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Post Construction Stormwater Management Plan Narrative

Atlantic Sunrise Project

Permanent Access Roads
Fairmount Township
Luzerne County
Pennsylvania

Prepared For:

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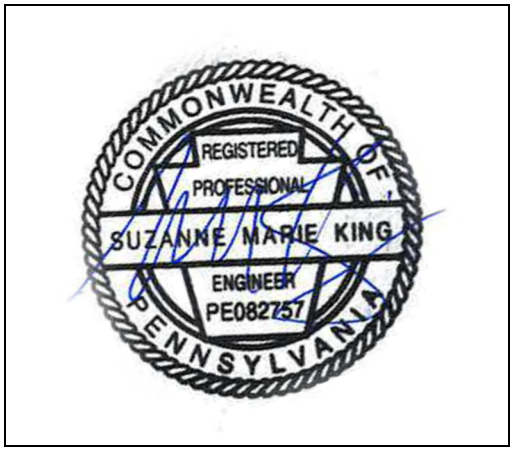

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CONTENTS

APPENDICES

Appendix	Description
Appendix A	Intentionally Omitted by Applicant
Appendix B	Intentionally Omitted by Applicant
Appendix C	United States Department of Agriculture Natural Resources Conservation Service Custom Soil Resource Report (Included under separate cover in Appendix C of the **E&SC Narrative for Luzerne County included in Section 2 of the ESCGP-2 NOI.**)
Appendix D	Supporting Information
Appendix G*	AR-LU-007.1 Specific Narrative and Calculations

* Road-specific Appendix letters correspond to the road-specific Appendix included in the **E&SC Narrative for Luzerne County included in Section 2 of the ESCGP-2 NOI**. Supporting calculations are provided for permanent access roads only in this narrative.

GENERAL INFORMATION

Project Description

The following post construction stormwater management (PCSM) narrative describes the PCSM designs for the permanent access roads to mainline valves (MLVs) to be constructed within Luzerne County (County), Pennsylvania as part of the Transcontinental Gas Pipe Line Company, LLC (Transco) Atlantic Sunrise Project ("Project"). This narrative supplements the Erosion & Sediment Control (E&SC) Plan and Site Restoration (SR) Plan Narrative included in **Section 2 of the Erosion and Sediment Control General Permit 2 (ESCGP-2) Notice of Intent (NOI)**.

The Project includes modifications to the existing Transco Mainline system to reverse the direction of flow, enabling new north-to-south capabilities (bi-directional flow) to transport this new source of natural gas to existing markets. In Luzerne County, the main Project improvements that the temporary and permanent access roads will support include installation of a 30-inch-diameter greenfield pipeline referred to as the Central Penn Line (CPL) North pipeline.

Where possible, existing public and private roads will be utilized to provide access to the pipeline ROW during and after construction. During construction, E&SC BMPs will be installed along all access roads as shown on the road-specific Soil Erosion Control Plans included in the Erosion & Sediment Control and Layout Plans for Access Roads in **Section 2 of the ESCGP-2 NOI**.

Permanent gravel access roads will be installed, and maintained by Transco, to provide access MLVs and select portions of the pipeline right of way (ROW) for pipeline maintenance and inspections in accordance with applicable regulatory guidelines. The increase in impervious area for the permanent access roads that provide access to the MLVs is permanent. However, the proposed increase in impervious area for the permanent access roads to the pipeline ROW is temporary. Similar to temporary access roads, upon construction completion, the proposed road materials will be removed and the impacted areas will be restored to pre-construction conditions. Transco operations will use the restored road surface to access the ROW as necessary in the future. Typically, pickup trucks will be used to perform routine maintenance and inspections and the trucks are capable of driving over grassy areas similar to the pipeline ROW. The permanent access roads to be restored to pre-construction conditions are not included in this PCSM Narrative. Only the access roads to MLV sites with permanent improvements are included in this PCSM Narrative.

References

E&SC Best Management Practices (E&SC BMPs), in accordance with the standards and specifications in the Pennsylvania Department of Environmental Protection's (PADEP's) "Erosion and Sediment Pollution Control Program Manual," Technical Guidance No. 363-2134-008, as amended and updated (E&SC Manual) will be used during the construction phase of the project. The proposed practices are designed to achieve the regulatory standard of minimizing the potential for accelerated erosion and sedimentation associated with temporary earth disturbance activities. The E&SC BMPs will remain in place until the surrounding area has reached final stabilization. An area shall be considered to have achieved final stabilization when it has a minimum uniform 70% perennial vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated surface erosion and subsurface characteristic sufficient to resist sliding and other movements.

PCSM BMPs, in accordance with the PADEP's "Pennsylvania Stormwater Best Management Practices Manual," Technical Guidance No. 363-0300-002, as amended and updated (PCSM Manual), will be used for site restoration and post construction stormwater management measures.

Impacts to wetlands, streams or waterbodies will be avoided to the maximum extent practicable. Refer to the Wetland Delineation Report provided as **Section 5 of the ESCGP-2 NOI** for information supporting wetland mapping shown on the E&SC Plans (**Section 2 of the ESCGP-2 NOI**).

Permanent Access Roads

The following permanent access roads that will provide access to an MLV are proposed to be constructed in Luzerne County to support the CPL North pipeline:

Access Road	Mile Post (MP)	Major River Basin	Receiving Water	Existing Use	Chapter 93 Designated Use	Impairment	Total Maximum Daily Load
LU-007.1	MP 6.7	Susquehanna River	UNT to Maple Run	None	HQ-CWF, MF	None	None

1.0 COMMON INFORMATION

1.1 Topographic Features

See **Appendices E and F** for road-specific United States Geological Survey mapping.

1.2 Soil Characteristics

AECOM prepared the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Custom Soil Resource Report for the counties crossed by the CPL North pipeline. The NRCS Custom Soil Resource Report for Luzerne County, Pennsylvania and the Soil Association Maps prepared by Wood Group Inc. are included in Appendix C of the **E&SC Narrative for Luzerne County included in Section 2 of the ESCGP-2 NOI.** Soil type and use limitations for the permanent access road to the MLV site in Luzerne County are presented in Table 1.2.1 below.

Table 1.2.1

Soil Type and Use Limitations for Luzerne County

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
LcB	Lackawanna very stony silt loam	0-12%	X	C	X			X	X	X			X	X				X
MsB	Morris very stony silt loam	0-8%	X	C/S	X	X		X	X	X	X		X	X				X
OpD	Oquaga and lordstown ext. stony silt loam	8-25%	X	C	X	X			X		X			X				
WmB	Wellsboro very stony silt loam	3-8%	X	C/S	X	X		X	X	X	X	X		X				X

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

Table 1.2.2

Soil Use Limitations Resolutions

Limitation	Resolution
Slopes	Excavations should be stabilized to prevent erosion and contractor should employ proper construction techniques to ensure safety on steep slope areas.
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 as necessary.
Easily Erodible	Temporary and permanent E&SC BMPs will be employed throughout the construction and operation of the access roads.
Flooding	Ensure that the access roads have has proper drainage and no obstructions within floodway/floodplain.
High Water Table	A geotechnical investigation was conducted to minimize conflicts with saturated zones.
Hydric/Hydric Inclusions	A wetland investigation was completed. Impacts to wetlands have been minimized by modifying the access road alignment to avoid wetlands and/or protecting wetlands with E&SC BMPs where existing roads are adjacent to wetlands.
Low Strength	A maximum of 3:1 slopes area proposed.
Slow Percolation	A field investigation of percolation rates at the infiltration areas will be 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 water movement via pipe bedding.
Poor Source of Topsoil	Existing topsoil, which has proven to be suitable, will be reused on the site.
Frost Action	Gravel specified in lieu of pavement to minimize frost effects.
Shrink-Swell	Gravel specified in lieu of 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

The proposed permanent access road is located in agricultural lands. The proposed land use is for a permanent access road intended to provide a means of ingress/egress to/from the MLV site for operations. The proposed alteration of the land includes

modifying the existing access road ROW to accommodate a 14 foot wide gravel access road. Installing the access road requires grading activity to construct the new road. See the **E&SC Plans for Luzerne County included in Section 2 of the ESCGP-2 NOI**.

Characterization of Land Use

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

1. Agricultural Land – land associated with active cultivation of rROW 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.
2. Upland Forest/Woodland – includes upland deciduous forest, evergreen forest, and mixed (deciduous and evergreen) forest, but does not include forested wetlands.
3. 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.
4. Transportation Land – land used for transportation purposes, including interstate highways; state, county, and local highways and roads; and railroad lines.
5. Residential Land – residential areas, including yards of individual residences.
6. 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.
7. Wetlands – includes wetlands covered with emergent, scrub-shrub, and forested vegetation.
8. Open Water – include rivers, streams, creeks, canals, and other linear waterbodies, as well as lakes, ponds, and other non-flowing waterbodies.

Area Types

The access road construction ROW is comprised of the following area types:

- Limit of Disturbance (LOD) Area – The LOD area is the construction ROW for the access roads. For most roads, this area is 50 feet wide and centered on the centerline of the access road. In areas where grading and/or E&SC BMPs require more room, the LOD has been expanded to encompass the proposed improvement area.
- ESCGP-2 Permit Boundary/Site Area – The ESCGP-2 Permit Boundary/Site Area is the area to be permitted for improvements with the Chapter 102 Application. This area is slightly larger than the LOD area. The limit of the ESCGP-2 Permit Boundary/Site Area is typically offset 5 feet from the LOD limit for access roads.

  Future changes made to the LOD area that are still within the ESCGP-2 Permit Boundary/ Site Area would likely be considered a minor modification to the Project's Chapter 102 Permit. However, future changes to the LOD area that are outside the ESCGP-2 Permit Boundary/Site Area may require a major modification to the Permit.
- Area of Minimum Disturbance/Reduced Grading – The Area of Minimum Disturbance/Reduced Grading is the area within the LOD area that is outside the proposed grading area. Disturbances within the Area of Minimum Disturbance/Reduced Grading will be minimal.
- LOD Area within Floodway/Floodplain – The LOD Area within Floodway/Floodplain is the area within the LOD that is within a FEMA (Federal Emergency Management Agency) designated Floodplain or an assumed floodway that extends approximately 50 feet from the top of bank of a stream landward. The LOD Area within Floodway/Floodplain have been coordinated with the Chapter 105 Permit application. For most of the access roads, where the LOD crosses a floodway/floodplain, the LOD area has been minimized and the existing road will be used. Where the existing road cannot support the intended traffic loads, timber matting will be installed to provide an adequate driving surface.
- Stormwater Management Area – The Stormwater Management Area is calculated using Worksheet #3. For the permanent access roads, the Stormwater Management Area is equal to the LOD Area because no credit is taken for protected areas. The LOD is minimized at wetlands and streams to mimimize impacts. Where the LOD crosses a floodway/floodplain, the existing road will be used with matting, as necessary.

- Area Controlled by BMPs – The Area Controlled by BMPs is the drainage area that discharges to either the vegetated channel or MLV pad. The pre- and post-construction cover types for the Area Controlled by BMPs are summarized in Worksheet #4.

Minimize Soil Compaction in Infiltration Areas

Prior to installing the pipeline, the infiltration bed area will be protected by construction fence. A portion of the MLV site infiltration bed is within the construction travel way for the pipe installation and cannot be protected by the construction fence. Timber matting will be installed across the proposed MLV site to spread construction vehicle loads and minimize soil compaction during construction of the pipeline. Once the travel way is no longer needed, the timber matting will be removed.

The top 20 inches of soil within the footprint of the timber matting installed across the MLV infiltration area will be tilled with a solid-shank ripper to loosen the soil and promote infiltration. If necessary, the tilling operations will be extended to the other infiltration areas if compaction has occurred during installation of the pipeline. Tilling will be performed when the soil is dry.

During grading operations for the PCSM BMPs and access road, construction equipment shall avoid excessive compaction and/or land disturbance. If excavation leads to substantial compaction of the subgrade, 18 inches shall be removed and replaced with a blend of topsoil and sand to promote infiltration and biological growth. At the very least, topsoil shall be thoroughly deep plowed into the subgrade to penetrate the compacted zone and promote aeration and the formation of macropores. Following this, the area should be disked prior to final grading.

1.4 Project Site Runoff

The E&SC BMPs for the access roads are sized using E&SC Worksheets 1 and 11 of the PADEP E&SC Manual. These worksheets take into consideration the slope length above the sediment barrier and the drainage area contributing to the channel, respectively. (See the road-specific appendices of the **E&SC Narrative for Luzerne County included in Section 2 of the ESCGP-2 NOI** for road-specific worksheets.)

For temporary access roads and permanent access roads that provide access to the pipeline ROW only, no permanent change in cover is proposed. Disturbed areas will be restored to pre-construction conditions. Therefore, no change in runoff rate or volume is anticipated.

For permanent access roads that provide access to MLVs, a summary table presenting the change in runoff volume for the 2-year 24-hour design storm and the change in peak rate of runoff for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year 24-hour design storms for pre-construction and post construction conditions, along with the supporting calculations, are provided for each permanent access road in the road-specific narratives appended to this narrative.

Act 167 Summary

The proposed permanent access roads located in Luzerne County were designed to meet the Luzerne County Act 167 Phase II Stormwater Management Plan. This PCSM/SR narrative provides evidence that the Act 167 standards for stormwater runoff rate release, stormwater volume, and water quality are met. AR-LU-007.1 is a proposed permanent access road that provides access to a main line valve site. The proposed improvements for AR-LU-007.1 will be permanent and remain in place after construction and throughout the life of the pipeline. Only AR-LU-007.1 will be subject to the PCSM requirements of the Luzerne ACT 167 Plan.

Plan Requirements

The watersheds within Luzerne 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 two proposed permanent access roads located in Luzerne County are 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 locations of the proposed permanent access roads are not subject to more restrictive release rates, they have 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 Luzerne County Act 167 Phase II requires that water quality and volume control design be provided to meet standards in the BMP Manual. AR-LU-007.1 has been designed to meet the volume control guidelines recommended in the 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 Luzerne County Act 167 Phase II Stormwater Management Plan.

1.5 Surface Water Classification

The locations and Chapter 93 designation of the streams and wetlands near the LOD for the permanent access roads are shown on the PCSM Plans (**Section 2 of the ESCGP-2 NOI**).

1.6 BMP Description

E&SC BMPs, consistent with the PADEP E&SC Manual, are planned to be used along the temporary and permanent access roads before, during, and after earth disturbance activities. E&SC BMPs will be installed prior to disturbance. Installation and maintenance guidelines, as well as E&SC BMP locations are described in the **E&SC Narrative for Luzerne County included in Section 2 of the NOI** and shown on the E&SC Plans (**Section 2 of the ESCGP-2 NOI**) and the Best Management Practices and Quantities Plan.

For permanent access roads that require an increase in impervious area, additional PCSM BMPs will be installed to manage the additional runoff created by the change in pre- and post-development conditions. The PCSM BMPs that will be used for the permanent access roads include the following:

PCSM BMPs

- Vegetated Channel: Vegetated channels shall be installed to collect and attentuate runoff volume from adjacent impervious areas, allowing some pollutants to settle out in the process. Permanent Check Dams are used to enhance attenuation and pollutant removal.
- Check Dams: Check Dams will be installed as shown on the Plans and Detail Sheets. Check Dams dissipate energy from the concentrated flow in roadside ditches and channels to prevent erosion of the channel and at the outlet.The Check Dams will be earthen check dams with a height of 12 inches, typically.
- Infiltration Berm: An infiltration berm will be installed as shown on the Plans and Detail Sheets. The infiltration berm wil retain flow and allow for infiltration for volume control.
- Stone Valve Site Void Storage: Runoff from the proposed permanent access roads may be detained in the void space between the stone at the MLV sites (mainline valves) to attenuate the peak rate of runoff for up to the 100-year design storm event. The valve sites will be comprised of 6 inches of AASHTO #8 aggregate over a heavy nonwoven geotextile over 12 inches to 30 inches of AASHTO #57 aggregate. The depth of the AASHTO #57 aggregate varies based on the detention volume needed to attenuate the volume of runoff for the 100-

year storm. Dewatering calculations for the valve sites are included in the road-specific narratives appended to this narrative.

- Riprap Aprons/Outlet Protection: Riprap Aprons shall be installed to dissipate energy from flow concentrated at culverts and drainage channels. Permanent Riprap Aprons will remain in place and be part of the final PCSM design.
- Permanent Vegetative Stabilization: Upon reaching final grades, and upon cessation of earth disturbance activities, disturbed areas will receive topsoil, seed, and mulch to establish permanent vegetative stabilization.

1.7 BMP Installation Sequence

Refer to the E&SC Plans (**Section 2 of the ESCGP-2 NOI**) for the location of the proposed work and the associated E&SC and PCSM BMPs. A road-specific construction sequence is provided in **Appendix E**.

1.8 Supporting Calculations and Measurements

Supporting calculations for each permanent access road design are provided in the road-specific narratives appended to this narrative.

The access roads have been designed to meet the requirements of 25 Pa. Code§§ 102.8, including sections 102.8(g)(2) & 102.8(g)(3) as reproduced below:

(g) PCSM Plan stormwater analysis. Except for regulated activities that require site restoration or reclamation, and small earth disturbance activities identified in subsection (n), PCSM Plans for proposed activities requiring a permit under this chapter require the following additional information:

> (1) Predevelopment site characterization and assessment of soil and geology including appropriate infiltration and geotechnical studies that identify location and depths of test sites and methods used.
>
> (2) Analysis demonstrating that the PCSM BMPs will meet the volume reduction and water quality requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change for storms up to and including the 2-year/24-hour storm event when compared to preconstruction runoff volume and water quality. The analysis for the 2-year/24-hour storm event shall be conducted using the following minimum criteria:
>
> > (i) Existing predevelopment nonforested pervious areas must be considered meadow in good condition or its equivalent except for repair,

reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction or restoration of utility infrastructure when the site will be returned to existing condition.

(ii) When the existing project site contains impervious area, 20% of the existing impervious area to be disturbed must be considered meadow in good condition or better, except for repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction, or restoration of utility infrastructure when the site will be returned to existing condition.

(iii) When the existing site contains impervious area and the existing site conditions have public health, safety or environmental limitations, the applicant may demonstrate to the Department that it is not practicable to satisfy the requirement in subparagraph (ii), but the stormwater volume reduction and water quality treatment will be maximized to the extent practicable to maintain and protect existing water quality and existing and designated uses.

(iv) Approaches other than that required under paragraph (2) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (2) or will maintain and protect existing water quality and existing and designated uses by maintaining the site hydrology, water quality, and erosive impacts of the conditions prior to initiation of any earth disturbance activities.

(3) Analysis demonstrating that the PCSM BMPs will meet the rate requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change in peak rate for the 2-, 10-, 50-, and 100-year/24-hour storm events in a manner not to exceed preconstruction rates.

(i) Hydrologic computations or a routing analysis are required to demonstrate that this requirement has been met.

(ii) Exempt from this requirement are Department- approved direct discharges to tidal areas or Department-approved no detention areas.

(iii) Approaches other than that required under paragraph (3) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (3) or will maintain and protect existing water quality and

existing and designated uses by maintaining the preconstruction site hydrologic impact.

1.9 Plan Drawings

Full size copies of the permanent access road PCSM Plans have been provided under separate cover in **Section 3 of the ESCGP-2 NOI**.

Preparer Qualifications are included in **Appendix D**.

1.10 Long Term Operation and Maintenance Schedule

E&SC BMPs shall be maintained properly throughout Project construction as described in the **E&SC Narrative for Luzerne County included in Section 2 of the NOI**. Until an access road is stabilized, the associated E&SC BMPs shall be maintained properly. Maintenance shall include inspections of E&SC BMPs after each runoff event and on a weekly basis. Preventative and remedial maintenance work, including clean out, repair, replacement, re-grading, reseeding, and re-mulching must be initiated immediately. If the E&SC BMPs fail to perform as expected, replacement E&SC BMPs, or modifications of those installed will be required.

After project completion, the PCSM BMPs will be monitored and maintained as described below:

Monitoring

Transco's personnel (Operations) will perform visual inspections on an annual basis after permit closure to ascertain that the PCSM BMPs are functioning and operating effectively to ensure the MLV sites and associated permanent access roads are causing no undue burden on the property owner or adjacent owners. Repairs of deficiencies will be initiated within ten business days of discovery.

Maintenance

The Contractor will be responsible for the maintenance of the PCSM BMPs during construction. After construction, the PCSM BMPs will be owned and maintained by Transco.

Maintenance of the PCSM BMPs after acceptance by the Owner will consist of routine cleaning of accumulated sediment and debris. The specific maintenance steps and schedule are listed below:

PCSM BMPs Inspection

PCSM BMPs (vegetated channels and rock within the MLV site) are to be inspected annually for sediment, build-up and erosion debris. The sediment, debris, trash and any other waste material removed from the PCSM BMPs shall be disposed of at a suitable disposal or recycling site and in compliance with local, state and federal waste regulations.

- Vegetated Channel and Check Dams: Vegetated channels shall be inspected annually and within 48 hours after every major storm event (> 1 inch rainfall depth) as follows:
    - Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation);
    - 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 vegetated channel operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when vegetated channel is dry to avoid rutting;
    - Inspect for litter; remove prior to mowing;
    - Inspect for uniformity in cross-section and longitudinal slope, correct as needed; and
    - Inspect vegetated channel inlet and outlet for signs of erosion or blockage, correct as needed.

  Maintenance activities to be done 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;
    - Rototill and replant vegetated channel if draw down time is more than 48 hours;
    - Inspect and correct check dams when signs of altered water flow (channelization, obstructions, erosion, etc.) are identified; and

  - Water during dry periods, fertilize, and apply pesticide only when absolutely necessary.

- Infiltration Berm: The infiltration berm shall be inspected annually and within 48 hours after every major storm event (> 1 inch rainfall depth) as follows:
  - Inspect slope and integrity of berm to ensure proper functionality;
  - 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, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility;
  - Avoid running heavy equipment over the infiltration area at the base of the berm;
  - Remove accumulated trash and debris; and
  - Inspect for signs of flow channelization; restore level gradient immediately after deficiencies are observed.
- Stone Valve Site Void Storage: MLV sites shall be inspected annually as follows:
  - Inspect and correct erosion problems, disruption to stone, and sediment and debris accumulation;
  - Inspect stone 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 decompact the top AASHTO #8 layer to address ponding; and
  - Remove litter.

Annual Records of Maintenance Procedures

The Owner shall maintain a checklist whenever the PCSM BMPs are inspected and cleaned. An annual list of inspections and major cleaning operations and repairs shall be maintained. Upon request, the local CCD or enforcement officials shall have access to those records. The Owner shall ensure compliance with ESCGP-2 Permit requirements by meeting all ongoing recordkeeping maintenance, and other applicable ESCGP-2 and PADEP permit conditions.

1.11 Material Recycling and Disposal

Maintenance of the permanent access roads that provide access to the MLV sites will require the removal of materials (i.e., sediment, debris, and litter). The materials shall be dispose of at suitable disposal or recycling sites in compliance with local, state and federal regulations.

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

1.12 Soil Conditions and Geologic Formations

AECOM conducted a review of the proposed CPL North pipeline for the potential of geologic formation which may cause pollution if disturbed or exposed during construction.

Karst Bedrock Formations

As identified by AECOM, naturally–occurring bedrock formations and soils types that may cause pollution are present along portions of the CPL North construction ROW. Bedrock formations that may cause pollution are associated with karst or acid-forming conditions include the following:

- Conestoga Formation
- Vintage Formation
- Buffalo Springs Formation
- Ledger Formation
- Zooks Corner Formation
- Snitz Creek Formation
- Millbach Formation
- Stonehenge Formation
- Epler Formation
- Richenbach Formation
- Ontelaunee Formation
- Annville Formation
- Hershey-Myerstown Formation
- Keyser-Tonoloway Formation

There are two bedrock formations that do not form significant karst terrain along the proposed CPL North pipelines, which include Hamburg Sequence/limestone unit and Hamilton Group/Tully limestone unit.

Acid-Producing Sulfide Bedrock Formations

In the review of the NRCS data for the proposed CPL North pipeline route, several acid-producing sulfide bedrock formations are located along the proposed route. These formations are as follows:

- Pottsville Formation (anthracite coal-bearing)
- Llewelyn Formation (anthracite coal bearing)

Formations containing variable amounts of pyrite or other sulfide minerals that may only locally be acid-producing are found along the proposed CPL North pipeline. These formations can be determined only by site-specific acid-drainage investigation, and are identified as follows:

- Octoraro schist
- Conestoga phyllite
- Antietam-Harpers schist
- Kinzers shale
- Cocalico shale
- Hamburg/Martinsburg shale

Table 6 in the Best Management Practices and Quantities Plan provides the locations of the acidic bedrock.

Acidic Soils

For the proposed CPL North pipeline, based on review of the attached NRCS Custom Soil Resource Report provided in **Appendix C**, acidity levels of the soils found along the proposed CPL North route do not fall within the pH range that is considered to be a potential source of pollution that must be mitigated. Should acidic soils with a pH of 4.0 or lower be encountered during the construction of the temporary and permanent access roads, the following Acid Producing Soils and Bedrock Control Plan shall be implemented. Table 5 in the Best Management Practices and Quantities Plan provides the locations of soils and their respective acidity levels. A road specific Soil Acidity Table is included for each road in the road specific appendices attached to this document.

Acid Producing Soils and Bedrock Control Plan

The following acid producing soils control plan was developed to identify BMPs and procedures for minimizing the potential for pollution associated with the disturbance of the areas associated with the construction of the temporary and permanent access roads that contain acid-producing soils with a pH less than 4.0.

1. Contractor shall limit the excavation area and exposure time when high acid-producing soils are encountered. Locations where acidic soils are anticipated to

be present along the access roads are provided in the road specific narratives included in this document and on the E&SC plans included in Section 2 of the ESCGP-2 NOI.

2. Contractor shall separately store topsoil stripped from the site away from temporarily stockpiled high acid-producing soils and bedrock.

3. Contractor shall stockpile high acid-producing soils and bedrock material on level ground to minimize its movement, especially when these materials have a high clay content.

4. Contractor shall cover temporarily stockpiled high acid-producing soil and bedrock material to be exposed more than 7 days with properly anchored, heavy-grate sheets of polyethylene, where possible. If not possible, stockpiles shall be covered with a minimum of three to six inches of wood chips to minimize erosion of the stockpile. In addition, the contractor shall install silt fence at the toe of the stockpile slope to contain movement of material. Contractor shall not apply topsoil to the high acid-producing soil or bedrock stockpiles to prevent topsoil contamination.

5. Contractor shall ultimately dispose of high acid-producing soils or bedrock with a pH of four or less, or containing iron sulfide (including borrow from cuts) by placing the material combined with limestone at the rate of 6 tons per acre (or 275 pounds per 1,000 square feet of surface area) and covering the mixture with a minimum of 12 inches of settled soils with a pH of five or more except as follows:

    a. In the areas where trees or shrubs are to be planted, the contractor shall cover the limestone/soil mixture with a minimum of 24 inches of soils with a pH of five or more.

    b. Contractor shall not locate any disposal area within 24 inches of any surface of a slope or bank, such as berms, stream banks, ditches, and other surface waters to prevent potential lateral leaching damages.

6. At the end of each day, contractor shall clean all equipment used to handle high acid-producing soils or bedrock to prevent spreading of high-acid materials to other parts of the proposed right-of-way, into streams, or stormwater conveyances, and to protect machinery from accelerated corrosion.

7. Contractor shall provide and install non-vegetative erosion controls (stone tracking pads, strategically-place limestone check dams, silt fences, wood chips)

to limit the movement of high acid-producing soils from, around, or off areas disturbed for access road construction.

8. Following the burial or removal of high acid-producing soils and bedrock, top soiling, and seeding of the areas restored after the removal of the temporary access roads and permanent access roads that provide access to the pipeline right-of-way, Transco shall monitor the site for approximately six to 12 months to assure there is adequate stabilization and that no high-acid soil or bedrock problems emerge. Contractor shall correct any problems that are discovered within this time period.

9. If problems occur where high acid-producing soils or bedrock have been placed or buried, the applicant shall monitor these areas for at least two years to assure there is no migration of potential acid leachate.

1.13 Thermal Impacts

Thermal impacts associated with access roads will be avoided to the maximum extent practicable by implementing the following measures:

- Limit removal of vegetation, especially tree cover, to only that necessary for construction;
- Install a gravel surface for the access roads rather than asphalt;
- Incorporate the use of stone at mainline valves and vegetated channels with earthen check dams to provide storage for stormwater runoff; and
- Minimize impacts to existing riparian corridors.

See the road-specific narratives for a road-specific discussion on thermal impacts.

1.14 E&SC Plan and PCSM Plan Consistency

The E&SC Plans (**Section 2 of the ESCGP-2 NOI**), the E&SC Narrative, and this PCSM Narrative have been designed and will be constructed to be consistent with the PCSM Plans (**Section 2 of the ESCGP-2 NOI**). Following completion of construction, disturbed areas shall be stabilized and the long-term maintenance of the PCSM BMPs will begin.

1.15 Riparian Buffer Waiver

A comprehensive Riparian Buffer narrative is provided in the “Erosion and Sediment Control Plan Narrative” for the portion of the CPL North pipeline located in Luzerne County (**Section 2 of the ESCGP-2 NOI**).

No permanent access roads within Luzerne County require a riparian buffer waiver.

1.16 Antidegradation Requirements

The permanent access roads have been designed to maintain pre-construction rates of runoff by detaining and infiltrating stormwater within the MLV site and vegetated channels. There are no opportunities for non-discharge alternatives such as connecting to a sewer system or capturing stormwater in rain barrels for reuse as irrigation.

1.17 TMDL

Road-specific Total Maximum Daily Load (TMDL) discussions are provided in the road-specific narratives.

APPENDIX A

Intentionally Omitted by Applicant

APPENDIX B

Intentionally Omitted by Applicant

APPENDIX C

United States Department of Agriculture Natural Resources Conservation Service Custom Soil Resource Report

Included under separate cover in Appendix C of the E&SC Narrative for Luzerne County included in Section 2 of the ESCGP-2 NOI

APPENDIX D

Supporting Information

Appendix D.1 – Preparer Qualifications
Appendix D.2 – North American Green Product Data

Appendix D.1 – Preparer Qualifications

NAME OF PLAN PREPARER: Suzanne Marie King, PE

FORMAL EDUCATION:

Name of College or Technical Institute: Roger Williams University / Stanford University

Curriculum or Program: General Engineering / Structural Engineering

Dates of Attendance: **From:** RWU: 9/1998 / SU: 9/2002 **To:** RWU: 5/2002 / SU: 5/2003

Degree Received RWU: Bachelor of Science - General Engineering
SU: Masters of Science - Structural Engineering

OTHER TRAINING:

Name of Training:		
Presented By:		
Date:		

EMPLOYMENT HISTORY:

Current Employer:	BL Companies
Telephone:	781-619-9500
Former Employer:	Woodard & Curran BKF Engineers
Telephone:	401-273-1007 650-482-6300

RECENT PERMANENT STORMWATER FACILITY PLANS PREPARED:

Name of Project:	Treasure Island Redevelopment	Canal Street Improvements	Beechwood Museum
County:	San Francisco	Essex	Newport
Municipality:	San Francisco, CA	Salem, MA	Newport, RI
Permit Number:	N/A	N/A	N/A
Approving Agency:	Treasure Island Development Authority (TIDA)	City of Salem & Massachusetts Emergency Management Agency	City of Newport & Coastal Resources Management Council

Appendix D.2 – North American Green Product Data

ROLLMAX™
ROLLED EROSION CONTROL

Specification Sheet – EroNet™ DS75™ Erosion Control Blanket

DESCRIPTION

The ultra short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 45 days. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a polypropylene netting having an approximate 0.50 x 0.50 (1.27 x 1.27 cm) mesh with photodegradable accelerators to provide breakdown of the netting within approximately 45 days, depending upon geographical location and elevation. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The DS75 shall meet Type 1.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	100% Straw Fiber	0.5 lbs/sq yd (0.27 kg/sm)
Netting	Top side only, lightweight photodegradable with photo accelerators	1.5 lb/1000 sq ft (0.73 g/sm)
Thread	Degradable	

Standard Roll Sizes			
Width	6.67 (2.03 m)	8.0 ft (2.4 m)	16 ft (4.87 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)	108 ft (32.92 m)
Weight ± 10%	40 lbs (18.14 kg)	50 lbs (22.68 kg)	96 lbs (43.54 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)	192 sq yd (165.5 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.45 in. (11.43 mm)
Resiliency	ECTC Guidelines	78.8%
Water Absorbency	ASTM D1117	375%
Mass/Unit Area	ASTM 6475	8.57 oz/sy (291 g/sm)
Swell	ECTC Guidelines	15%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.31 oz-in
Light Penetration	ASTM D6567	10%
Tensile Strength - MD	ASTM D6818	105.6 lbs/ft (1.57 kN/m)
Elongation - MD	ASTM D6818	34%
Tensile Strength - TD	ASTM D6818	42.0 lbs/ft (0.62 kN/m)
Elongation - TD	ASTM D6818	25.2%
Biomass Improvement	ASTM D7322	286%

Design Permissible Shear Stress	
Unvegetated Shear Stress	1.55 psf (74 Pa)
Unvegetated Velocity	5.00 fps (1.52 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2.1	≥ 2:1
≤ 20 ft (6 m)	0.029	N/A	N/A
20-50 ft	0.11	N/A	N/A
≥ 50 ft (15.2 m)	0.19	N/A	N/A

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.055
0.50 – 2.0 ft	0.055-0.021
≥ 2.0 ft (0.60 m)	0.021

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Specification Sheet – EroNet™ C125® Erosion Control Blanket

DESCRIPTION

The long-term double net erosion control blanket shall be a machine-produced mat of 100% coconut fiber with a functional longevity of up to 36 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom sides with a heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and an approximate 0.63 x 0.63 in (1.59 x 1.59 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The C125 shall meet Type 4 specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	100% Coconut Fiber	0.5 lbs/sq yd (0.27 kg/sm)
Netting	Heavyweight photodegradable with UV additives	3 lbs/1000 sq ft (1.47 g/sm)
Thread	Black polypropylene	

Standard Roll Sizes		
Width	6.67 (2.03 m)	8 ft (2.44 m)
Length	108 ft (32.92 m)	112 ft (35.14 m)
Weight ± 10%	44 lbs (19.95 kg)	56.25 (25.5 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.22 in. (5.59 mm)
Resiliency	ECTC Guidelines	82%
Water Absorbency	ASTM D1117	167%
Mass/Unit Area	ASTM 6475	7.73 oz/sy (262.8 g/sm)
Swell	ECTC Guidelines	13%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	0.75 oz-in
Light Penetration	ASTM D6567	16.6%
Tensile Strength - MD	ASTM D6818	472.8 lbs/ft (7.01 kN/m)
Elongation - MD	ASTM D6818	25.6%
Tensile Strength - TD	ASTM D6818	225.6 lbs/ft (3.35 kN/m)
Elongation - TD	ASTM D6818	33.9%
Biomass Improvement	ASTM 7322	257%

Design Permissible Shear Stress	
Unvegetated Shear Stress	2.25 psf (108 Pa)
Unvegetated Velocity	10.0 fps (3.05 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.001	0.029	0.082
20-50 ft	0.036	0.060	0.096
≥ 50 ft (15.2 m)	0.070	0.090	0.110

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.022
0.50 – 2.0 ft	0.022-0.014
≥ 2.0 ft (0.60 m)	0.014

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ROLLMAX™
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Specification Sheet – EroNet™ S75® Erosion Control Blanket

DESCRIPTION

The short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a lightweight photodegradable polypropylene netting having an approximate 0.50 x 0.50 in. (1.27 x 1.27 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The S75 shall meet Type 2.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	100% Straw Fiber	0.5 lbs/sq yd (0.27 kg/sm)
Netting	Top side only, lightweight photodegradable	1.5 lb/1000 sq ft (0.73 kg/100 sm)
Thread	Degradable	

Standard Roll Sizes			
Width	6.67 ft (2.03 m)	8.0 ft (2.4 m)	16 ft (4.87 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)	108 ft (32.92 m)
Weight ± 10%	40 lbs (18.14 kg)	50 lbs (22.68 kg)	96 lbs (43.54 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)	192 sq yd (165.5 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.50 in. (12.7 mm)
Resiliency	ECTC Guidelines	78.8%
Water Absorbency	ASTM D1117	301%
Mass/Unit Area	ASTM D6475	9.76 oz/sy (332 g/sm)
Swell	ECTC Guidelines	15%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.31 oz-in
Light Penetration	ASTM D6567	6.0%
Tensile Strength - MD	ASTM D6818	122.4 lbs/ft (1.81 kN/m)
Elongation - MD	ASTM D6818	36.1%
Tensile Strength - TD	ASTM D6818	79.2 lbs/ft (1.17 kN/m)
Elongation - TD	ASTM D6818	26.8%
Biomass Improvement	ASTM D7322	301%

Design Permissible Shear Stress	
Unvegetated Shear Stress	1.55 psf (74 Pa)
Unvegetated Velocity	5.00 fps (1.52 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.029	N/A	N/A
20-50 ft	0.11	N/A	N/A
≥ 50 ft (15.2 m)	0.19	N/A	N/A

NTPEP Large-Scale Slope Testing
ASTM D6459 - C-factor = 0.012

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.055
0.50 – 2.0 ft	0.055-0.021
≥ 2.0 ft (0.60 m)	0.021

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Specification Sheet – EroNet™ SC150® Erosion Control Blanket

DESCRIPTION

The extended-term double net erosion control blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut fiber with a functional longevity of up to 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and an approximate 0.63 x 0.63 in (1.59 x 1.59 cm) mesh, and on the bottom side with a lightweight photodegradable polypropylene netting with an approximate 0.50 x 0.50 (1.27 x 1.27 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The SC150 shall meet Type 3.B specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	70% Straw Fiber 30% Coconut Fiber	0.35 lbs/sq yd (0.19 kg/sm) 0.15 lbs/sq yd (0.08 kg/sm)
Netting	Top: Heavyweight photodegradable with UV additives	3 lbs/1000 sq ft (1.47 kg/100 sm)
	Bottom: lighweight photodegradable	1.5 lb/1000 sq ft (0.73 kg/100 sm)
Thread	Degradable	

Standard Roll Sizes			
Width	6.67 ft (2.03 m)	8 ft (2.4 m)	16.0 ft (4.87 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)	108 ft (32.92 m)
Weight ± 10%	44 lbs (19.95 kg)	55 lbs (24.95 kg)	105.6 lbs (47.9 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)	192 sq yd (165.6 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.35 in. (8.89 mm)
Resiliency	ECTC Guidelines	75%
Water Absorbency	ASTM D1117	342%
Mass/Unit Area	ASTM D6475	7.87 oz/sy (267.6 g/sm)
Swell	ECTC Guidelines	30%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	1.11 oz-in
Light Penetration	ASTM D6567	6.2%
Tensile Strength - MD	ASTM D6818	362.4 lbs/ft (5.37 kN/m)
Elongation - MD	ASTM D6818	29.4%
Tensile Strength - TD	ASTM D6818	136.8 lbs/ft (2.03 kN/m)
Elongation - TD	ASTM D6818	27.6%
Biomass Improvement	ASTM D7322	481%

Design Permissible Shear Stress	
Unvegetated Shear Stress	2.00 psf (96 Pa)
Unvegetated Velocity	8.0 fps (2.44 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.001	0.048	0.100
20-50 ft	0.051	0.079	0.145
≥ 50 ft (15.2 m)	0.10	0.110	0.190

NTPEP Large-Scale Slope
ASTM D6459 - C-factor = 0.031

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.050
0.50 – 2.0 ft	0.050-0.018
≥ 2.0 ft (0.60 m)	0.018

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Specification Sheet – BioNet® SC150BN™ Erosion Control Blanket

DESCRIPTION

The extended-term double net erosion control blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut fiber with a functional longevity of up to 18 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom sides with a 100% biodegradable woven natural organic fiber netting. The netting shall consist of machine directional strands formed from two intertwined yarns with cross directional strands interwoven through the twisted machine strands (commonly referred to as Leno weave) to form an approximate 0.50 x 1.0 in. (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The SC150BN shall meet Type 3.B specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17

Material Content		
Matrix	70% Straw Fiber	0.35 lbs/sq yd (0.19 kg/sm)
	30% Coconut Fiber	0.15 lbs/sq yd (0.08 kg/sm)
Netting	Top: Leno woven 100% biodegradable jute	9.35 lb/1000 sq ft (4.5 kg/100 sm)
	Bottom: 100% biodegradable organic jute	7.7 lb/1000 sq ft (3.76 kg/100 sm)
Thread	Biodegradable	

Standard Roll Sizes			
Width	6.67 ft (2.03 m)	8.0 ft (2.4 m)	15.5 ft (4.72 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)	90 ft (27.43 m)
Weight ± 10%	52.22 lbs (23.69 kg)	65.28 lbs (29.61 kg)	101.2 lbs (45.9 kg)
Area	80 sq yd (66.9 sm)	100 sq yd (83.61 sm)	155 sq yd (129.6 sm)
	Leno weave top only	Leno top and bottom	Leno top and bottom

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.25 in. (6.35 mm)
Resiliency	ECTC Guidelines	86%
Water Absorbency	ASTM D1117	311%
Mass/Unit Area	ASTM D6475	8.32 oz/sy (282.9 g/sm)
Swell	ECTC Guidelines	46%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	0.42 oz-in
Light Penetration	ASTM D6567	7.6%
Tensile Strength - MD	ASTM D6818	201.6 lbs/ft (2.99 kN/m)
Elongation - MD	ASTM D6818	13.4%
Tensile Strength - TD	ASTM D6818	164.4 lbs/ft (2.44 kN/m)
Elongation - TD	ASTM D6818	14.2%
Biomass Improvement	ASTM D7322	641 %

Design Permissible Shear Stress	
Unvegetated Shear Stress	2.10 psf (100 Pa)
Unvegetated Velocity	8.00 fps (2.44 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.001	0.029	0.063
20-50 ft	0.051	0.055	0.092
≥ 50 ft (15.2 m)	0.10	0.080	0.120

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.050
0.50 – 2.0 ft	0.050-0.018
≥ 2.0 ft (0.60 m)	0.018

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Specification Sheet – VMax® P550® Turf Reinforcement Mat

DESCRIPTION

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% UV stable polypropylene fiber matrix incorporated into permanent three-dimensional turf reinforcement matting. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra heavy UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.5 x 0.5 inch (1.27 x 1.27 cm) openings, and covered by an ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81cm) centers with UV stabilized polypropylene thread to form permanent three-dimensional turf reinforcement matting. All mats shall be manufactured with a colored thread stitched along both outer edges as an overlap guide for adjacent mats.

The P550 shall meet Type 5A, 5B, and 5C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.18

Material Content		
Matrix	100% UV stable polypropylene fiber	0.5 lb/sy (0.27 kg/sm)
Netting	Top and Bottom, UV-Stabilized Polypropylene	24 lb/1000 sf (11.7 kg/100 sm)
	Middle, Corrugated UV-Stabilized Polypropylene	24 lb/1000 sf (11.7 kg/100 sm)
Thread	Polypropylene, UV Stable	

Standard Roll Sizes	
Width	6.5 ft (2.0 m)
Length	55.5 ft (16.9 m)
Weight ± 10%	52 lbs (23.59 kg)
Area	40 sy (33.4 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.72 in. (18.29 mm)
Resiliency	ASTM 6524	95%
Density	ASTM D792	0.892 g/cm^3
Mass/Unit Area	ASTM 6566	21.25 oz/sy (723 g/sm)
UV Stability	ASTM D4355/ 1000 HR	100%
Porosity	ECTC Guidelines	96%
Stiffness	ASTM D1388	366.3 oz-in.
Light Penetration	ASTM D6567	16.5%
Tensile Strength – MD	ASTM D6818	1421 lbs/ft (21.07 kN/m)
Elongation – MD	ASTM D6818	40.5%
Tensile Strength – TD	ASTM D6818	1191.6 lbs/ft (17.67 kN/m)
Elongation – TD	ASTM D6818	28.8%
Biomass Improvement	ASTM D7322	378%

Design Permissible Shear Stress	Short Duration	Long Duration
Phase 1: Unvegetated	4.0 psf (191 Pa)	3.25 psf (156 Pa)
Phase 2: Partially Veg.	12.0 psf (576 Pa)	12.0 psf (576 Pa)
Phase 3: Fully Veg.	14.0 psf (672 Pa)	12.0 psf (576 Pa)
Unvegetated Velocity	12.5 fps (3.8 m/s)	
Vegetated Velocity	25 fps (7.6 m/s)	

NTPEP ASTM D6460 Large Scale Channel	
Vegetated Shear Stress	>13.2 psf (632 Pa)
Vegetated Velocity	>24.5 fps (7.47 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2.1	≥ 2:1
≤ 20 ft (6 m)	0.0005	0.015	0.043
20-50 ft	0.0173	0.031	0.050
≥ 50 ft (15.2 m)	0.035	0.047	0.057

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.041
0.50 – 2.0 ft	0.040-0.013
≥ 2.0 ft (0.60 m)	0.013

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ROLLMAX™
ROLLED EROSION CONTROL

Specification Sheet – VMax® SC250® Turf Reinforcement Mat

DESCRIPTION

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 70% straw and 30% coconut fiber matrix incorporated into permanent three-dimensional turf reinforcement matting. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra heavy UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.5 x 0.5 inch (1.27 x 1.27 cm) openings, and covered by an heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81cm) centers with UV stabilized polypropylene thread to form permanent three-dimensional turf reinforcement matting. All mats shall be manufactured with a colored thread stitched along both outer edges as an overlap guide for adjacent mats.

The SC250 shall meet Type 5A, 5B, and 5C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.18

Material Content		
Matrix	70% Straw Fiber	0.35 lb/sq yd (0.19 kg/sm)
	30% Coconut Fiber	0.15 lbs/sq yd (0.08 kg/sm)
Netting	Top and Bottom, UV-Stabilized Polypropylene	5 lb/1000 sq ft (2.44 kg/100 sm)
	Middle, Corrugated UV-Stabilized Polypropylene	24 lb/1000 sf (11.7 kg/100 sm)
Thread	Polypropylene, UV Stable	

Standard Roll Sizes	
Width	6.5 ft (2.0 m)
Length	55.5 ft (16.9 m)
Weight ± 10%	34 lbs (15.42 kg)
Area	40 sq yd (33.4 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.62 in. (15.75 mm)
Resiliency	ASTM 6524	95.2%
Density	ASTM D792	0.891 g/cm^3
Mass/Unit Area	ASTM 6566	16.13 oz/sy (548 g/sm)
UV Stability	ASTM D4355/ 1000 HR	100%
Porosity	ECTC Guidelines	99%
Stiffness	ASTM D1388	222.65 oz-in.
Light Penetration	ASTM D6567	4.1%
Tensile Strength – MD	ASTM D6818	709 lbs/ft (10.51 kN/m)
Elongation – MD	ASTM D6818	23.9%
Tensile Strength – TD	ASTM D6818	712 lbs/ft (10.56 kN/m)
Elongation – TD	ASTM D6818	36.9%
Biomass Improvement	ASTM D7322	441%

Design Permissible Shear Stress		
	Short Duration	**Long Duration**
Phase 1: Unvegetated	3.0 psf (144 Pa)	2.5 psf (120 Pa)
Phase 2: Partially Veg.	8.0 psf (383 Pa)	8.0 psf (383 Pa)
Phase 3: Fully Veg.	10.0 psf (480 Pa)	8.0 psf (383 Pa)
Unvegetated Velocity	9.5 fps (2.9 m/s)	
Vegetated Velocity	15 fps (4.6 m/s)	

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2.1	≥ 2:1
≤ 20 ft (6 m)	0.0010	0.0209	0.0507
20-50 ft	0.0081	0.0266	0.0574
≥ 50 ft (15.2 m)	0.0455	0.0555	0.081

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.040
0.50 – 2.0 ft	0.040-0.012
≥ 2.0 ft (0.60 m)	0.011

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ROLLMAX™
ROLLED EROSION CONTROL

Specification Sheet – VMax® W3000™ High-Performance Turf Reinforcement Mat

DESCRIPTION

The VMax® W3000™ high performance turf reinforcement mat (HPTRM) is a machine-produced mat of 100% UV-stabilized high denier poly yarns woven into permanent, high strength three-dimensional turf reinforcement matting. The mat consists of a woven bottom layer integrally interlaced into a woven corrugated middle layer, with poly tendons on the top side spanning the entire machine direction. The mat is designed to provide sufficient thickness, optimum open area and three-dimensionality for effective erosion control and vegetation reinforcement against high flow induced shear forces. The mat has high tensile strength providing excellent damage resistance and increased bearing capacity of vegetated soils subject to heavy loads from maintenance equipment and other vehicular traffic. The corrugated structure provides a highly frictional surface to prevent sod slippage when sod is installed over the mat. When used as surface protection without sod overlay, the corrugated structure encapsulates the seed and soil in place while promoting self-soil infilling of the system.

