3.23)	**3.77** (3.48-4.11)	**4.48** (4.11-4.87)	**5.55** (5.06-6.00)	**6.48** (5.86-6.99)	**7.52** (6.74-8.09)	**8.69** (7.69-9.33)	**10.5** (9.10-11.2)	**12.0** (10.3-12.8)
2-day	**2.79** (2.58-3.05)	**3.38** (3.13-3.69)	**4.31** (3.99-4.70)	**5.10** (4.70-5.54)	**6.26** (5.73-6.77)	**7.25** (6.59-7.83)	**8.34** (7.52-8.98)	**9.54** (8.52-10.3)	**11.3** (9.96-12.2)	**12.8** (11.1-13.8)
3-day	**2.96** (2.74-3.22)	**3.58** (3.32-3.90)	**4.55** (4.21-4.95)	**5.38** (4.96-5.83)	**6.60** (6.05-7.13)	**7.65** (6.96-8.24)	**8.79** (7.94-9.46)	**10.1** (9.00-10.8)	**11.9** (10.5-12.8)	**13.5** (11.8-14.5)
4-day	**3.13** (2.90-3.39)	**3.78** (3.50-4.10)	**4.80** (4.44-5.20)	**5.66** (5.22-6.12)	**6.94** (6.37-7.48)	**8.04** (7.33-8.65)	**9.24** (8.37-9.93)	**10.6** (9.49-11.3)	**12.5** (11.1-13.5)	**14.2** (12.4-15.2)
7-day	**3.65** (3.39-3.94)	**4.38** (4.07-4.74)	**5.50** (5.11-5.94)	**6.45** (5.97-6.96)	**7.86** (7.24-8.46)	**9.05** (8.28-9.73)	**10.4** (9.42-11.1)	**11.8** (10.6-12.7)	**13.9** (12.4-14.9)	**15.7** (13.8-16.8)
10-day	**4.14** (3.86-4.45)	**4.96** (4.63-5.34)	**6.16** (5.74-6.62)	**7.15** (6.64-7.67)	**8.57** (7.92-9.19)	**9.75** (8.97-10.4)	**11.0** (10.1-11.8)	**12.4** (11.2-13.2)	**14.3** (12.9-15.3)	**15.9** (14.2-17.0)
20-day	**5.63** (5.30-5.99)	**6.69** (6.30-7.12)	**8.05** (7.58-8.56)	**9.15** (8.60-9.73)	**10.7** (10.0-11.3)	**11.9** (11.1-12.6)	**13.1** (12.2-14.0)	**14.4** (13.4-15.3)	**16.2** (14.9-17.2)	**17.6** (16.0-18.7)
30-day	**6.98** (6.60-7.38)	**8.24** (7.80-8.72)	**9.74** (9.21-10.3)	**10.9** (10.3-11.6)	**12.6** (11.9-13.3)	**13.9** (13.0-14.7)	**15.2** (14.2-16.1)	**16.5** (15.4-17.5)	**18.3** (16.9-19.4)	**19.6** (18.1-20.9)
45-day	**8.82** (8.38-9.27)	**10.4** (9.87-10.9)	**12.1** (11.5-12.7)	**13.4** (12.7-14.0)	**15.1** (14.3-15.8)	**16.3** (15.5-17.1)	**17.6** (16.6-18.5)	**18.8** (17.7-19.7)	**20.3** (19.0-21.4)	**21.4** (20.0-22.5)
60-day	**10.5** (10.0-11.1)	**12.4** (11.8-13.0)	**14.2** (13.6-14.9)	**15.6** (14.9-16.4)	**17.4** (16.6-18.3)	**18.8** (17.8-19.7)	**20.0** (19.0-21.0)	**21.2** (20.1-22.3)	**22.7** (21.4-23.8)	**23.7** (22.3-25.0)

[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.

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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 Lancaster County, Pennsylvania

River Road 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

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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 LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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: Lancaster County, Pennsylvania
Survey Area Data: Version 10, Sep 19, 2014

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

Date(s) aerial images were photographed: Mar 26, 2011—Mar 2, 2012

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

Lancaster County, Pennsylvania (PA071)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CbB	Chester silt loam, 3 to 8 percent slopes	0.0	0.2%
GbB	Glenelg silt loam, 3 to 8 percent slopes	2.1	75.3%
MbD	Manor very stony silt loam, 8 to 25 percent slopes	0.7	24.5%
Totals for Area of Interest		**2.8**	**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.

Lancaster County, Pennsylvania

CbB—Chester silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tt7y
Elevation: 10 to 1,170 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Chester

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 10 inches: silt loam
BE - 10 to 17 inches: silt loam
Bt1 - 17 to 22 inches: clay loam
Bt2 - 22 to 30 inches: clay loam
Bt3 - 30 to 38 inches: clay loam
Bt4 - 38 to 56 inches: loam
C - 56 to 92 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

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

Minor Components

Glenville

Percent of map unit: 10 percent

Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Linear
Across-slope shape: Concave

Mt. airy

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Gladstone

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

GbB—Glenelg silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l6s3
Elevation: 200 to 2,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Glenelg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 22 inches: silt loam
C - 22 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 72 to 120 inches to paralithic 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: High (about 9.3 inches)

Interpretive groups

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

Minor Components

Glenville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear

MbD—Manor very stony silt loam, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: l6t0
Elevation: 200 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Manor, Very Stony

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Parent material: Residuum weathered from mica schist

Typical profile

A - 0 to 10 inches: channery silt loam
B - 10 to 23 inches: channery silt loam
C - 23 to 60 inches: channery loam

Properties and qualities

Slope: 8 to 25 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 72 to 120 inches to paralithic 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: Moderate (about 9.0 inches)

Interpretive groups

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

Minor Components

Glenville

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear

Chester

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Glenelg

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

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