Material Content		
Bottom	100% UV stable poly fiber weave	Black/Green
Corrugated Middle	100% UV stable poly fiber weave	Black/Green
Top	100% UV stable Poly Tendons	Green

Standard Roll Sizes	
Width	10 ft (3.05 m)
Length	90 ft (27.4 m)
Weight ± 10%	90 lbs (41.0 kg)
Area	100 sy (83.6 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.40 in. (10.2 mm)
Resiliency	ASTM D6524	98%
Mass/Unit Area	ASTM 6566	14.7oz/sy (495 g/m2)
Tensile Strength - MD	ASTM D6818	3600 lbs/ft (52.6 kN/m)
Elongation - MD	ASTM D6818	35%*
Tensile Strength - TD	ASTM D6818	3800 lbs/ft (55.5 kN/m)
Elongation - TD	ASTM D6818	20%*
Light Penetration	ASTM D6567	12%
UV Stability	ASTM D4355	>80% @3000 hrs

** Measured on fabric prior to corrugation for true measurement of base fabric elongation*

Design Permissible Shear Stress*	
Vegetated Shear Stress	16 psf (766 Pa)
Vegetated Velocity	25 fps (7.6 m/s)

**Values extrapolated through ASTM D6460 testing*

ASTM D6460 Large Scale Channel	
Vegetated Shear Stress	>13.2 psf (632 Pa)
Vegetated Velocity	>24.5 fps (7.47 m/s)

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APPENDIX G
AR-LU-007.1 Specific Narrative and Calculations

G.1 Site Specific Narrative
- a. Narrative
- b. TMDL Discussion
- c. Minimized Soil Compaction
- d. Thermal Impact Analysis
- e. Acidic Soil Management Plan
- f. Road Specific Construction Sequence
- g. Permanent Access Road Summary Sheet (NOI PCSM Table)

G.2 Location Map

G.3 Predevelopment Calculations
- a. Predevelopment Drainage Area Map
- b. 1-Year Rainfall Event
- c. 2-Year Rainfall Event
- d. 5-Year Rainfall Event
- e. 10-Year Rainfall Event
- f. 25-Year Rainfall Event
- g. 50-year Rainfall Event
- h. 100-Year Rainfall Event

G.4 Post Development Calculations
- a. Post Development Drainage Area Map
- b. 1-Year Rainfall Event
- c. 2-Year Rainfall Event
- d. 5-Year Rainfall Event
- e. 10-Year Rainfall Event
- f. 25-Year Rainfall Event
- g. 50-year Rainfall Event
- h. 100-Year Rainfall Event

G.5 Conveyance Calculations
- a. E&S Worksheet 11
- b. NAG Swale Lining Analysis
- c. Figure 9.3-Riprap Apron Design

G.6 PCSM BMP Calculations
- a. Check Dam Volume Calculations

G.7 Water Quality Worksheets
- a. Flow Chart A – Stormwater Calculation Process
- b. Worksheet 1. General Site Information
- c. Worksheet 2. Sensitive Natural Resources
- d. Worksheet 3. Nonstructural BMP Credits
- e. Flow Chart B – Control Guideline 1 Process
- f. Worksheet 4. Change in Runoff Volume for 2-Yr Storm Event
- g. Worksheet 5. Structural BMP Volume Credits
- h. Worksheet 10. Water Quality Compliance for Nitrate
- ***i. Worksheet 11. BMPs for Pollution Prevention***
- ***j. Worksheet 12. Water Quality Analysis of Pollutant Loading from All Disturbed Areas***
- ***k. Worksheet 13. Pollutant Reduction Through BMP Applications***

G.8 Infiltration Information
- a. Infiltration Summary
- b. Field Observation Report
- c. Supplemental Field Observation Report

G.9 Off-Site Discharge Analysis
- a. Adequacy of Off-Site Discharge

G.10 Storage Volume Analysis
- a. Storage Volume Analysis

G.11 Sediment Barrier Table
- ***a. E&S Worksheet #1***

G.1 Site Specific Narrative

a. Narrative
b. TMDL Discussion
c. Minimized Soil Compaction
d. Thermal Impact Analysis
e. Acidic Soil Management Plan
f. Road Specific Construction Sequence
g. Permanent Access Road Summary Sheet (NOI PCSM Table)

ACCESS ROAD: AR-LU-007.1

ACT 167 PLAN: Luzerne County Act 167, adopted June 2010

TMDL: None

NARRATIVE:

AR-LU-007.1 is a proposed permanent access road (PAR) located in Fairmount Township, Luzerne County, Pennsylvania. The intent of this PAR is to provide permanent maintenance and operational access to the proposed Main Line Valve 02 (CN-MLV-02) located on the proposed 30" Central Penn Line North Pipeline. The PAR is approximately 100 feet long over relatively hilly terrain. The proposed permanent access road begins at Tripp Road and terminates at the MLV site at approximate milepost 6.7. The access road will be entirely located within the pipeline permanent right of way. Within the pipeline right of way, the proposed temporary sediment barriers are included in the Pipeline E&S Plan and shown in grey on the Access Road Plan for coordination purposes.

During construction, the access road will be 14 feet wide with a temporary rock construction entrance and driveway apron sized for the anticipated vehicles and equipment using the road during construction. Upon completion of the construction activities, the temporary construction entrance and driveway apron will be removed and a permanent access road will be constructed. The permanent road will have a width of 14 feet and a cross slope of 2% directing runoff in a northerly direction into a vegetated channel for infiltration with check dams. A vegetated channel for diversion purposes with check dams will be constructed on the south side of the proposed road and MLV pad to capture and divert uphill runoff.

Runoff from a portion of the disturbed site will be directed to the proposed MLV site. The MLV site will be constructed with a 6-inch thick layer of AASHTO #8 stone on top of nonwoven geotextile and an 18-inch thick layer of AASHTO #57 stone. As summarized in the infiltration calculations in Appendix G.8, the detained water stored in the voids of the MLV stone pad will infiltrate to the surrounding ground over approximately 8 hours, behind the check dams over approximately 48 hours, and behind the infiltration berm with retentive grading over approximately 7 hours.

Water Quality Worksheet #4 was used to complete the Control Guideline 1 (CG-1) volume analysis for the 2 year 24-hour storm. The storage volume provided by the MLV pad is greater than the required volume per Worksheet #4.

Pre-development and post-development runoff hydrographs were developed for the 1, 2, 5, 10, 25, 50 and 100 year 24-hour storm events using the SCS TR-20 method. Directing runoff from the proposed gravel road to the vegetated channel for infiltration and MLV pad mitigates the potential impact from the proposed development.

TMDL DISCUSSION:

The nearest surface waters to receive runoff from this road are not subject to TMDL restrictions.

MINIMIZED SOIL COMPACTION:

The Project seeks to minimize soils compaction impacts associated with access roads to the maximum extent practicable. Construction and operations traffic will utilize the proposed road. The permanent access road is within the permanent right of way of the pipeline, reducing the area of impact. The roadway width has been minimized to 14 feet.

Prior to installing the pipeline, the infiltration bed area will be protected by construction fence. A portion of the MLV site infiltration bed is within the construction travel way for the pipe installation and cannot be protected by the construction fence. Timber matting will be installed across the proposed MLV site to spread construction vehicle loads and minimize soil compaction during construction of the pipeline. Once the travel way is no longer needed, the timber matting will be removed.

The top 20 inches of soil within the footprint of the timber matting installed across the MLV infiltration area will be tilled with a solid-shank ripper to loosen the soil and promote infiltration. If necessary, the tilling operations will be extended to the other infiltration areas if compaction has occurred during installation of the pipeline. Tilling will be performed when the soil is dry.

During grading operations for the PCSM BMPs and access road, construction equipment shall avoid excessive compaction and/or land disturbance. If excavation leads to substantial compaction of the subgrade, 18 inches shall be removed and replaced with a blend of topsoil and sand to promote infiltration and biological growth. At the very least, topsoil shall be thoroughly deep plowed into the subgrade to penetrate the compacted zone and promote aeration and the formation of macropores. Following this, the area should be disked prior to final grading.

THERMAL IMPACT ANALYSIS:

Thermal impacts associated with AR-LU-007.1 will be avoided to the maximum extent practicable. The following measures have been implemented to minimize thermal impacts:

- AR-LU-007.1 is a permanent access road constructed of gravel. This roadway surface minimizes the thermal impact because it allows for runoff to flow over the roadway surface to the proposed vegetated channel for infiltration and MLV pad.

- This road is proposed in a location that minimizes tree removal. The ability to use this road without the removal of additional trees acts to minimize the thermal impact of this road.

- Vegetated channels for infiltration with check dams are proposed adjacent to the proposed permanent access road. The vegetated channels for infiltration and check dams promote infiltration of the runoff from the proposed impervious road. Infiltration allows the runoff to assimilate to ground water temperatures which are minimally influenced by seasonal temperature changes, minimizing the thermal impact of this road.

ACIDIC SOIL MANAGEMENT PLAN:

AR-LU-007.1 Soil Acidity Table		
Soil Map Symbol	Soil Name	PH
LcB	Lackawanna channery silt loam, 3 to 8 percent slopes, extremely stony	5.1

An Acid Producing Soils Control Plan is included as part of this application. The plan identifies the measures to be used to control pollution associated with construction of access roads that contain acid-producing soils. The plan requires that these measures be applied only for soils with a pH less than 4.0 as recommended by the Natural Resources Conservation Service (NRCS). The table above depicts the soil types present on this road as well as the acidity of the soils. The pH of the soils on this road are outside the threshold established by the Acid Producing Soils Control Plan. Therefore, the measures prescribed in the plan do not need to be implemented for this road.

ANTIDEGRADATION REQUIREMENTS:

AR-LU-007.1 is located within a special protection watershed. There are no opportunities for non-discharge alternatives such as connecting to a sewer system or capturing stormwater in rain barrels for reuse as irrigation.

AR-LU-007.1 has been designed to maintain pre-construction rates of runoff by detaining and infiltrating stormwater within the MLV site and vegetated channels.

During construction, Antidegradation Best Available Combination of Technologies (ABACT) E&SC BMPs, such as rock construction entrances with wash racks and compost filter sock, are proposed to be installed on the access roads.

ROAD SPECIFIC CONSTRUCTION SEQUENCE:
ACCESS ROAD: AR-LU-007.1

1. At least 7 days prior to starting earth disturbance activities, including clearing and grubbing, the owner and/or operator shall invite all contractors, Environmental Inspectors, the landowner, appropriate municipal officials, the E&S plan preparer, the PCSM plan preparer, the licensed professional responsible for oversight of critical stages of implementation of the PCSM plan, and a representative from the local conservation district to an on-site preconstruction meeting.

2. At least 3 days prior to starting earth disturbance activities, or expanding into an area previously unmarked, the Pennsylvania One Call System Inc. shall be notified at 1-800-242-1776 for the location of existing underground utilities.

3. Hold pre-construction conference with the Environmental Inspectors, local County Conservation District (CCD), PADEP and Design Engineer.

4. Survey crews locate and stake all special areas of concern (i.e., wetlands, streams, culverts, other utilities, etc.), edge of proposed access road, and field locate the limit of disturbance.

5. Install orange construction fence around areas to be preserved***, including infiltration areas to be protected***.

6. Locate staging areas and access points including the rock construction entrance with wash rack. Install sediment barriers (compost filter sock) down slope of these areas.

7. Perform tree cutting where required. (Areas with tree cutting shall be restored to meadow in good condition.)

8. ***Strip and stockpile topsoil; Install compost filter sock around stockpile. Stockpiled soil shall not exceed 35 feet in height, have maximum side slopes of 2:1, and be surrounded by 12" compost filter sock. Excavated material that is not to be reused in the work area is to be immediately removed from the site and properly disposed of at an approved facility or permitted waste area.***

9. Install rock construction entrance with wash rack and gravel driveway apron.

10. Remove brush to effectively install ***sediment barriers as shown on the Pipeline E&SC Plans under separate cover***.

11. The Compliance Manager shall provide PADEP at least three days' notice prior to bulk earth disturbance and upon completed installation of ***sediment barriers***.

12. If applicable, install security fence. The necessity of a security fence will be at the discretion of the Contractor.

13. ***Install sediment barriers as shown on the pipeline E&SC plans. The pipeline improvements will be installed prior to the MLV site and permanent access road improvements.***

14. ***Install timber matting over infiltration area as shown on the E&SC Plans to minimize compaction due to construction traffic. Minimize traffic through this area.***

15. Proceed with major clearing and grubbing.

16. ***Install the pipeline.***

17. Upon ***completion of backfilling the pipeline trench,*** temporary cessation of an earth disturbance activity, or stage of an activity where the cessation of earth disturbance activities will exceed four days, the disturbed areas shall be immediately seeded, mulched, or otherwise protected from accelerated erosion and sedimentation pending future earth disturbance activities. For an earth disturbance activity or stage 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. Temporary stabilization will not occur on active vehicular travel ways within the right of way. The on-site environmental inspector will log daily activity within the limits of disturbance and notify the Contractor of areas requiring temporary stabilization (i.e., areas where work has ceased for at least four days).

18. Begin construction staking for layout of access road.

19. ***Remove the timber matting in the MLV site.***

20. Grade the access road ***and MLV site*** as shown on the E&SC Plans.

21. ***Remove excess excavated soil from the site and properly disposed of the material at an approved facility or permitted waste area.***

22. ***Till the top 20 inches of soil within the footprint of the timber matting installed across the MLV infiltration area with a solid-shank ripper to loosen the soil and promote infiltration. Extend tilling operations to the other infiltration areas if compaction has occurred during installation of the pipeline. Tilling shall be performed when the soil is dry.***

23. The Compliance Manager shall provide PADEP at least three days' notice prior to installing the vegetated channels, infiltration berm, and stone and geotextile fabric within the MLV pads.

a. Install the vegetated channels and infiltration berm where specified on the E&SC & PCSM Plans (Section 2 of the ESCGP-2 NOI). Note: this is a critical stage of PCSM plan to be observed by a licensed professional or designee. Begin vegetated channel construction only when the upgradient temporary erosion and sediment control measures are in place. Vegetated channels should be constructed and stabilized early in the construction schedule, preferably before mass earthwork increase the rate and volume of runoff.

b. Rough grade the vegetated channel. Equipment shall avoid excessive compaction and/or land disturbance. Excavating equipment should operate from the side of the channel and never on the bottom. If excavation leads to substantial compaction of the subgrade (where infiltration is proposed), 18 inches shall be removed and replaced with a blend of topsoil and sand to promote infiltration and biological growth. At the very least, topsoil shall be thoroughly deep plowed into the subgrade in order to penetrate the compacted zone and promote aeration and the formation of macropores. Following this, the area should be disked prior to final grading.

c. Construct check dams.

d. Fine grade the vegetated channel. Accurate grading is crucial for channels. Even the smallest nonconformities may compromise flow conditions.

e. Seed, vegetate and install protective lining as per approved plans and according to final planting list. Vegetation should be established as soon as possible to prevent erosion and scour. Seed mix and season of planting are provided under separate cover in the Best Management Practices and Quantities Plan Set.

f. Rough grade the MLV pad. Equipment shall avoid excessive compaction and/or land disturbance. If excavation leads to substantial compaction of the subgrade, 18 inches shall be removed and replaced with a blend of topsoil and sand to promote infiltration and biological growth. At the very least, topsoil shall be thoroughly deep plowed into the subgrade to penetrate the compacted zone and promote aeration and the formation of macropores. Following this, the area should be disked prior to final grading.

g. Caution shall be observed when excavating above the recently installed gas pipeline. Prior to excavation over the gas pipeline, confirm the depth of cover over the pipe. Decompact the pipe trench backfill as described in the previous Step.

h. Place the stone and geotextile fabric within the MLV pad as specified on the E&SC & PCSM Plans. NOTE: This is a critical stage of PCSM Plan to be observed by a licensed professional or designee.

24. Immediately stabilize the access road with geotextile and gravel surfacing where indicated in the E&SC Plans.

25. ***Replace stockpiled topsoil as applicable and final grade the disturbed areas. Immediately fertilize, seed and stabilize disturbed areas at finished grade.***

26. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner shall contact the local CCD for an inspection prior to the removal of the ***sediment barriers***. Vegetated areas must achieve a minimum uniform 70% perennial cover over the entire disturbed area to be considered stabilized. Roadways and parking areas should have at least a clean subbase in place to be considered stabilized. ***In agricultural use areas, an area shall be considered to have achieved final stabilization if the above conditions are met or if an area exhibits any ground cover conditions normally associated with active agricultural practices, including but not limited to bare earth on cultivated land, temporary vegetative cover on cultivated land, or pasture not meeting a minimum uniform 70% perennial vegetative cover.***

27. Upon local CCD and Transco approval of stabilization and re-vegetation, ***either:***

    a. ***Leave the compost filter sock in place, cut open the mesh, and spread the mulch as a soil supplement; or***

    b. Remove the ***compost filter sock***, stabilize areas disturbed by removal, and properly dispose/recycle the ***compost filter sock.***

28. Remove orange construction fencing and security fence.

29. Upon completion of all earth disturbance activities, removal of the ***sediment barriers***, and permanent stabilization of all disturbed areas, the Owner shall contact the local CCD for a final inspection.

Permanent Access Road Summary Sheet

Access Road Number:	AR-LU-007.1			
Watershed Name:	Maple Run, CWF, MF			
Act 167 Plan Name:	Luzerne County Act 167		Date Adopted: June 2010	
Design Storm Frequency	2 year	Pre-construction	Post-construction	Net Change
Rainfall Amount	2.88 inches			
Impervious area (acres)		0.00	0.15	0.15
Volume of stormwater runoff (cf) without planned stormwater BMPs		1,210	1,841	631
Volume of stormwater runoff (cf) with planned stormwater BMPs			164	(1,046)

Pre- vs. Post-construction Peak Rate of Flow Summary			
Stormwater discharge rate for the design frequency storm (cfs)	Pre-construction	Post-construction	Net Change
1) 1-Year/24-Hour	0.70	0.20	(0.50)
2) 2-Year/24-Hour	1.20	0.45	(0.75)
3) 5-Year/24-Hour	2.01	1.00	(1.01)
4) 10-Year/24-Hour	2.79	1.72	(1.07)
5) 25-Year/24-Hour	4.07	2.28	(1.79)
6) 50-Year/24-Hour	5.29	3.36	(1.93)
7) 100-Year/24-Hour	6.76	4.87	(1.89)

Summary Description of Restoration BMPs - Permanent Access Roads			
BMP	Function	Volume of stormwater treated (cf)	Acres treated
Natural area conservation: Pre-construction drainage pattern intact		0	0.00
Access road design: Ditches Berms	Infiltration/ Recharge/Storage	 475 901	 0.08 0.36
Stormwater energy dissipaters: Riprap Aprons	Infiltration/ Recharge/Storage	0	0.00
Other: MLV Stone Pad Void Storage	Infiltration/ Recharge/Storage	1,202	0.20

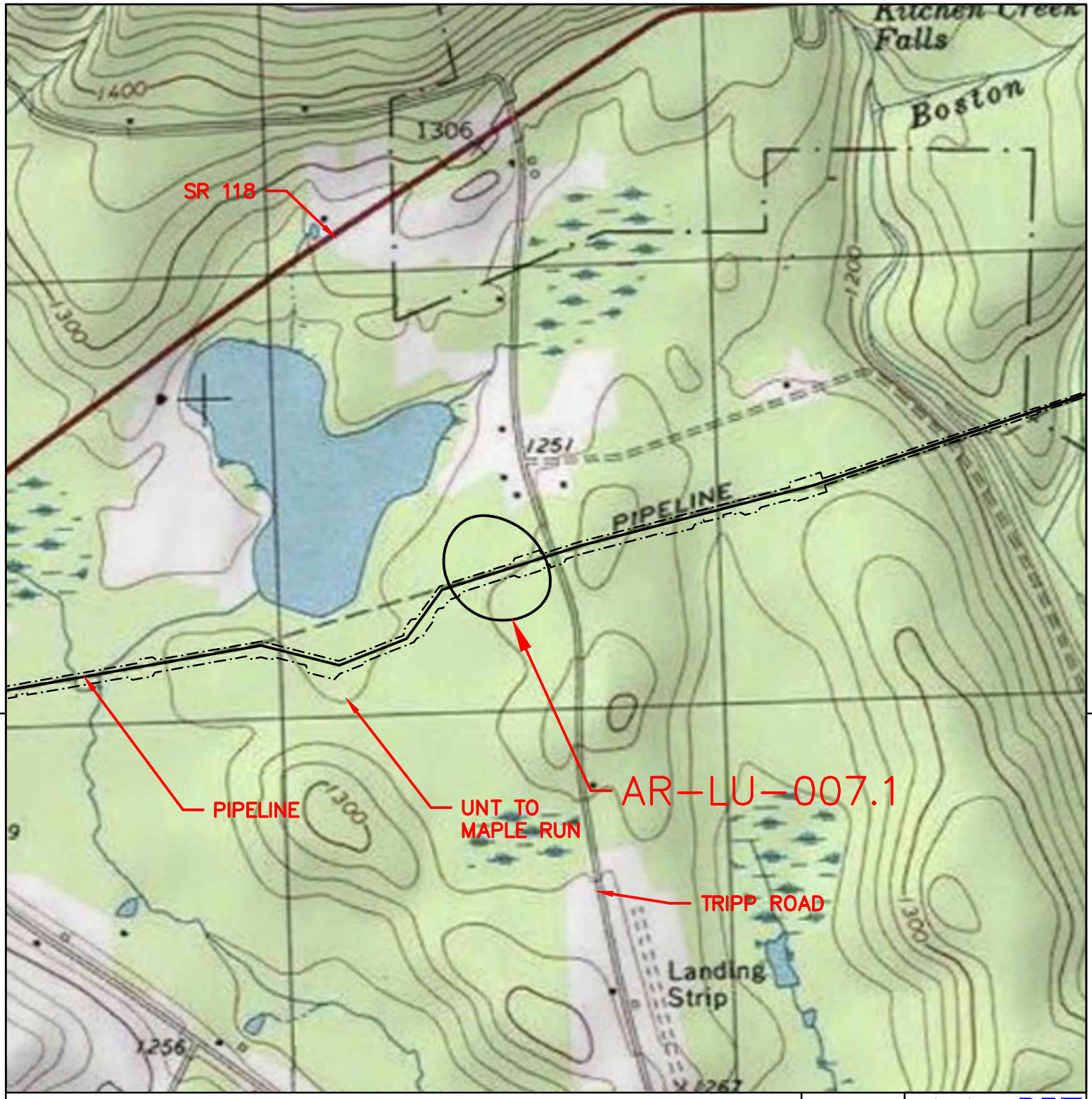
Off-site Discharge Analysis:

The point of interest (POI) for the access road stormwater design is the downstream point where the access road watershed currently discharges off-site. As shown in the tables above, there is no increase in volume or peak rate of runoff at the POI. Therefore, the existing drainage pattern will be unchanged and erosion, damage, or nuisance to off-site properties is not anticipated to be caused by the Project improvements.

Loading Ratio:		***Channel***	***MLV Pad***
Maximum Impervious Loading Ratio	***4.0***	***:1 (5:1 Max)***	***1.5 :1 (5:1 Max)***
Maximum Total Loading Ratio	***7.9***	***:1 (8:1 Max)***	***2.6 :1 (8:1 Max)***

Supporting Areas	***Channel***	***MLV Pad***	***Unit***
Impervious Drainage Area	***0.04***	***0.12***	***Acres***
Infiltration Area	***0.01***	***0.08***	***Acres***
Total Drainage Area	***0.08***	***0.20***	***Acres***

G.2 Location Map



RED ROCK QUADRANGLE | SWEET VALLEY QUAD

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING
BL Companies

N

GRAPHIC SCALE
1,000 500 0 1,000
SCALE IN FEET

ATLANTIC SUNRISE

PROPOSED 30" NATURAL GAS PIPELINE

USGS LOCATION MAP
PERMANENT AR-LU-007.1
FAIRMOUNT TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

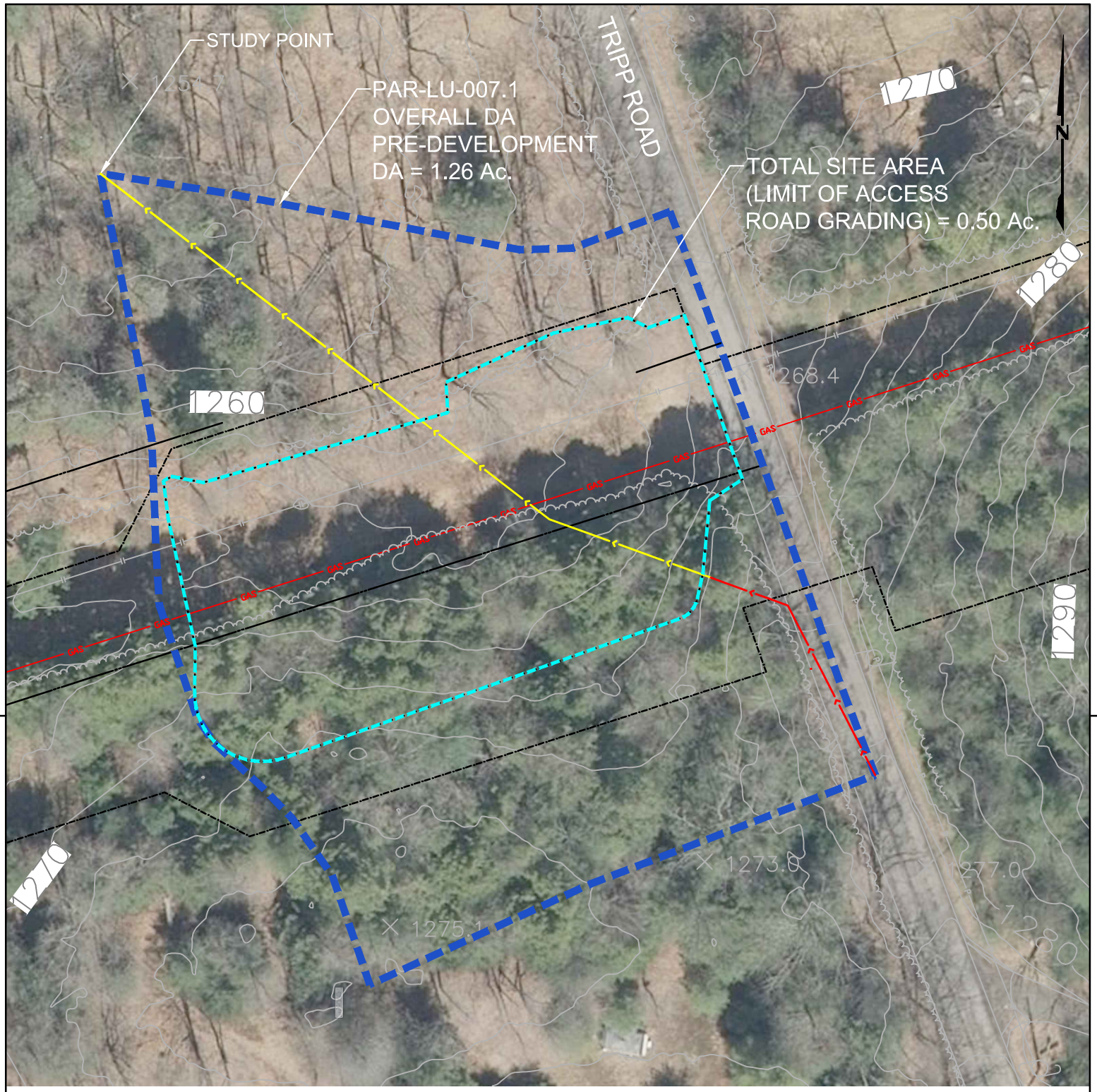
Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
				1161481		

DRAWN BY: CLM	DATE: 11/11/15	ISSUED FOR BID:	SCALE: 1"=1,000'
CHECKED BY:	DATE:	ISSUED FOR CONSTRUCTION:	
APPROVED BY:	DATE:	DRAWING NUMBER: 24-1601-70-28-A/ 1683_3-AR-LU-007.1	SHEET 1 OF 1
WO: 1161481			

G.3 Predevelopment Calculations

a. Predevelopment Drainage Area Map
b. 1-Year Rainfall Event
c. 2-Year Rainfall Event
d. 5-Year Rainfall Event
e. 10-Year Rainfall Event
f. 25-Year Rainfall Event
g. 50-year Rainfall Event
h. 100-Year Rainfall Event



PRE-DEVELOPMENT DRAINAGE AREA MAP

0 25 50
SCALE IN FEET

ISSUED FOR PERMITTING

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING
BL Companies

LEGEND

- TIME OF CONCENTRATION- SHEET FLOW
- TIME OF CONCENTRATION- SHALLOW CONCENTRATED FLOW
- DRAINAGE AREA
- PROPOSED GAS PIPELINE (GAS — GAS)
- TOTAL SITE AREA

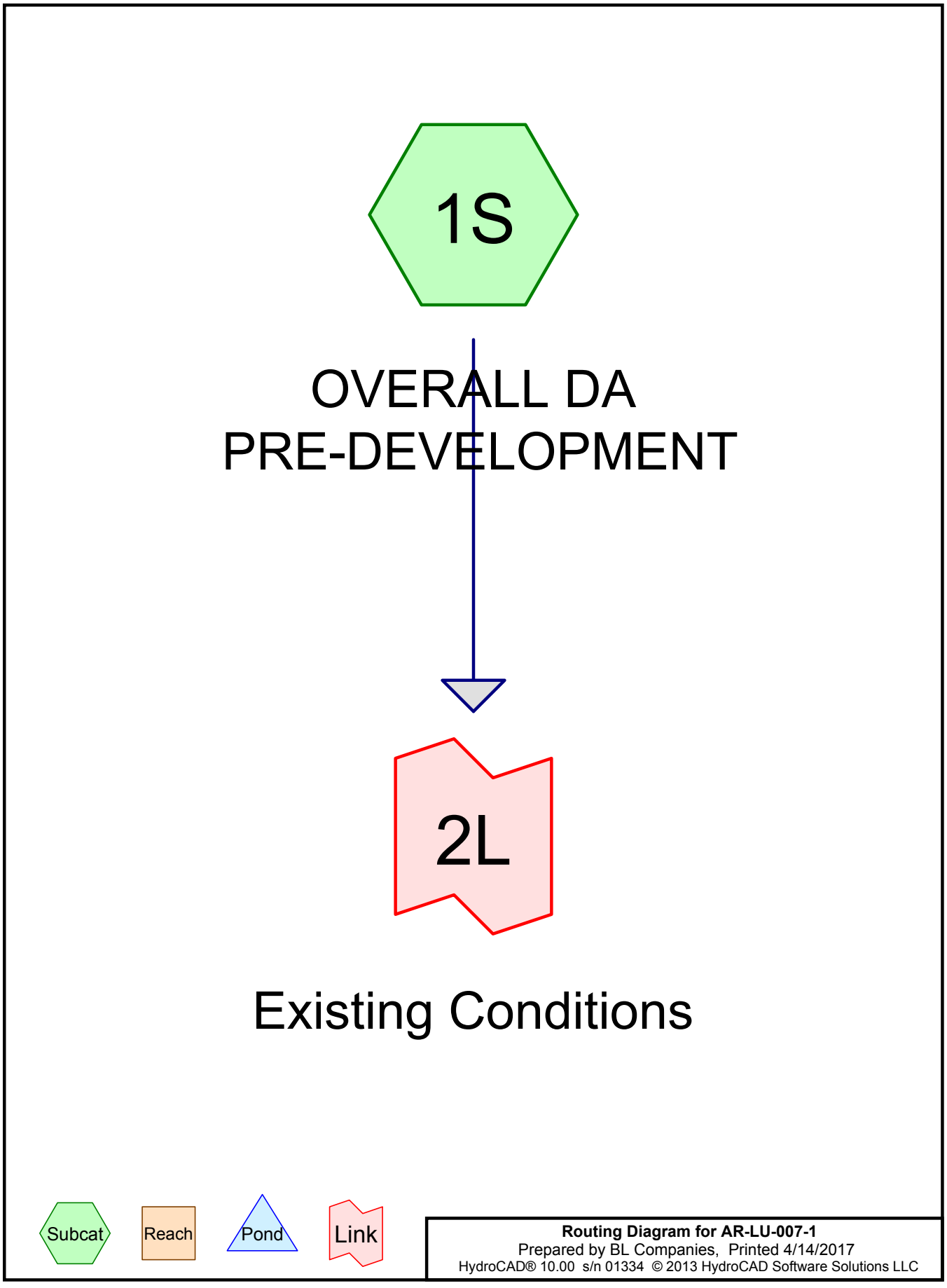
ATLANTIC SUNRISE PROJECT -
CENTRAL PENN LINE NORTH

PROPOSED 30" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-LY-007.1 PRE
FAIRMOUNT TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

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

DRAWN BY: OLC	DATE: 11/11/15	ISSUED FOR BID:	SCALE: 1" = 50'
CHECKED BY: BJP	DATE: 11/11/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: BJP	DATE: 11/11/15	DRAWING NUMBER:	AR-LU-007.1 PRE
WO:			


1S
OVERALL DA
PRE-DEVELOPMENT
2L
Existing Conditions
Subcat
Reach
Pond
Link
Routing Diagram for AR-LU-007-1
Prepared by BL Companies, Printed 4/14/2017
HydroCAD® 10.00 s/n 01334 © 2013 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
13,102	71	Meadow, non-grazed, HSG C (1S)
1,524	98	Paved parking, HSG C (1S)
40,385	70	Woods, Good, HSG C (1S)

Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

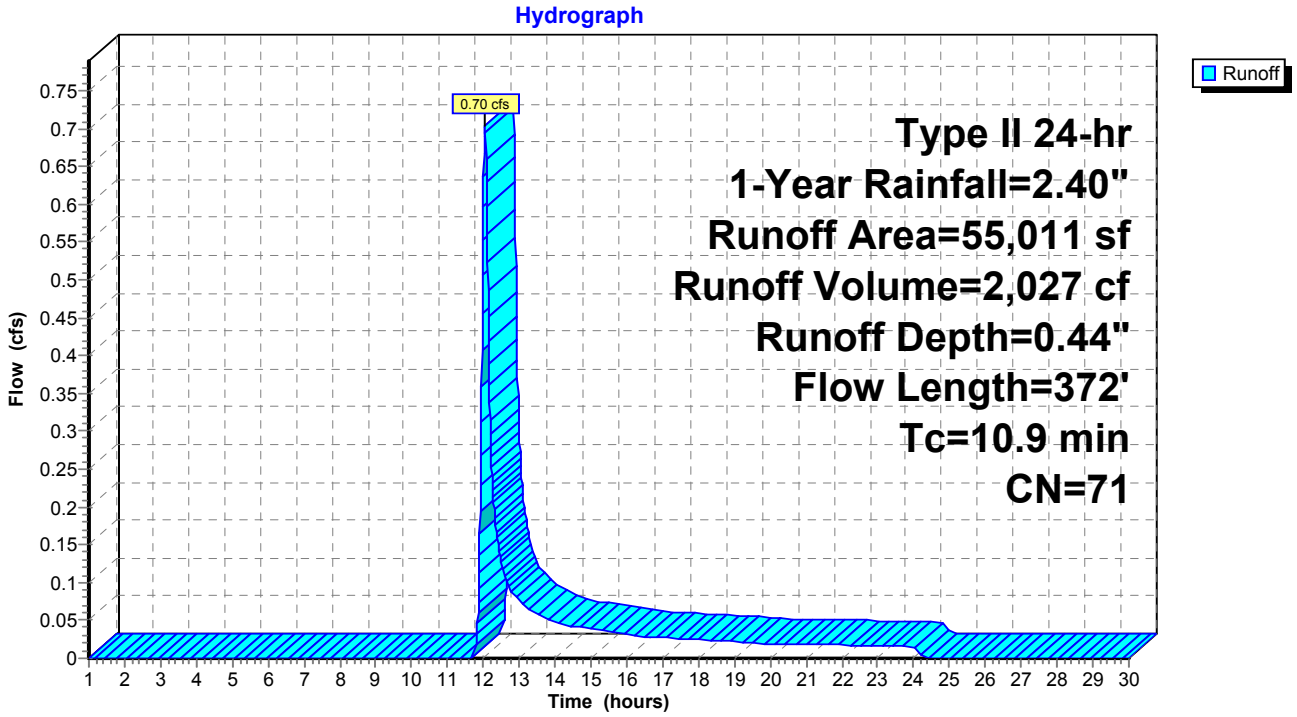
Runoff = 0.70 cfs @ 12.05 hrs, Volume= 2,027 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

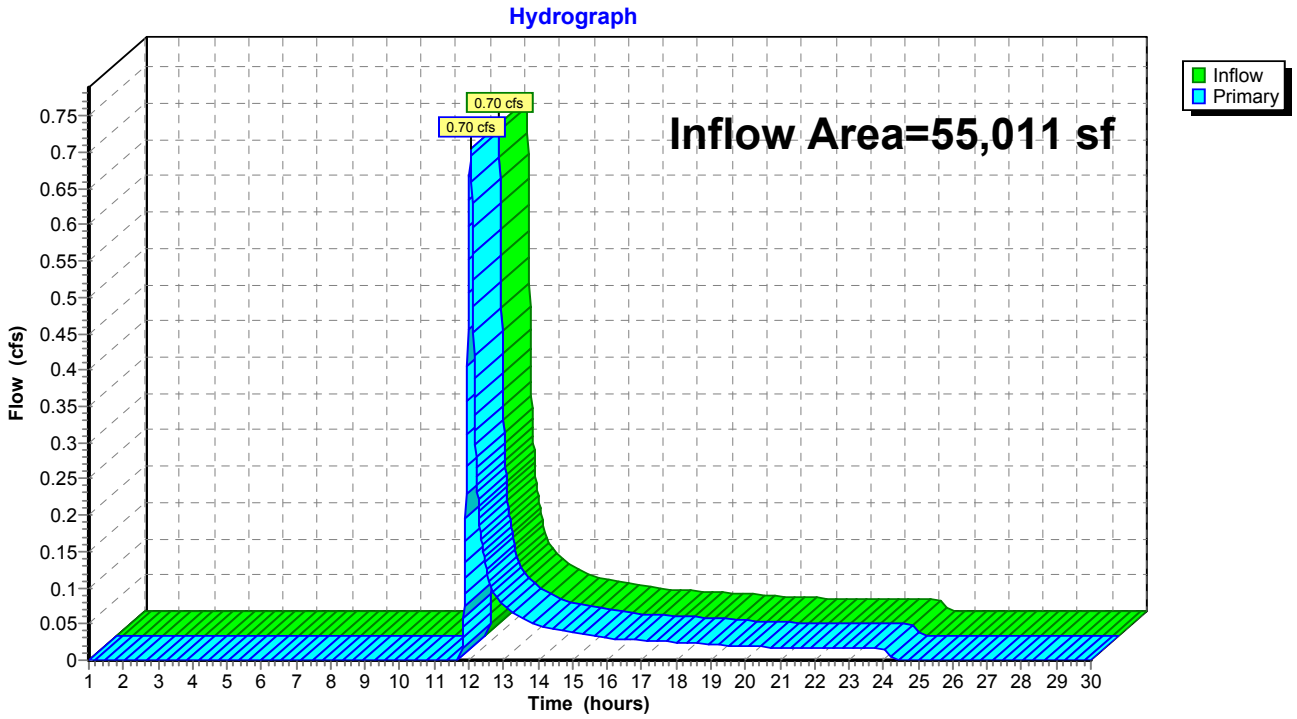


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 0.44" for 1-Year event
Inflow = 0.70 cfs @ 12.05 hrs, Volume= 2,027 cf
Primary = 0.70 cfs @ 12.05 hrs, Volume= 2,027 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

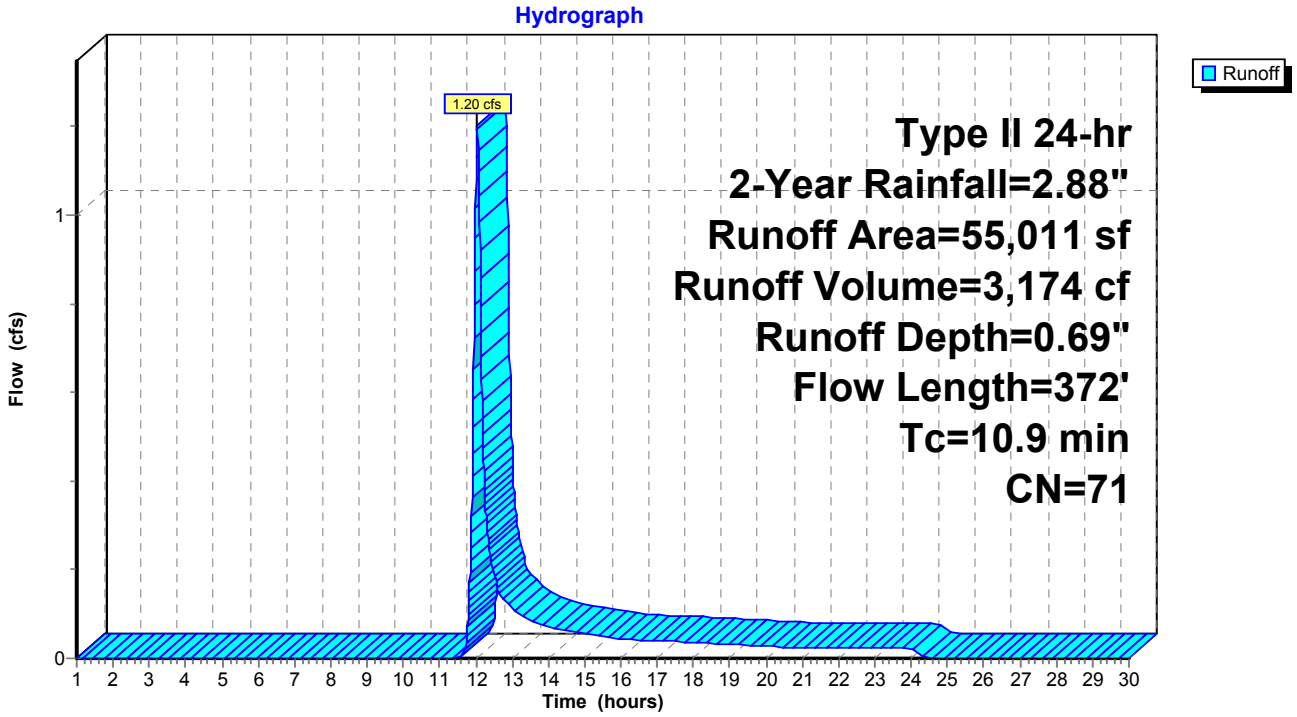
Runoff = 1.20 cfs @ 12.04 hrs, Volume= 3,174 cf, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

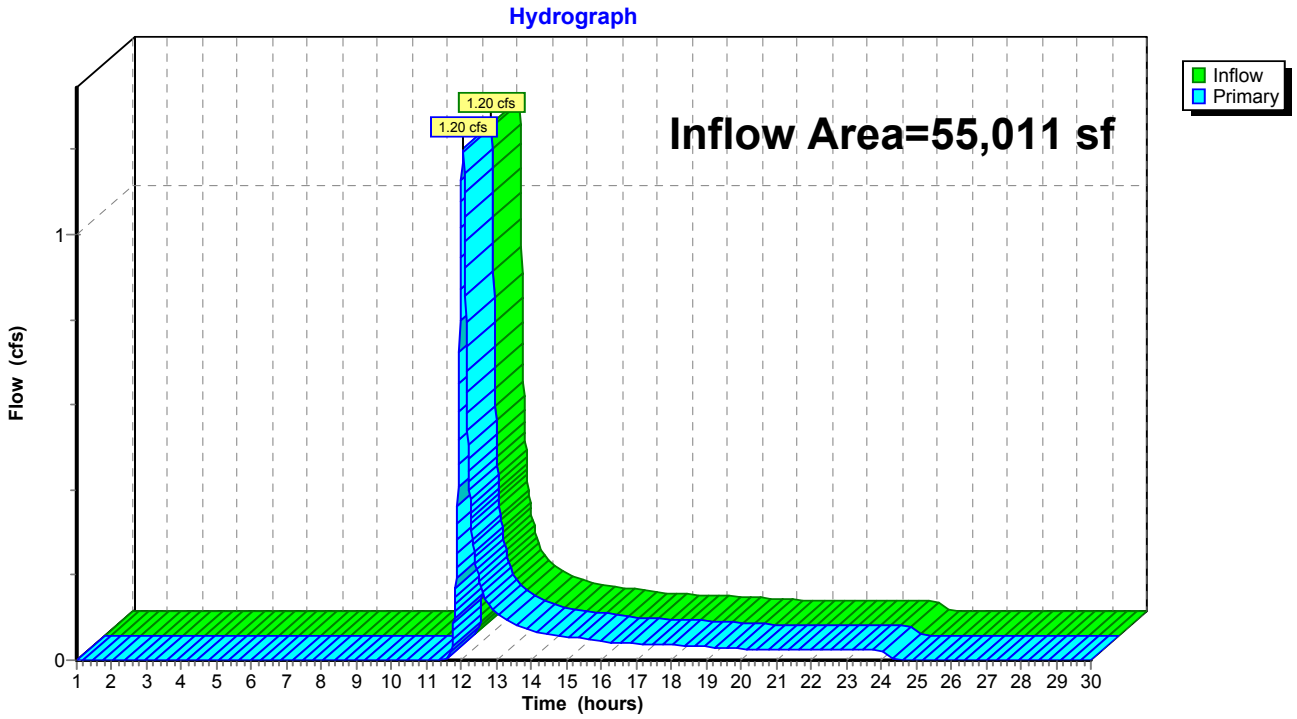


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 0.69" for 2-Year event
Inflow = 1.20 cfs @ 12.04 hrs, Volume= 3,174 cf
Primary = 1.20 cfs @ 12.04 hrs, Volume= 3,174 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

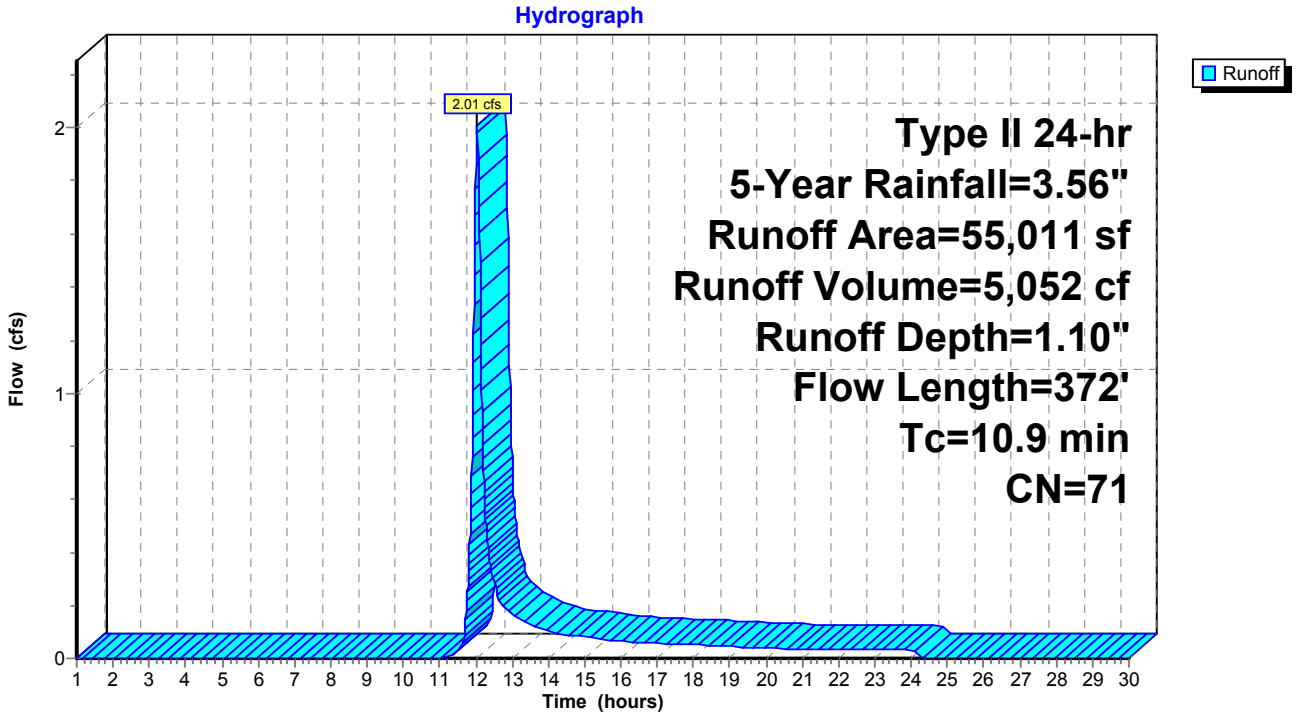
Runoff = 2.01 cfs @ 12.04 hrs, Volume= 5,052 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

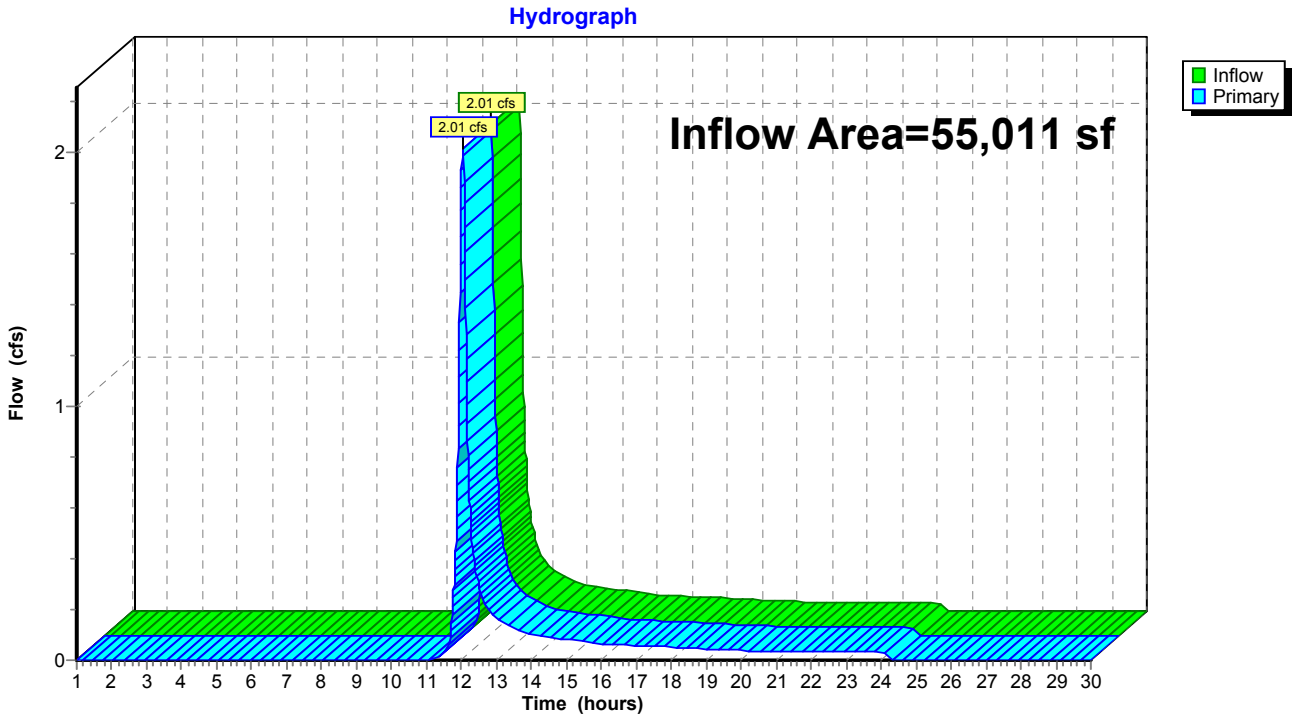


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 1.10" for 5-Year event
Inflow = 2.01 cfs @ 12.04 hrs, Volume= 5,052 cf
Primary = 2.01 cfs @ 12.04 hrs, Volume= 5,052 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

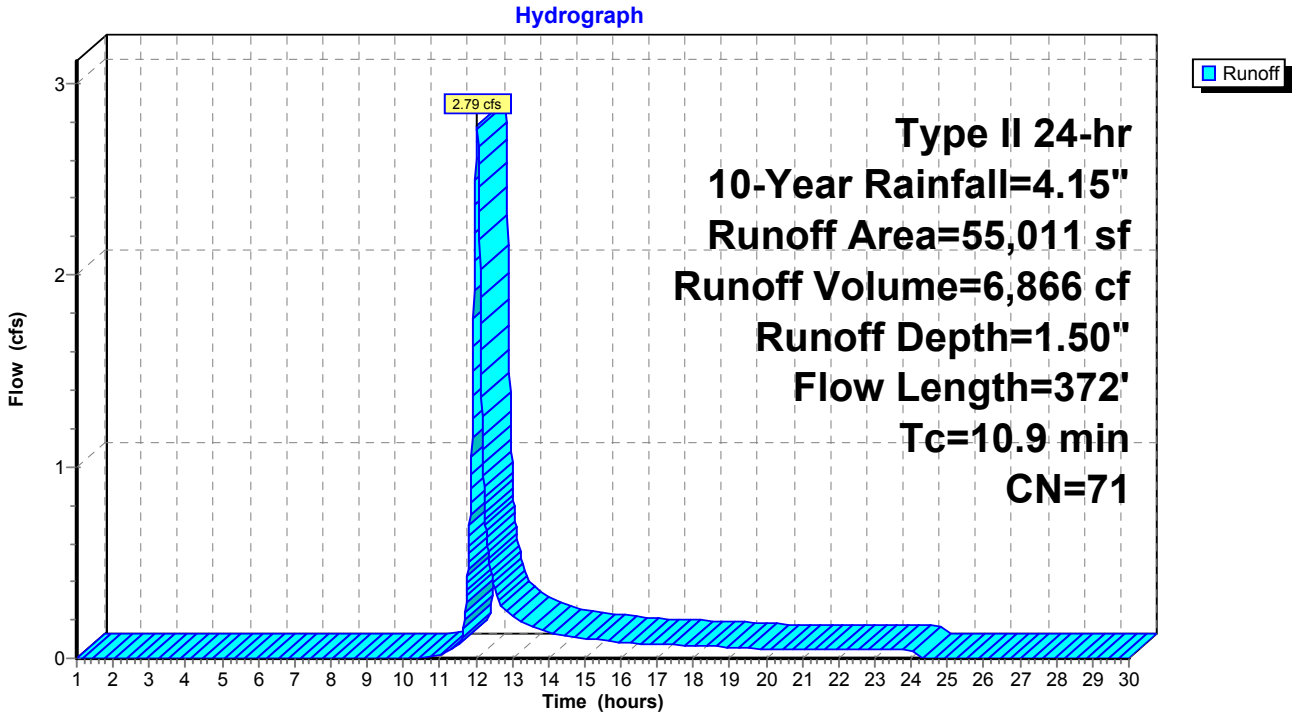
Runoff = 2.79 cfs @ 12.03 hrs, Volume= 6,866 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

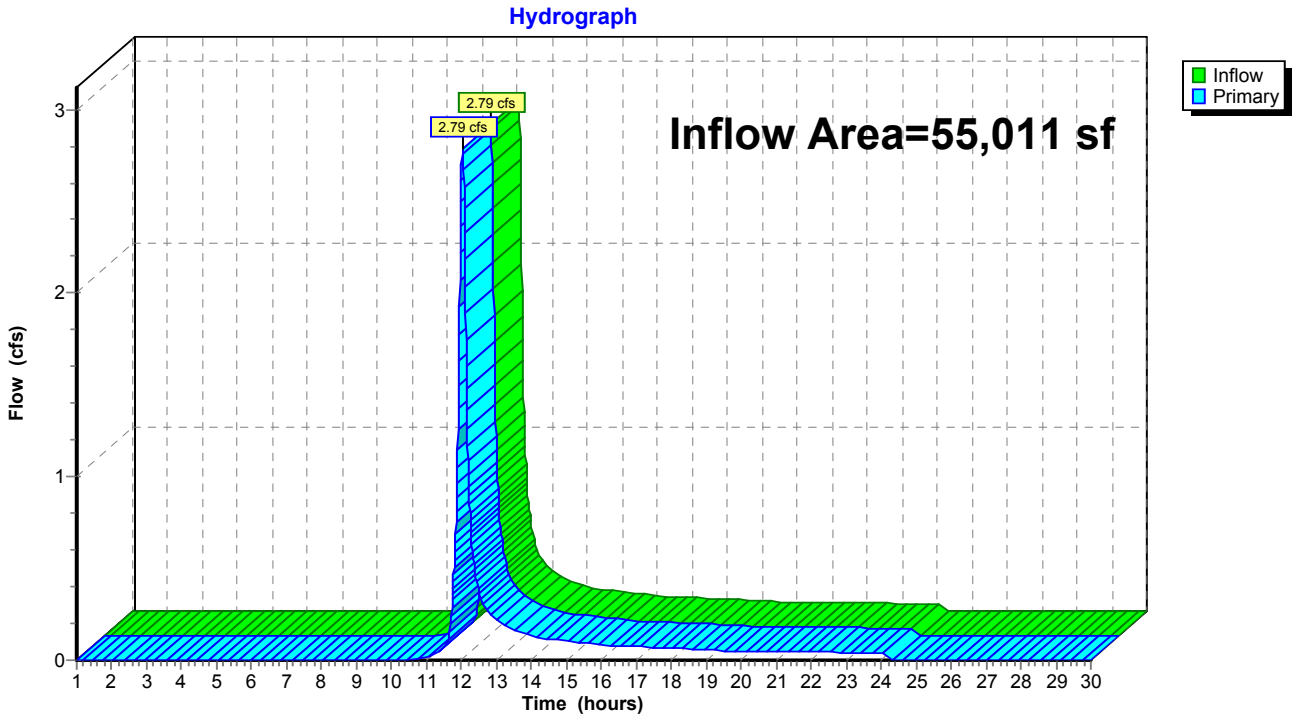


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 1.50" for 10-Year event
Inflow = 2.79 cfs @ 12.03 hrs, Volume= 6,866 cf
Primary = 2.79 cfs @ 12.03 hrs, Volume= 6,866 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

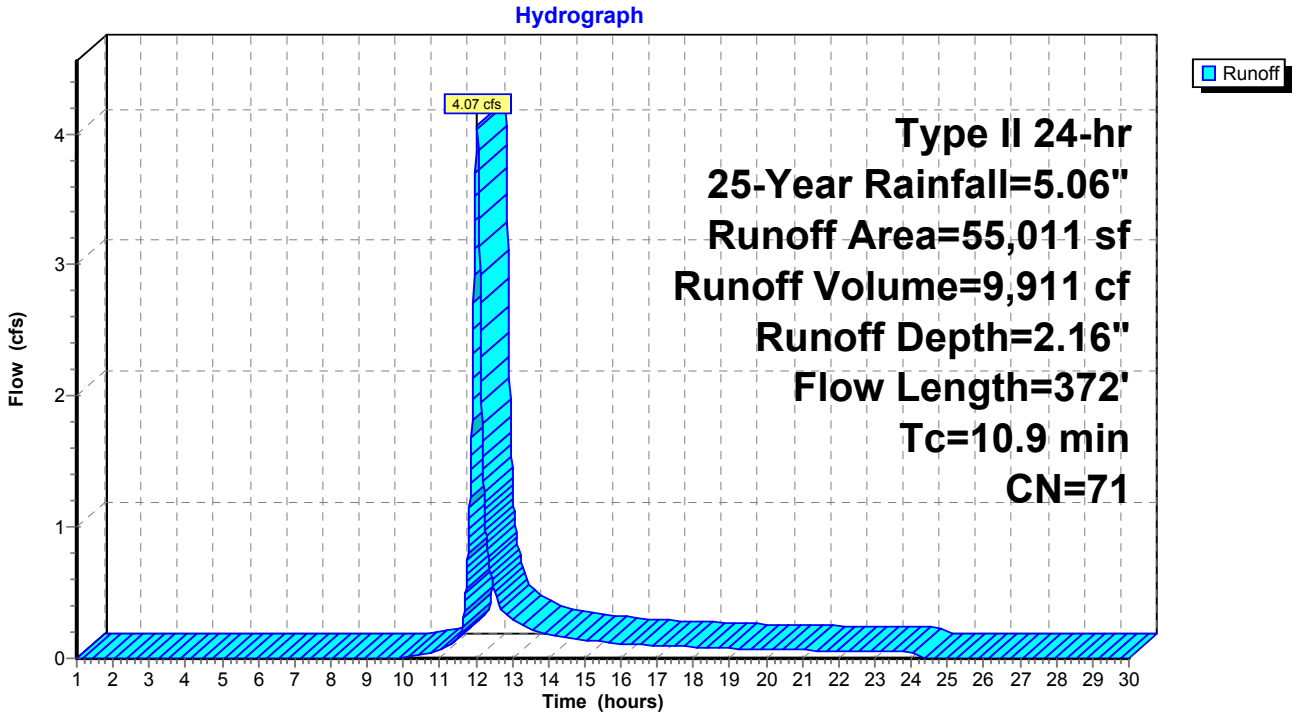
Runoff = 4.07 cfs @ 12.03 hrs, Volume= 9,911 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

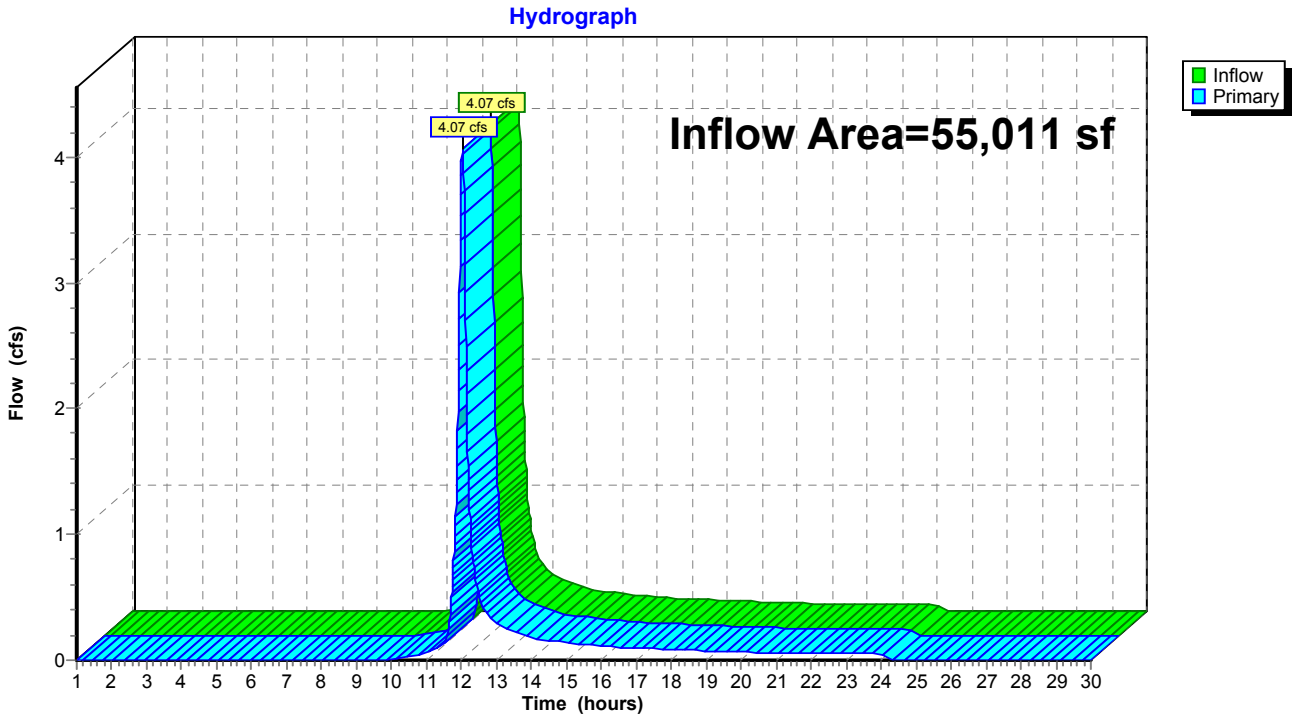


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 2.16" for 25-Year event
Inflow = 4.07 cfs @ 12.03 hrs, Volume= 9,911 cf
Primary = 4.07 cfs @ 12.03 hrs, Volume= 9,911 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

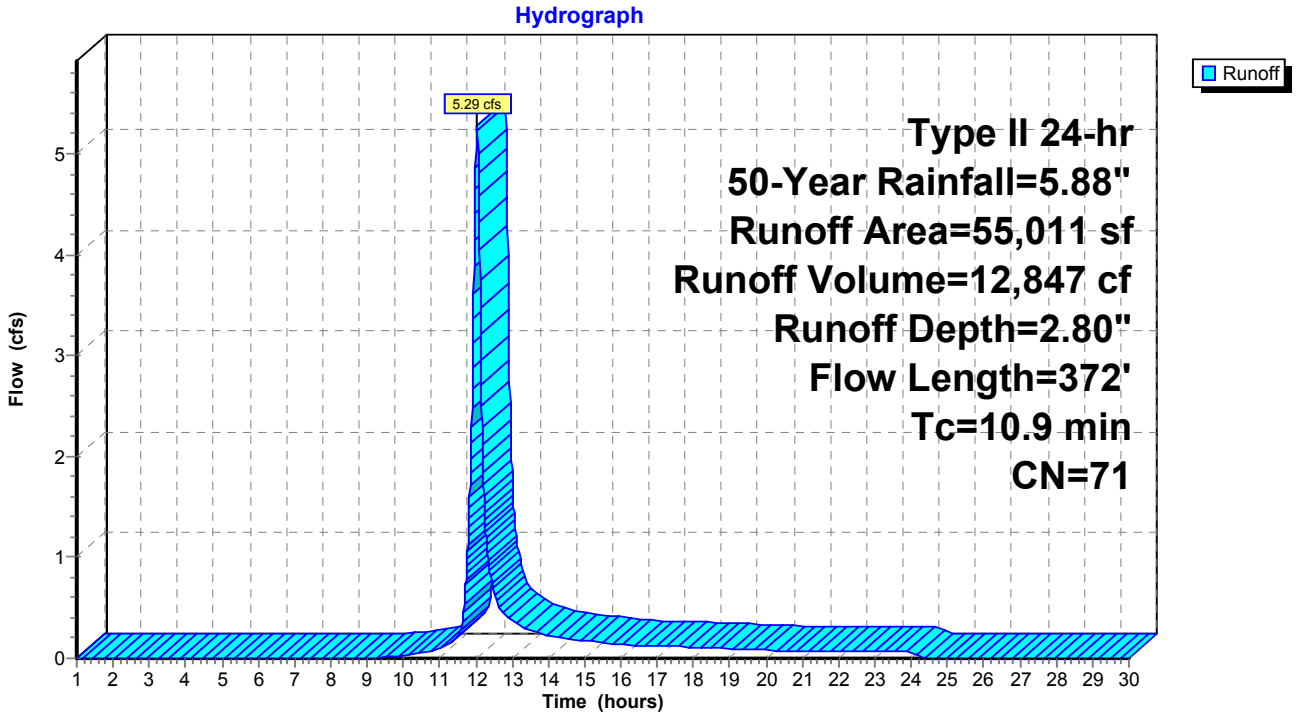
Runoff = 5.29 cfs @ 12.03 hrs, Volume= 12,847 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

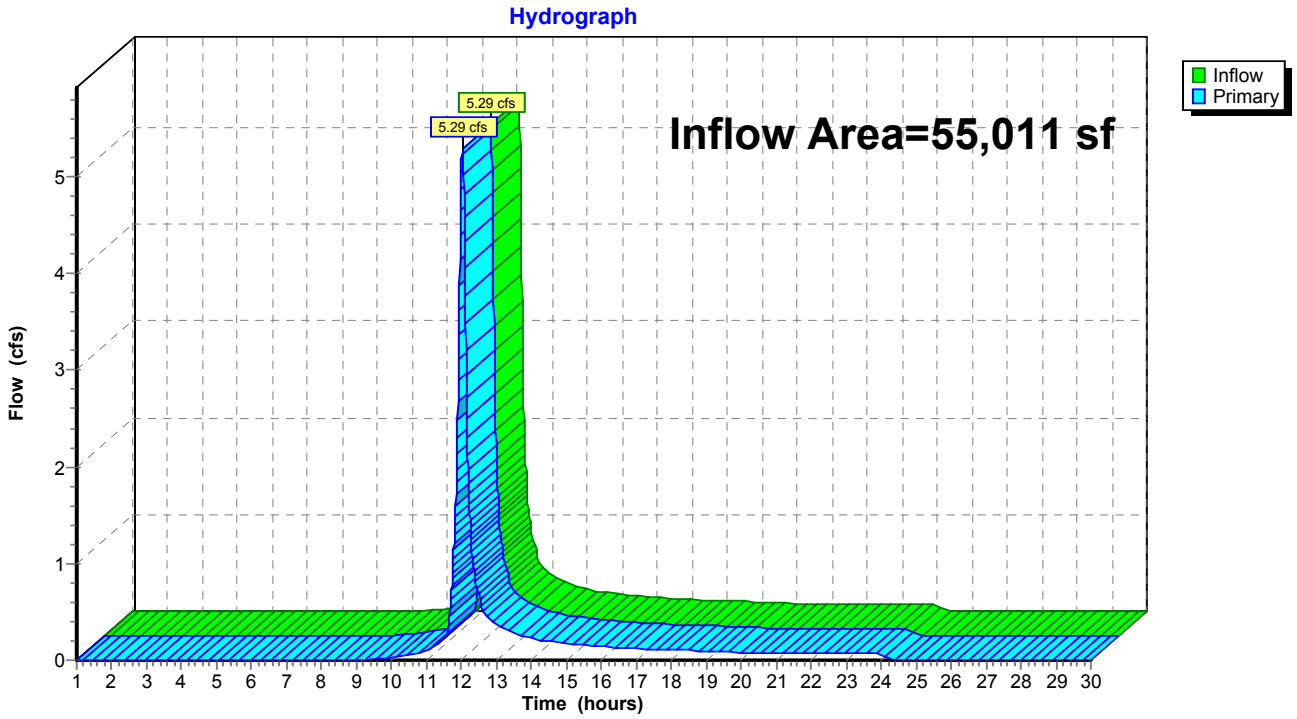


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 2.80" for 50-Year event
Inflow = 5.29 cfs @ 12.03 hrs, Volume= 12,847 cf
Primary = 5.29 cfs @ 12.03 hrs, Volume= 12,847 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



Summary for Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

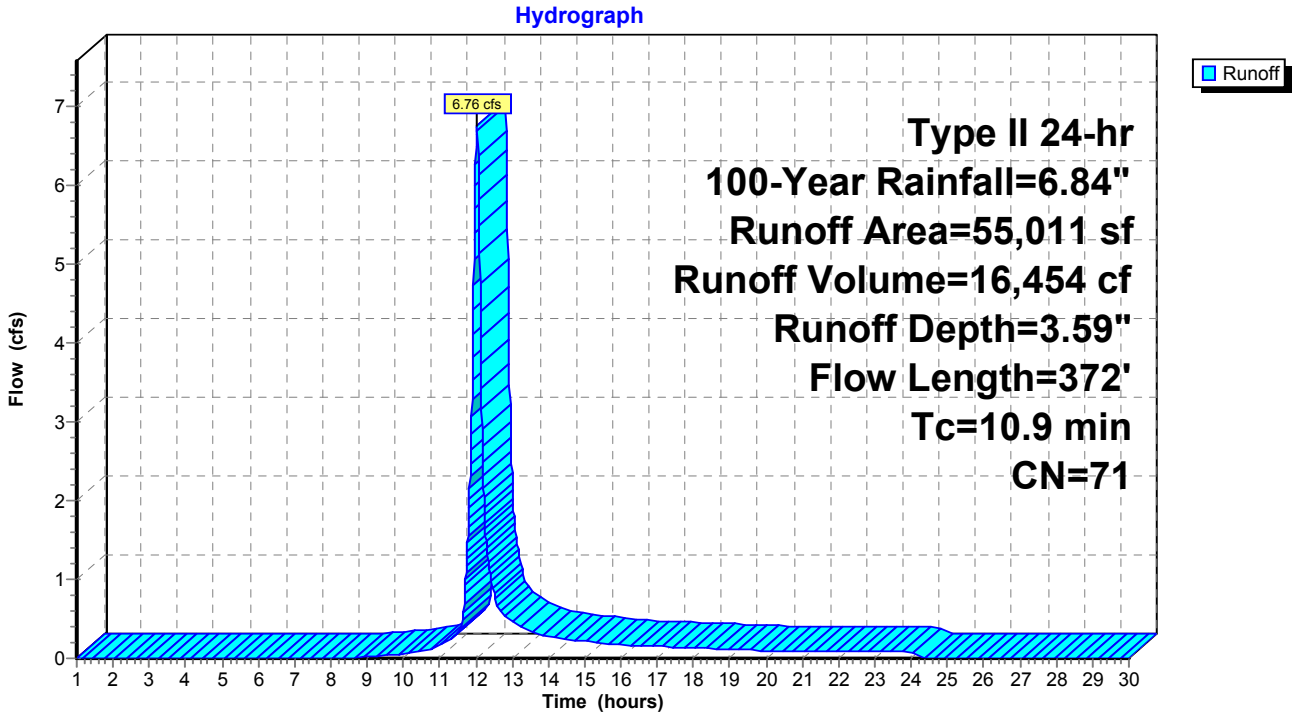
Runoff = 6.76 cfs @ 12.03 hrs, Volume= 16,454 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

Area (sf)	CN	Description
40,385	70	Woods, Good, HSG C
13,102	71	Meadow, non-grazed, HSG C
1,524	98	Paved parking, HSG C
55,011	71	Weighted Average
53,487		97.23% Pervious Area
1,524		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.8	7	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
5.7	23	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.6	67	0.1200	1.73		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.6	64	0.0600	1.71		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
2.5	141	0.0350	0.94		**Shallow Concentrated Flow, SC3** Woodland Kv= 5.0 fps
10.9	372	Total			

Subcatchment 1S: OVERALL DA PRE-DEVELOPMENT

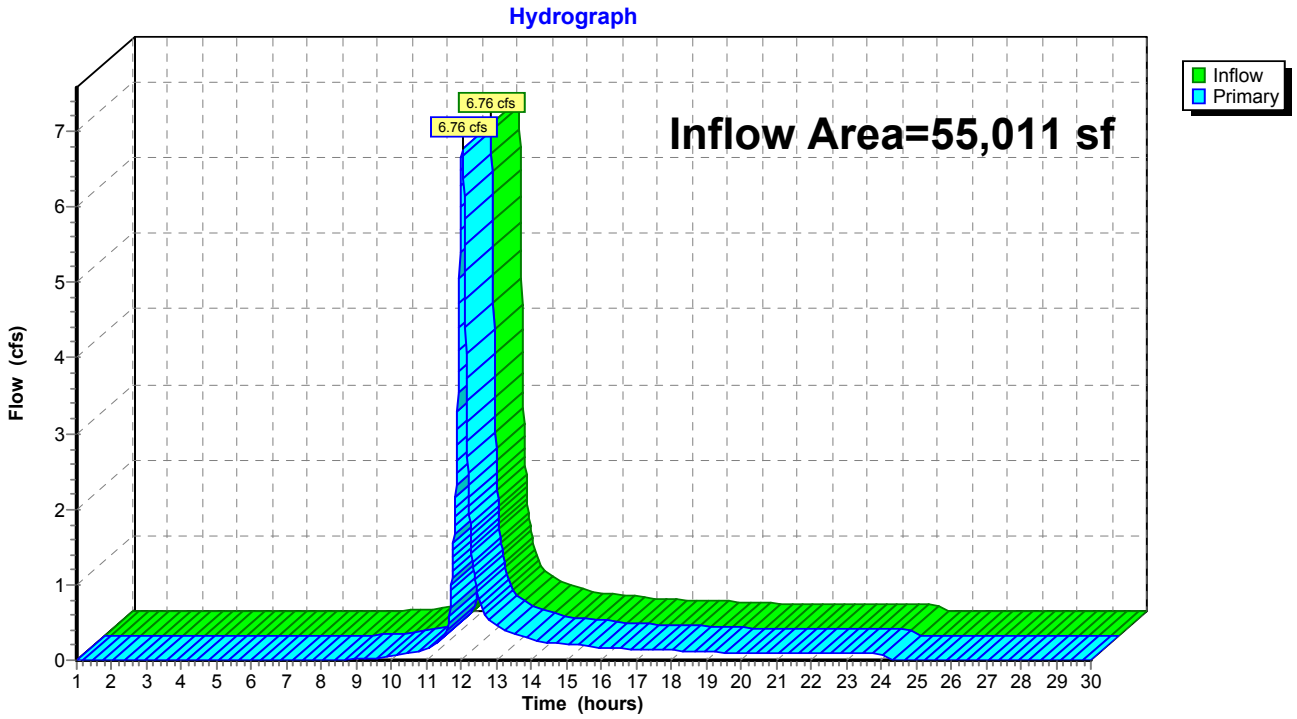


Summary for Link 2L: Existing Conditions

Inflow Area = 55,011 sf, 2.77% Impervious, Inflow Depth = 3.59" for 100-Year event
Inflow = 6.76 cfs @ 12.03 hrs, Volume= 16,454 cf
Primary = 6.76 cfs @ 12.03 hrs, Volume= 16,454 cf, Atten= 0%, Lag= 0.0 min

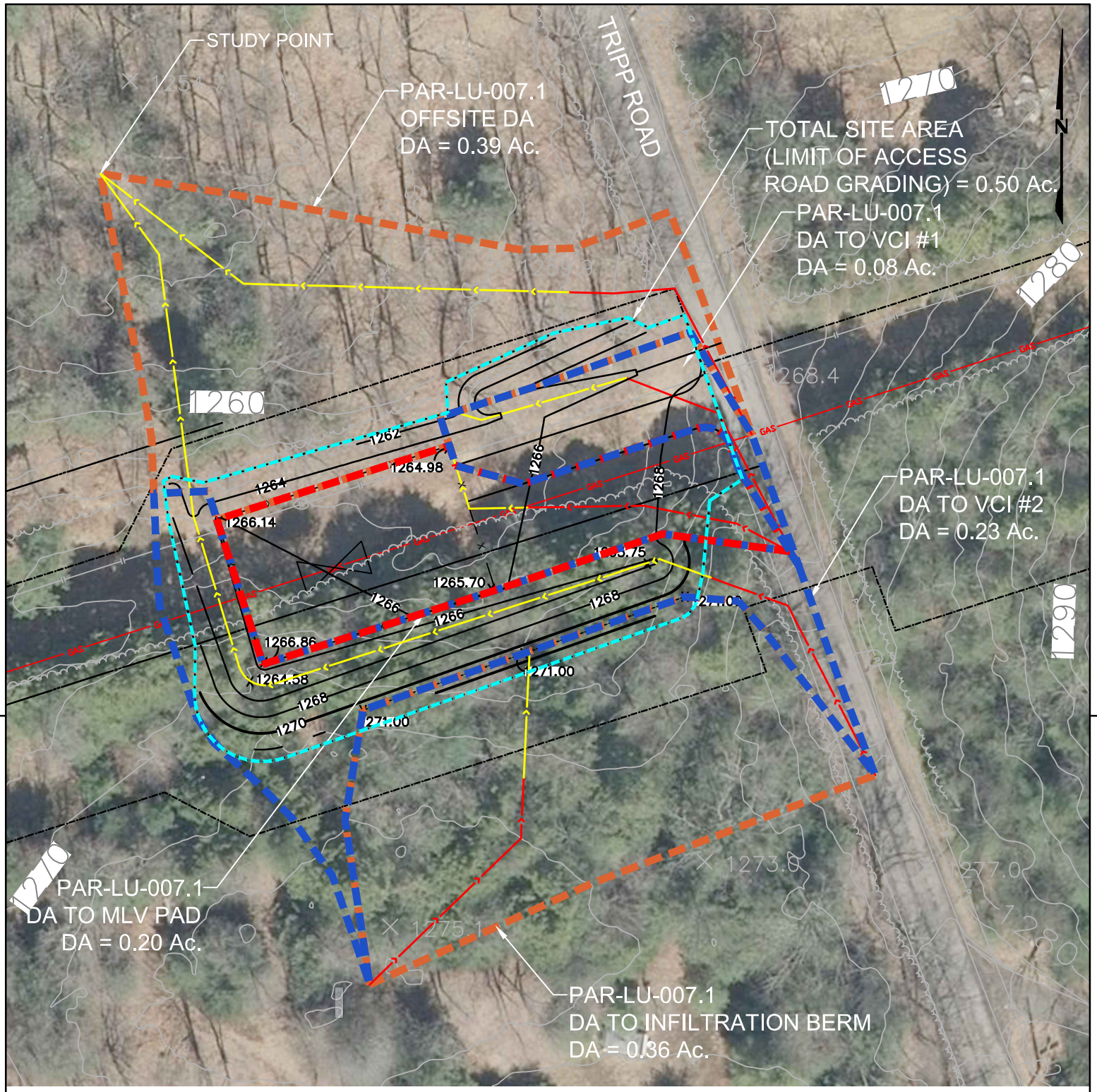
Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 2L: Existing Conditions



G.4 Post Development Calculations

a. Post Development Drainage Area Map
b. 1-Year Rainfall Event
c. 2-Year Rainfall Event
d. 5-Year Rainfall Event
e. 10-Year Rainfall Event
f. 25-Year Rainfall Event
g. 50-year Rainfall Event
h. 100-Year Rainfall Event



POST-DEVELOPMENT DRAINAGE AREA MAP

0 25 50
SCALE IN FEET

ISSUED FOR PERMITTING

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING
BL Companies

LEGEND

- TIME OF CONCENTRATION-SHEET FLOW
- TIME OF CONCENTRATION-SHALLOW CONCENTRATED FLOW
- DRAINAGE AREA
- PROPOSED GAS PIPELINE (GAS)
- TOTAL SITE AREA

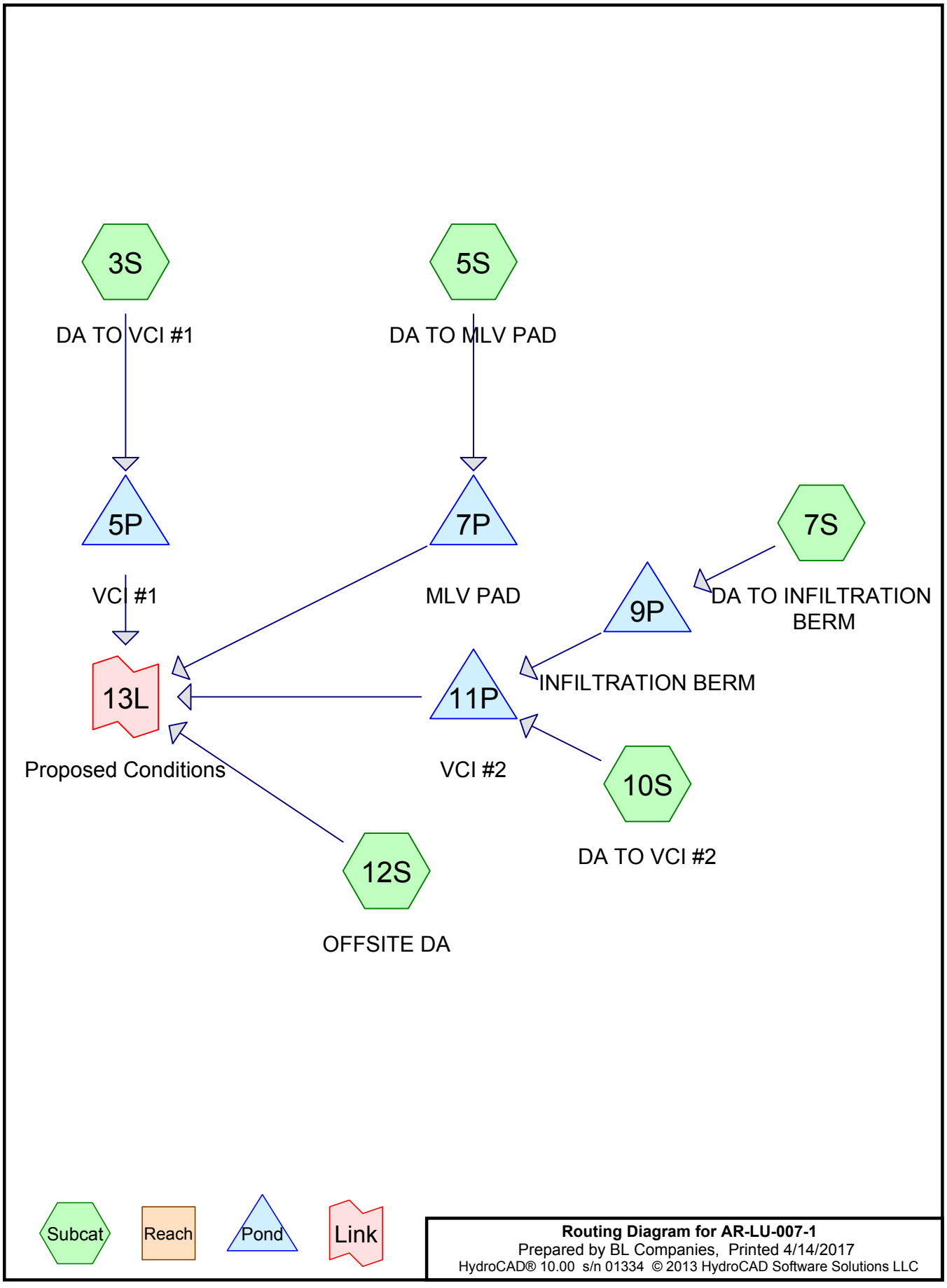
ATLANTIC SUNRISE PROJECT -
CENTRAL PENN LINE NORTH

PROPOSED 30" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-LY-007.1 POST
FAIRMOUNT TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

Williams

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

DRAWN BY: OLC	DATE: 11/11/15	ISSUED FOR BID:	SCALE: 1" = 50'
CHECKED BY: BJP	DATE: 11/11/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: BJP	DATE: 11/11/15	DRAWING NUMBER:	AR-LU-007.1 POST
WO:			



Routing Diagram for AR-LU-007-1
Prepared by BL Companies, Printed 4/14/2017

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,040	98	Crushed Stone Pad, HSG C (5S)
1,419	89	Gravel roads, HSG C (3S, 5S)
5,467	71	Meadow Fair, HSG C (3S, 5S)
19,015	71	Meadow, non-grazed, HSG C (7S, 10S, 12S)
1,325	98	Paved parking, HSG C (7S, 10S, 12S)
464	98	Paved road, HSG C (3S)
115	98	Paved roads , HSG C (5S)
22,166	70	Woods, Good, HSG C (7S, 10S, 12S)

Summary for Subcatchment 3S: DA TO VCI #1

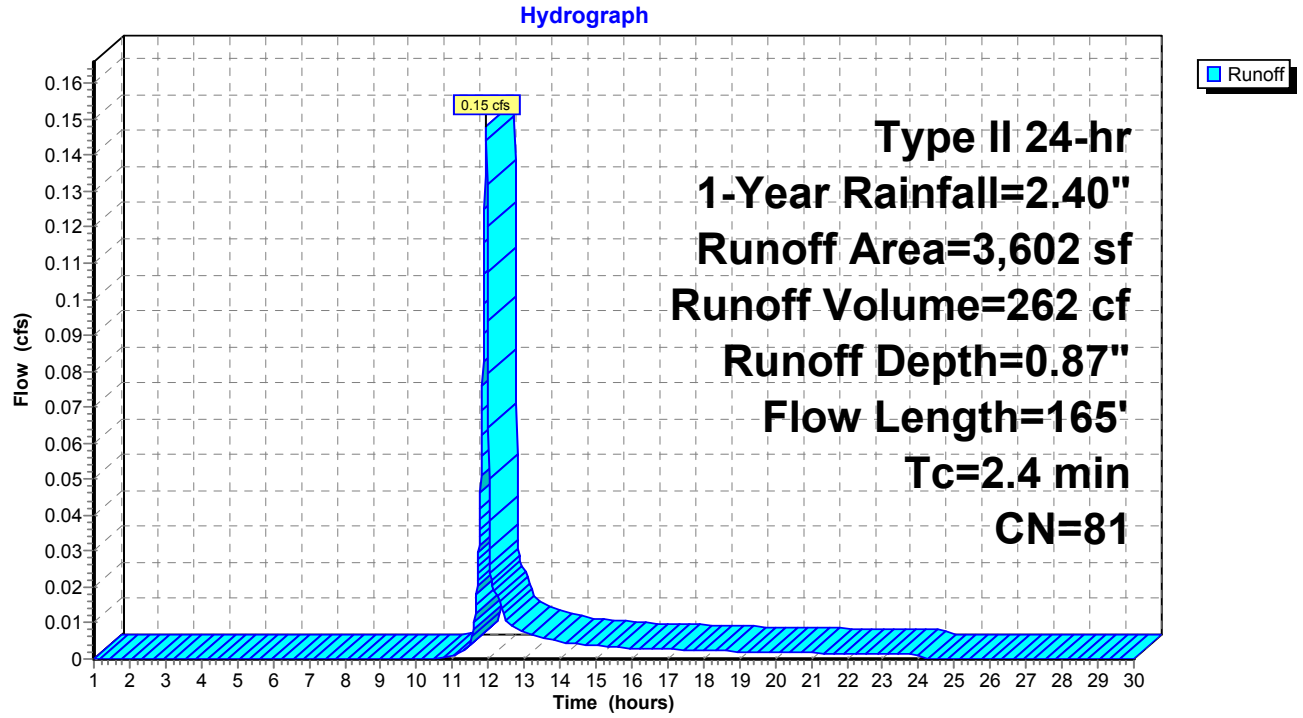
Runoff = 0.15 cfs @ 11.93 hrs, Volume= 262 cf, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 0.87" for 1-Year event
Inflow = 0.15 cfs @ 11.93 hrs, Volume= 262 cf
Outflow = 0.02 cfs @ 12.29 hrs, Volume= 137 cf, Atten= 89%, Lag= 21.4 min
Primary = 0.02 cfs @ 12.29 hrs, Volume= 137 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.01' @ 12.29 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 256.3 min calculated for 137 cf (52% of inflow)
Center-of-Mass det. time= 123.7 min (972.0 - 848.3)

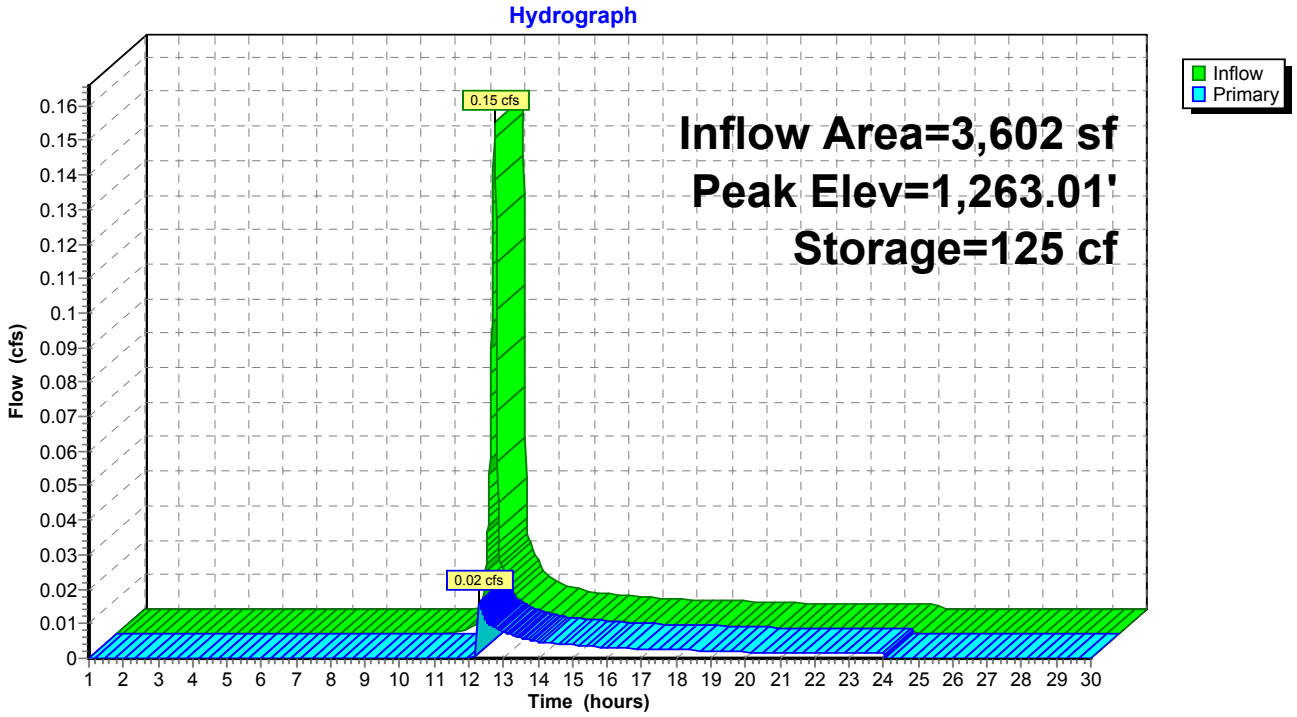
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.01 cfs @ 12.29 hrs HW=1,263.01' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.22 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.15 cfs
0.02 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.01'
Storage=125 cf
Flow (cfs)
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

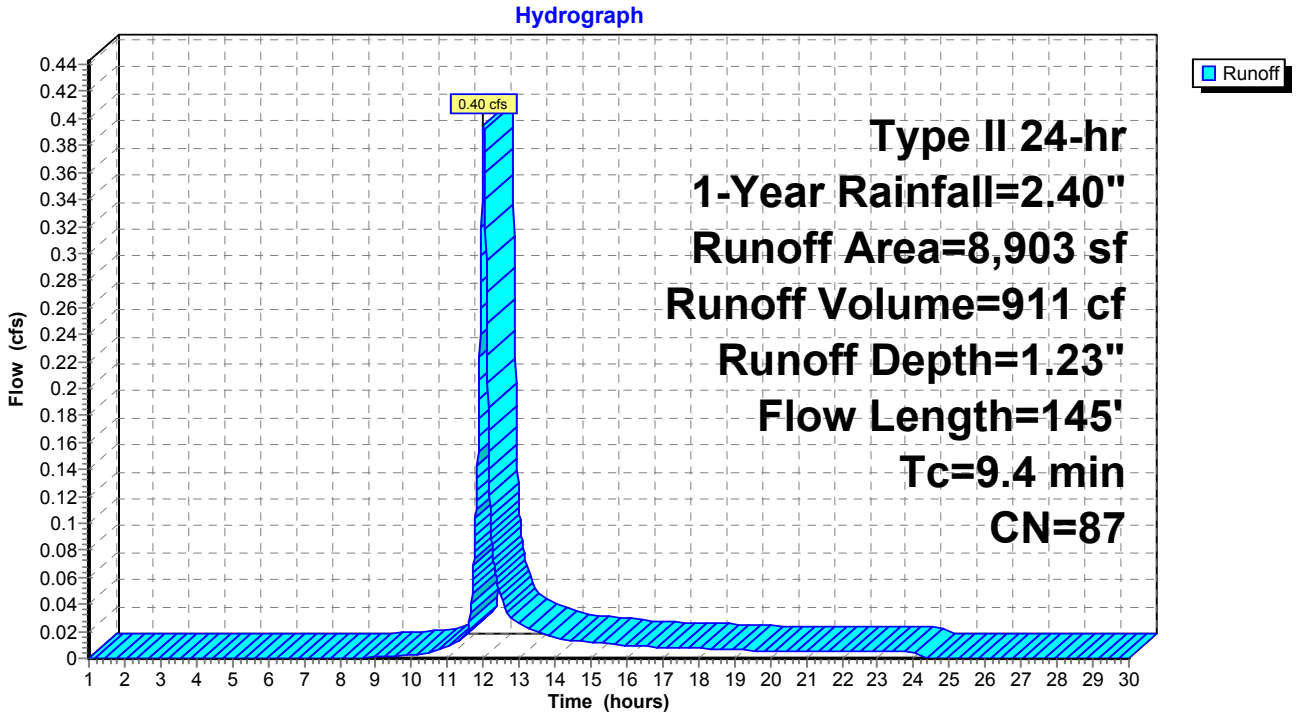
Runoff = 0.40 cfs @ 12.01 hrs, Volume= 911 cf, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 1.23" for 1-Year event
Inflow = 0.40 cfs @ 12.01 hrs, Volume= 911 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.33' @ 24.53 hrs Surf.Area= 4,053 sf Storage= 911 cf

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

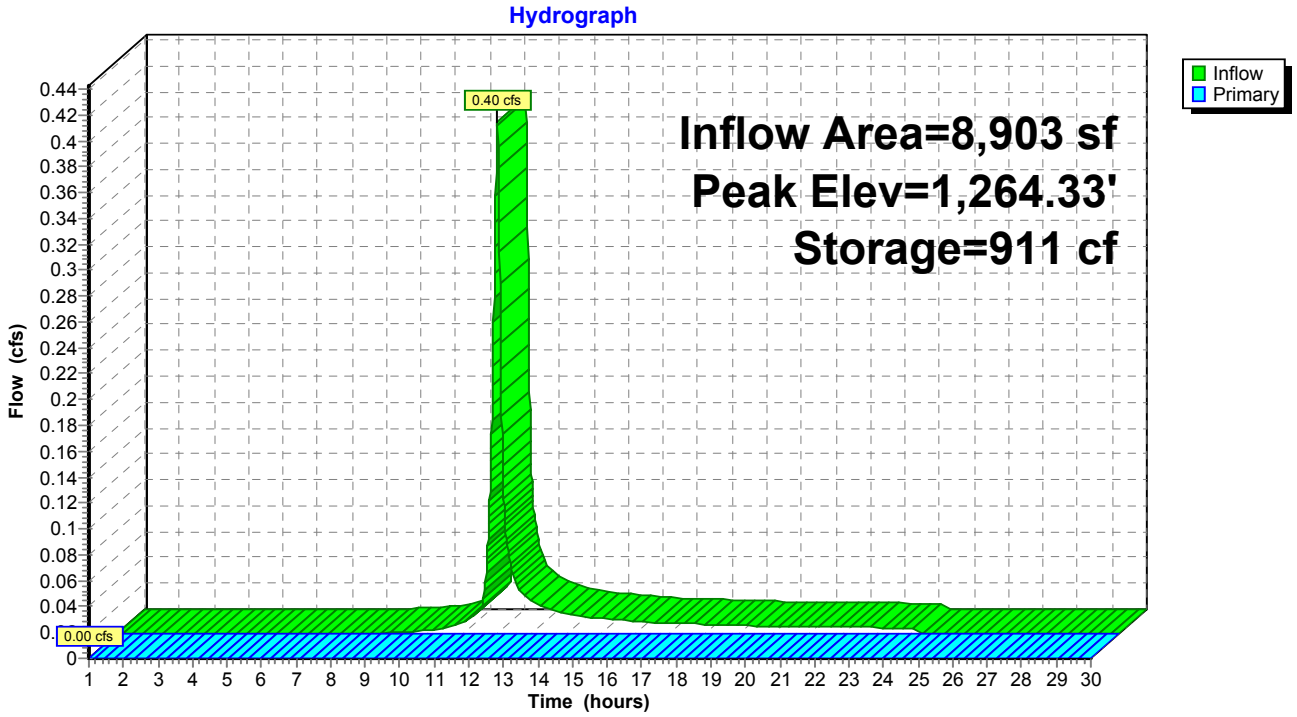
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,263.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

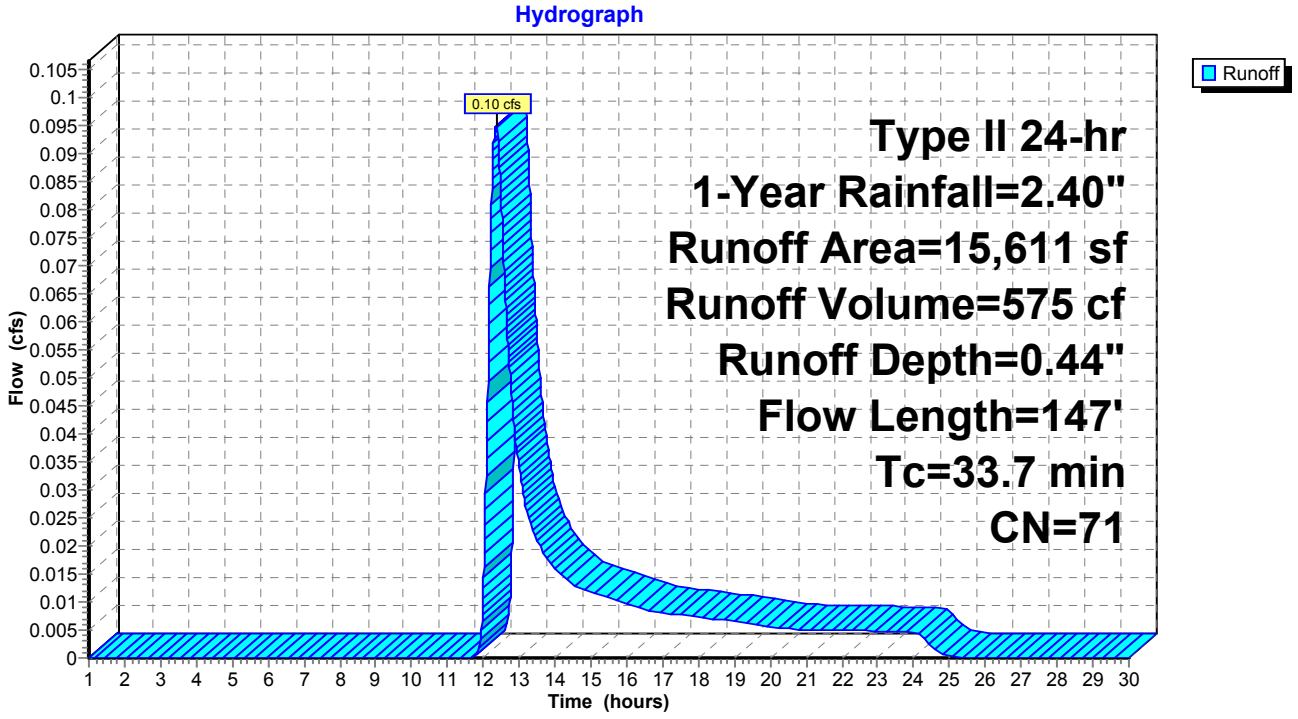
Runoff = 0.10 cfs @ 12.35 hrs, Volume= 575 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 0.44" for 1-Year event
Inflow = 0.10 cfs @ 12.35 hrs, Volume= 575 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,270.08' @ 25.92 hrs Surf.Area= 1,078 sf Storage= 575 cf

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

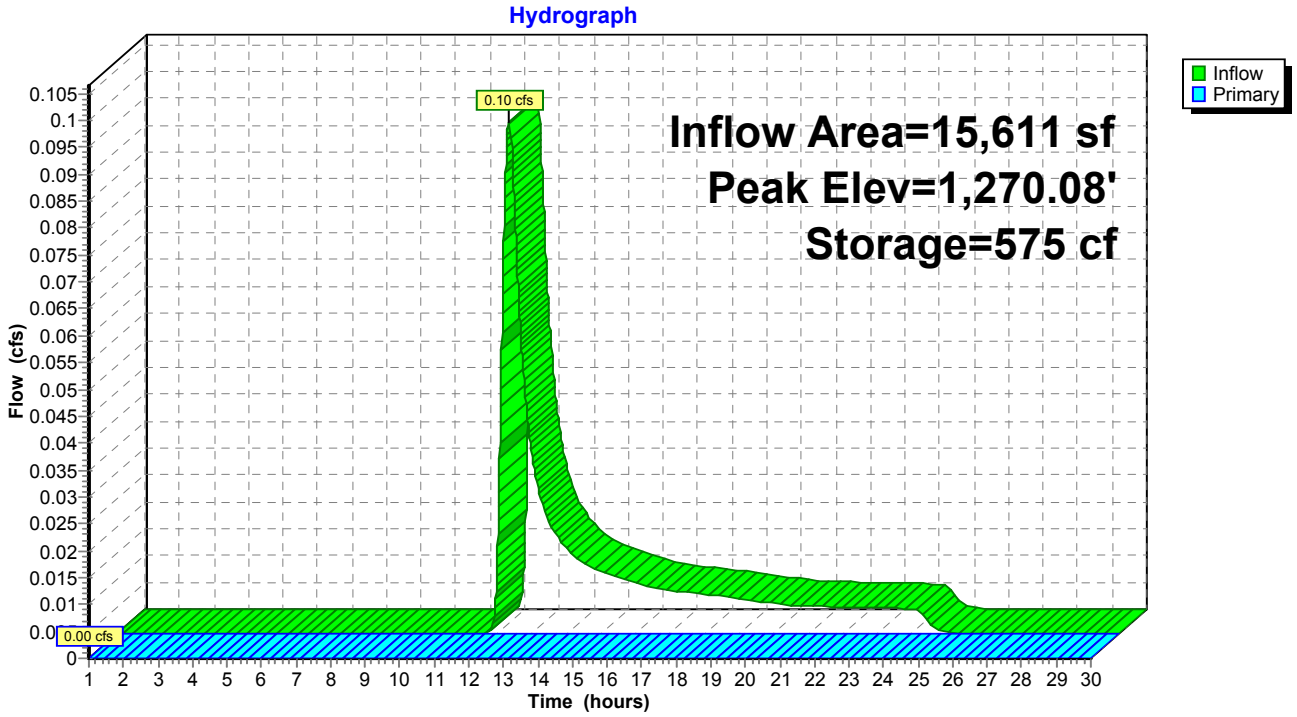
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,269.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

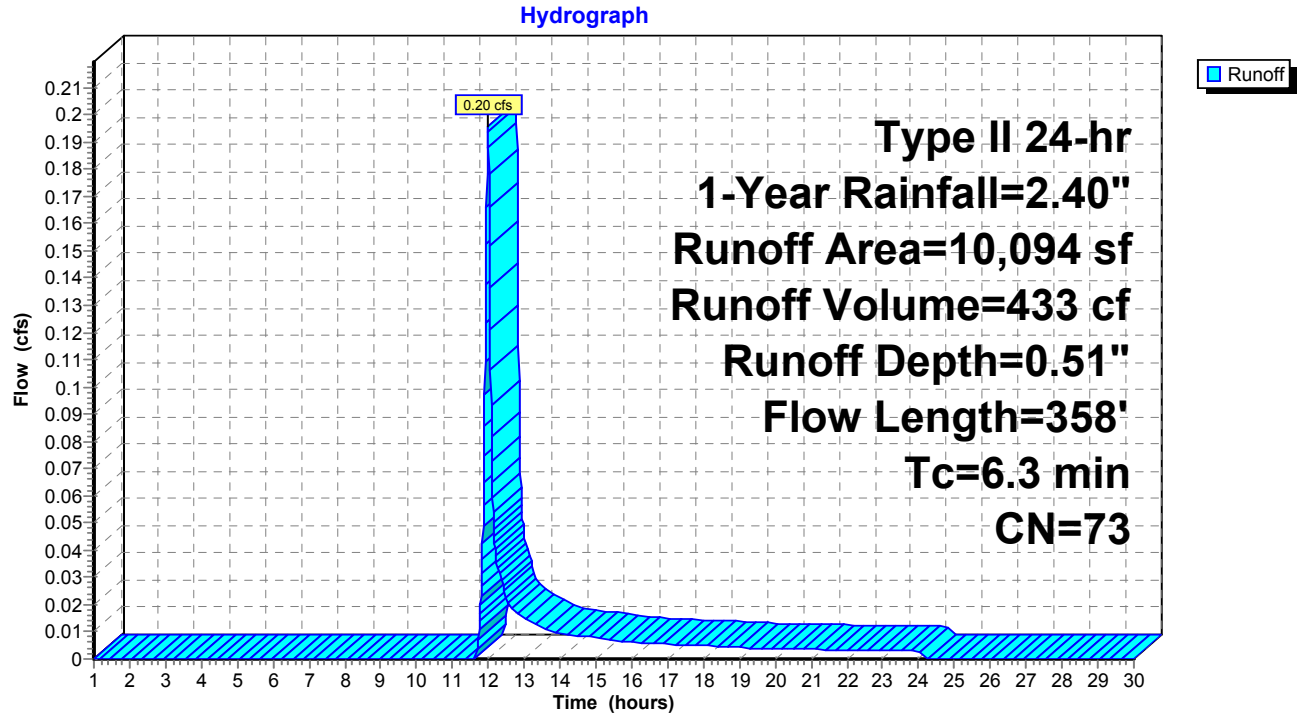
Runoff = 0.20 cfs @ 11.99 hrs, Volume= 433 cf, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 0.20" for 1-Year event
Inflow = 0.20 cfs @ 11.99 hrs, Volume= 433 cf
Outflow = 0.01 cfs @ 17.99 hrs, Volume= 83 cf, Atten= 97%, Lag= 360.2 min
Primary = 0.01 cfs @ 17.99 hrs, Volume= 83 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.00' @ 17.99 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 534.1 min calculated for 83 cf (19% of inflow)
Center-of-Mass det. time= 365.2 min (1,249.9 - 884.7)

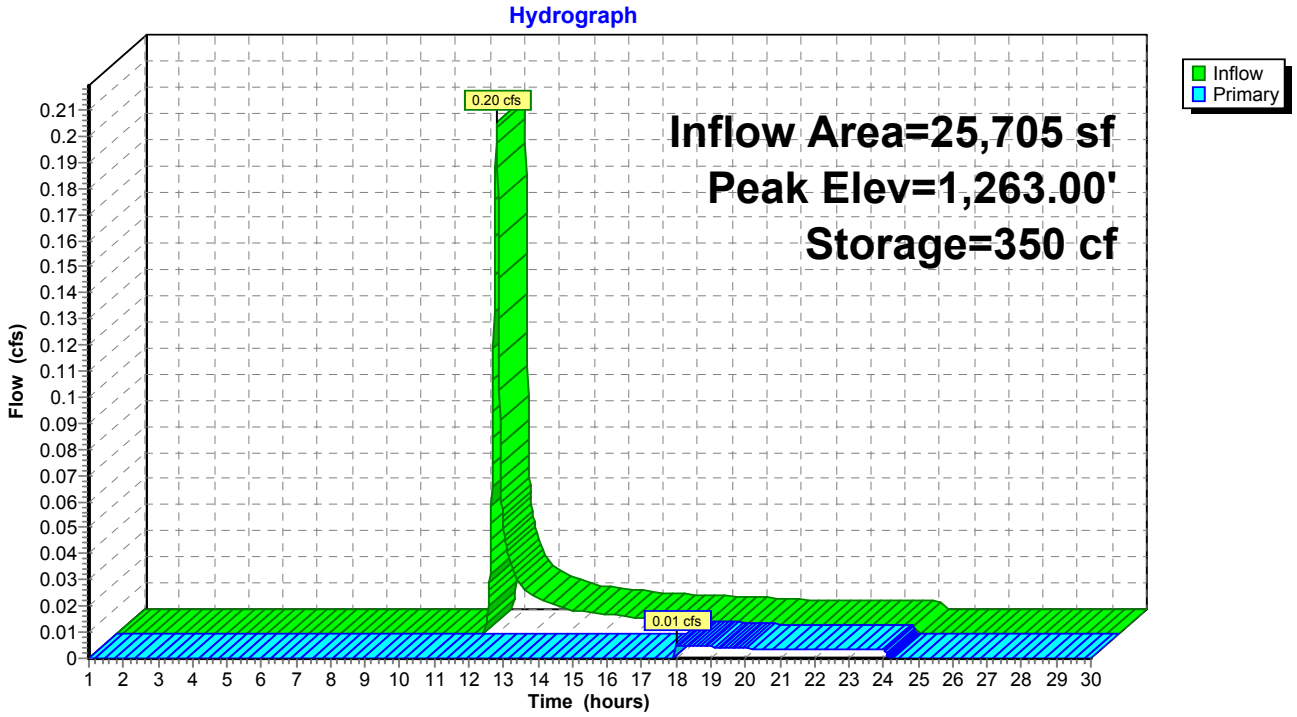
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 17.99 hrs HW=1,263.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.14 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

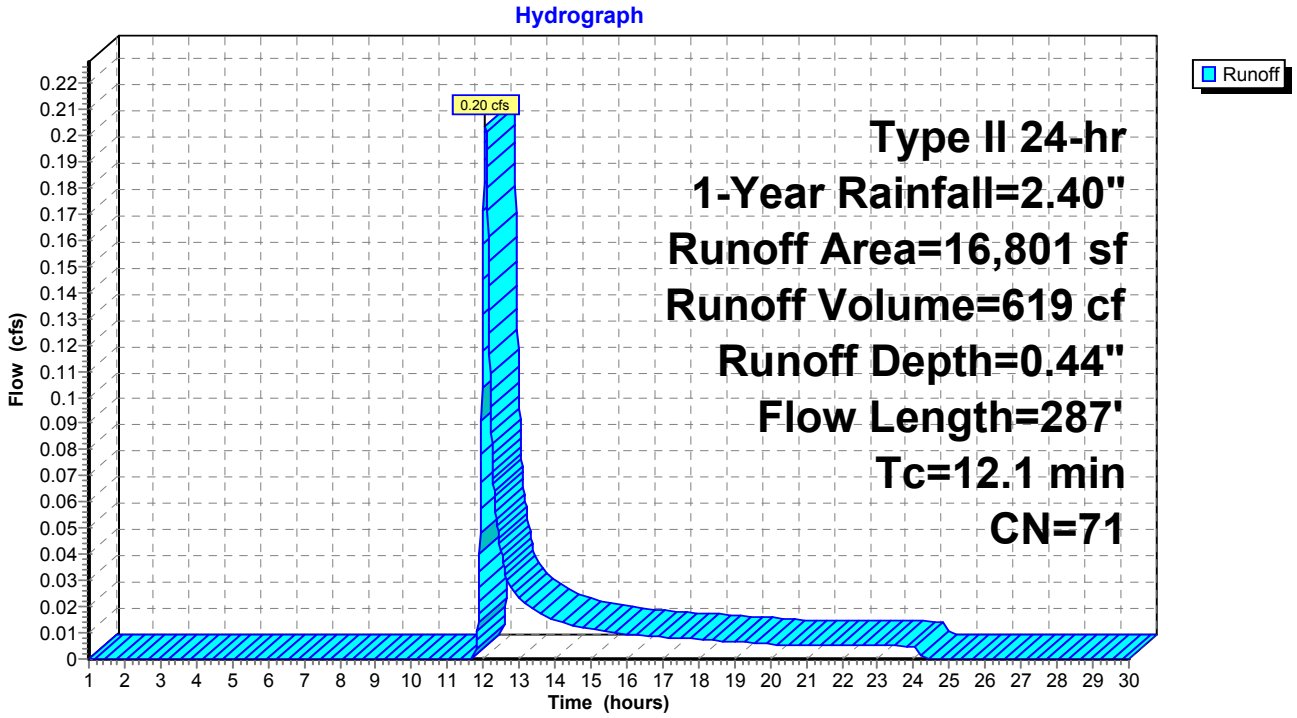
Runoff = 0.20 cfs @ 12.06 hrs, Volume= 619 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.40"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

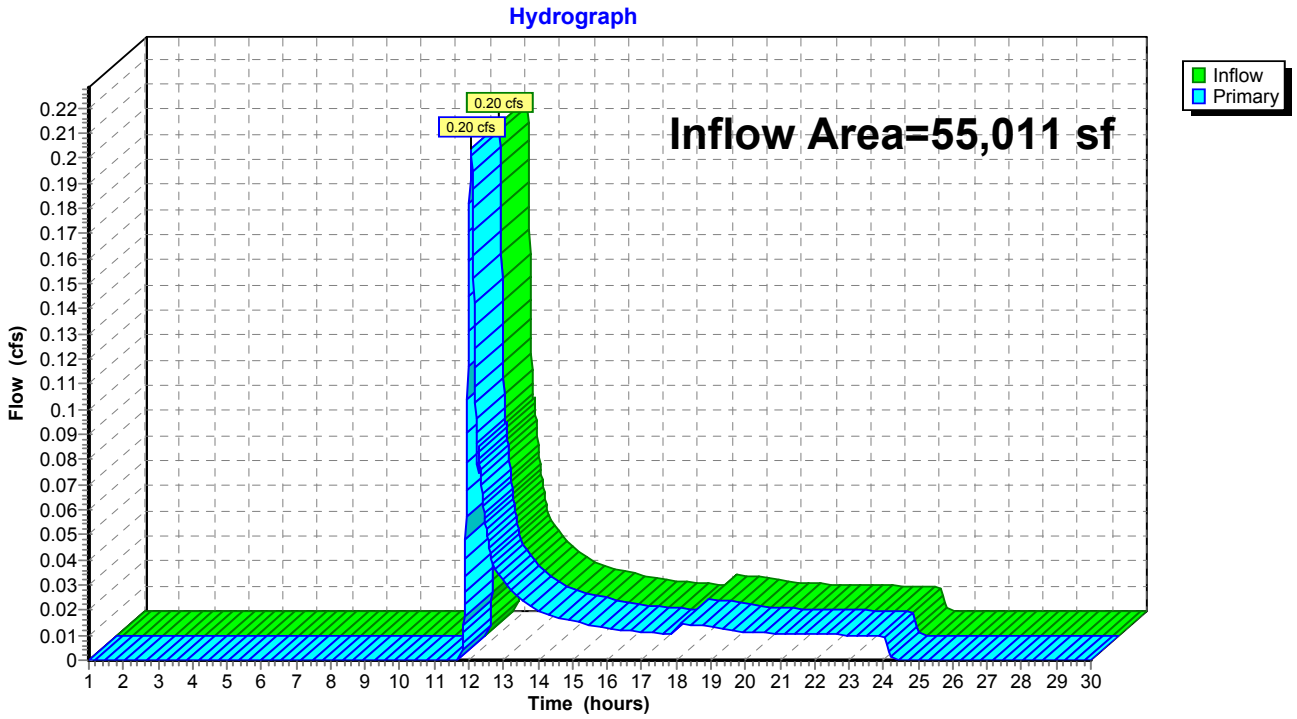


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 0.18" for 1-Year event
Inflow = 0.20 cfs @ 12.06 hrs, Volume= 838 cf
Primary = 0.20 cfs @ 12.06 hrs, Volume= 838 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

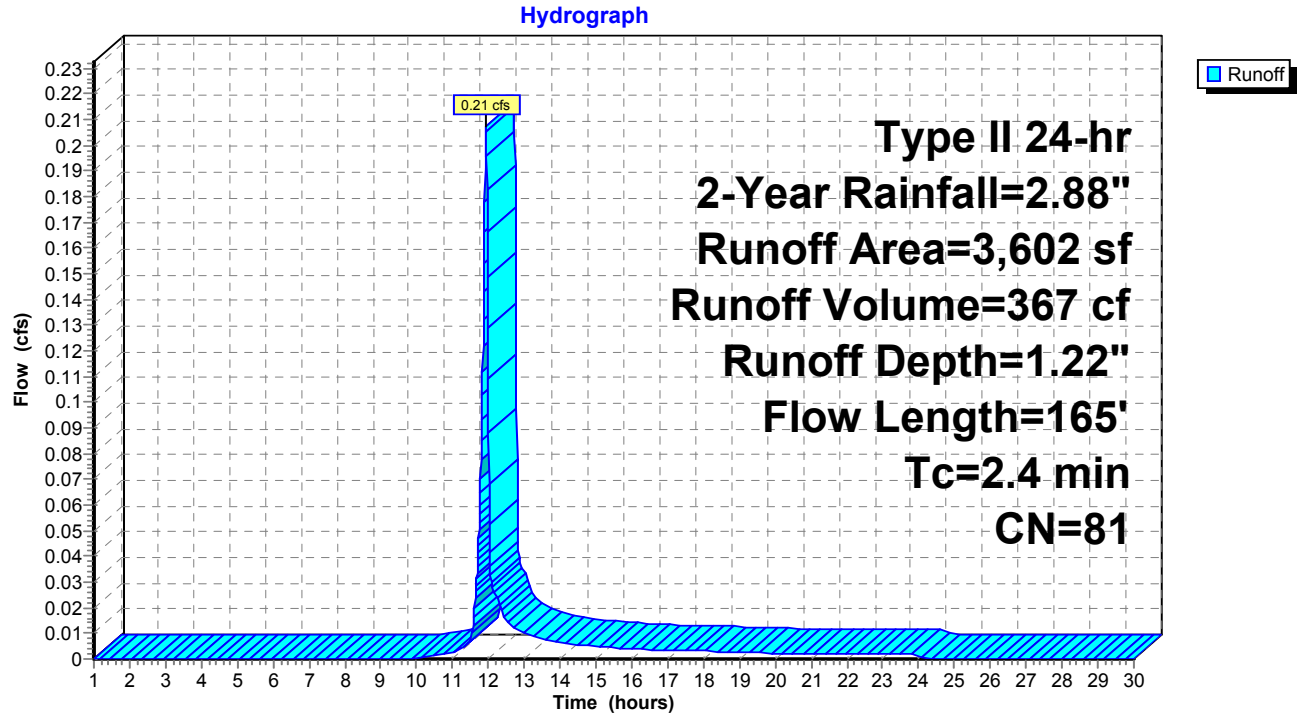
Runoff = 0.21 cfs @ 11.93 hrs, Volume= 367 cf, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 1.22" for 2-Year event
Inflow = 0.21 cfs @ 11.93 hrs, Volume= 367 cf
Outflow = 0.25 cfs @ 11.95 hrs, Volume= 247 cf, Atten= 0%, Lag= 1.3 min
Primary = 0.25 cfs @ 11.95 hrs, Volume= 247 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.06' @ 11.95 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 177.4 min calculated for 247 cf (67% of inflow)
Center-of-Mass det. time= 65.1 min (903.4 - 838.3)

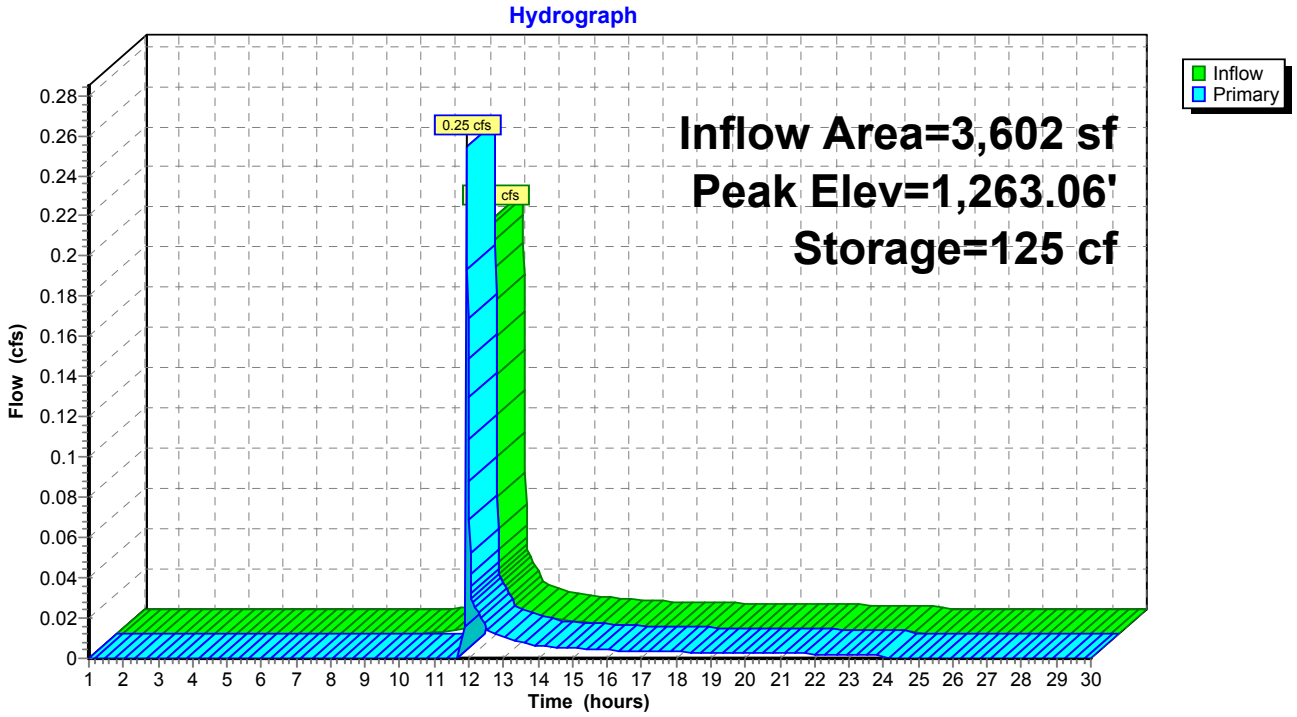
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.22 cfs @ 11.95 hrs HW=1,263.05' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.22 cfs @ 0.55 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
Inflow Area=3,602 sf
Peak Elev=1,263.06'
Storage=125 cf
0.25 cfs
cfs
Flow (cfs)
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

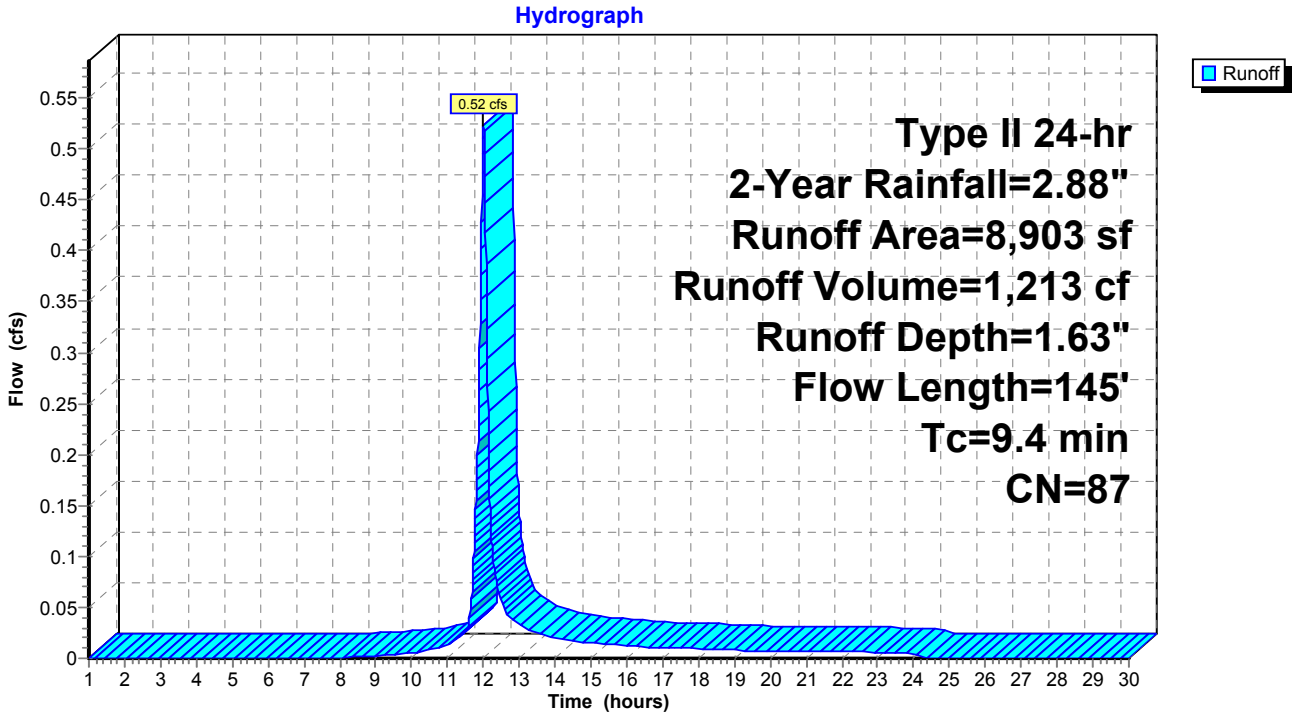
Runoff = 0.52 cfs @ 12.01 hrs, Volume= 1,213 cf, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 1.63" for 2-Year event
Inflow = 0.52 cfs @ 12.01 hrs, Volume= 1,213 cf
Outflow = 0.01 cfs @ 24.04 hrs, Volume= 14 cf, Atten= 99%, Lag= 721.9 min
Primary = 0.01 cfs @ 24.04 hrs, Volume= 14 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.50' @ 24.04 hrs Surf.Area= 4,644 sf Storage= 1,202 cf

Plug-Flow detention time= 897.3 min calculated for 14 cf (1% of inflow)
Center-of-Mass det. time= 614.5 min (1,438.0 - 823.4)

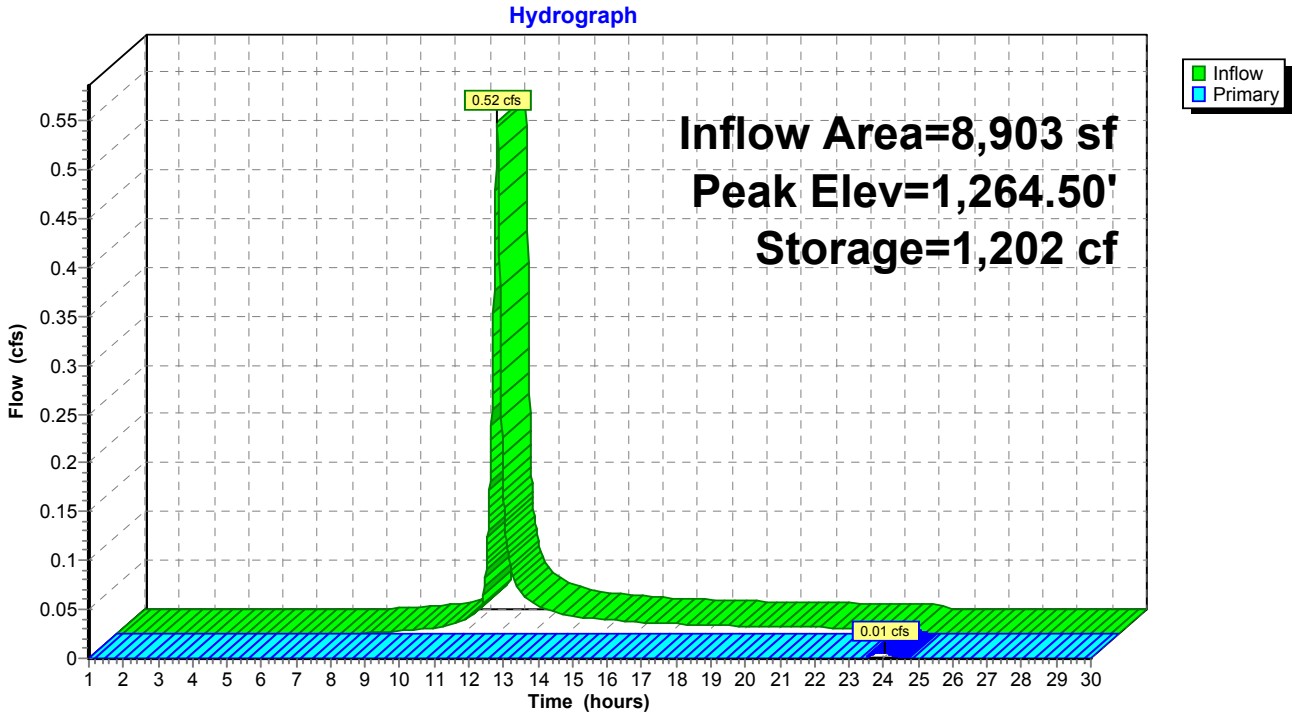
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 24.04 hrs HW=1,264.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.00 cfs @ 0.10 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

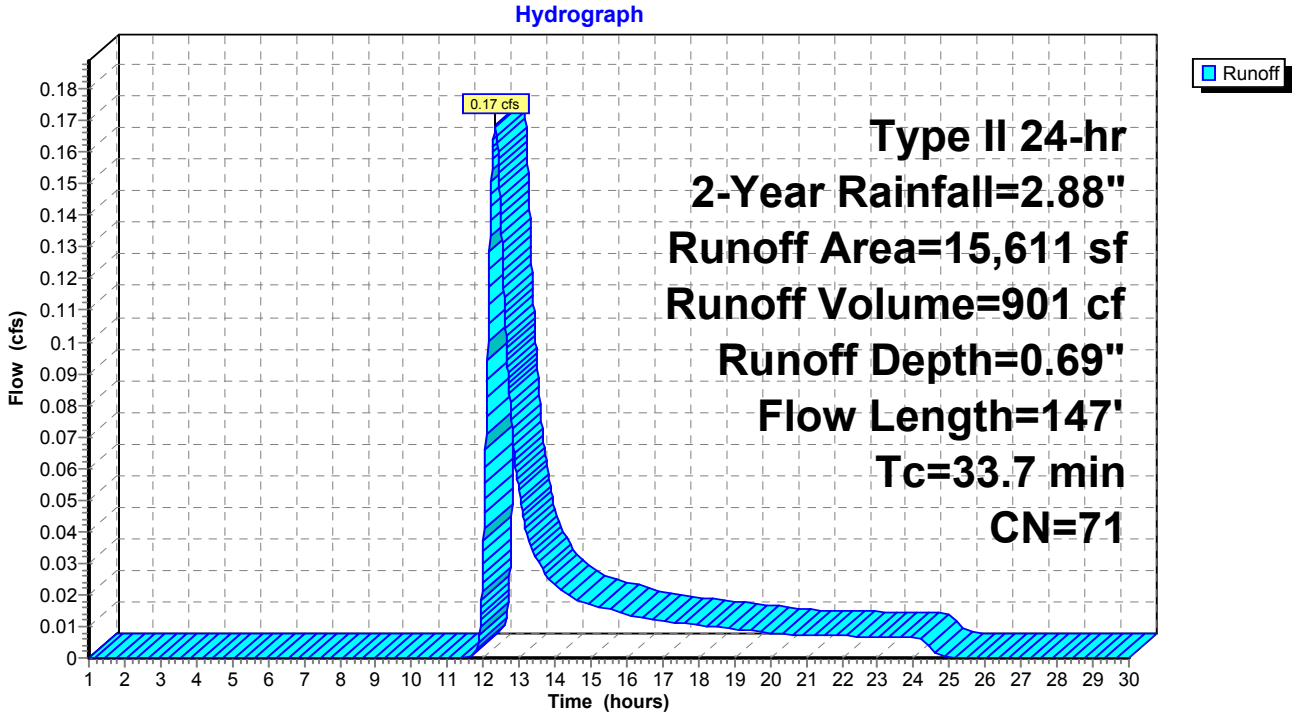
Runoff = 0.17 cfs @ 12.32 hrs, Volume= 901 cf, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 0.69" for 2-Year event
Inflow = 0.17 cfs @ 12.32 hrs, Volume= 901 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,270.34' @ 25.92 hrs Surf.Area= 1,391 sf Storage= 901 cf

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

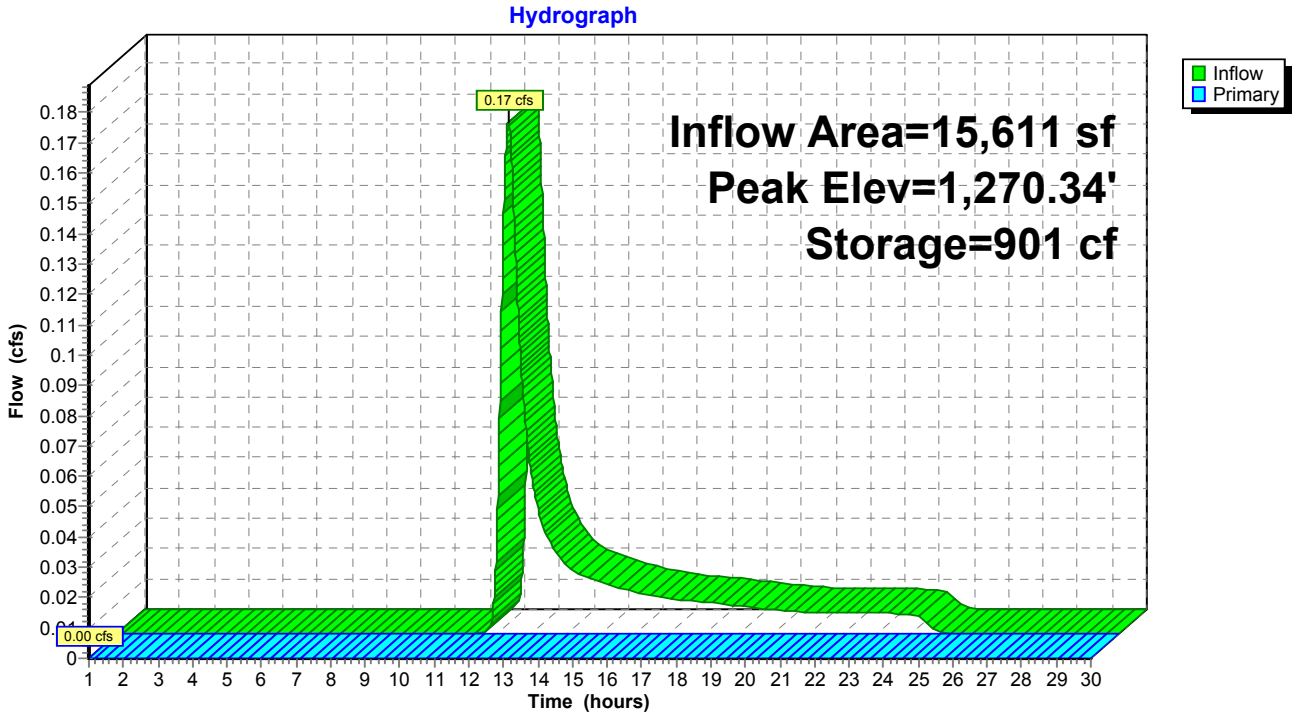
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,269.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

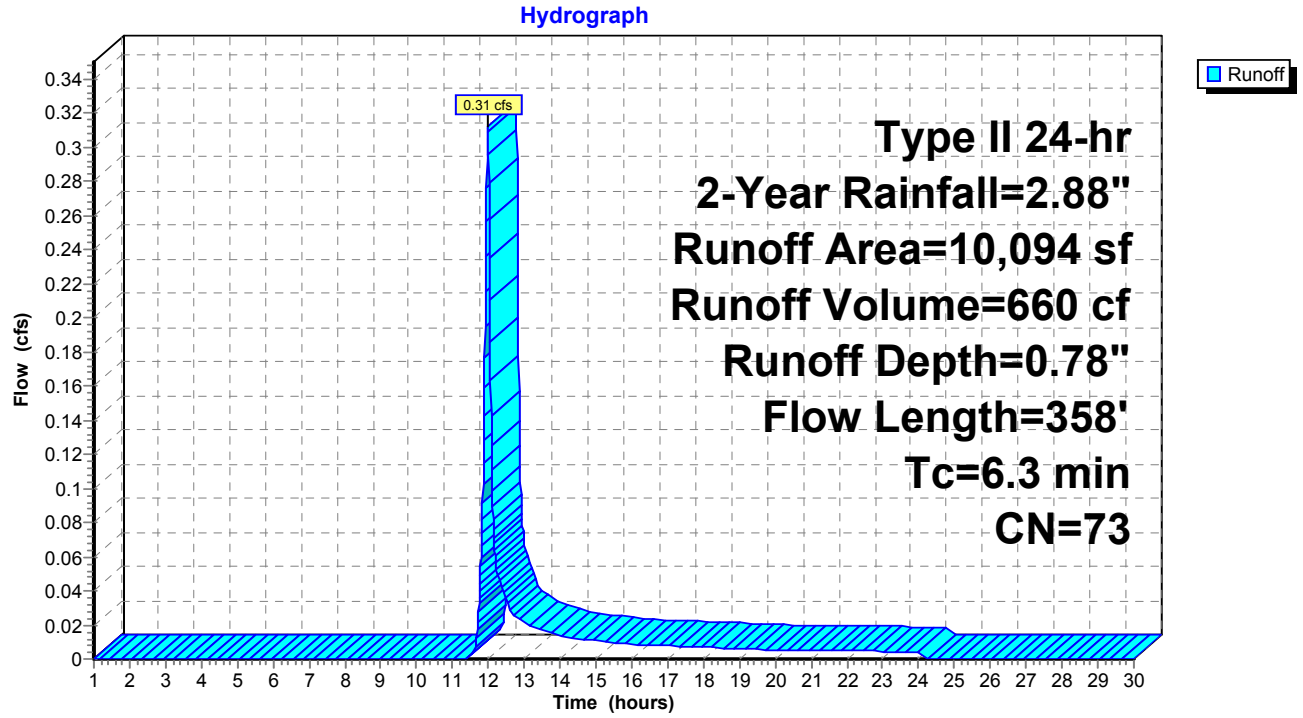
Runoff = 0.31 cfs @ 11.99 hrs, Volume= 660 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 0.31" for 2-Year event
Inflow = 0.31 cfs @ 11.99 hrs, Volume= 660 cf
Outflow = 0.02 cfs @ 13.01 hrs, Volume= 310 cf, Atten= 93%, Lag= 61.4 min
Primary = 0.02 cfs @ 13.01 hrs, Volume= 310 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.01' @ 13.01 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 308.5 min calculated for 310 cf (47% of inflow)
Center-of-Mass det. time= 161.1 min (1,030.8 - 869.7)

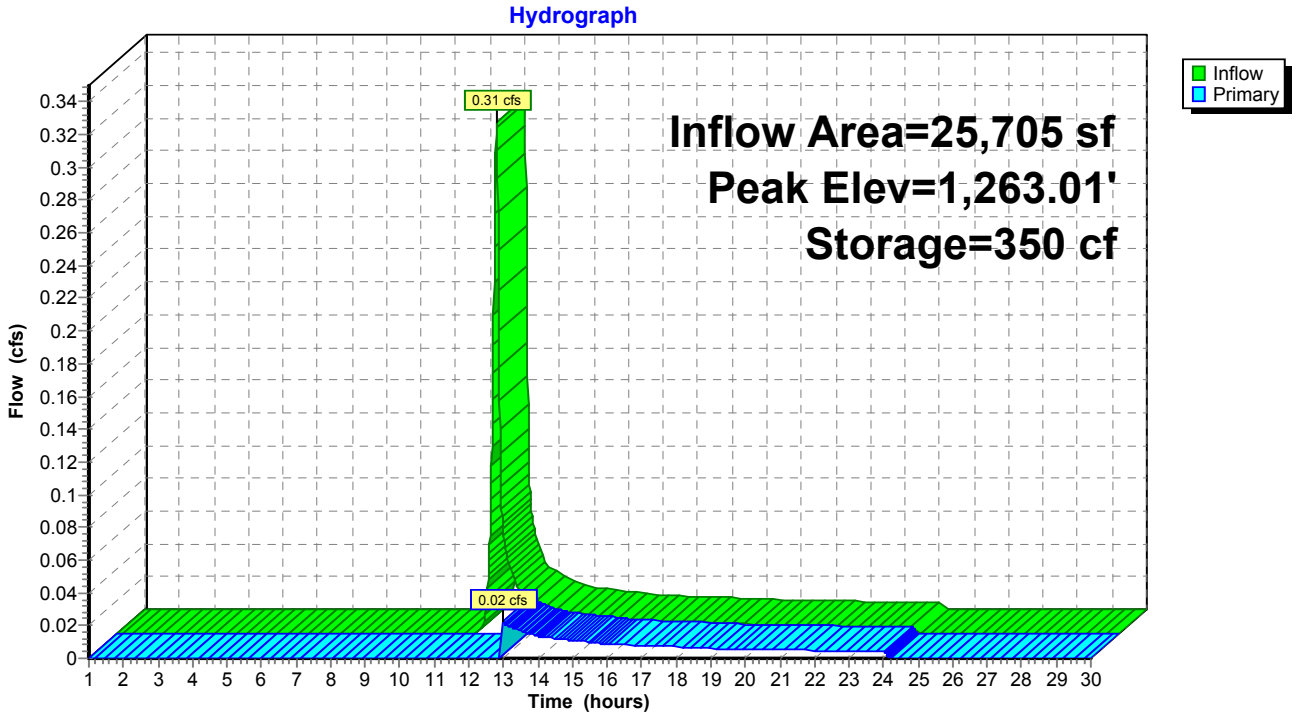
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.02 cfs @ 13.01 hrs HW=1,263.01' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.22 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

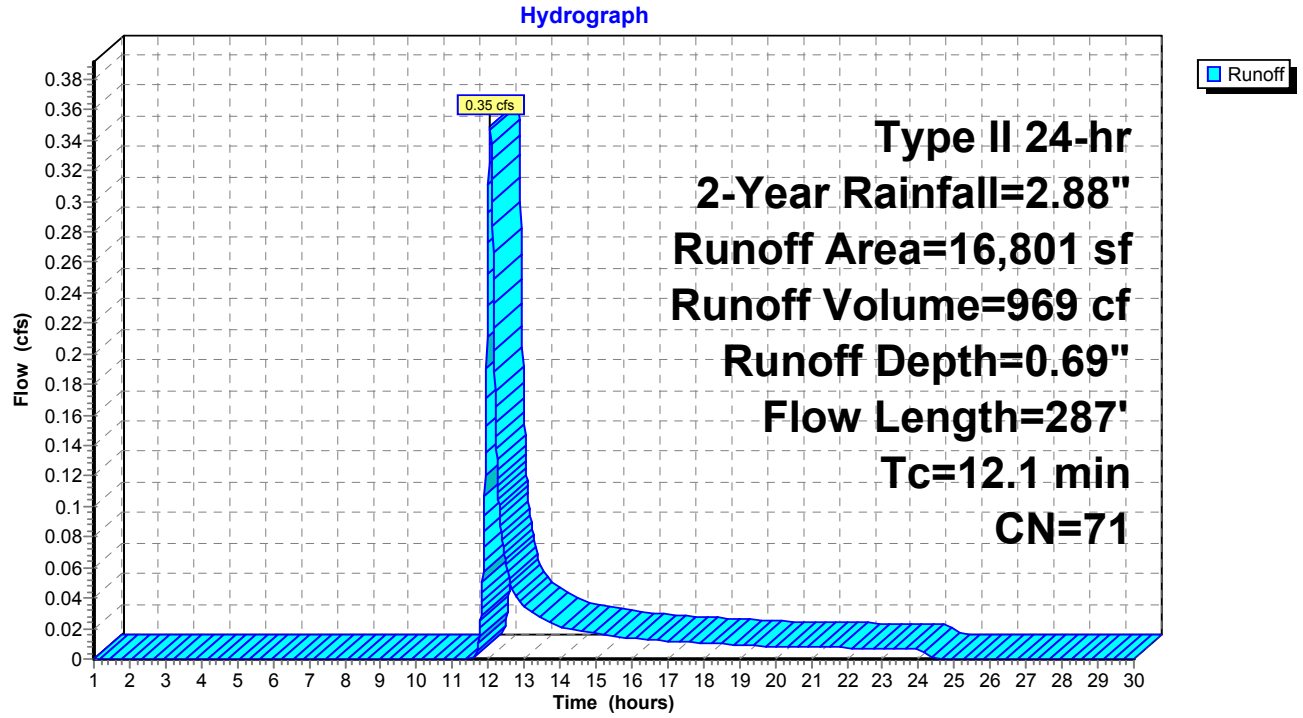
Runoff = 0.35 cfs @ 12.06 hrs, Volume= 969 cf, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=2.88"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

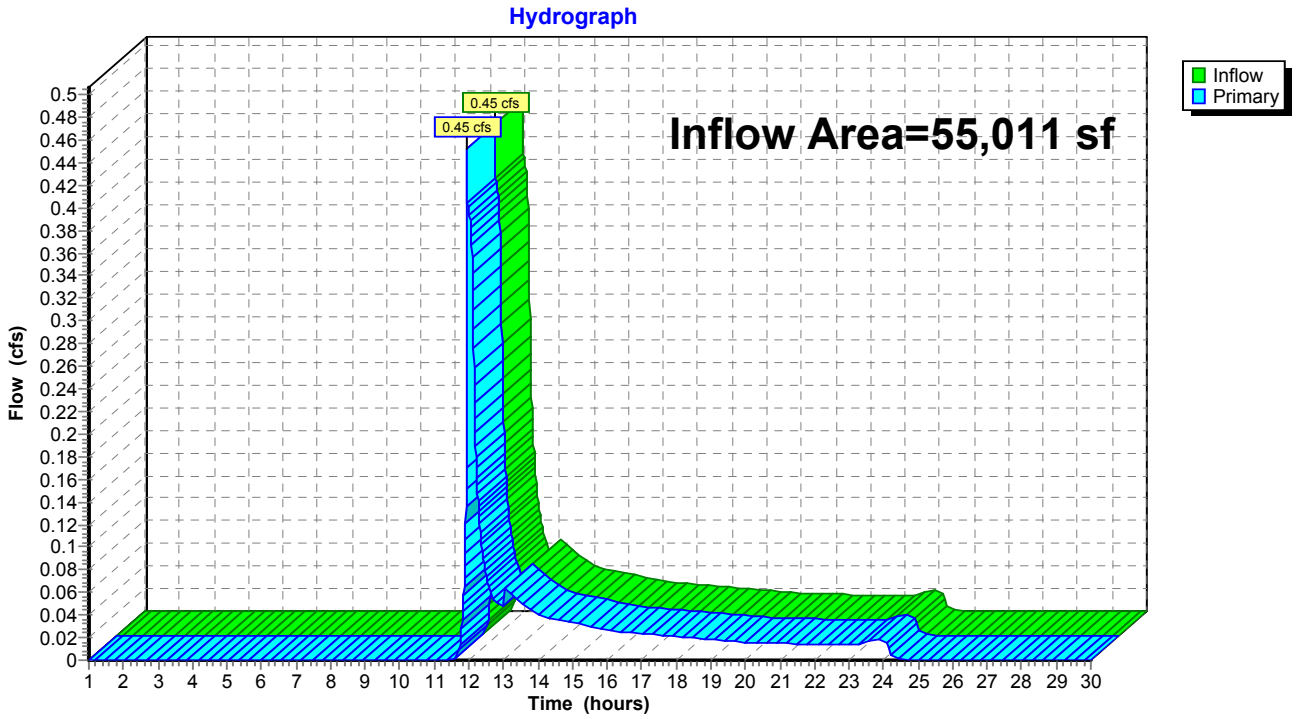


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 0.34" for 2-Year event
Inflow = 0.45 cfs @ 11.95 hrs, Volume= 1,539 cf
Primary = 0.45 cfs @ 11.95 hrs, Volume= 1,539 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

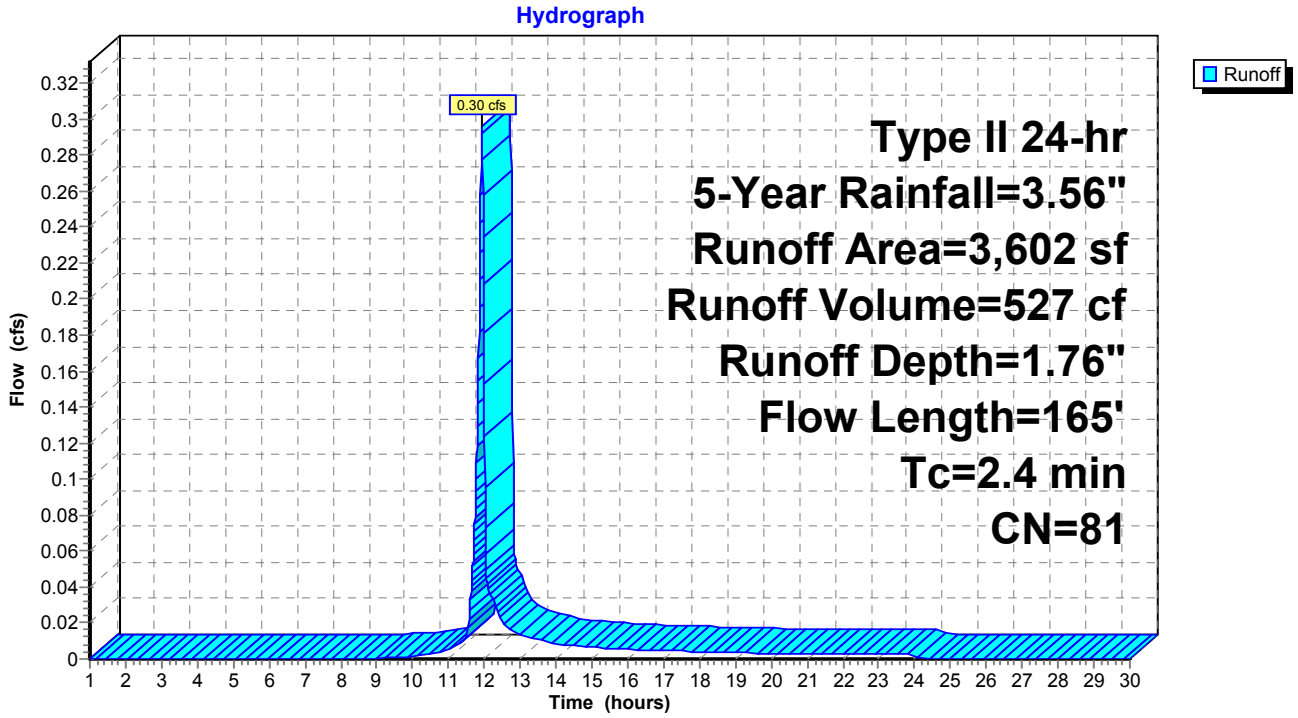
Runoff = 0.30 cfs @ 11.93 hrs, Volume= 527 cf, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 1.76" for 5-Year event
Inflow = 0.30 cfs @ 11.93 hrs, Volume= 527 cf
Outflow = 0.30 cfs @ 11.93 hrs, Volume= 398 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.30 cfs @ 11.93 hrs, Volume= 398 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.06' @ 11.93 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 138.8 min calculated for 398 cf (75% of inflow)
Center-of-Mass det. time= 43.8 min (871.6 - 827.8)

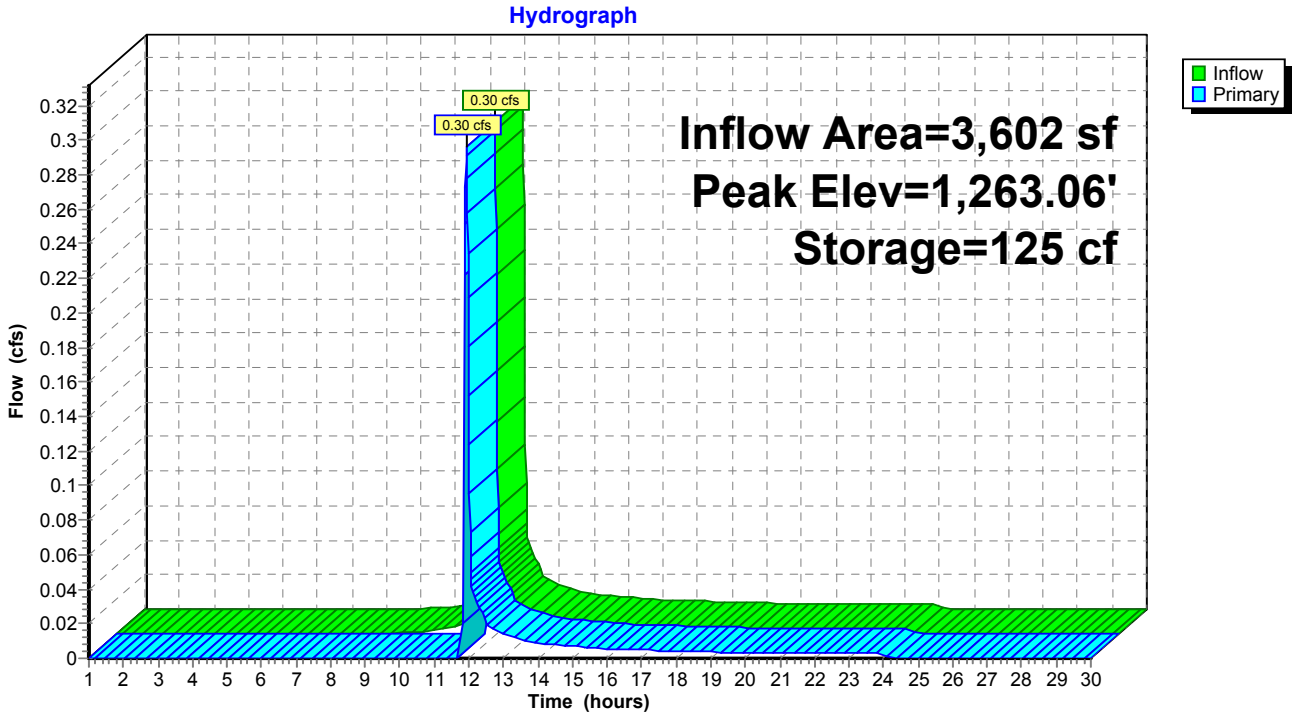
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.29 cfs @ 11.93 hrs HW=1,263.06' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.29 cfs @ 0.60 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.30 cfs
0.30 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.06'
Storage=125 cf
Flow (cfs)
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

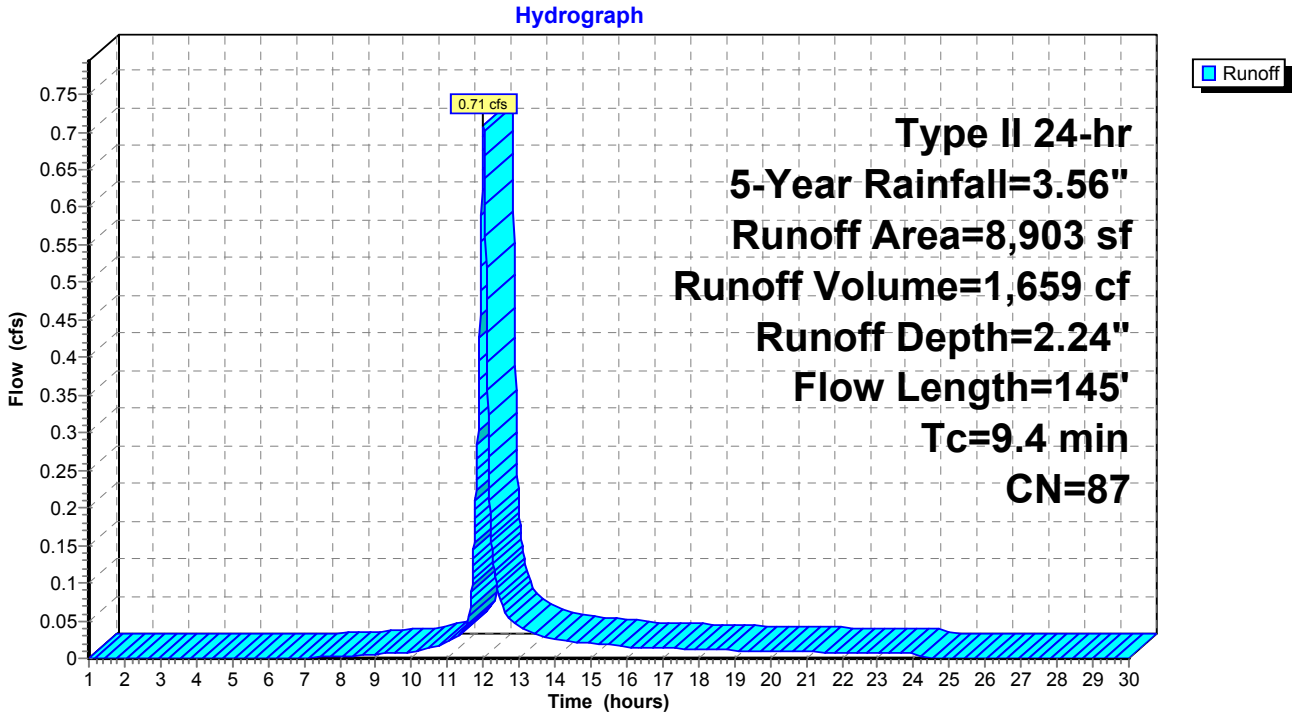
Runoff = 0.71 cfs @ 12.01 hrs, Volume= 1,659 cf, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 2.24" for 5-Year event
Inflow = 0.71 cfs @ 12.01 hrs, Volume= 1,659 cf
Outflow = 0.02 cfs @ 14.18 hrs, Volume= 460 cf, Atten= 97%, Lag= 130.2 min
Primary = 0.02 cfs @ 14.18 hrs, Volume= 460 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.51' @ 14.18 hrs Surf.Area= 4,644 sf Storage= 1,212 cf

Plug-Flow detention time= 393.9 min calculated for 460 cf (28% of inflow)
Center-of-Mass det. time= 260.9 min (1,075.4 - 814.5)

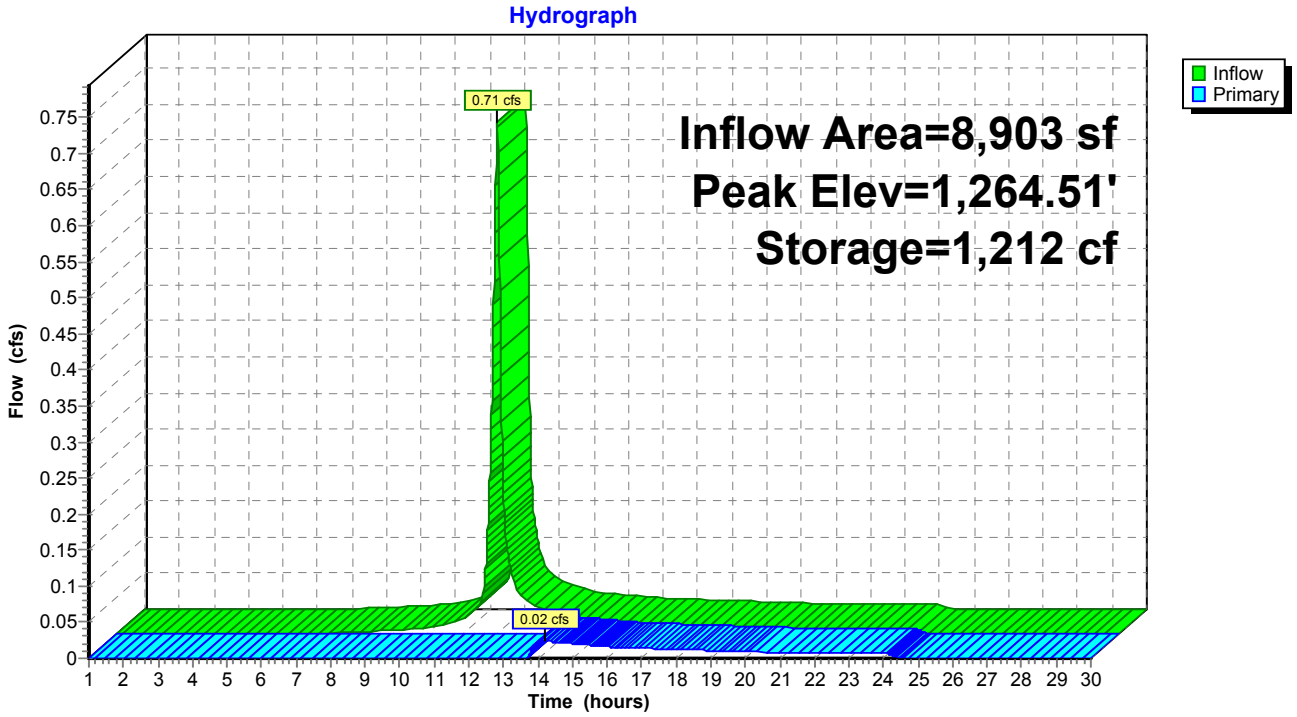
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.01 cfs @ 14.18 hrs HW=1,264.51' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.01 cfs @ 0.20 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

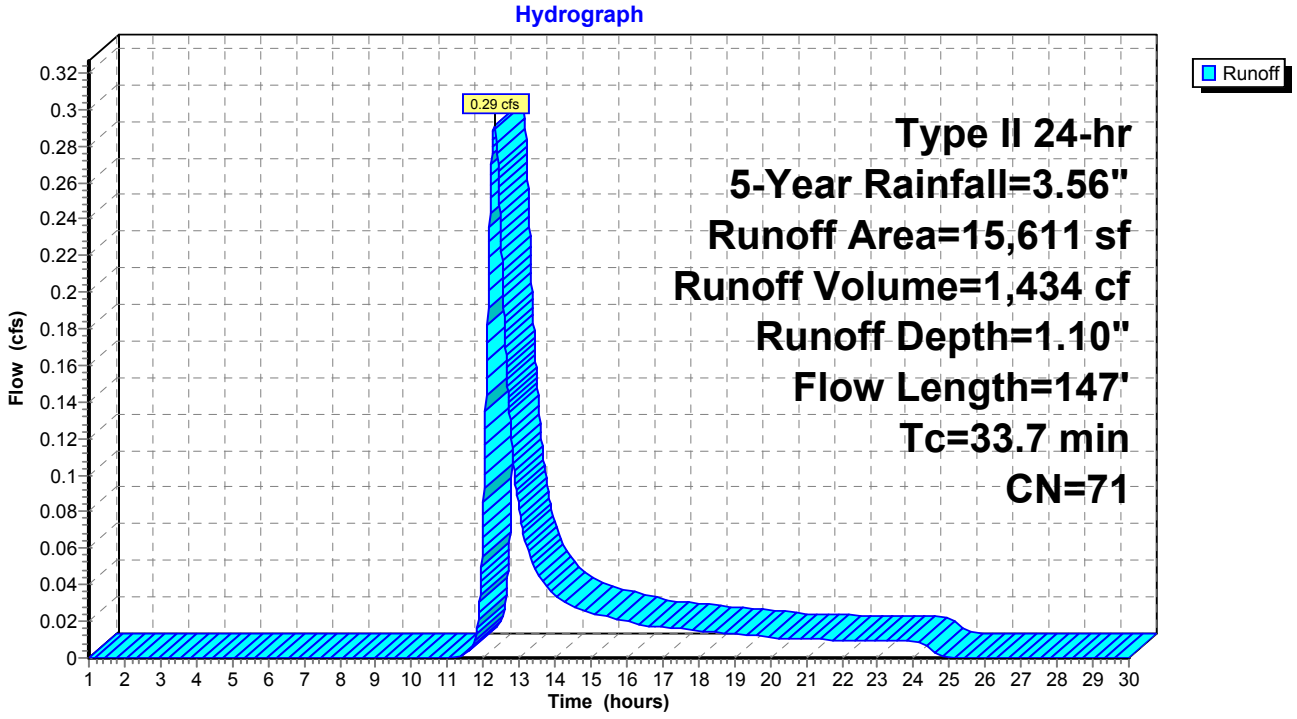
Runoff = 0.29 cfs @ 12.32 hrs, Volume= 1,434 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 1.10" for 5-Year event
Inflow = 0.29 cfs @ 12.32 hrs, Volume= 1,434 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,270.67' @ 25.92 hrs Surf.Area= 1,843 sf Storage= 1,434 cf

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

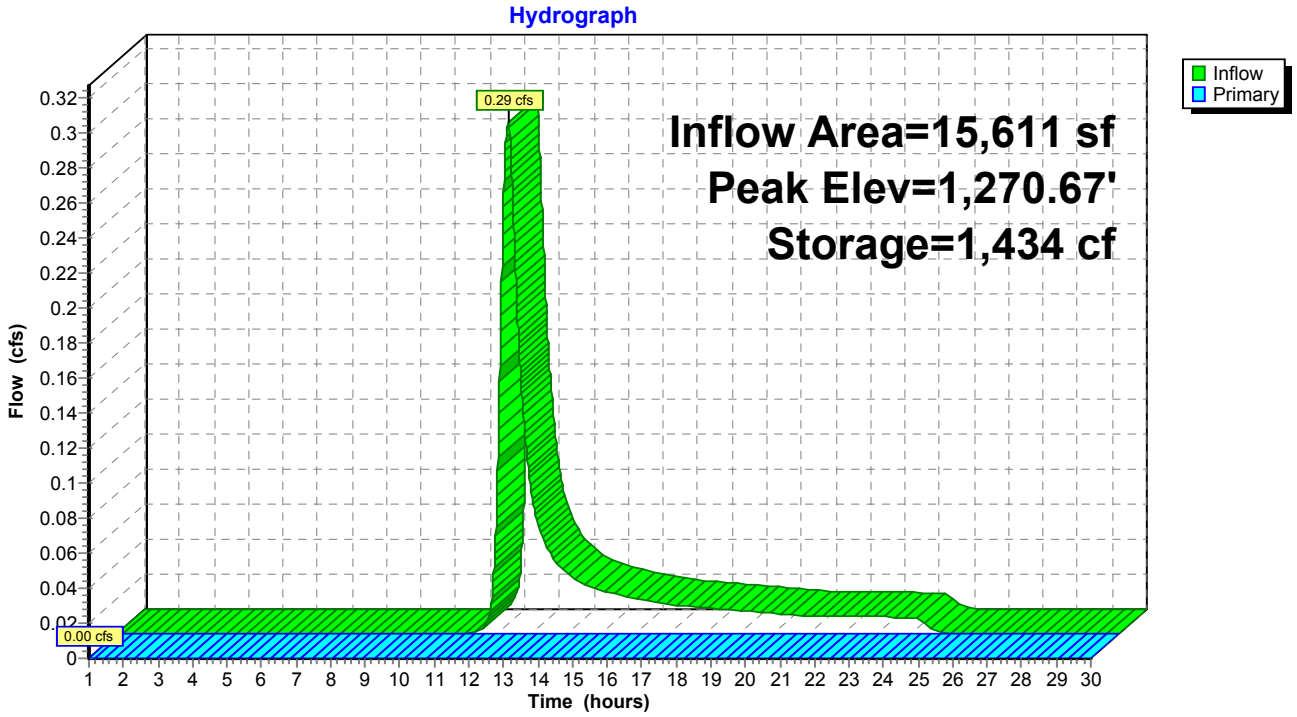
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,269.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

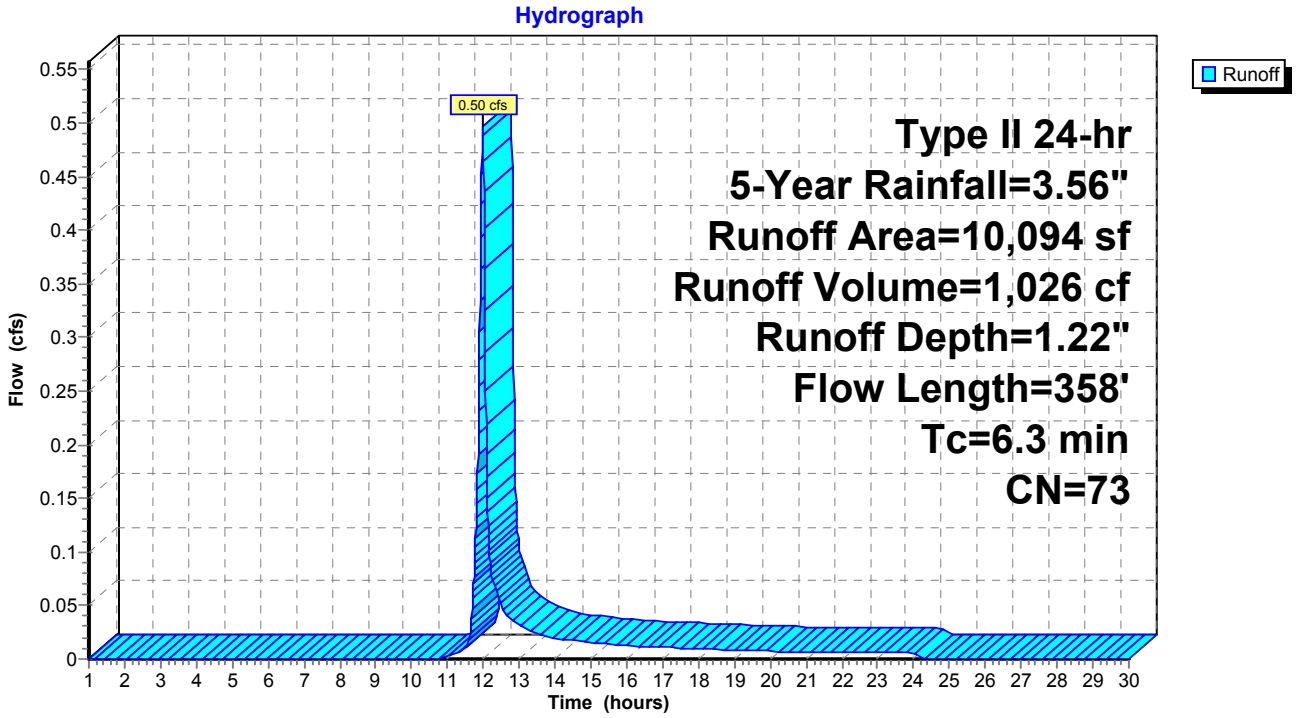
Runoff = 0.50 cfs @ 11.98 hrs, Volume= 1,026 cf, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 0.48" for 5-Year event
Inflow = 0.50 cfs @ 11.98 hrs, Volume= 1,026 cf
Outflow = 0.37 cfs @ 12.05 hrs, Volume= 673 cf, Atten= 26%, Lag= 4.3 min
Primary = 0.37 cfs @ 12.05 hrs, Volume= 673 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.06' @ 12.05 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 194.6 min calculated for 673 cf (66% of inflow)
Center-of-Mass det. time= 74.6 min (930.2 - 855.6)

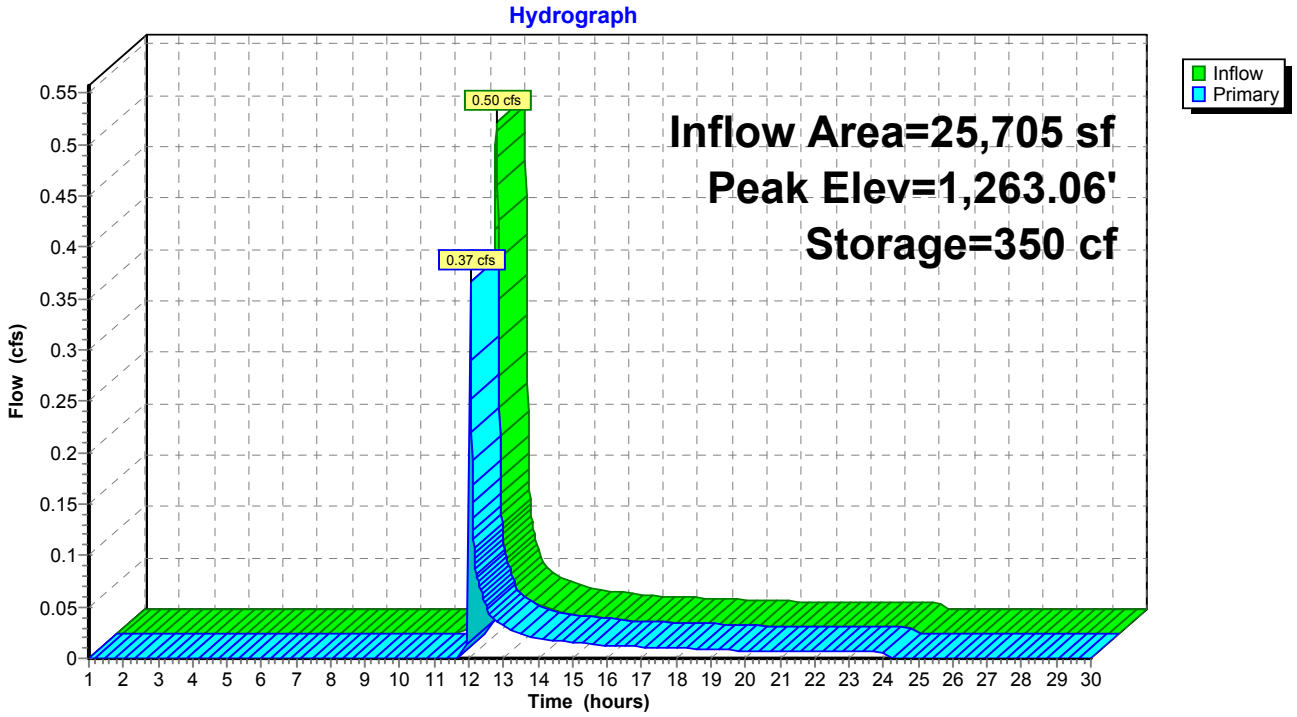
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.32 cfs @ 12.05 hrs HW=1,263.06' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.57 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

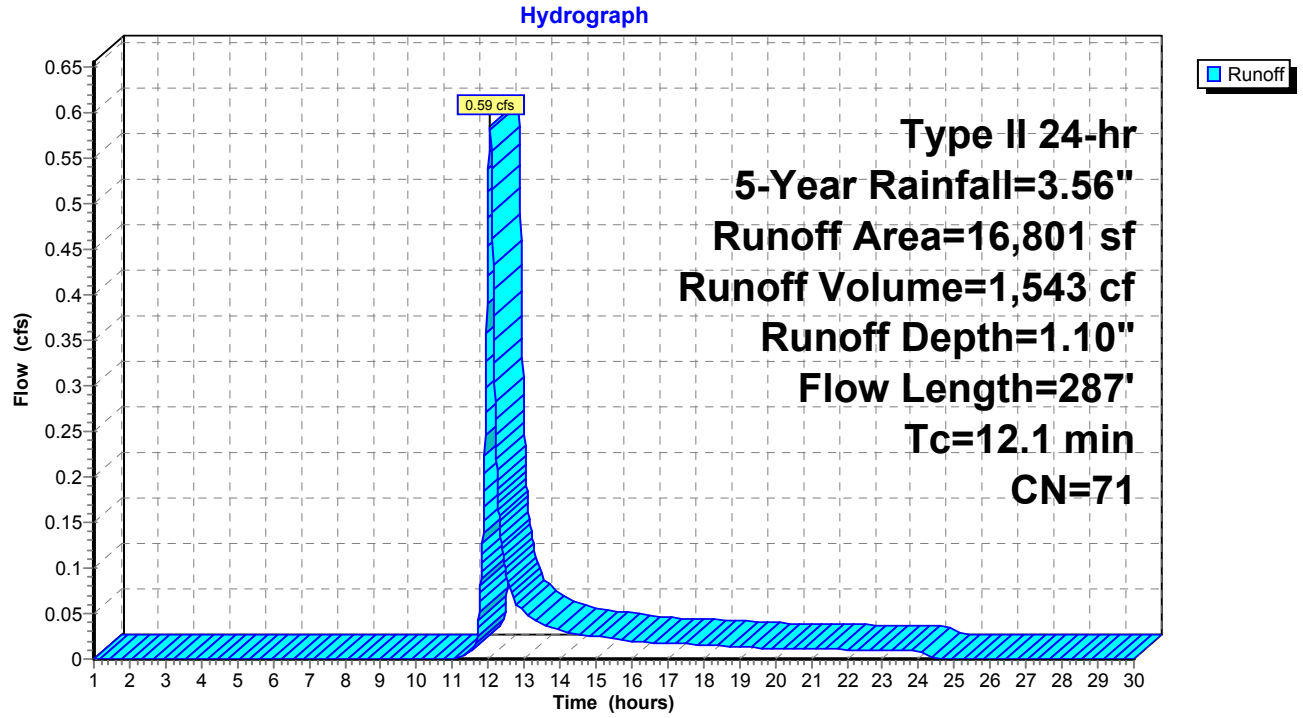
Runoff = 0.59 cfs @ 12.05 hrs, Volume= 1,543 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.56"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

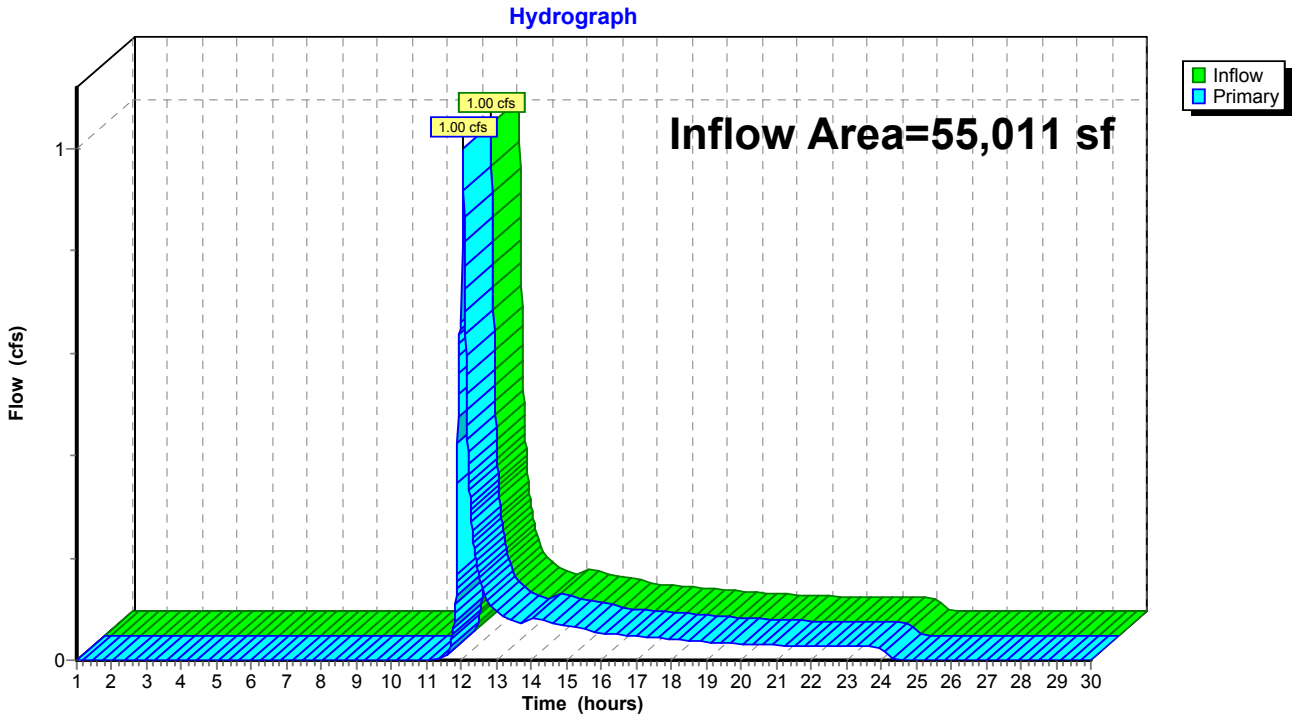


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 0.67" for 5-Year event
Inflow = 1.00 cfs @ 12.05 hrs, Volume= 3,073 cf
Primary = 1.00 cfs @ 12.05 hrs, Volume= 3,073 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

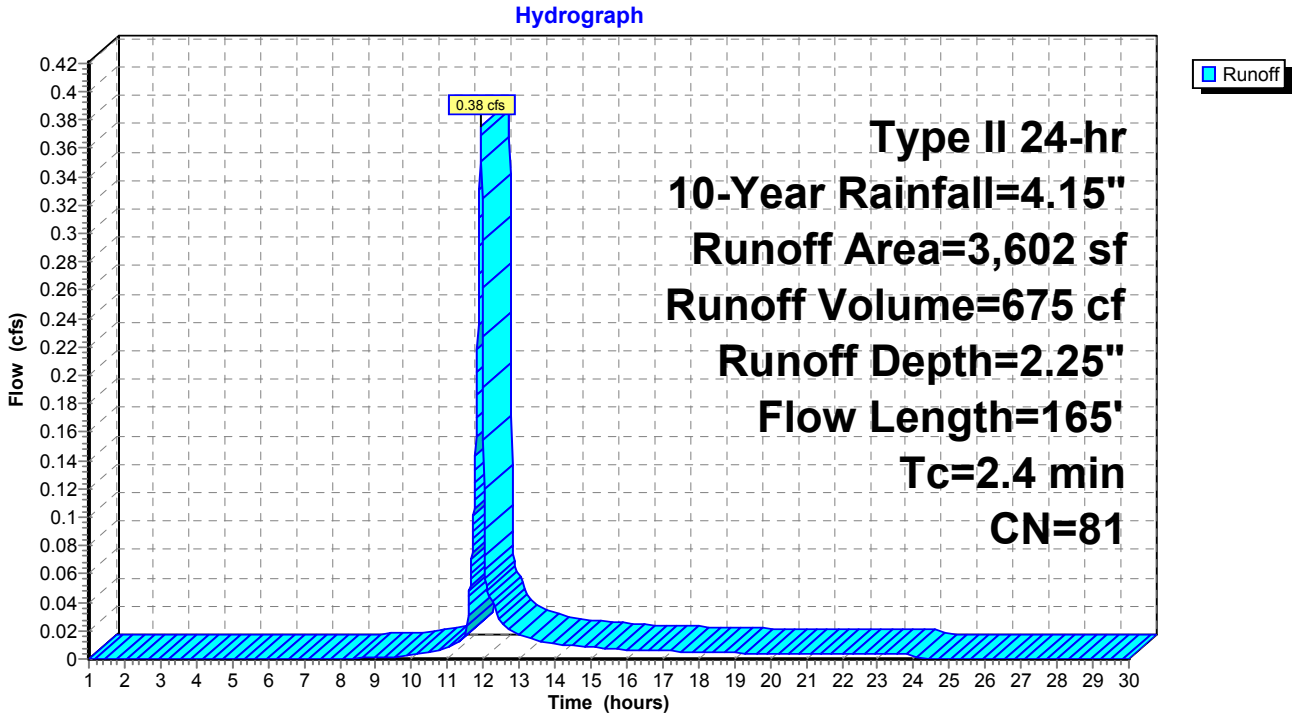
Runoff = 0.38 cfs @ 11.93 hrs, Volume= 675 cf, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 0.38 cfs @ 11.93 hrs, Volume= 675 cf
Outflow = 0.38 cfs @ 11.93 hrs, Volume= 546 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 11.93 hrs, Volume= 546 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.07' @ 11.93 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 114.2 min calculated for 546 cf (81% of inflow)
Center-of-Mass det. time= 33.2 min (853.9 - 820.7)

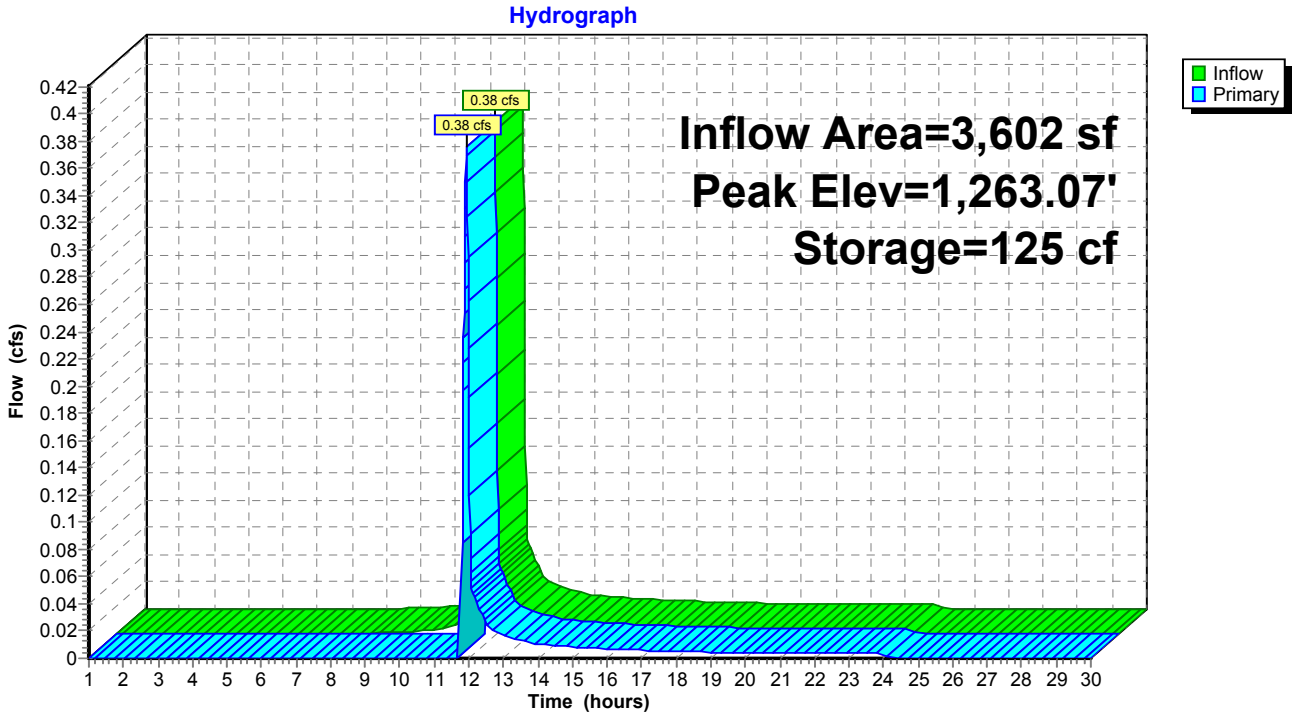
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.37 cfs @ 11.93 hrs HW=1,263.07' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.37 cfs @ 0.65 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.38 cfs
0.38 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.07'
Storage=125 cf
Flow (cfs)
Time (hours)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38 0.4 0.42
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Summary for Subcatchment 5S: DA TO MLV PAD

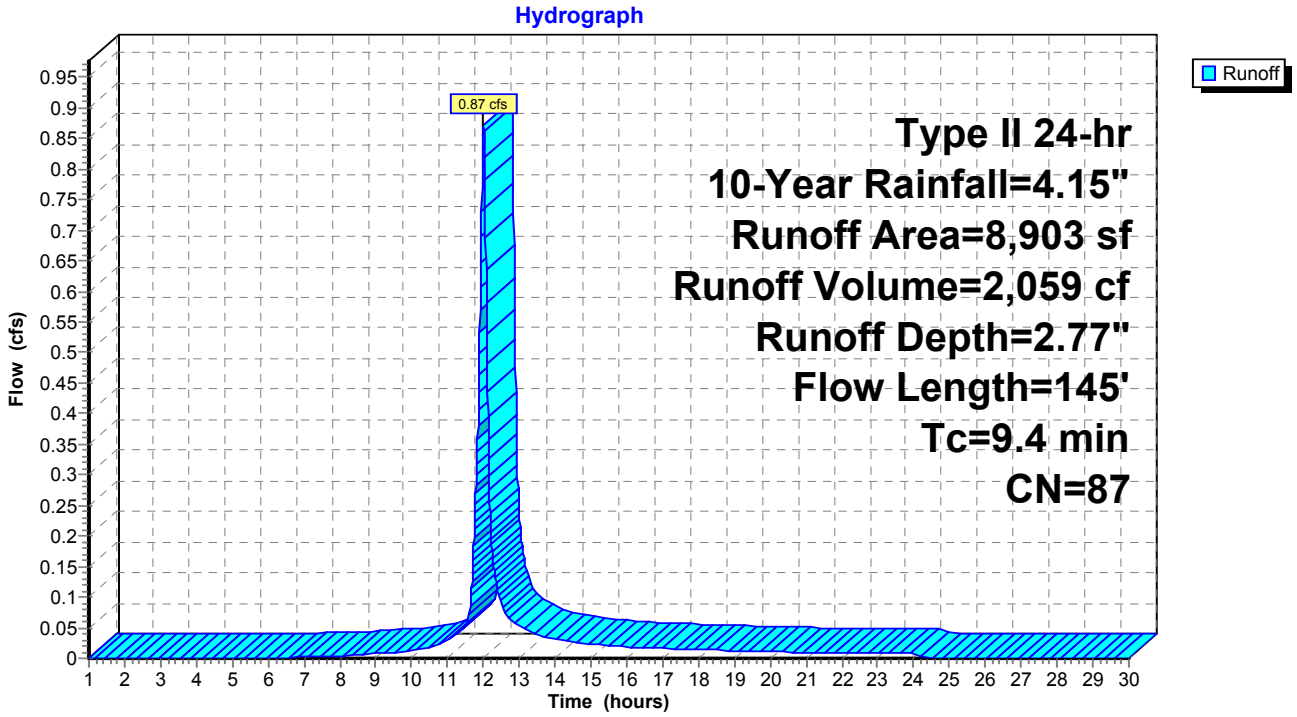
Runoff = 0.87 cfs @ 12.01 hrs, Volume= 2,059 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 2.77" for 10-Year event
Inflow = 0.87 cfs @ 12.01 hrs, Volume= 2,059 cf
Outflow = 0.08 cfs @ 12.53 hrs, Volume= 859 cf, Atten= 90%, Lag= 31.3 min
Primary = 0.08 cfs @ 12.53 hrs, Volume= 859 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.52' @ 12.53 hrs Surf.Area= 4,644 sf Storage= 1,241 cf

Plug-Flow detention time= 280.6 min calculated for 859 cf (42% of inflow)
Center-of-Mass det. time= 160.7 min (969.1 - 808.4)

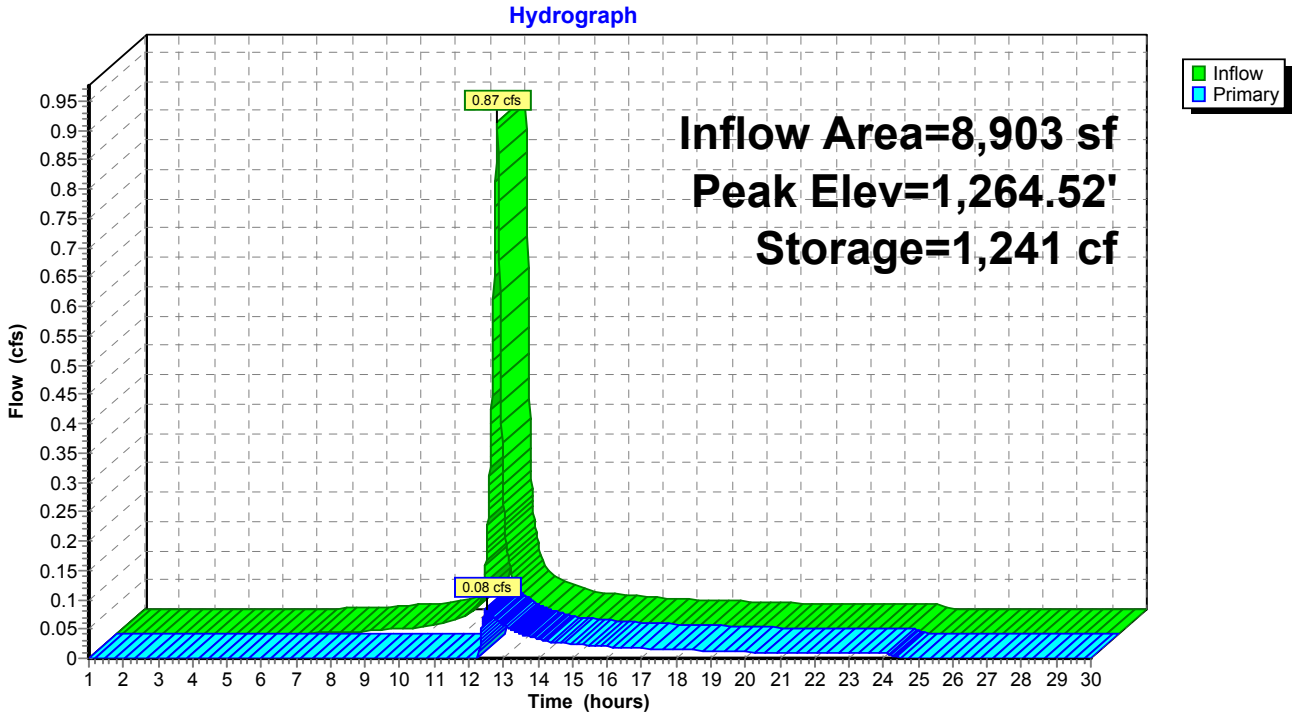
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.08 cfs @ 12.53 hrs HW=1,264.52' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.08 cfs @ 0.37 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

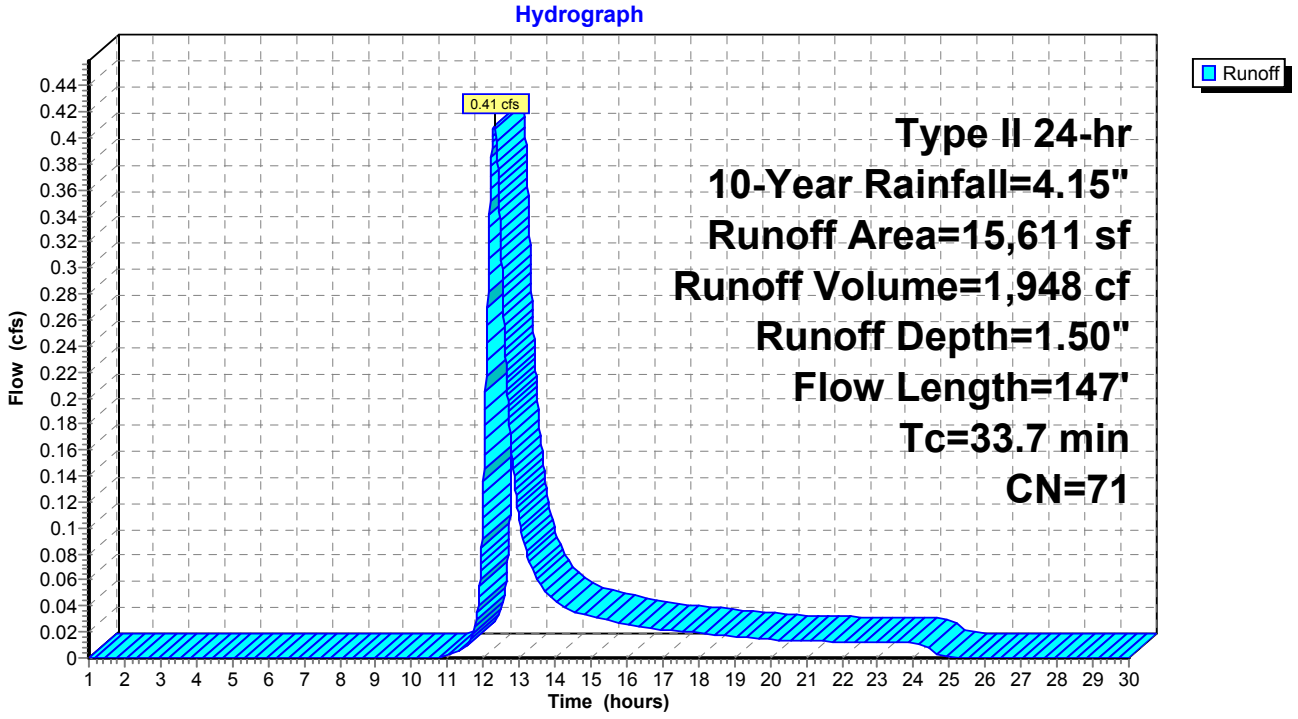
Runoff = 0.41 cfs @ 12.32 hrs, Volume= 1,948 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 1.50" for 10-Year event
Inflow = 0.41 cfs @ 12.32 hrs, Volume= 1,948 cf
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,270.93' @ 25.92 hrs Surf.Area= 2,243 sf Storage= 1,948 cf

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

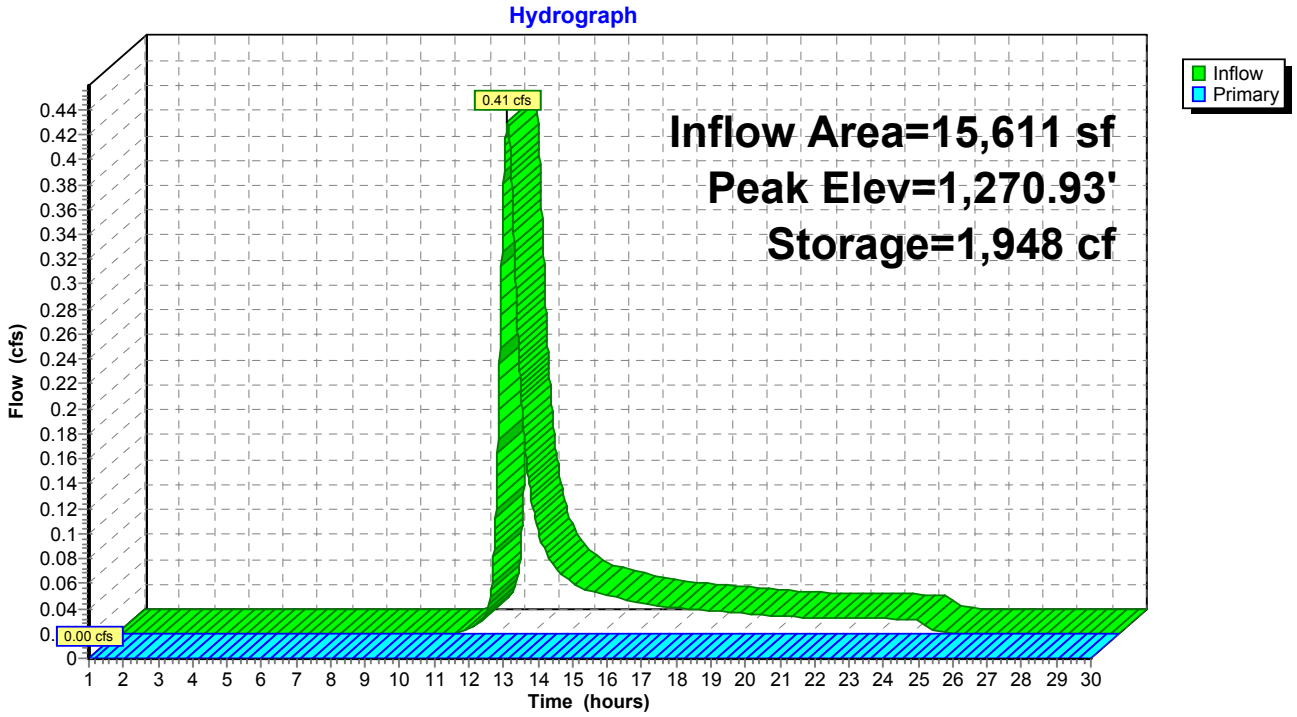
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,269.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

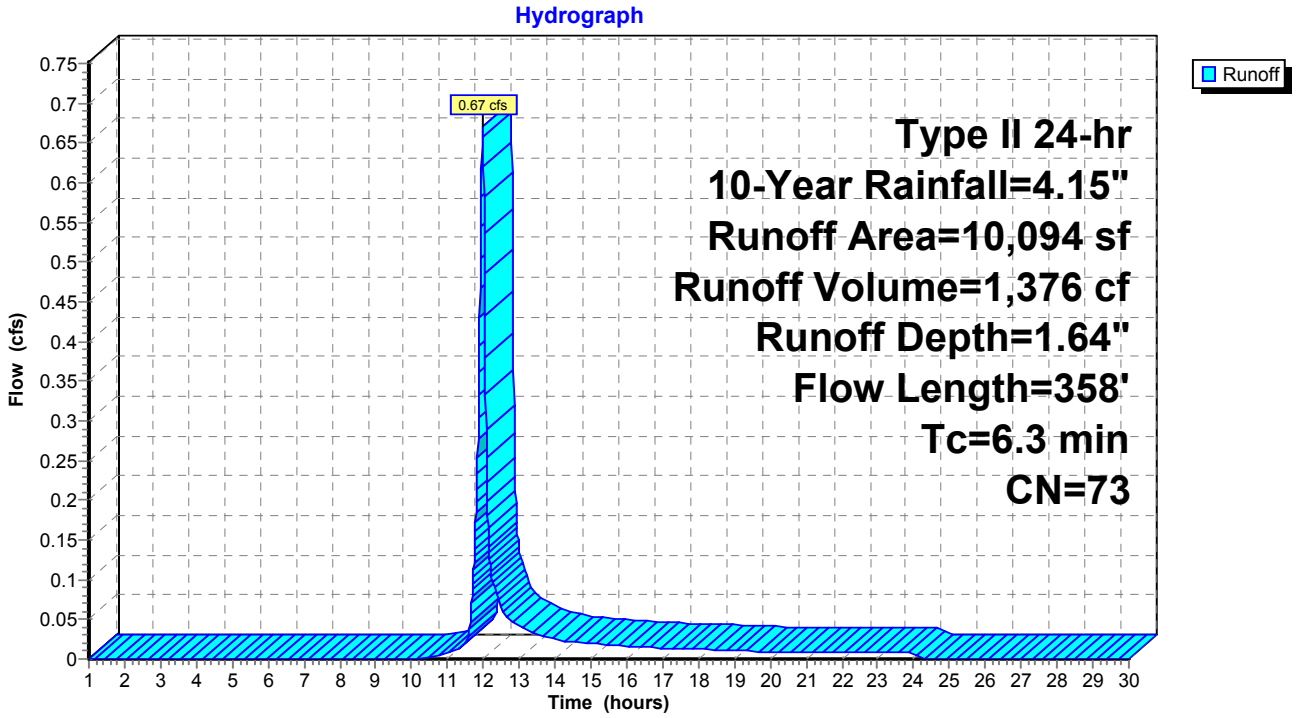
Runoff = 0.67 cfs @ 11.98 hrs, Volume= 1,376 cf, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 0.64" for 10-Year event
Inflow = 0.67 cfs @ 11.98 hrs, Volume= 1,376 cf
Outflow = 0.82 cfs @ 11.97 hrs, Volume= 1,040 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.82 cfs @ 11.97 hrs, Volume= 1,040 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.10' @ 11.97 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 142.9 min calculated for 1,040 cf (76% of inflow)
Center-of-Mass det. time= 45.1 min (891.8 - 846.7)

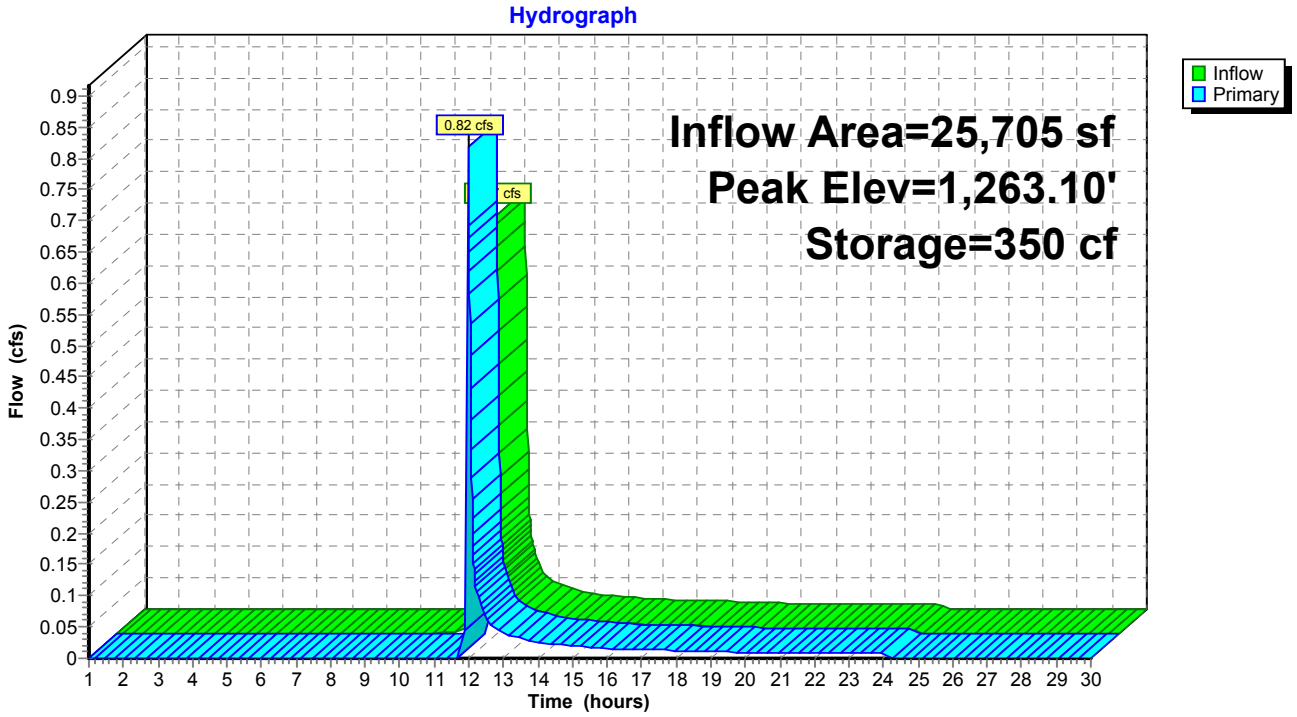
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.72 cfs @ 11.97 hrs HW=1,263.10' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.72 cfs @ 0.75 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

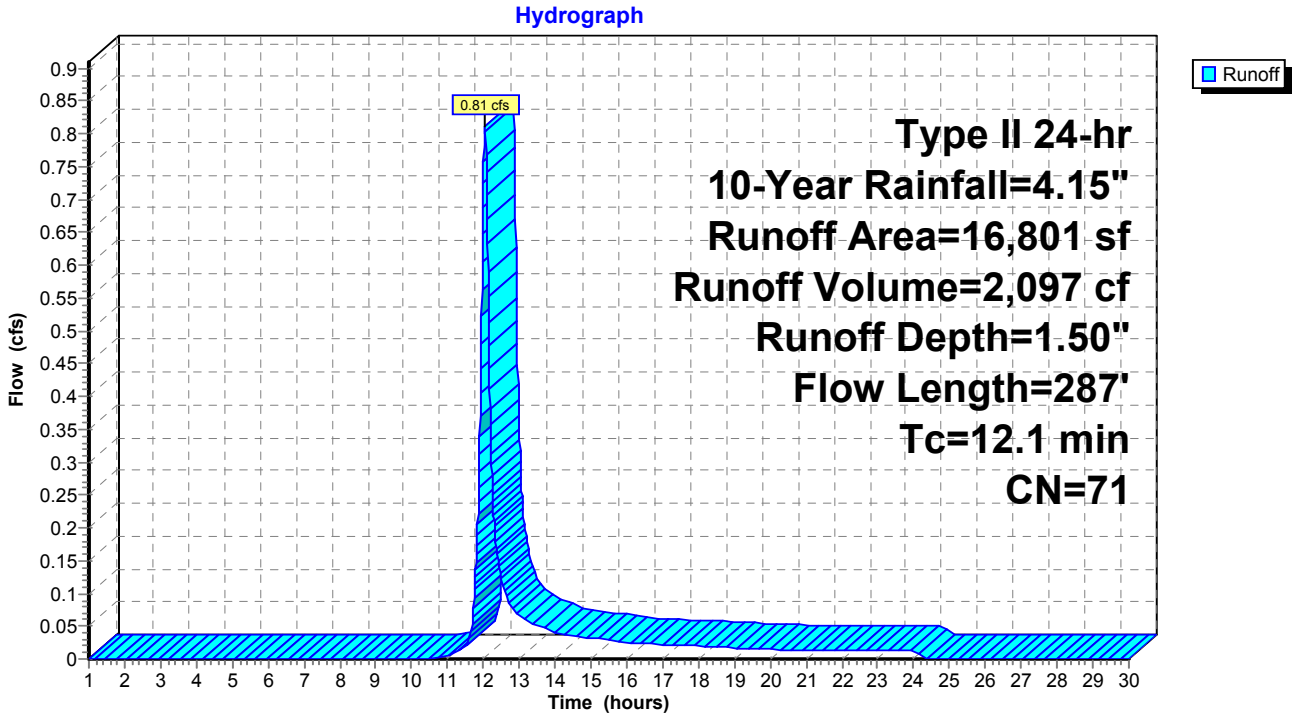
Runoff = 0.81 cfs @ 12.05 hrs, Volume= 2,097 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.15"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

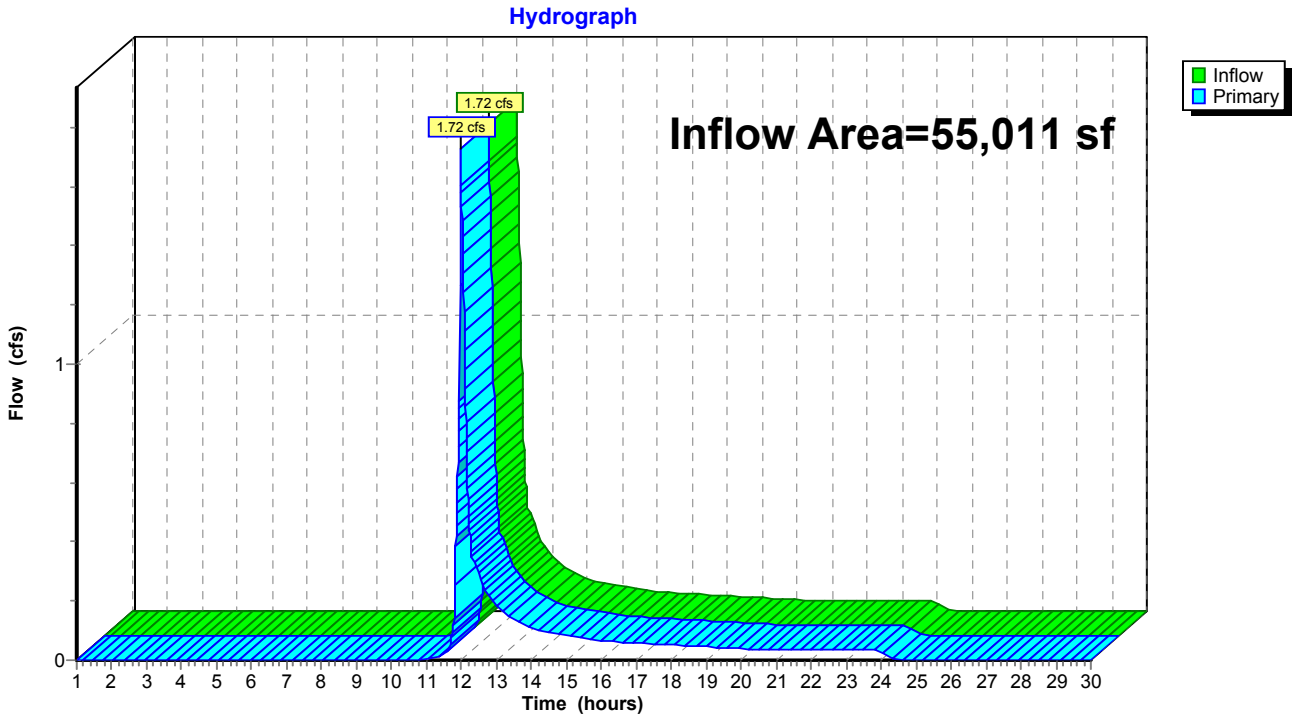


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 0.99" for 10-Year event
Inflow = 1.72 cfs @ 11.97 hrs, Volume= 4,543 cf
Primary = 1.72 cfs @ 11.97 hrs, Volume= 4,543 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

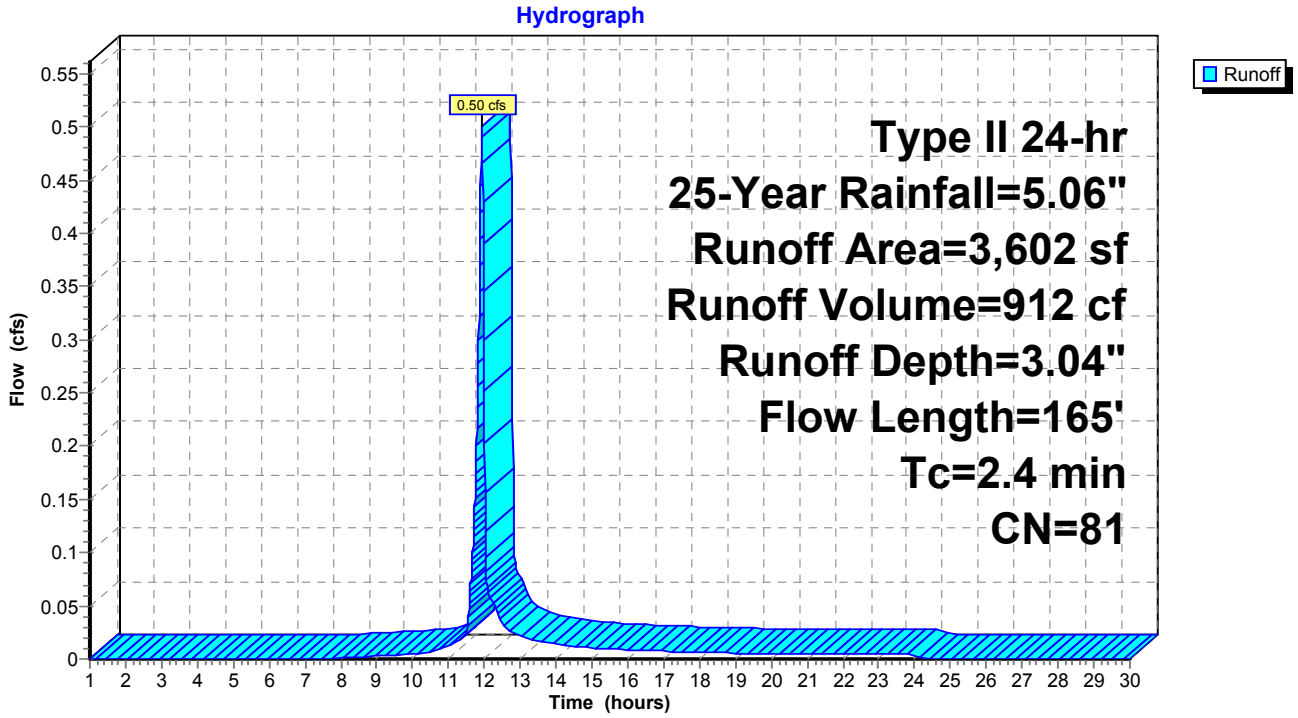
Runoff = 0.50 cfs @ 11.93 hrs, Volume= 912 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 3.04" for 25-Year event
Inflow = 0.50 cfs @ 11.93 hrs, Volume= 912 cf
Outflow = 0.50 cfs @ 11.93 hrs, Volume= 792 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 11.93 hrs, Volume= 792 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.09' @ 11.93 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 87.4 min calculated for 791 cf (87% of inflow)
Center-of-Mass det. time= 24.6 min (836.8 - 812.1)

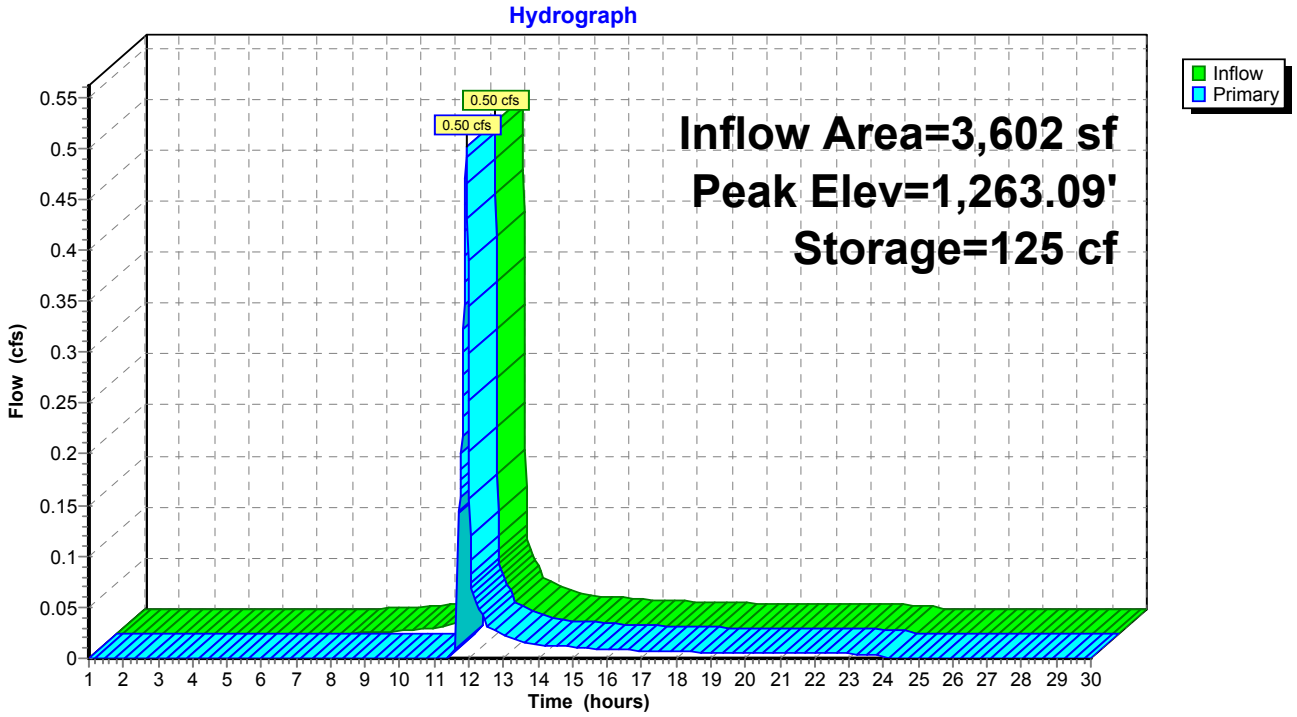
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.50 cfs @ 11.93 hrs HW=1,263.09' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.50 cfs @ 0.72 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.50 cfs
0.50 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.09'
Storage=125 cf
Flow (cfs)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

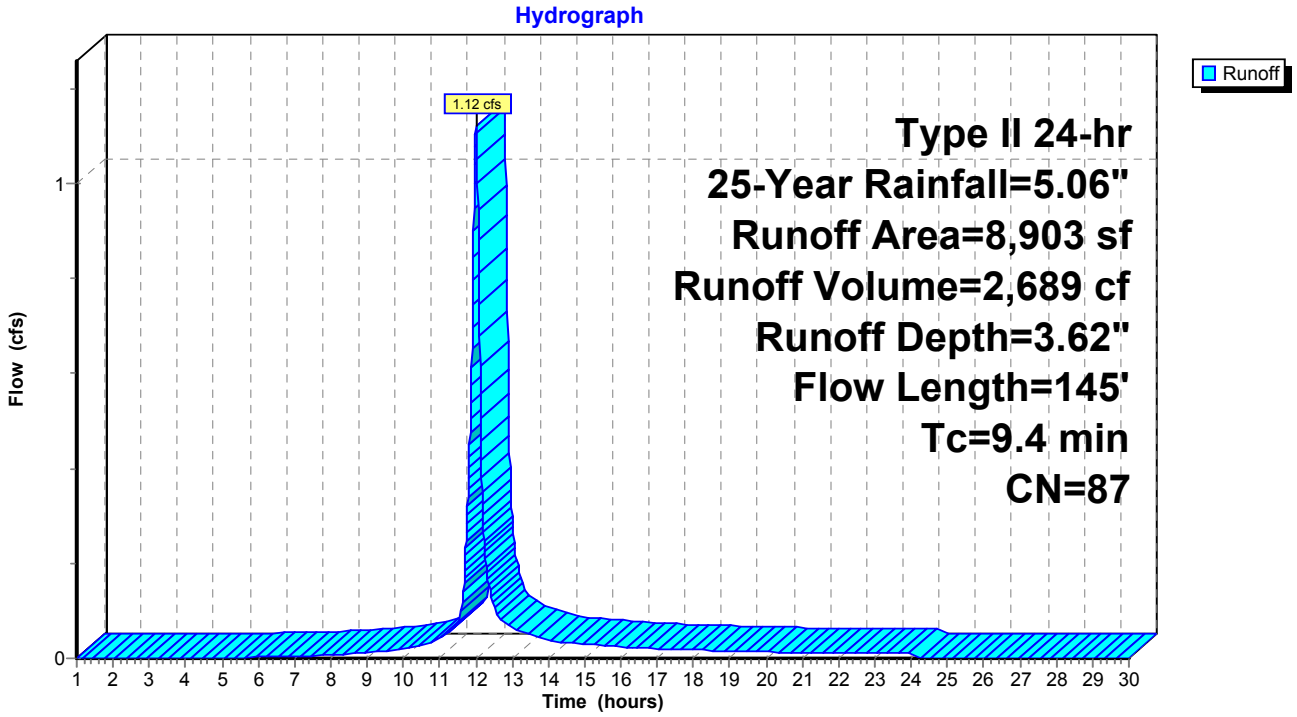
Runoff = 1.12 cfs @ 12.01 hrs, Volume= 2,689 cf, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 3.62" for 25-Year event
Inflow = 1.12 cfs @ 12.01 hrs, Volume= 2,689 cf
Outflow = 0.50 cfs @ 12.13 hrs, Volume= 1,490 cf, Atten= 55%, Lag= 7.5 min
Primary = 0.50 cfs @ 12.13 hrs, Volume= 1,490 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.58' @ 12.13 hrs Surf.Area= 4,644 sf Storage= 1,339 cf

Plug-Flow detention time= 211.7 min calculated for 1,489 cf (55% of inflow)
Center-of-Mass det. time= 102.5 min (903.3 - 800.8)

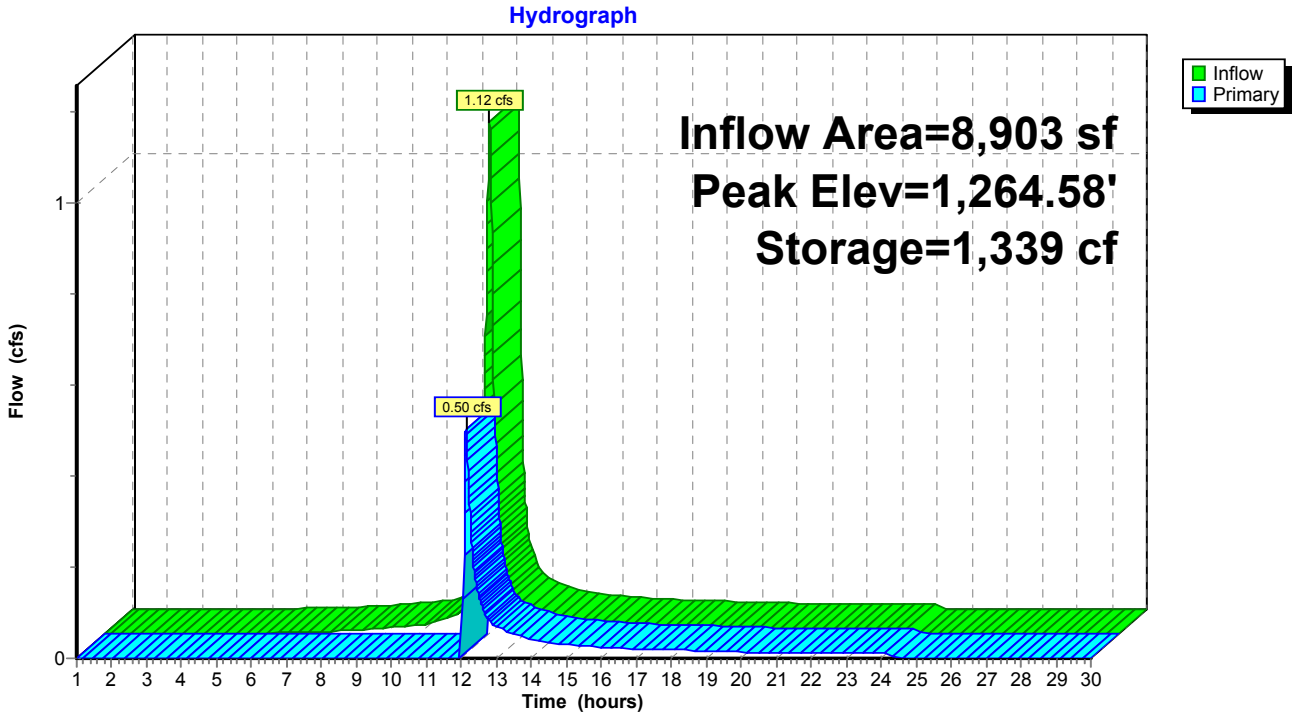
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.50 cfs @ 12.13 hrs HW=1,264.57' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.50 cfs @ 0.67 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

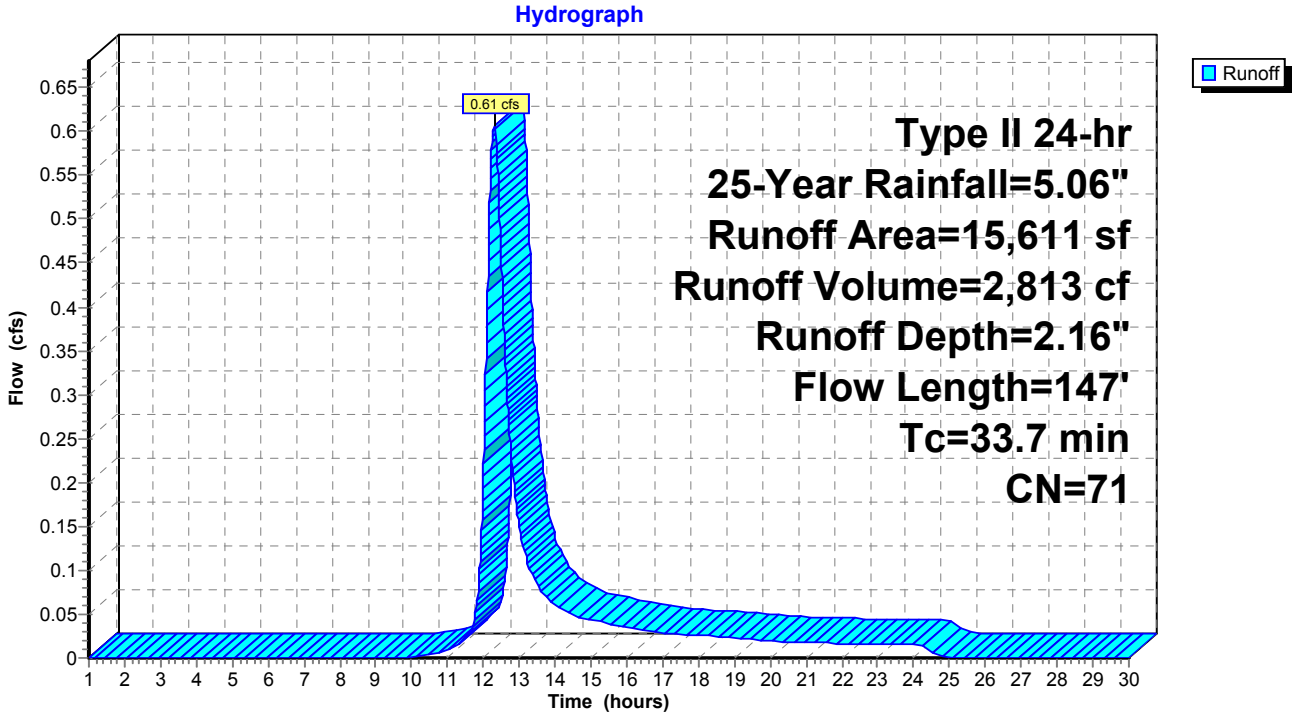
Runoff = 0.61 cfs @ 12.31 hrs, Volume= 2,813 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 2.16" for 25-Year event
Inflow = 0.61 cfs @ 12.31 hrs, Volume= 2,813 cf
Outflow = 0.04 cfs @ 15.47 hrs, Volume= 730 cf, Atten= 94%, Lag= 189.9 min
Primary = 0.04 cfs @ 15.47 hrs, Volume= 730 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,271.00' @ 15.47 hrs Surf.Area= 2,348 sf Storage= 2,084 cf

Plug-Flow detention time= 429.0 min calculated for 730 cf (26% of inflow)
Center-of-Mass det. time= 286.8 min (1,153.7 - 866.8)

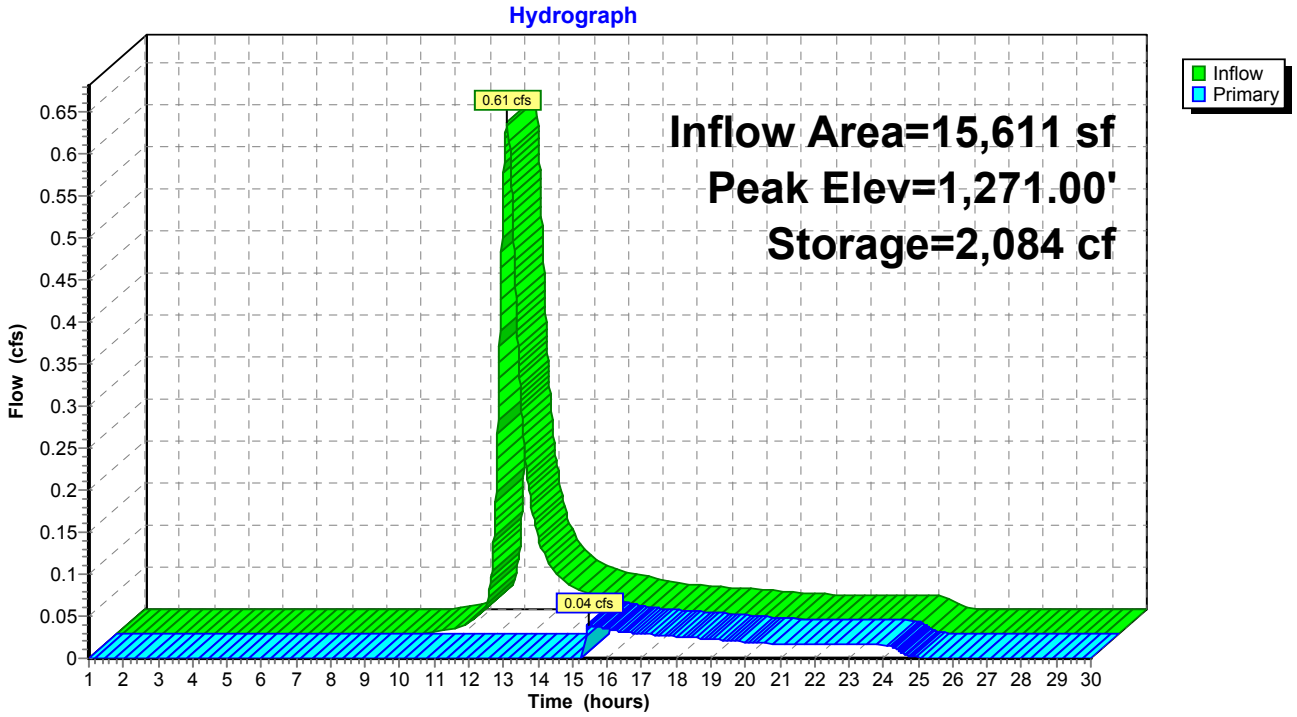
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.01 cfs @ 15.47 hrs HW=1,271.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.01 cfs @ 0.07 fps)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

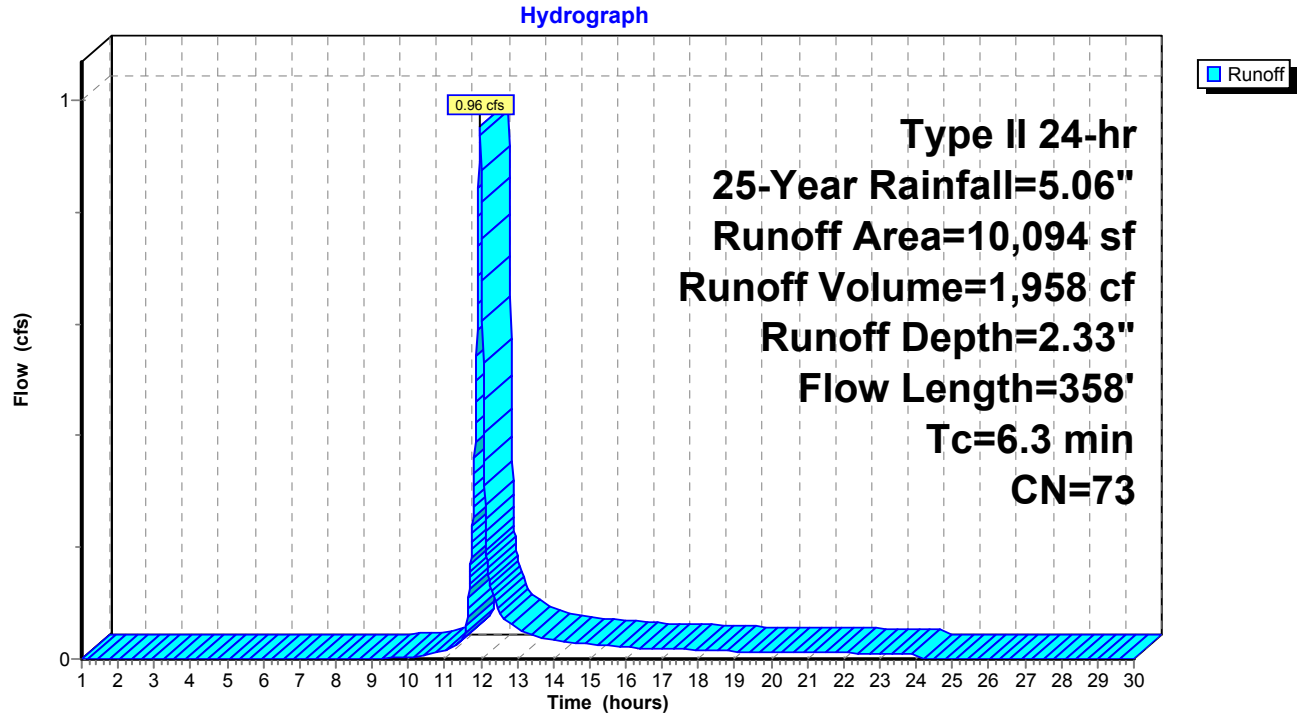
Runoff = 0.96 cfs @ 11.98 hrs, Volume= 1,958 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 1.26" for 25-Year event
Inflow = 0.96 cfs @ 11.98 hrs, Volume= 2,688 cf
Outflow = 0.96 cfs @ 11.98 hrs, Volume= 2,337 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.96 cfs @ 11.98 hrs, Volume= 2,337 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.12' @ 11.98 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 98.8 min calculated for 2,337 cf (87% of inflow)
Center-of-Mass det. time= 34.1 min (956.8 - 922.6)

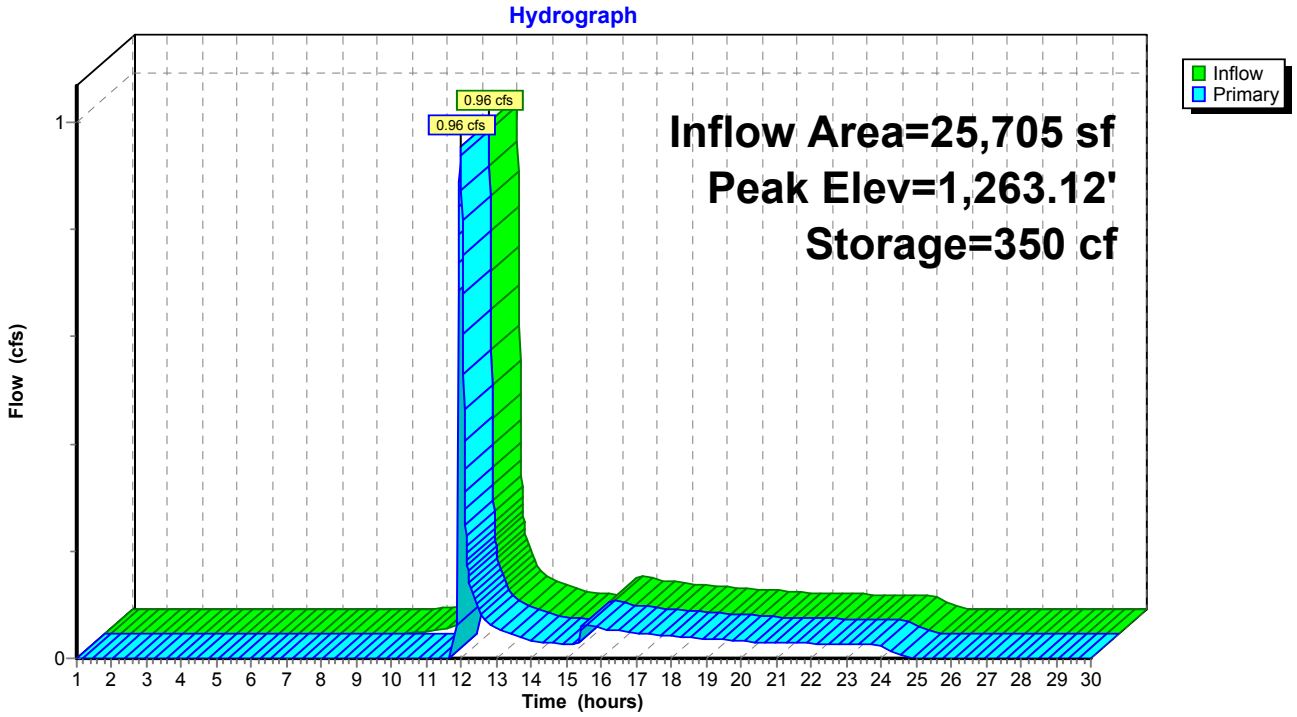
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.95 cfs @ 11.98 hrs HW=1,263.12' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.95 cfs @ 0.83 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

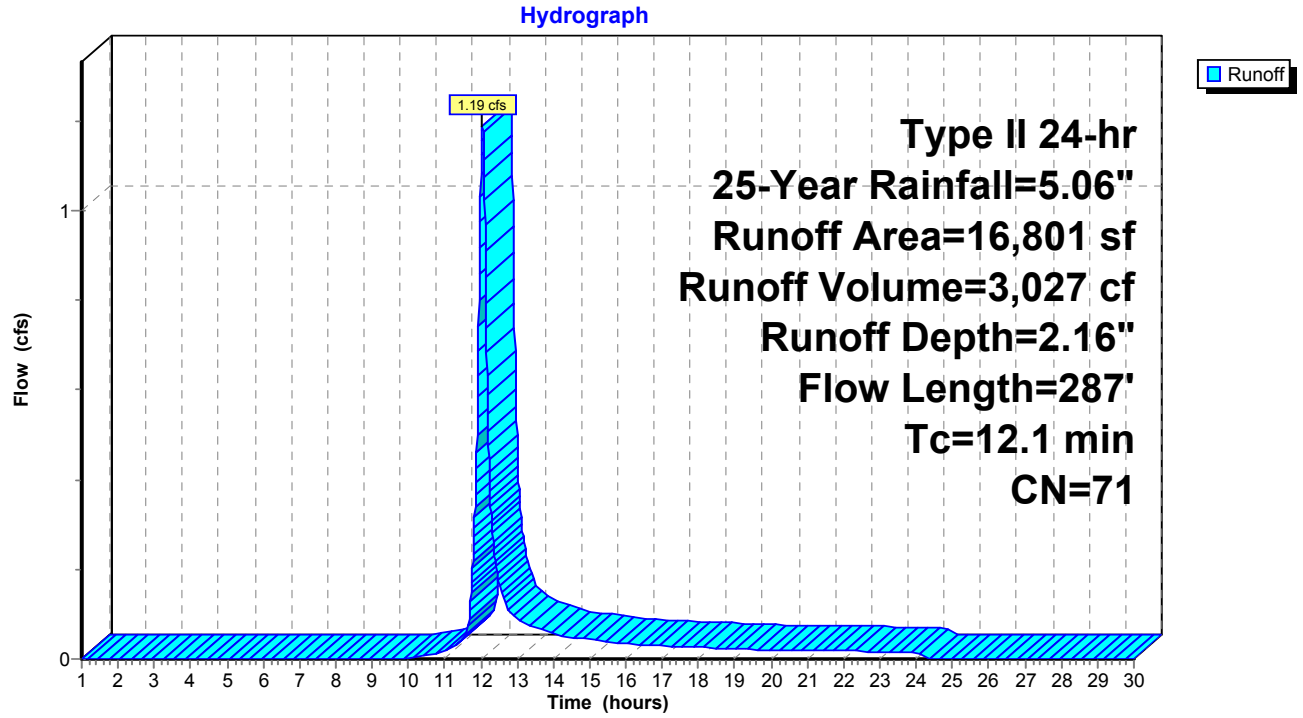
Runoff = 1.19 cfs @ 12.04 hrs, Volume= 3,027 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.06"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

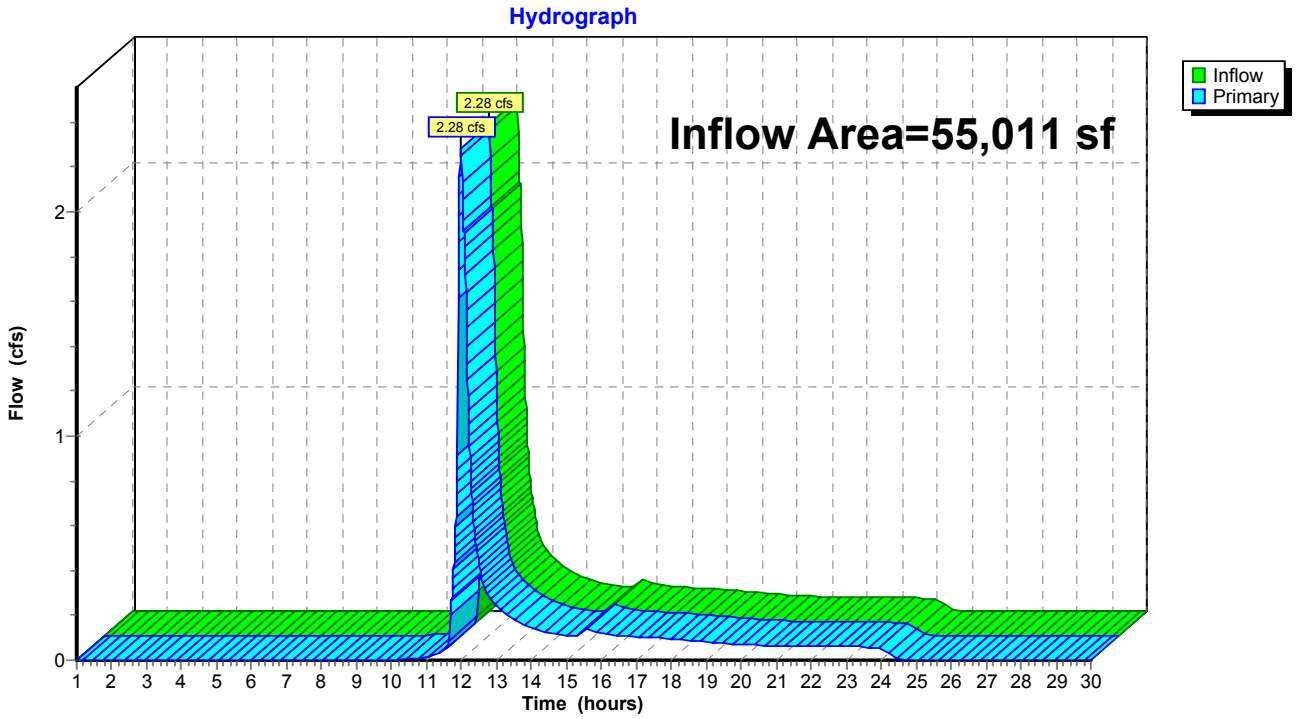


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 1.67" for 25-Year event
Inflow = 2.28 cfs @ 11.98 hrs, Volume= 7,645 cf
Primary = 2.28 cfs @ 11.98 hrs, Volume= 7,645 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

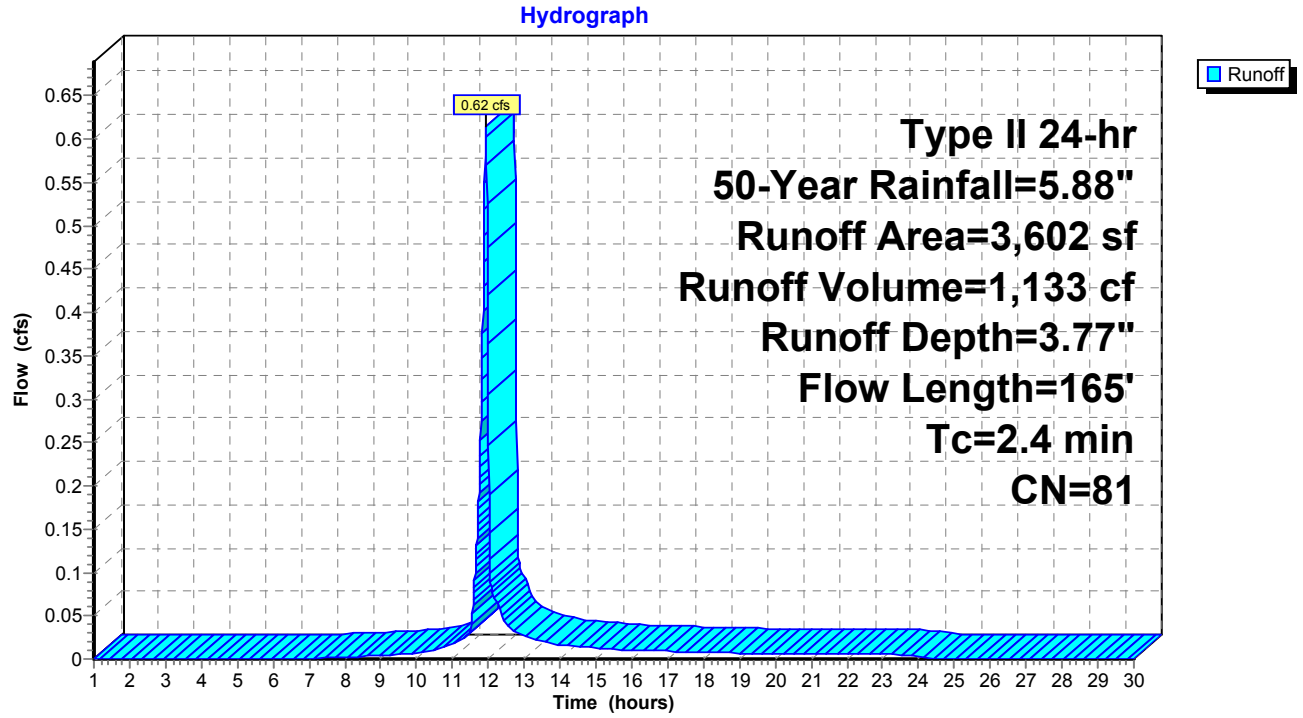
Runoff = 0.62 cfs @ 11.93 hrs, Volume= 1,133 cf, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 3.77" for 50-Year event
Inflow = 0.62 cfs @ 11.93 hrs, Volume= 1,133 cf
Outflow = 0.62 cfs @ 11.93 hrs, Volume= 1,008 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.62 cfs @ 11.93 hrs, Volume= 1,008 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.10' @ 11.93 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 77.8 min calculated for 1,008 cf (89% of inflow)
Center-of-Mass det. time= 22.7 min (828.6 - 806.0)

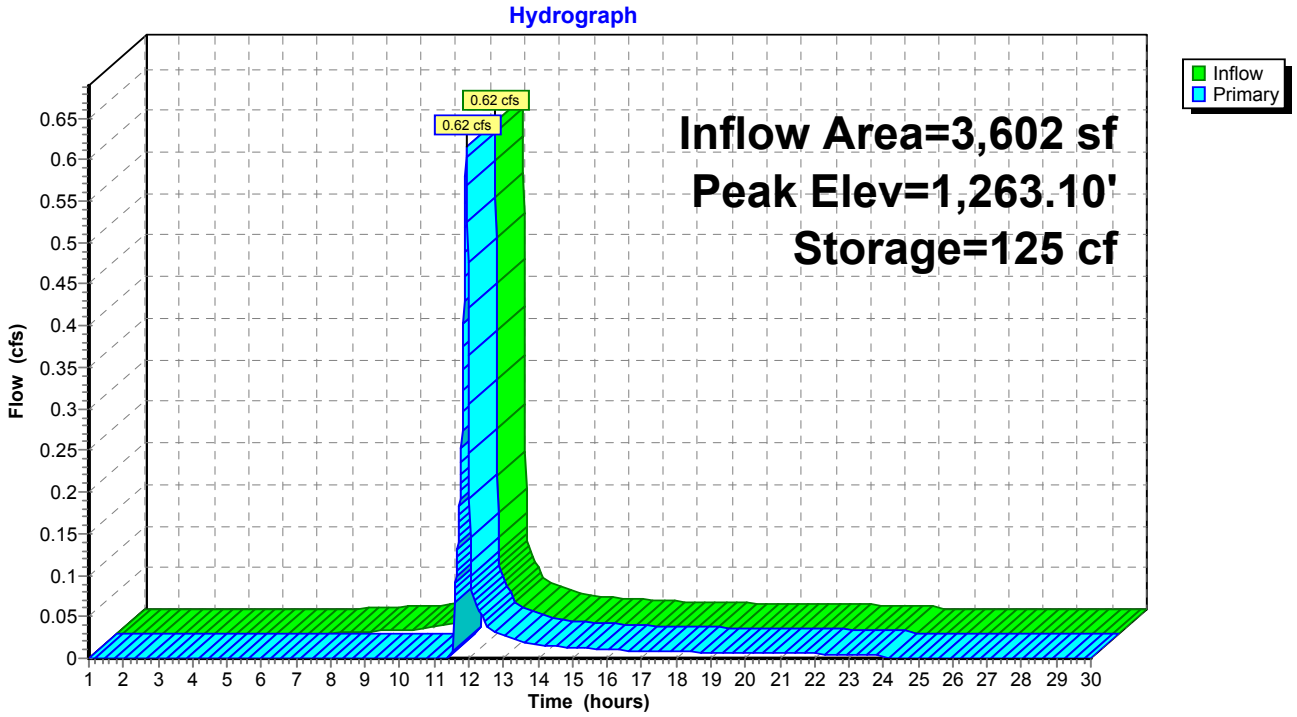
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.61 cfs @ 11.93 hrs HW=1,263.10' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.61 cfs @ 0.77 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.62 cfs
0.62 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.10'
Storage=125 cf
Flow (cfs)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

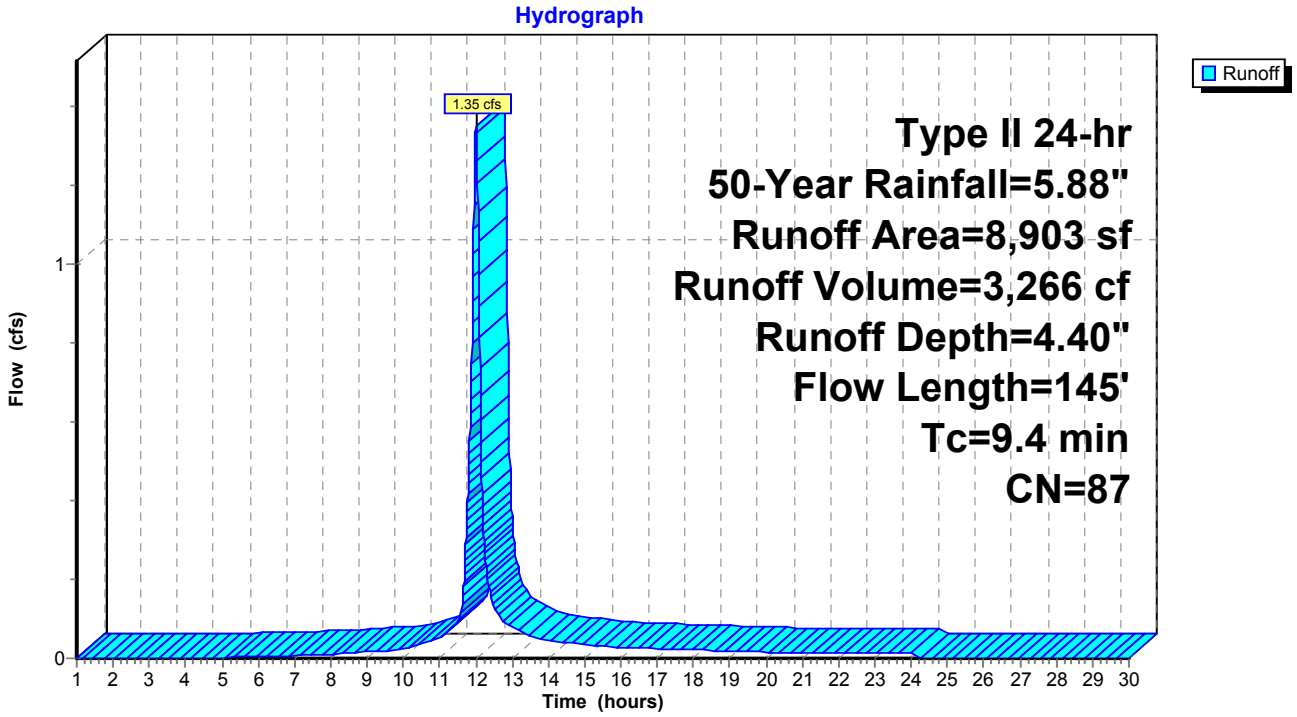
Runoff = 1.35 cfs @ 12.01 hrs, Volume= 3,266 cf, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 4.40" for 50-Year event
Inflow = 1.35 cfs @ 12.01 hrs, Volume= 3,266 cf
Outflow = 1.00 cfs @ 12.08 hrs, Volume= 2,067 cf, Atten= 26%, Lag= 4.3 min
Primary = 1.00 cfs @ 12.08 hrs, Volume= 2,067 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.62' @ 12.08 hrs Surf.Area= 4,644 sf Storage= 1,420 cf

Plug-Flow detention time= 183.9 min calculated for 2,067 cf (63% of inflow)
Center-of-Mass det. time= 81.0 min (876.4 - 795.3)

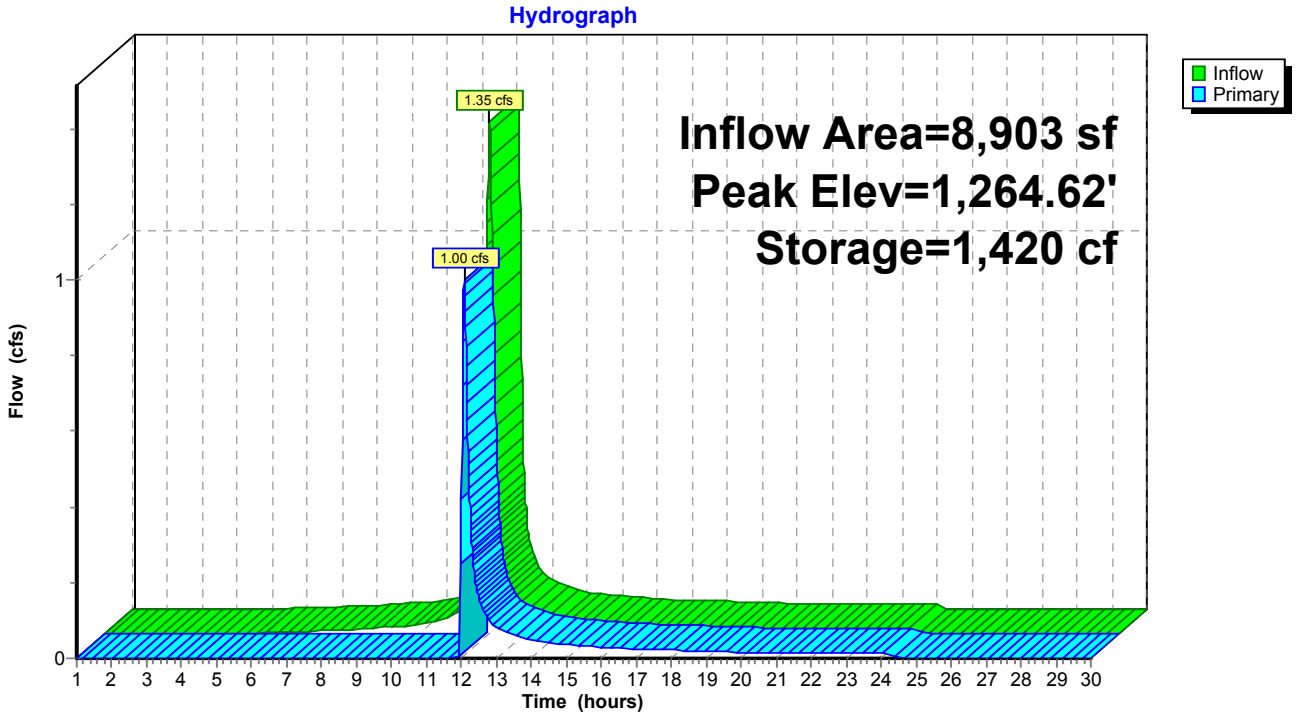
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.00 cfs @ 12.08 hrs HW=1,264.62' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 1.00 cfs @ 0.84 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

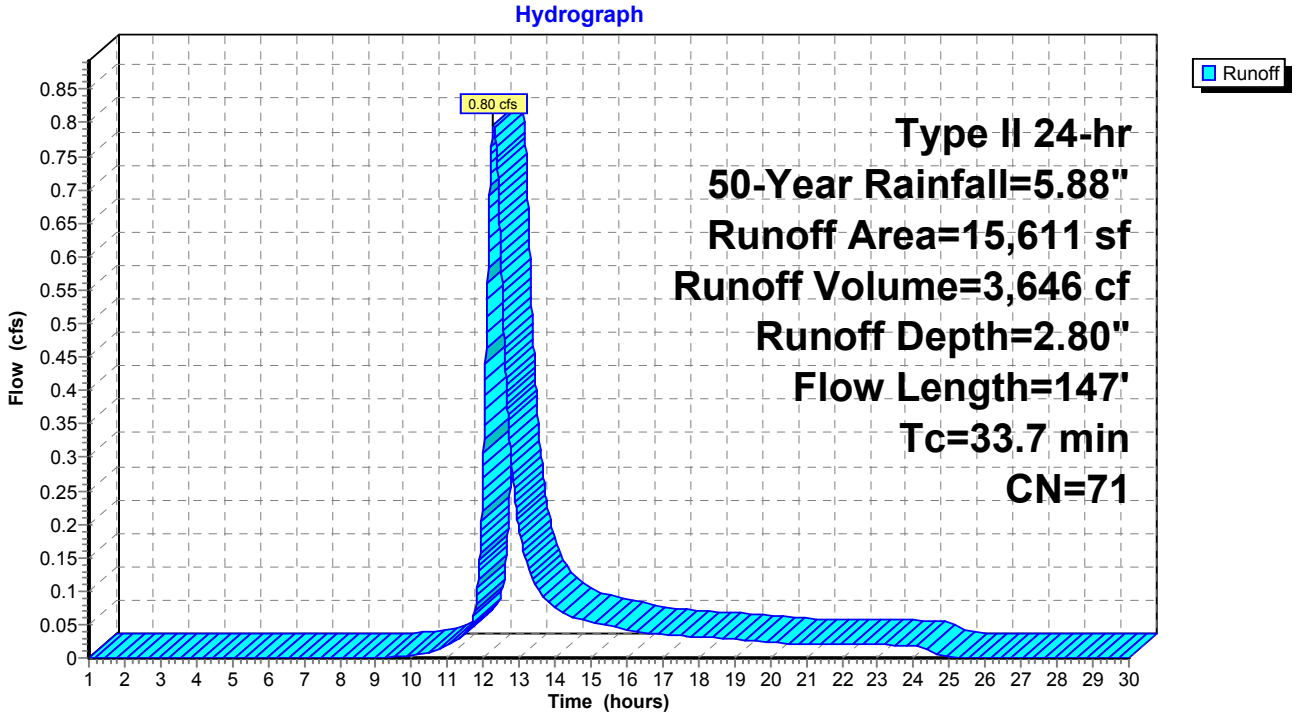
Runoff = 0.80 cfs @ 12.29 hrs, Volume= 3,646 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 2.80" for 50-Year event
Inflow = 0.80 cfs @ 12.29 hrs, Volume= 3,646 cf
Outflow = 0.16 cfs @ 13.13 hrs, Volume= 1,564 cf, Atten= 80%, Lag= 50.0 min
Primary = 0.16 cfs @ 13.13 hrs, Volume= 1,564 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,271.00' @ 13.13 hrs Surf.Area= 2,353 sf Storage= 2,091 cf

Plug-Flow detention time= 290.2 min calculated for 1,563 cf (43% of inflow)
Center-of-Mass det. time= 161.1 min (1,020.4 - 859.3)

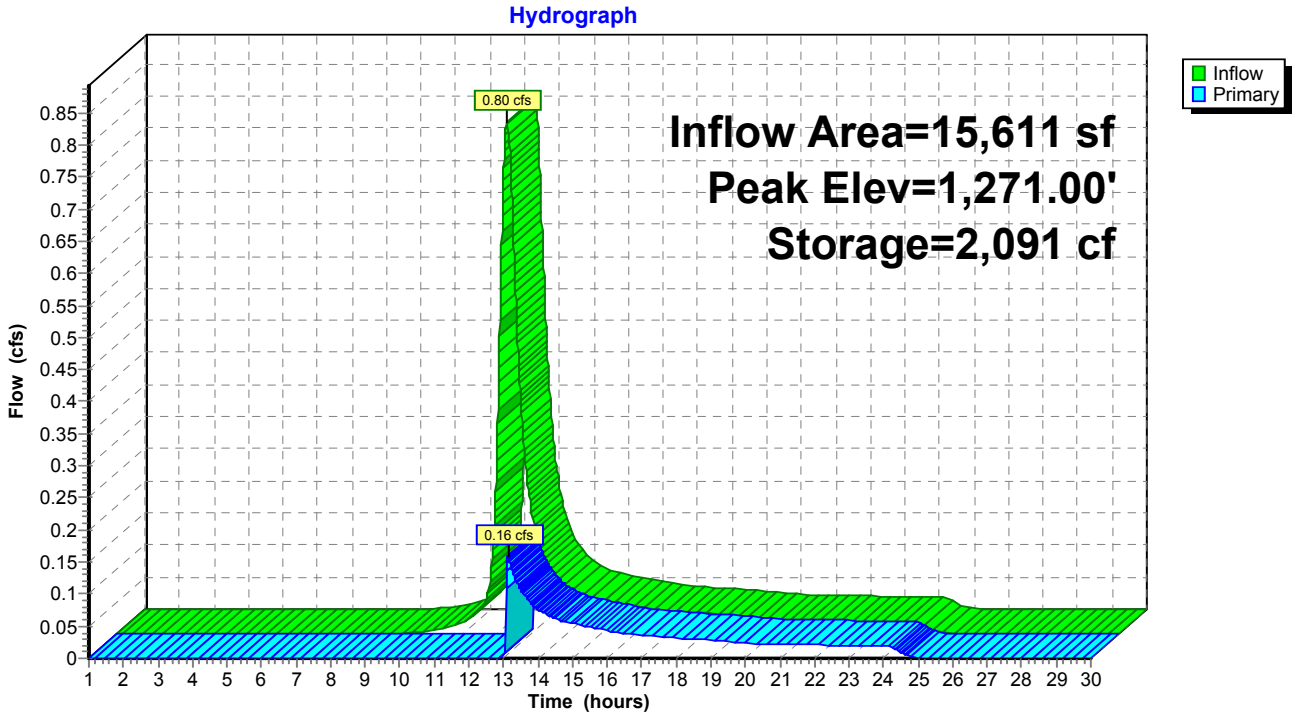
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.06 cfs @ 13.13 hrs HW=1,271.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.14 fps)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

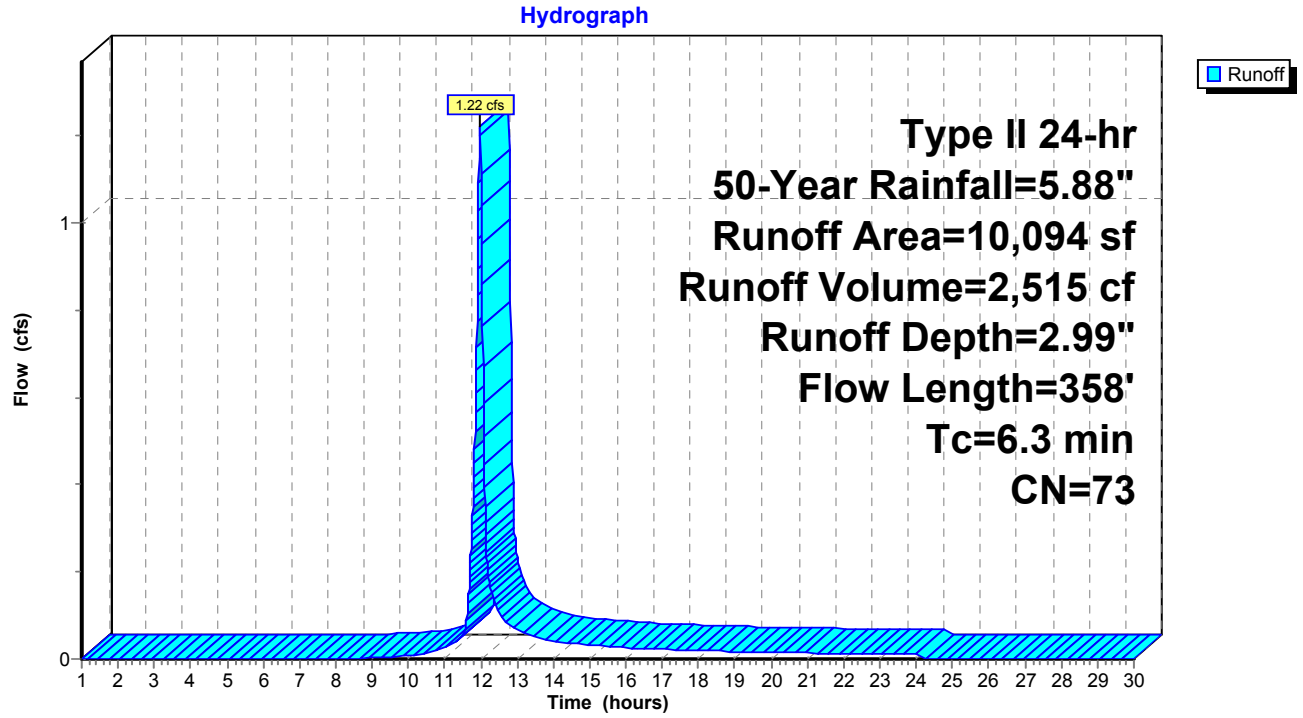
Runoff = 1.22 cfs @ 11.98 hrs, Volume= 2,515 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 1.90" for 50-Year event
Inflow = 1.22 cfs @ 11.98 hrs, Volume= 4,078 cf
Outflow = 1.22 cfs @ 11.98 hrs, Volume= 3,730 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.22 cfs @ 11.98 hrs, Volume= 3,730 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.14' @ 11.98 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 64.5 min calculated for 3,729 cf (91% of inflow)
Center-of-Mass det. time= 20.7 min (923.2 - 902.5)

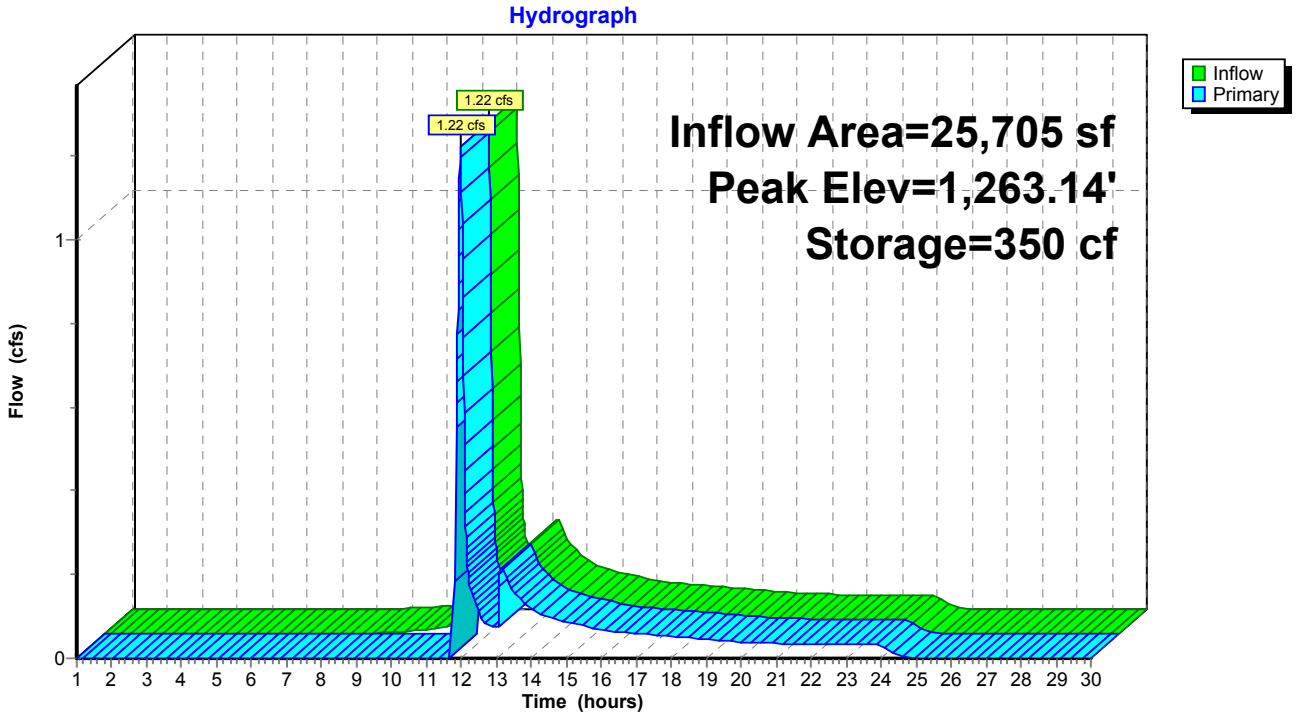
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.22 cfs @ 11.98 hrs HW=1,263.14' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 1.22 cfs @ 0.90 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

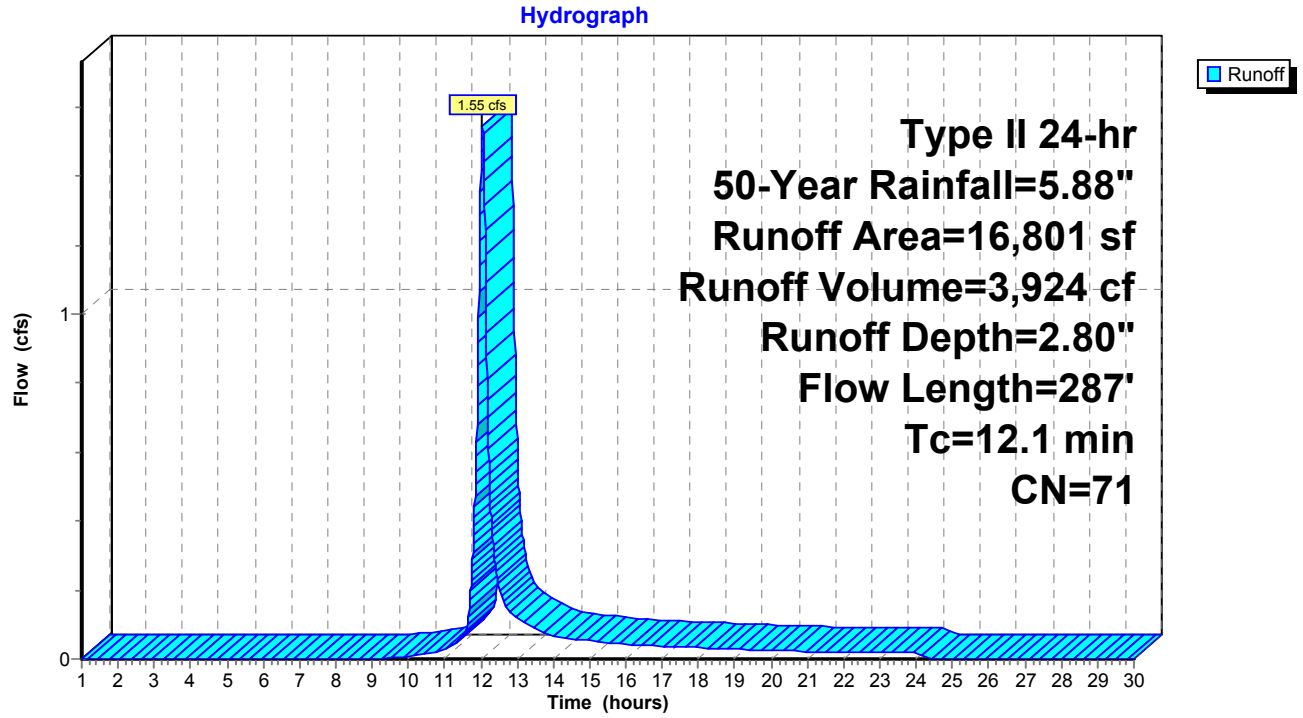
Runoff = 1.55 cfs @ 12.04 hrs, Volume= 3,924 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=5.88"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

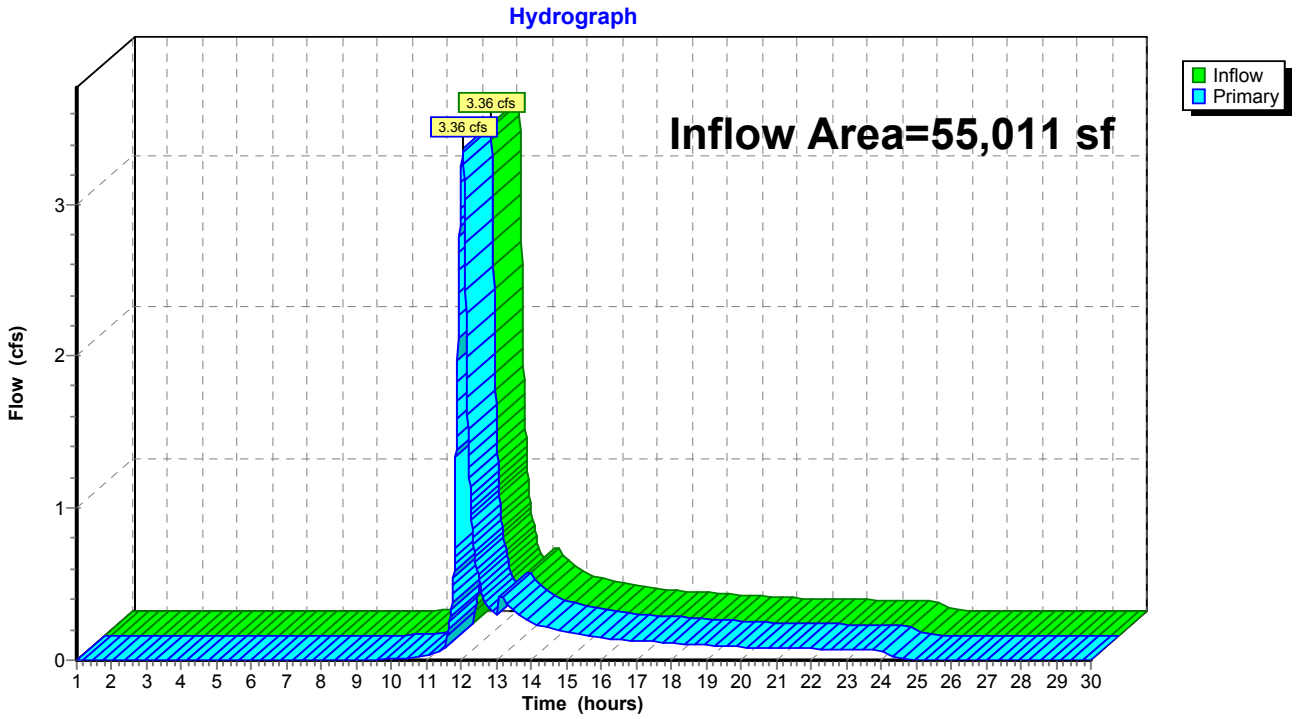


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 2.34" for 50-Year event
Inflow = 3.36 cfs @ 12.03 hrs, Volume= 10,728 cf
Primary = 3.36 cfs @ 12.03 hrs, Volume= 10,728 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



Summary for Subcatchment 3S: DA TO VCI #1

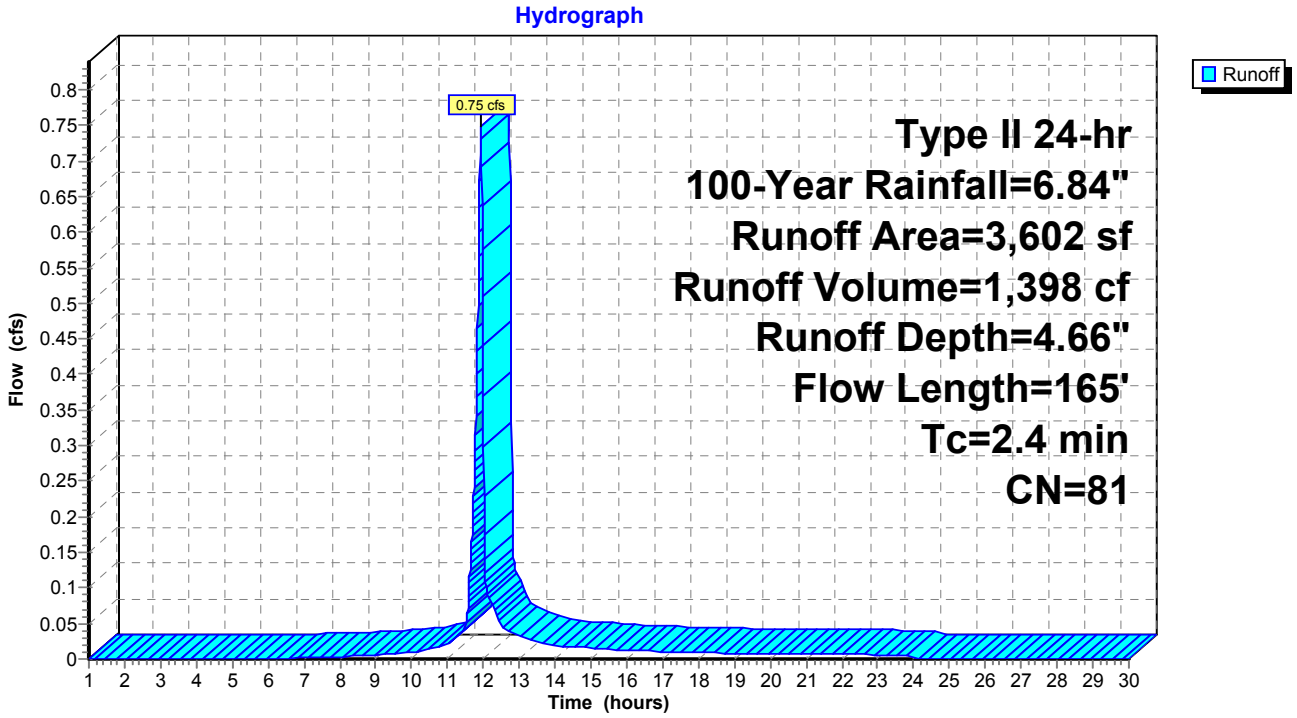
Runoff = 0.75 cfs @ 11.93 hrs, Volume= 1,398 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

	Area (sf)	CN	Description
*	464	98	Paved road, HSG C
	1,267	89	Gravel roads, HSG C
*	1,871	71	Meadow Fair, HSG C
	3,602	81	Weighted Average
	3,138		87.12% Pervious Area
	464		12.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	63	0.0800	2.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
0.3	20	0.0400	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
1.2	17	0.3300	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.4	65	0.0400	3.00		**Shallow Concentrated Flow, C1** Grassed Waterway Kv= 15.0 fps
2.4	165	Total			

Subcatchment 3S: DA TO VCI #1



Summary for Pond 5P: VCI #1

Inflow Area = 3,602 sf, 12.88% Impervious, Inflow Depth = 4.66" for 100-Year event
Inflow = 0.75 cfs @ 11.93 hrs, Volume= 1,398 cf
Outflow = 0.75 cfs @ 11.93 hrs, Volume= 1,273 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.75 cfs @ 11.93 hrs, Volume= 1,273 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,263.11' @ 11.93 hrs Surf.Area= 0 sf Storage= 125 cf

Plug-Flow detention time= 67.5 min calculated for 1,273 cf (91% of inflow)
Center-of-Mass det. time= 20.8 min (820.8 - 800.0)

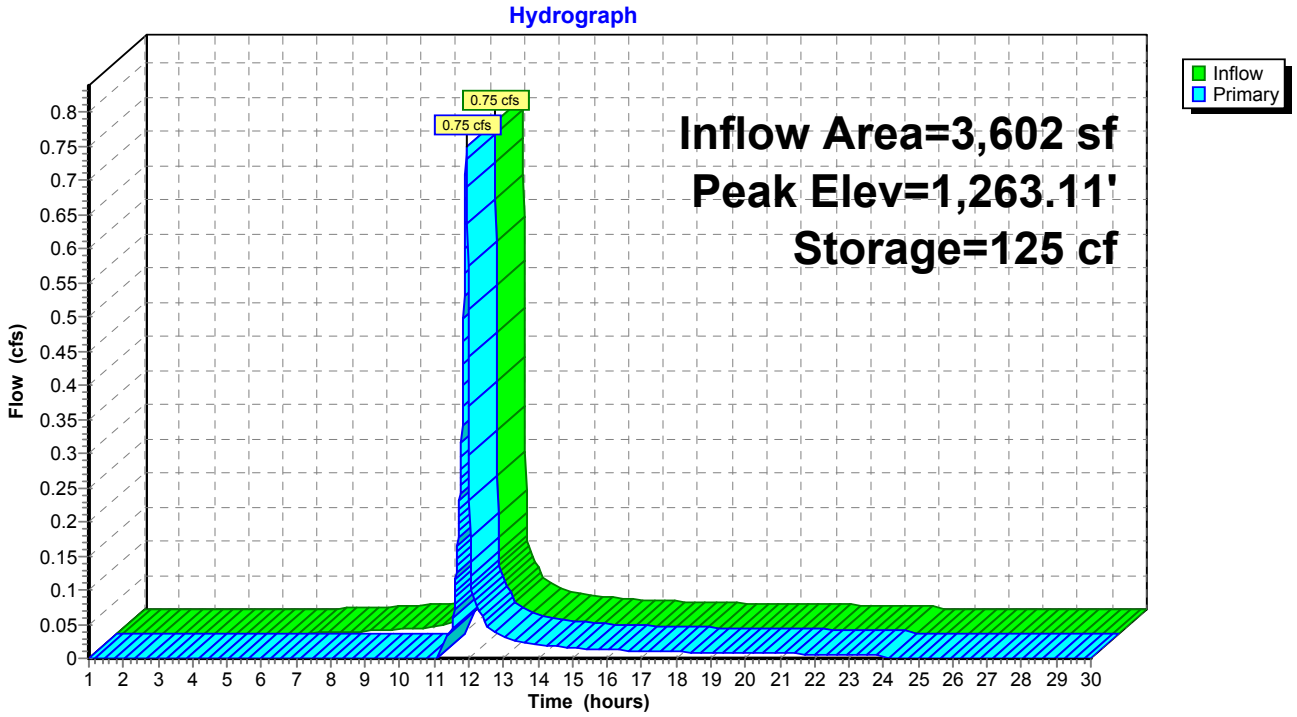
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	126 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	63
1,263.00	125
1,263.50	126

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.75 cfs @ 11.93 hrs HW=1,263.11' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.75 cfs @ 0.82 fps)

Pond 5P: VCI #1


Hydrograph
Inflow
Primary
0.75 cfs
0.75 cfs
Inflow Area=3,602 sf
Peak Elev=1,263.11'
Storage=125 cf
Flow (cfs)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Summary for Subcatchment 5S: DA TO MLV PAD

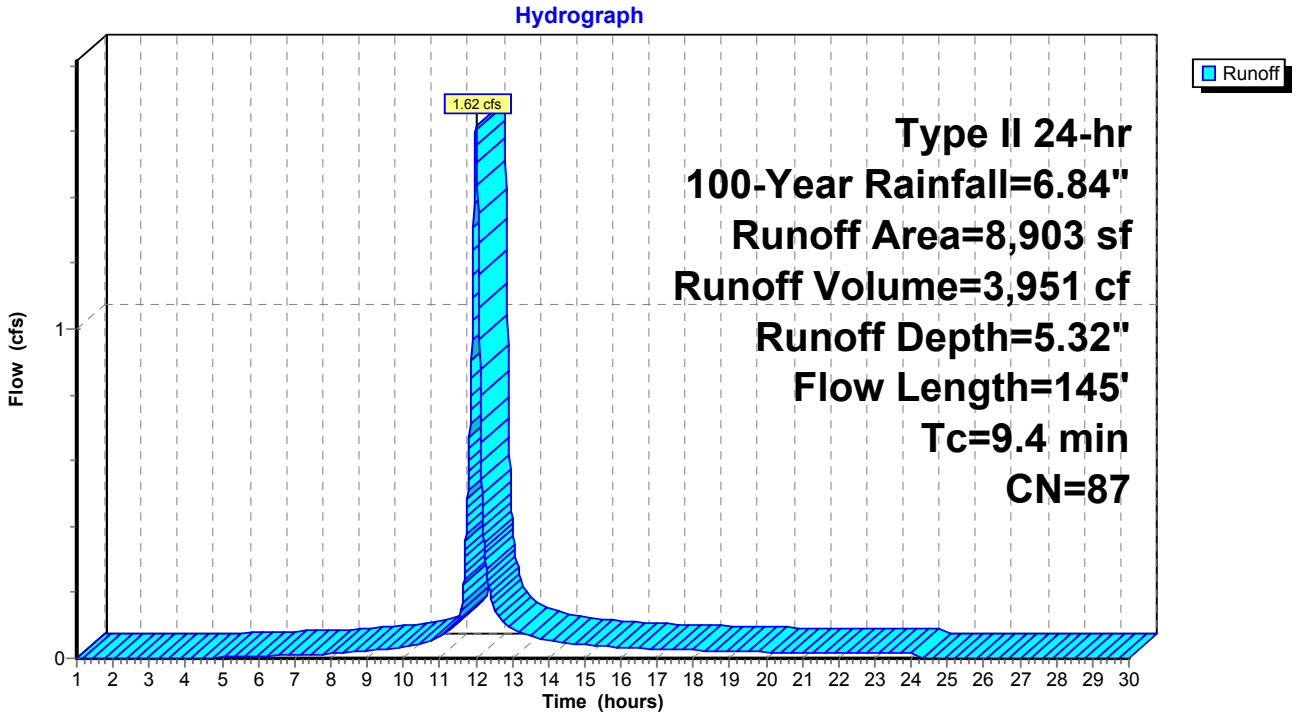
Runoff = 1.62 cfs @ 12.00 hrs, Volume= 3,951 cf, Depth= 5.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

	Area (sf)	CN	Description
	152	89	Gravel roads, HSG C
*	5,040	98	Crushed Stone Pad, HSG C
*	115	98	Paved roads , HSG C
*	3,596	71	Meadow Fair, HSG C
	0	70	Woods, Good, HSG C
	8,903	87	Weighted Average
	3,748		42.10% Pervious Area
	5,155		57.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0300	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.92"
3.2	46	0.2000	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
5.3	43	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.92"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	24	0.0100	1.61		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
9.4	145	Total			

Subcatchment 5S: DA TO MLV PAD



Summary for Pond 7P: MLV PAD

Inflow Area = 8,903 sf, 57.90% Impervious, Inflow Depth = 5.32" for 100-Year event
Inflow = 1.62 cfs @ 12.00 hrs, Volume= 3,951 cf
Outflow = 1.45 cfs @ 12.05 hrs, Volume= 2,751 cf, Atten= 10%, Lag= 2.6 min
Primary = 1.45 cfs @ 12.05 hrs, Volume= 2,751 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,264.65' @ 12.05 hrs Surf.Area= 4,644 sf Storage= 1,481 cf

Plug-Flow detention time= 164.4 min calculated for 2,751 cf (70% of inflow)
Center-of-Mass det. time= 68.2 min (858.2 - 790.1)

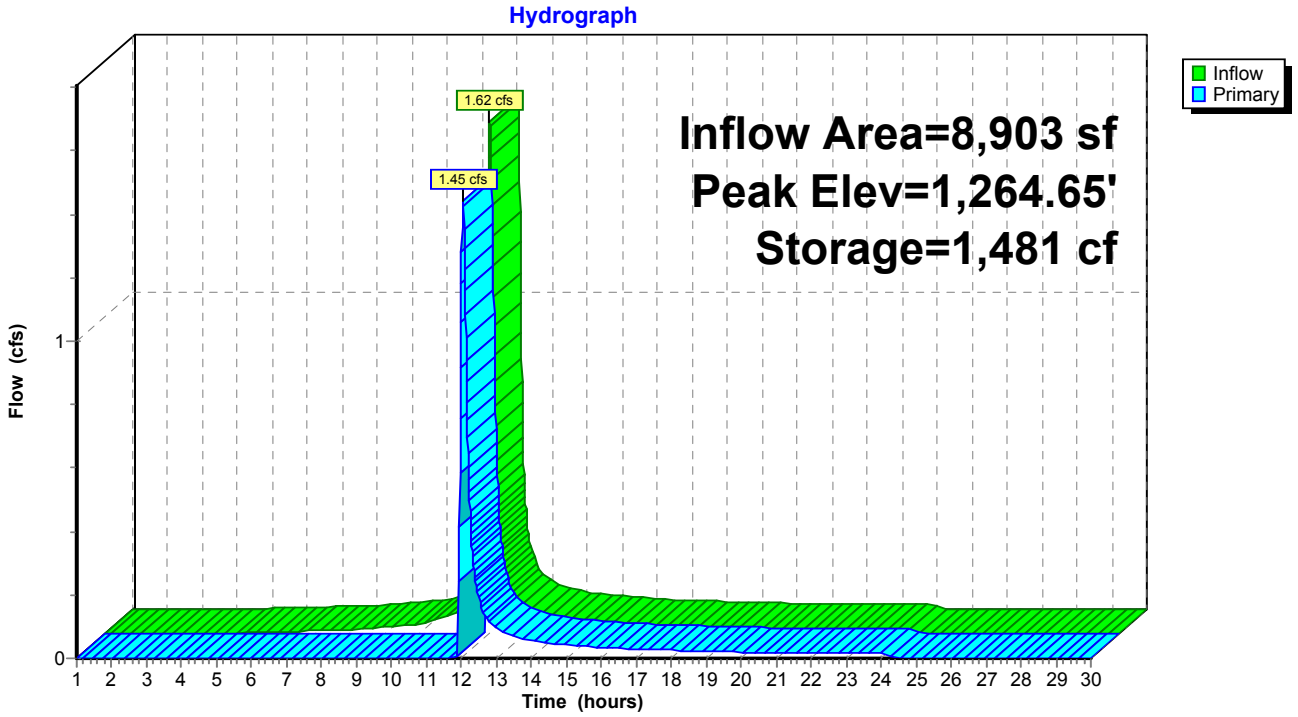
Volume	Invert	Avail.Storage	Storage Description
#1	1,263.00'	2,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,320 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,263.00	0	0	0
1,263.50	813	203	203
1,264.00	2,861	919	1,122
1,264.50	4,644	1,876	2,998
1,265.00	4,645	2,322	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	1,264.50'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.44 cfs @ 12.05 hrs HW=1,264.65' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 1.44 cfs @ 0.95 fps)

Pond 7P: MLV PAD



Summary for Subcatchment 7S: DA TO INFILTRATION BERM

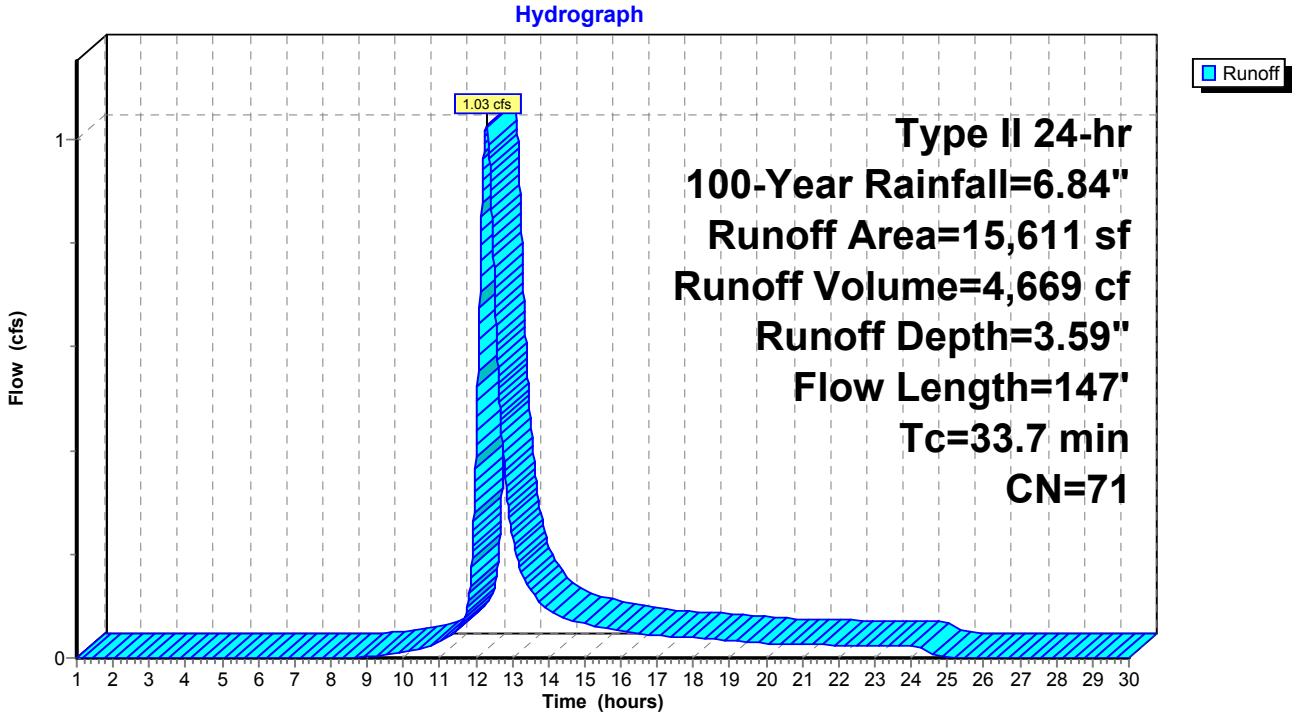
Runoff = 1.03 cfs @ 12.29 hrs, Volume= 4,669 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

Area (sf)	CN	Description
123	98	Paved parking, HSG C
10,225	70	Woods, Good, HSG C
5,263	71	Meadow, non-grazed, HSG C
15,611	71	Weighted Average
15,488		99.21% Pervious Area
123		0.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	100	0.0300	0.05		**Sheet Flow, Sheet1** Woods: Dense underbrush n= 0.800 P2= 2.92"
0.1	11	0.0700	1.32		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
0.3	36	0.0800	1.98		**Shallow Concentrated Flow, SC2** Short Grass Pasture Kv= 7.0 fps
33.7	147	Total			

Subcatchment 7S: DA TO INFILTRATION BERM



Summary for Pond 9P: INFILTRATION BERM

Inflow Area = 15,611 sf, 0.79% Impervious, Inflow Depth = 3.59" for 100-Year event
Inflow = 1.03 cfs @ 12.29 hrs, Volume= 4,669 cf
Outflow = 0.55 cfs @ 12.62 hrs, Volume= 2,588 cf, Atten= 47%, Lag= 19.9 min
Primary = 0.55 cfs @ 12.62 hrs, Volume= 2,588 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 6
Peak Elev= 1,271.01' @ 12.62 hrs Surf.Area= 2,367 sf Storage= 2,114 cf

Plug-Flow detention time= 220.3 min calculated for 2,588 cf (55% of inflow)
Center-of-Mass det. time= 101.9 min (954.1 - 852.2)

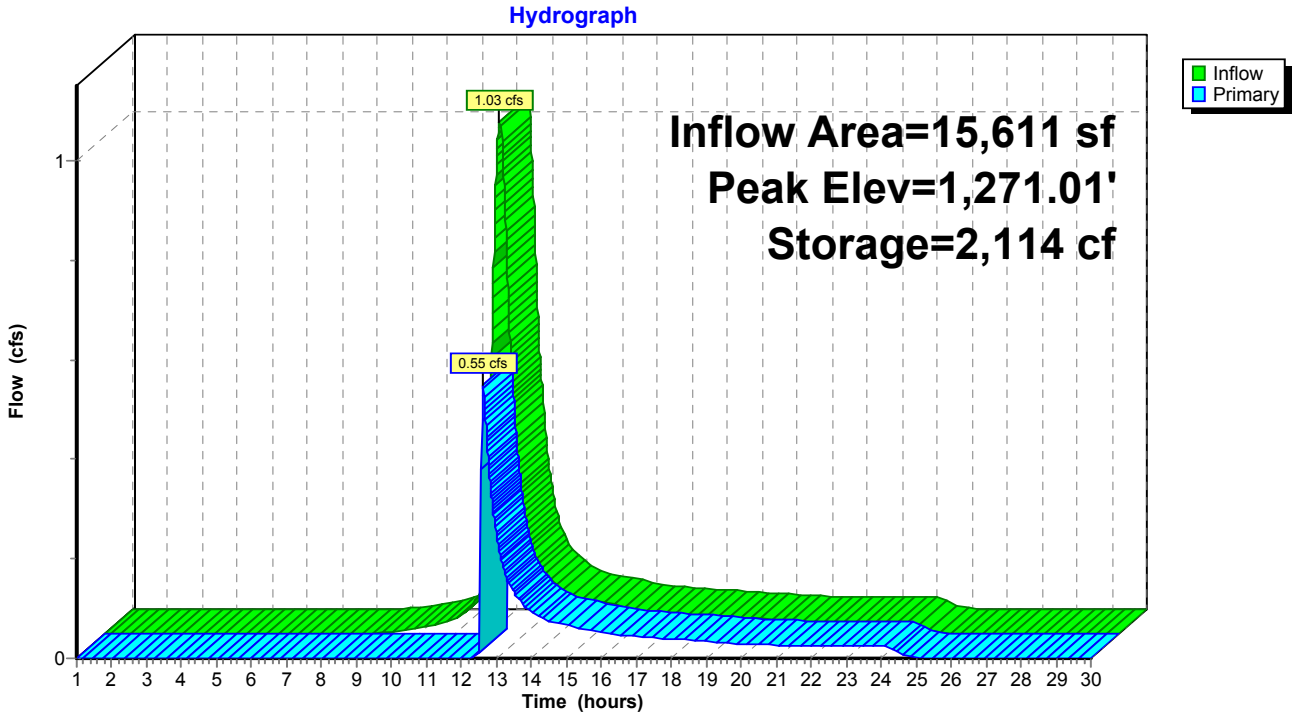
Volume	Invert	Avail.Storage	Storage Description
#1	1,269.00'	3,471 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,269.00	94	74.7	0	0	94
1,269.50	443	134.5	124	124	1,091
1,270.00	977	192.5	346	470	2,602
1,270.50	1,587	229.6	635	1,105	3,853
1,271.00	2,347	279.8	977	2,082	5,892
1,271.50	3,234	306.5	1,389	3,471	7,146

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**125.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.37 cfs @ 12.62 hrs HW=1,271.01' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.37 cfs @ 0.26 fps)

Pond 9P: INFILTRATION BERM



Summary for Subcatchment 10S: DA TO VCI #2

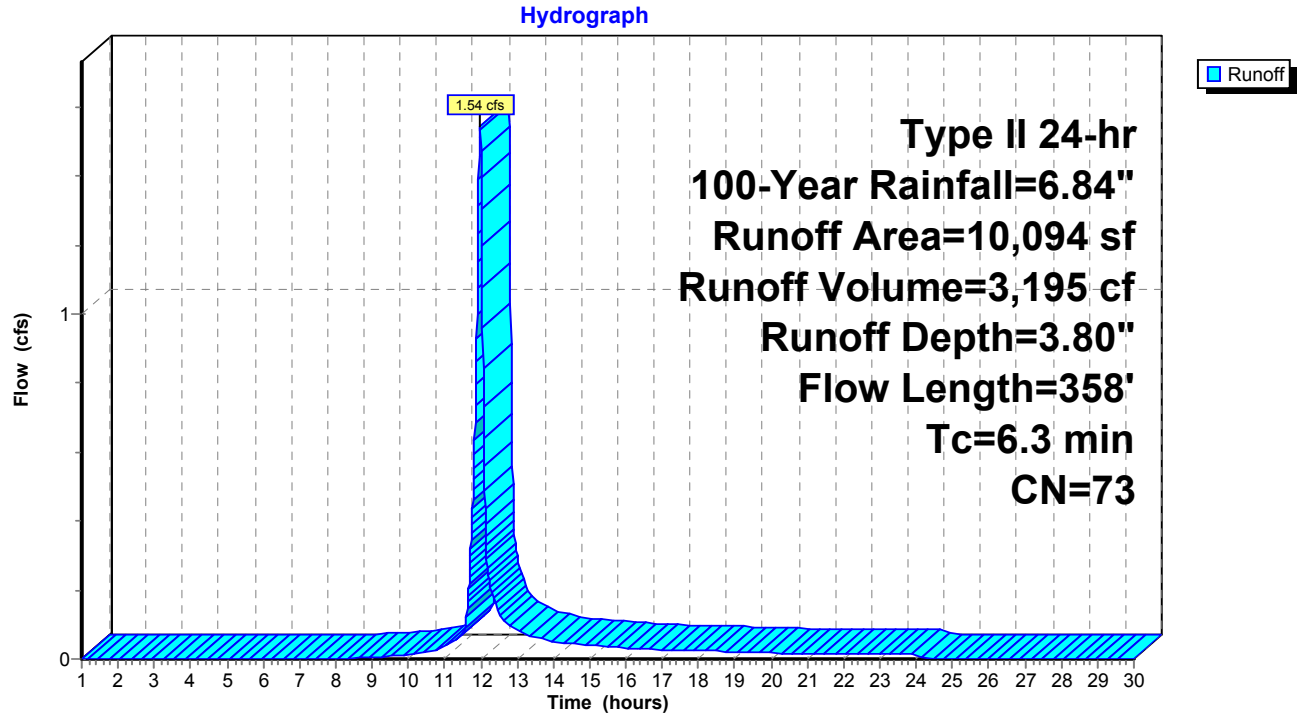
Runoff = 1.54 cfs @ 11.98 hrs, Volume= 3,195 cf, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

Area (sf)	CN	Description
647	98	Paved parking, HSG C
650	70	Woods, Good, HSG C
8,797	71	Meadow, non-grazed, HSG C
10,094	73	Weighted Average
9,447		93.59% Pervious Area
647		6.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0400	1.61		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
2.7	30	0.1300	0.19		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
0.1	9	0.1300	2.52		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
2.8	249	0.0100	1.50		**Shallow Concentrated Flow, SC2** Grassed Waterway Kv= 15.0 fps
6.3	358	Total			

Subcatchment 10S: DA TO VCI #2



Summary for Pond 11P: VCI #2

Inflow Area = 25,705 sf, 3.00% Impervious, Inflow Depth = 2.70" for 100-Year event
Inflow = 1.54 cfs @ 11.98 hrs, Volume= 5,782 cf
Outflow = 1.54 cfs @ 11.98 hrs, Volume= 5,436 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.54 cfs @ 11.98 hrs, Volume= 5,436 cf

Routing by Stor-Ind method, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs / 8
Peak Elev= 1,263.16' @ 11.98 hrs Surf.Area= 0 sf Storage= 350 cf

Plug-Flow detention time= 46.4 min calculated for 5,436 cf (94% of inflow)
Center-of-Mass det. time= 14.1 min (895.4 - 881.3)

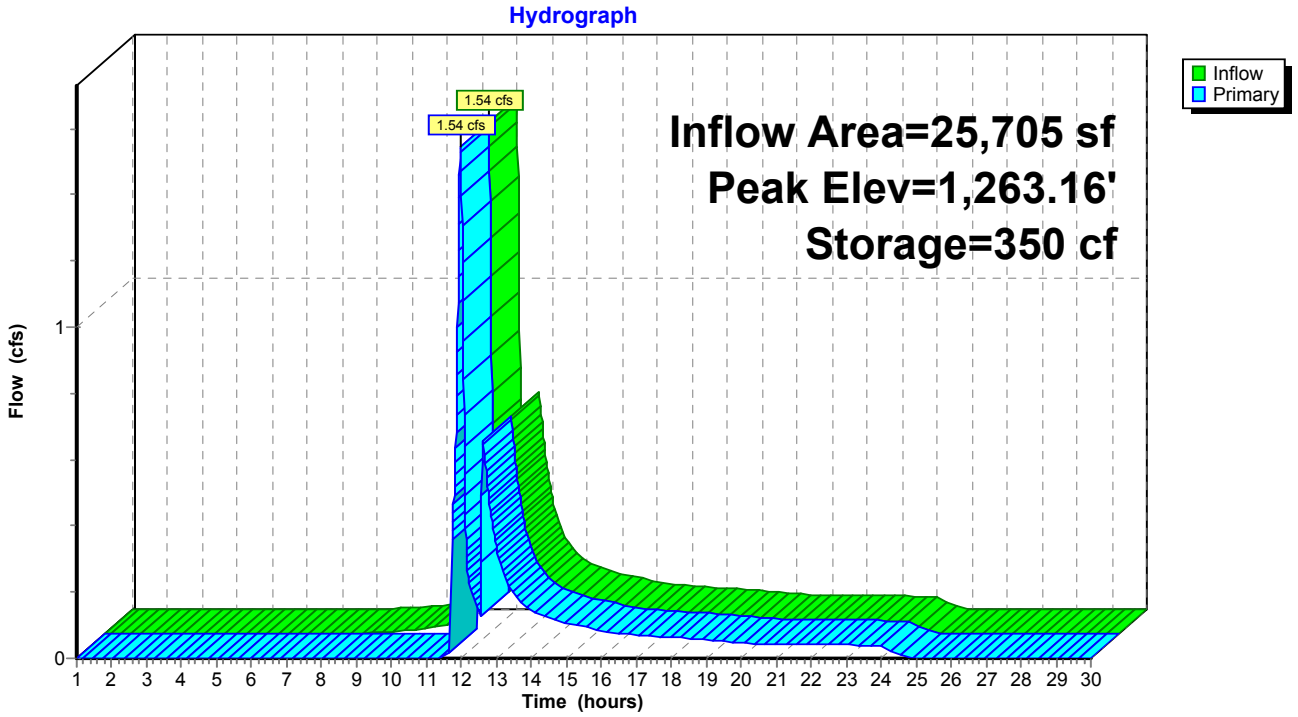
Volume	Invert	Avail.Storage	Storage Description
#1	1,262.00'	351 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,262.00	0
1,262.50	175
1,263.00	350
1,263.50	351

Device	Routing	Invert	Outlet Devices
#1	Primary	1,263.00'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.54 cfs @ 11.98 hrs HW=1,263.16' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.54 cfs @ 0.97 fps)

Pond 11P: VCI #2



Summary for Subcatchment 12S: OFFSITE DA

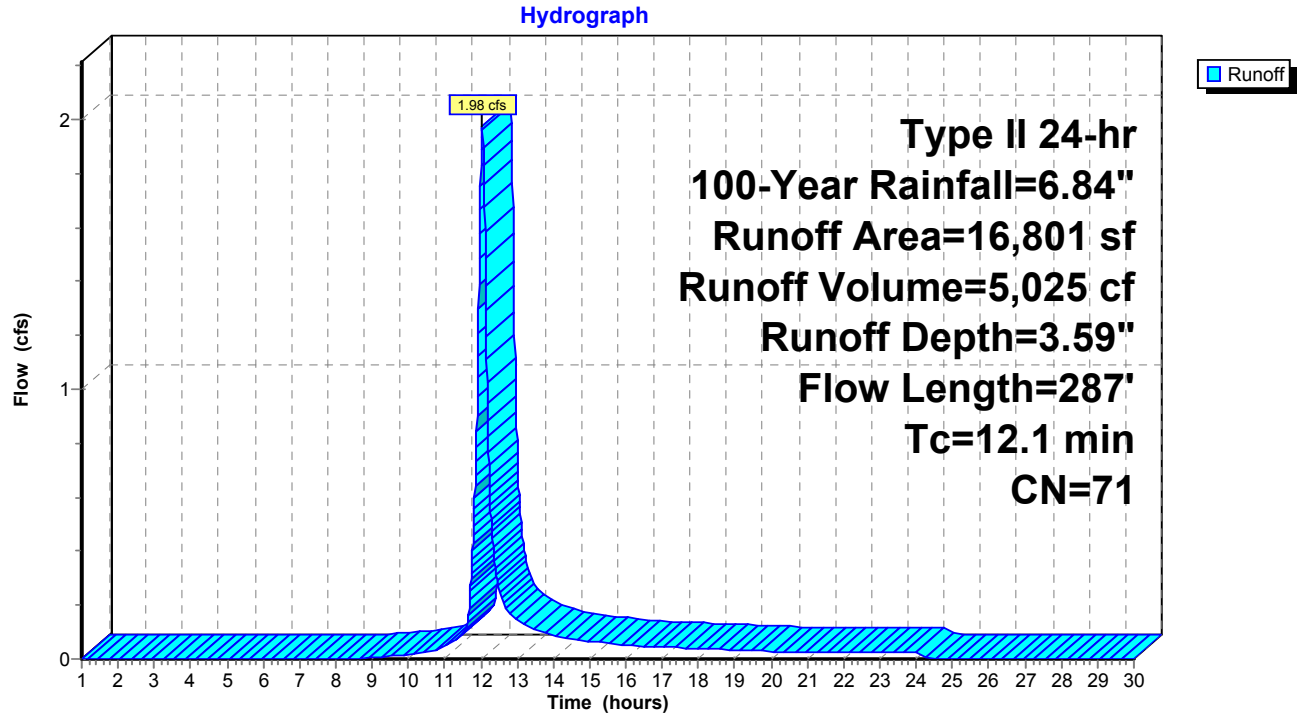
Runoff = 1.98 cfs @ 12.04 hrs, Volume= 5,025 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.84"

Area (sf)	CN	Description
555	98	Paved parking, HSG C
11,291	70	Woods, Good, HSG C
4,955	71	Meadow, non-grazed, HSG C
16,801	71	Weighted Average
16,246		96.70% Pervious Area
555		3.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	61	0.0400	1.57		**Sheet Flow, Sheet1** Smooth surfaces n= 0.011 P2= 2.92"
0.9	8	0.1300	0.14		**Sheet Flow, Sheet2** Grass: Dense n= 0.240 P2= 2.92"
7.3	31	0.1300	0.07		**Sheet Flow, Sheet3** Woods: Dense underbrush n= 0.800 P2= 2.92"
3.3	187	0.0350	0.94		**Shallow Concentrated Flow, SC1** Woodland Kv= 5.0 fps
12.1	287	Total			

Subcatchment 12S: OFFSITE DA

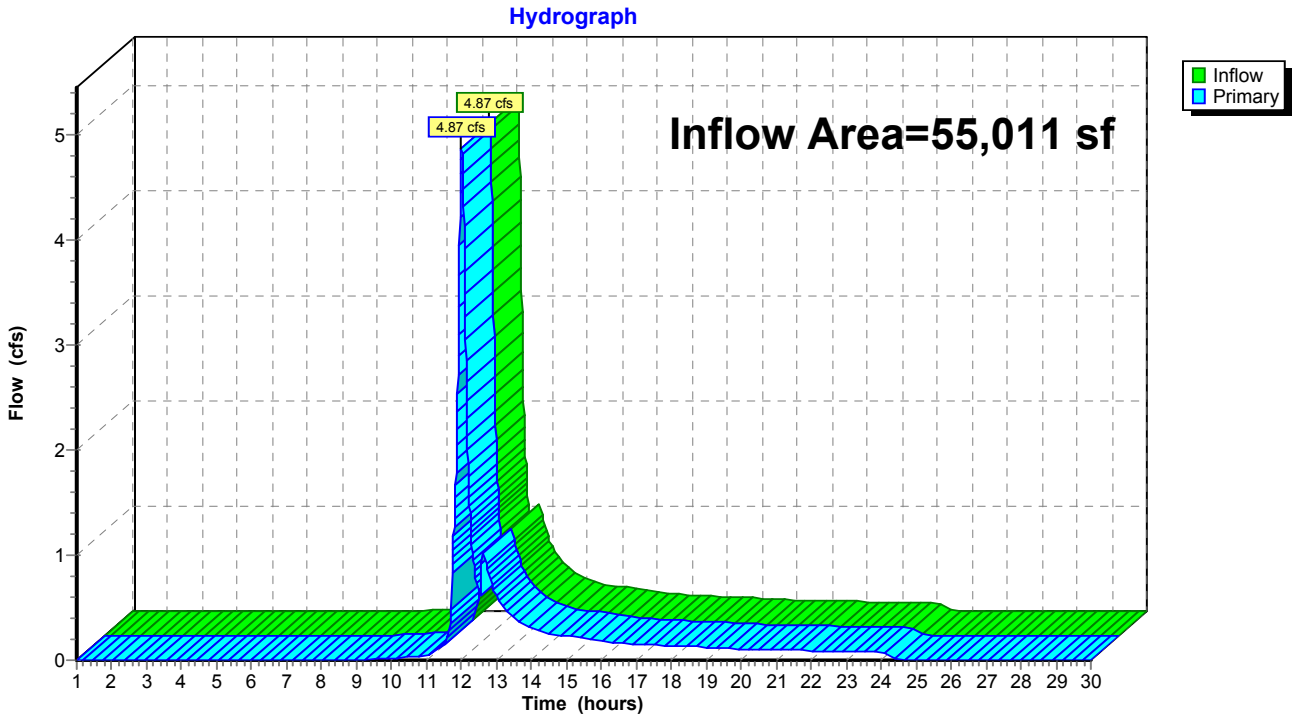


Summary for Link 13L: Proposed Conditions

Inflow Area = 55,011 sf, 12.62% Impervious, Inflow Depth = 3.16" for 100-Year event
Inflow = 4.87 cfs @ 12.01 hrs, Volume= 14,486 cf
Primary = 4.87 cfs @ 12.01 hrs, Volume= 14,486 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-30.00 hrs, dt= 0.01 hrs

Link 13L: Proposed Conditions



G.5 Conveyance Calculations

a. E&S Worksheet 11
b. NAG Swale Lining Analysis
c. Figure 9.3-Riprap Apron Design

E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Atlantic Sunrise

LOCATION: AR-LU-007.1 Vegetated Channel for Infiltration (VCI #1)

PREPARED BY: JMS ***REVISED BY: JMS*** DATE: 9/28/15 ***REV 09/19/16***

CHECKED BY: BJP ***CHECKED BY: SMK*** DATE: 9/28/15 ***REV 09/19/16***

CHANNEL OR CHANNEL SECTION		AR-LU-007.1 VCI Lining Only	AR-LU-007.1 VCI Lining/Grass
TEMPORARY OR PERMANENT?	(T OR P)	P	P
DESIGN STORM	(2, 5, OR 10 YR)	10	10
ACRES	(AC)	0.08	0.08
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	N/A	N/A
Qr (REQUIRED CAPACITY)	(CFS)	0.38	0.38
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.51	0.38
PROTECTIVE LINING[2]		S75	S75/Grass
n (MANNING'S COEFFICIENT)[2]		0.042	0.09
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.63	0.89
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	1.55	1.55
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.32	0.42
CHANNEL BOTTOM WIDTH	(FT)	2	2
CHANNEL SIDE SLOPES	(H:V)	3	3
D (TOTAL DEPTH)	(FT)	1.5	1.5
CHANNEL TOP WIDTH @ D	(FT)	11	11
d (CALCULATED FLOW DEPTH)	(FT)	0.13	0.17
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	2.78	3.02
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	15.38	11.76
d50 STONE SIZE	(IN)	N/A	N/A
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.31	0.43
R (HYDRAULIC RADIUS)		0.11	0.14
S (BED SLOPE)[3]	(FT/FT)	0.04	0.04
Sc (CRITICAL SLOPE)	(FT/FT)	0.054	0.232
.7Sc	(FT/FT)	0.038	0.162
1.3Sc	(FT/FT)	0.071	0.302
STABLE FLOW?	(Y/N)	N	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.02	0.0
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.5
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.5
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS	(S)	S	S

EQUIVALENT PIPE CALCULATION:

Q	n	s (ft/ft)	D (ft.)	D (in)	Round up to:
0.51	0.013	0.04	0.370	4.443	**12" pipe**

D = ((Q*n/(S^(1/2)*Pi*0.1478))^3/8)

Pipe Equivalence Calculation for Sizing Rip Rap Apron:

Use Manning's Equation

Q = (1.49/n)*A*(R^2/3)*(S^1/2)

Q = Flow Rate from Worksheet 11 (cfs)

n = Manning's Constant for Smooth Plastic Pipe = 0.013 (unitless)

A = Area of Pipe (ft) = 0.25 * Pi * D^2

D = Diameter of Pipe (ft)

R = Hydraulic Radius = A / P = (0.25 * Pi * D^2) / (Pi * D) = 0.25 * D

P = Perimeter of Pipe (ft) = Pi * D

S = Slope of channel from Worksheet 11 (ft/ft)

Solve Manning's Equation for Diameter of Pipe:

Q = (1.49/n)*A*(R^2/3)*(S^1/2)

Q = (1.49/n)*(0.25*Pi*D^2)*((0.25*D)^2/3)*(S^1/2)

Q*n*/(1.49*S^(1/2))=(0.25*Pi*D^2)*((0.25*D)^2/3)

Q*n*/(1.49*S^(1/2)*0.25*(0.25^2/3))=(Pi*D^2)*(D^2/3)

Q*n*/(S^(1/2)*Pi*0.1478)=(D^2)*(D^2/3)

Q*n*/(S^(1/2)*Pi*0.1478)=(D^8/3)

(Q*n*/(S^(1/2)*Pi*0.1478))^3/8=D

Multiply by 12 to convert feet to inches:

D = ((Q*n/(S^(1/2)*Pi*0.1478))^3/8) * 12

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

E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Atlantic Sunrise

LOCATION: AR-LU-007.1 Vegetated Channel for Infiltration #2 (VCI #2)

PREPARED BY: JMS ***REVISED BY: JMS*** DATE: 9/28/15 ***REV 09/19/16***

CHECKED BY: BJP ***CHECKED BY: SK*** DATE: 9/28/15 ***REV 09/19/16***

CHANNEL OR CHANNEL SECTION		AR-LU-007.1 VCI #2 Lining Only	AR-LU-007.1 VCI #2 Lining/Grass
TEMPORARY OR PERMANENT?	(T OR P)	P	P
DESIGN STORM	(2, 5, OR 10 YR)	10	10
ACRES	(AC)	0.23	0.23
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	N/A	N/A
Qr (REQUIRED CAPACITY)	(CFS)	0.67	0.67
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.68	0.68
PROTECTIVE LINING[2]		S75	S75/Grass
n (MANNING'S COEFFICIENT)[2]		0.043	0.12
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.10	0.53
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	1.55	1.55
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.14	0.25
CHANNEL BOTTOM WIDTH	(FT)	2	2
CHANNEL SIDE SLOPES	(H:V)	3	3
D (TOTAL DEPTH)	(FT)	1.5	1.5
CHANNEL TOP WIDTH @ D	(FT)	11	11
d (CALCULATED FLOW DEPTH)	(FT)	0.23	0.40
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.38	4.40
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	8.70	5.00
d50 STONE SIZE	(IN)	N/A	N/A
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.62	1.28
R (HYDRAULIC RADIUS)		0.18	0.28
S (BED SLOPE)[3]	(FT/FT)	0.01	0.01
Sc (CRITICAL SLOPE)	(FT/FT)	0.049	0.329
.7Sc	(FT/FT)	0.034	0.230
1.3Sc	(FT/FT)	0.063	0.428
STABLE FLOW?	(Y/N)	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.02	0.0
FREEBOARD BASED ON STABLE FLOW	(FT)	0.50	0.5
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.50	0.5
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS	(S)	S	S

EQUIVALENT PIPE CALCULATION:

Q	n	s (ft/ft)	D (ft.)	D (in)	Round up to:
0.68	0.013	0.01	0.537	6.442	**12" pipe**

D = ((Q*n/(S^(1/2)*Pi*0.1478))^3/8)

Pipe Equivalence Calculation for Sizing Rip Rap Apron:

Use Manning's Equation

Q = (1.49/n)*A*(R^2/3)*(S^1/2)

Q = Flow Rate from Worksheet 11 (cfs)

n = Manning's Constant for Smooth Plastic Pipe = 0.013 (unitless)

A = Area of Pipe (ft) = 0.25 * Pi * D^2

D = Diameter of Pipe (ft)

R = Hydraulic Radius = A / P = (0.25 * Pi * D^2) / (Pi * D) = 0.25 * D

P = Perimeter of Pipe (ft) = Pi * D

S = Slope of channel from Worksheet 11 (ft/ft)

Solve Manning's Equation for Diameter of Pipe:

Q = (1.49/n)*A*(R^2/3)*(S^1/2)

Q = (1.49/n)*(0.25*Pi*D^2)*((0.25*D)^2/3)*(S^1/2)

Q*n*/(1.49*S^(1/2))=(0.25*Pi*D^2)*((0.25*D)^2/3)

Q*n*/(1.49*S^(1/2)*0.25*(0.25^2/3))=(Pi*D^2)*(D^2/3)

Q*n*/(S^(1/2)*Pi*0.1478)=(D^2)*(D^2/3)

Q*n*/(S^(1/2)*Pi*0.1478)=(D^8/3)

(Q*n*/(S^(1/2)*Pi*0.1478))^3/8=D

Multiply by 12 to convert feet to inches:

D = ((Q*n/(S^(1/2)*Pi*0.1478))^3/8) * 12

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

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
Fax 812.867.0247
www.nagreen.com

Control Materials Design Software
Version 5.0

Project Name: ASR Access Roads
Project Number: 63544
Channel Name: AR-LU-007.1 VCI #1

Discharge	0.38
Peak Flow Period	24
Channel Slope	0.04
Channel Bottom Width	2
Left Side Slope	3
Right Side Slope	3
Low Flow Liner	
Retardance Class	C
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Silt Loam

S75

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
S75 Unvegetated	Straight	0.38 cfs	1.24 ft/s	0.13 ft	0.055	1.55 lbs/ft2	0.32 lbs/ft2	4.81	STABLE	D

Unreinforced Vegetation - Class C - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	0.38 cfs	0.44 ft/s	0.3 ft	0.25	4.2 lbs/ft2	0.75 lbs/ft2	5.61	STABLE	--
Underlying Substrate	Straight	0.38 cfs	0.44 ft/s	0.3 ft	--	0.04 lbs/ft2	0.001 lbs/ft2	48.11	STABLE	--

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
Fax 812.867.0247
www.nagreen.com

Control Materials Design Software
Version 5.0

Project Name: ASR Access Roads
Project Number: 63544
Channel Name: AR-LU-007.1 VCI #2

Discharge	0.67
Peak Flow Period	24
Channel Slope	0.01
Channel Bottom Width	2
Left Side Slope	3
Right Side Slope	3
Low Flow Liner	
Retardance Class	C
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Silt Loam

S75

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
S75 Unvegetated	Straight	0.67 cfs	1.09 ft/s	0.23 ft	0.043	1.55 lbs/ft2	0.14 lbs/ft2	10.88	STABLE	D

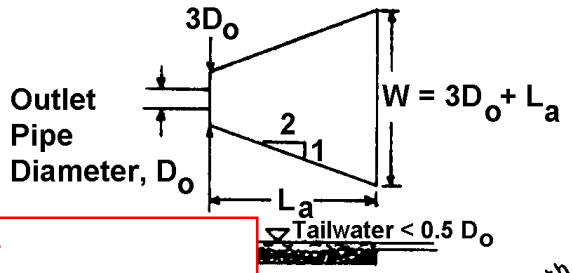
Unreinforced Vegetation - Class C - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	0.67 cfs	1.09 ft/s	0.23 ft	0.043	4.2 lbs/ft2	0.14 lbs/ft2	29.48	STABLE	--
Underlying Substrate	Straight	0.67 cfs	1.09 ft/s	0.23 ft	--	0.04 lbs/ft2	0.005 lbs/ft2	7.47	STABLE	--

PAR-LU-007.1 VCI #1
Q(10)=0.40 cfs, 12" pipe

Adapted from USDA - NRCS

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



Do=1'**
3Do=3'**
La=6' **
W=9'**
Rt=9"
Riprap R-Size=R-3**

363-2134-008 / March 31, 2012

NOT

ed for Box Cu

Check Velocity

Riprap R-Size: R-3

Maximum Velocity from Table 6.6 of E&S Manual: 6.5 ft/s

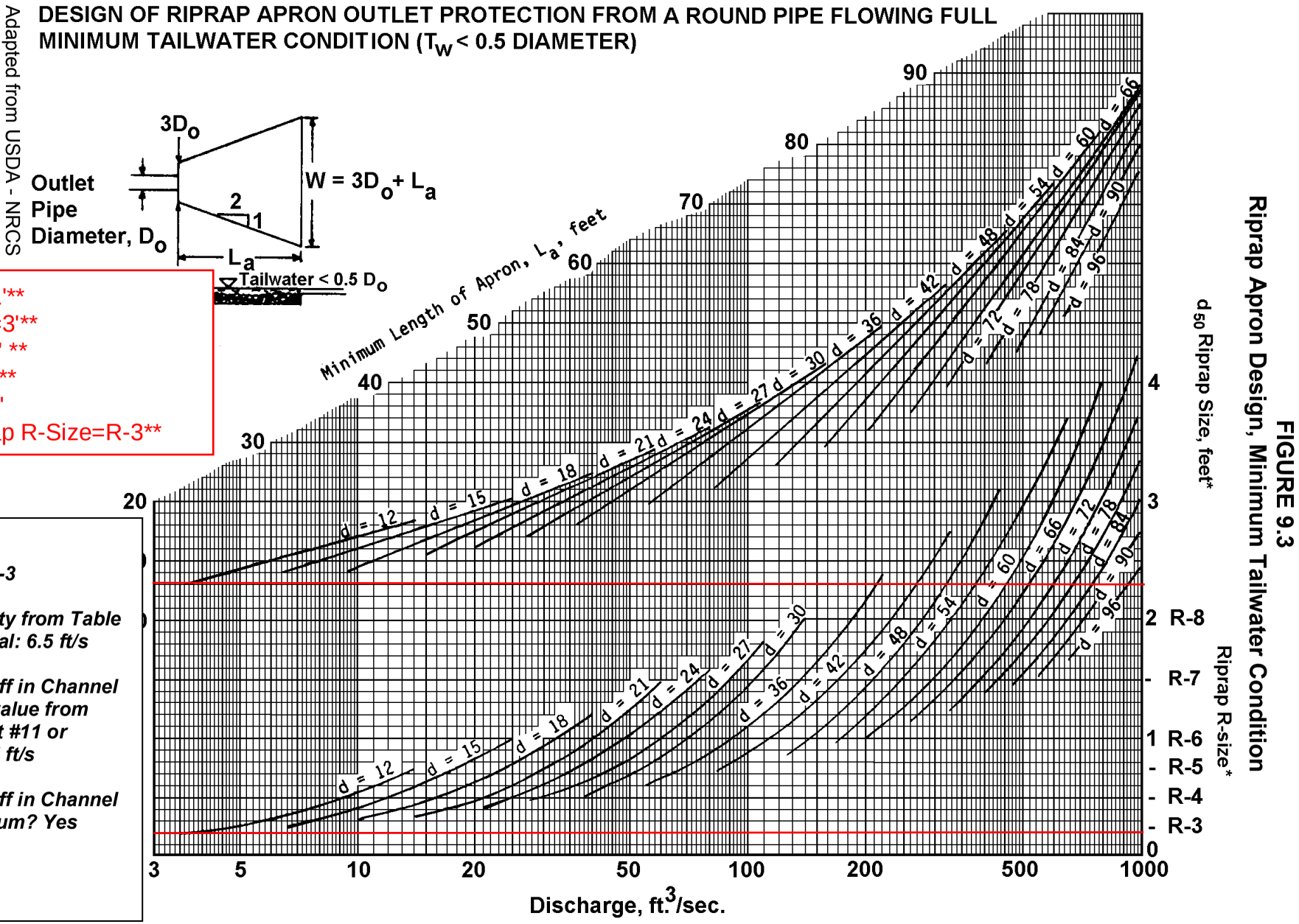
Velocity of Runoff in Channel from Worksheet #11: 1.55 ft/s

Velocity of Runoff in Channel less than Maximum? Yes

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.
**DIMENSIONS BASED ON MINIMUM SIZING CRITERIA FROM CHART

PAR-LU-007.1 VCI #2
Q(10)=0.68 cfs, 12" pipe



Do=1'**
3Do=3'**
La=6' **
W=9'**
Rt=9"
Riprap R-Size=R-3**

Check Velocity

Riprap R-Size: R-3

Maximum Velocity from Table 6.6 of E&S Manual: 6.5 ft/s

Velocity of Runoff in Channel (larger velocity value from either Worksheet #11 or HydroCAD): 1.15 ft/s

Velocity of Runoff in Channel less than Maximum? Yes

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

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

**DIMENSIONS BASED ON MINIMUM SIZING CRITERIA FROM CHART

363-2134-008 / March 3

G.6 PCSM BMP Calculations

a. Check Dam Volume Calculations

ATLANTIC SUNRISE NATURAL GAS PIPELINE PROJECT
(ACCESS ROAD) VEGETATED CHANNEL CHECKDAM VOLUME
PAR LU-007.1-Vegetated Channel for Infiltration #1

8/8/2016

TOTAL REACH VOLUME = 125 CF Width (W_B): 2 FT. Depth (H): 1 FT.

VEGETATED CHANNEL PAR-LU-007.1

ROAD STA 1+34 to 2+84

Input data

S =	0.040	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

$L_{storage}$ =	25	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	63	cf
$L_{spacing}$ =	30	ft
No. of Check Dams =	2	
Subreach Volume =	125	CF

ATLANTIC SUNRISE NATURAL GAS PIPELINE PROJECT
(ACCESS ROAD) VEGETATED CHANNEL CHECKDAM VOLUME
PAR LU-007.1-Vegetated Channel for Infiltration #2

8/8/2016

TOTAL REACH VOLUME = 250 CF Width (W_B): 2 FT. Depth (H): 1 FT.

VEGETATED CHANNEL PAR-LU-007.1

ROAD STA 0+00 to 1+75

Input data

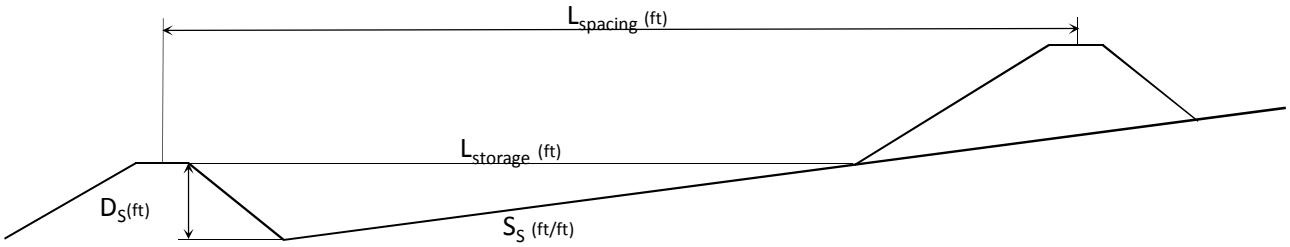
S =	0.010	ft/ft
H =	1	ft
W_B =	2	
z_1 =	3	
z_2 =	3	

Output data

$L_{storage}$=	100	ft
W_T =	8	ft
$W_T + W_B$ =	10	ft
V =	250	cf
$L_{spacing}$ =	105	ft
No. of Check Dams =	1	
Subreach Volume =	250	CF

EARTHEN CHECK DAM INFILTRATION VOLUME AND SPACING

Per the Pennsylvania Stormwater BMP Manual (pg 94), the minimum spacing ($L_{spacing}$) of check dams is determined by the length of the storage volume ($L_{storage}$) and the length to the check dam center line. The length of the storage volume is calculated by dividing the height of the rock filter (D_S) by the slope of the channel (S_S):



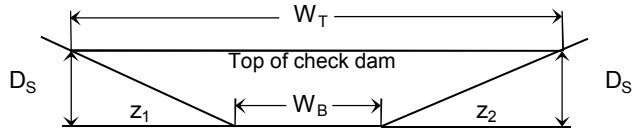
$L_{storage} = D_S / S_S$

Where: $L_{storage}$ = Storage Length
S_S = Channel slope
D_S = Height of the check dam

$L_{spacing} = L_{storage} + [(D_S+1)/(-S_S+0.5)]$

Where: $L_{spacing}$ = Check Dam Spacing
$L_{storage}$ = Storage Length
S_S = Channel slope
D_S = Height of the check dam

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



$V_S = 0.25 \times L_{storage} \times D_S \times (W_T + W_B)$

Where:

$L_{storage}$ = Storage Length
D_S = Height of check dam
W_T = check dam top width
W_B = check dam bottom width

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

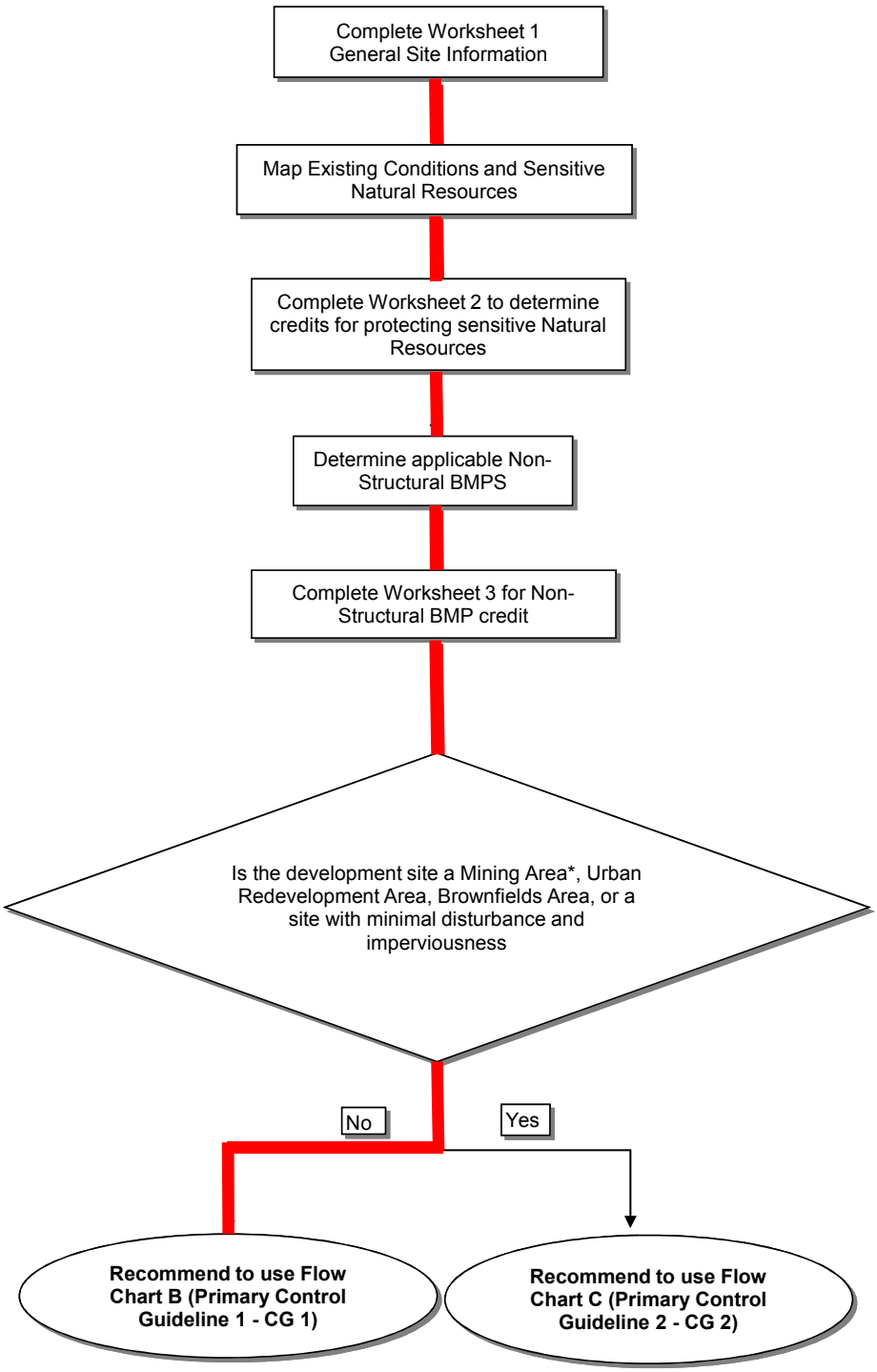
$W_T = W_B + z_1 + z_2$

Where: W_B = check dam bottom width
z_1 = side slope
z_2 = side slope

G.7 Water Quality Worksheets

a. Flow Chart A – Stormwater Calculation Process
b. Worksheet 1. General Site Information
c. Worksheet 2. Sensitive Natural Resources
d. Worksheet 3. Nonstructural BMP Credits
e. Flow Chart B – Control Guideline 1 Process
f. Worksheet 4. Change in Runoff Volume for 2-Yr Storm Event
g. Worksheet 5. Structural BMP Volume Credits
h. Worksheet 10. Water Quality Compliance for Nitrate
i. Worksheet 11. BMPs for Pollution Prevention
j. Worksheet 12. Water Quality Analysis of Pollutant Loading from All Disturbed Areas
k. Worksheet 13. Pollutant Reduction Through BMP Applications

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 28-Feb-16

Project Name: Atlantic Sunrise Pipeline AR-LU-007.1

Municipality: Fairmount Township

County: Luzerne

Total Area (acres): 0.50

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

Watershed: Fishing Creek

Sub-Basin: Upper Central Susquehanna River

Nearest Surface Water(s) to Receive Runoff: UNT to Maple Run

Chapter 93 - Designated Water Use: HQ-CWF, MF
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	
No	X

List Causes of Impairment:

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	X
No	

Existing River Conservation Plan?
http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/

Yes	
No	X

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

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

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

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

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

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A	0.00	0.00
Floodplains	N/A	0.00	0.00
Riparian Areas	N/A	0.00	0.00
Wetlands	N/A	0.00	0.00
Woodlands	N/A	0.00	0.00
Natural Drainage Ways	N/A	0.00	0.00
Steep Slopes, 15% - 25%	N/A	0.00	0.00
Steep Slopes, over 25%	N/A	0.00	0.00
Other:	N/A	0.00	0.00
Other:	N/A	0.00	0.00
TOTAL EXISTING:		0.00	0.00

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

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

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

3.1 Area of Minimum Disturbance/Reduced Grading 0.00 **Ac.**

TOTAL 0.00 **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
0.50	-	0.00	=	0.50

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

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

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

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

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

For Trees within 20 feet of impervious area:

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

5.1 Disconnect Roof Leaders to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

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

For all other disconnected roof areas

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

5.2 Disconnect Non-Roof impervious to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

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

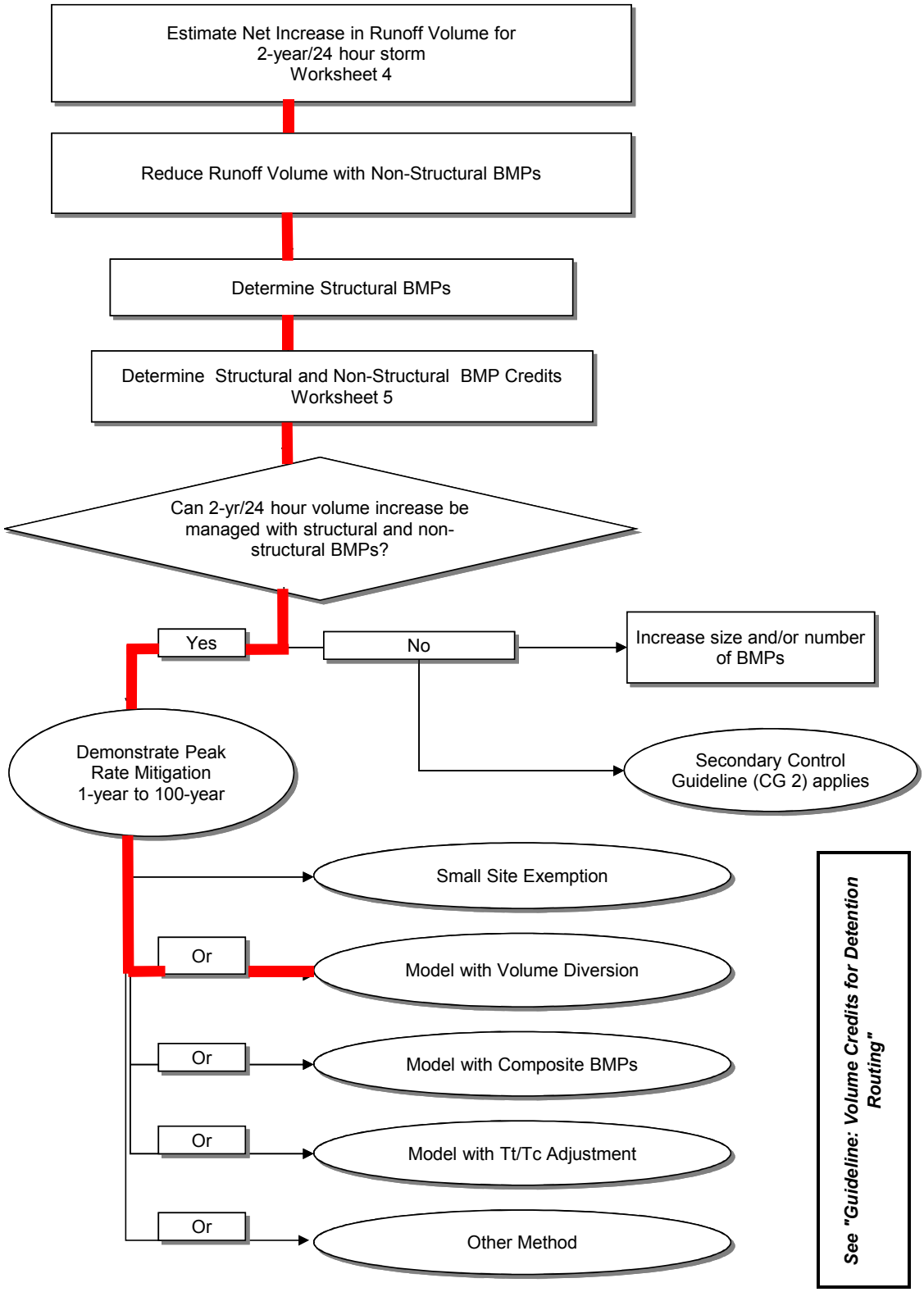
For all other disconnected roof areas

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 Pipeline AR-LU-007.1
DA: 1.26 acres
2-Year Rainfall: 2.88 in

Total Site Area:	0.50	**acres**	**NOTE: The total area for Worksheet 4 is equal to the Total Site Area (Limit of Grading) show on the drainage area maps.**
Protected Site Area:	0.00	**acres**	
Managed Area	0.50	**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)
Impervious	C	-	-	98	0.20	0.04	2.65	-
Meadow	C	10,821	0.25	71	4.08	0.82	0.69	624
Woods	C	10,839	0.25	70	4.29	0.86	0.65	586
Gravel	C	-	-	89	1.24	0.25	1.79	-
TOTAL:		21,660	0.50					1,210

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)
Impervious	C	-	-	98	0.20	0.04	2.65	-
Meadow	C	15,202	0.35	71	4.08	0.82	0.69	877
Woods	C	-	-	70	4.29	0.86	0.65	-
Gravel	C	6,459	0.15	89	1.24	0.25	1.79	964
TOTAL:		21,661	0.50					1,841

2-Year Volume Increase (ft^3)	**631**

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 Pipeline AR-LU-007.1
SUB-BASIN: Upper Central Susquehanna River

Required Control Volume (ft^3) - *from Worksheet 4* :		631
Non-structural Volume Credit (ft^3) - *from Worksheet 3* :	-	0
Structural Volume Reqmt (ft^3)		631

(Required Control Volume minus Non-structural Credit)

	Proposed BMP	Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		901
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		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check Dams in Vegetated Swales		475
	Storage in 24" stone MLV pad		1,202

Total Structural Volume (ft^3):	2,578
Structural Volume Requirement (ft^3):	631
DIFFERENCE	1,947

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		X
NS BMP 5.5.4 - Cluster Uses at Each Site		X
NS BMP 5.6.1 - Minimize Total Disturbed Area		X
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native		X
NS BMP 5.9.1 - Street Sweeping / Vacuuming		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
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		X
NS BMP 5.6.2 - Minimize Soil Compaction		X
Structural BMP 6.4.5 - Rain Garden / Bioretention		X
Structural BMP 6.4.8 - Vegetated Swale		X
Structural BMP 6.4.9 - Vegetated Filter Strip		X
Structural BMP 6.6.1 - Constructed Wetland		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration		X
Structural BMP 6.7.3 - Soils Amendment/Restoration		X

WORKSHEET 11. BMPS FOR POLLUTION PREVENTION

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

BMPs FOR POLLUTANT PREVENTION:

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

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

TOTAL SITE AREA (AC)	**0.50**
TOTAL DISTURBED AREA (AC)	**0.50**
DISTURBED AREA CONTROLLED BY BMPs (AC)	**0.45**

NOTE: Worksheet 12 calculates the pollutant loading for the actual disturbed area shown as the "Total Site Area (Limit of Grading)" on the drainage area maps.

TOTAL DISTURBED AREAS:

		POLLUTANT					POLLUTANT LOAD		
	LAND COVER CLASSIFICATION	**TSS EMC *(mg/l)***	**TP EMC *(mg/l)***	**Nitrate-Nitrite EMC *(mg/l as N)***	**COVER (Acres)**	**RUNOFF VOLUME (Acre-Feet)**	**TSS** (LBS)**	**TP** (LBS)**	**NO_3 (LBS)**
Pervious Surfaces	Forest	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00
	Meadow	47	0.19	0.3	0.35	0.02	2.56	0.01	0.02
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.15	0.02	3.47	0.01	0.02
						TOTAL LOAD	6.02	0.02	0.04
						REQUIRED REDUCTION (%)	**85%**	**85%**	**50%**
						REQUIRED REDUCTION (LBS)	5.12	0.02	0.02

* Pollutant Load = [EMC, mg/l] X [Volume, Acre-Feet] X [2.7, Unit Conversion]

** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Infiltration Berm**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	0.36

NOTE: Worksheet 13 calculates the pollutant reduction based on the drainage area to each BMP. As shown on the drainage area maps, the total drainage areas are larger than the "Total Site Area (Limit of Grading)".

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17	0.23	0.01	1.43	0.01	0.01
	Meadow	47	0.19	0.30	0.12	0.01	0.88	0.00	0.01
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.00	0.00	0.13	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00
	TOTAL LOAD TO THIS BMP TYPE						2.44	0.01	0.01
	POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)						**85%**	**85%**	**30%**
	POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)						2.07	0.01	0.00

	TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*2.07*	*0.01*	*0.00*
REQUIRED REDUCTION FROM WS12 (LBS)	*5.12*	*0.02*	*0.02*

Remaining Reduction

TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
3.05	*0.01*	*0.02*

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Vegetated Channel for Infiltration #1**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	0.08

NOTE: Worksheet 13 calculates the pollutant reduction based on the drainage area to each BMP. As shown on the drainage area maps, the total drainage areas are larger than the "Total Site Area (Limit of Grading)".

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00
	Meadow	47	0.19	0.30	0.04	0.00	0.31	0.00	0.00
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.01	0.00	0.49	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.03	0.00	0.68	0.00	0.00
						TOTAL LOAD TO THIS BMP TYPE	1.48	0.00	0.01
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)	**85%**	**85%**	**30%**
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	1.26	0.00	0.00

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*3.33*	*0.01*	*0.01*
REQUIRED REDUCTION FROM WS12 (LBS)	*5.12*	*0.02*	*0.02*

Remaining Reduction

TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
1.79	*0.00*	*0.01*

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Vegetated Channel for Infiltration #2**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	0.23

NOTE: Worksheet 13 calculates the pollutant reduction based on the drainage area to each BMP. As shown on the drainage area maps, the total drainage areas are larger than the "Total Site Area (Limit of Grading)".

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17	0.01	0.00	0.09	0.00	0.00
	Meadow	47	0.19	0.30	0.20	0.01	1.48	0.01	0.01
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.01	0.00	0.68	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.00	0.00	0.00	0.00	0.00
						TOTAL LOAD TO THIS BMP TYPE	2.25	0.01	0.01
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)	**85%**	**85%**	**30%**
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	1.91	0.01	0.00

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*5.24*	*0.02*	*0.01*
REQUIRED REDUCTION FROM WS12 (LBS)	*5.12*	*0.02*	*0.02*

Remaining Reduction

TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
-0.12	*0.00*	*0.01*

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13 - POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: **Storage in 18" MLV Pad**

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	0.19

NOTE: Worksheet 13 calculates the pollutant reduction based on the drainage area to each BMP. As shown on the drainage area maps, the total drainage areas are larger than the "Total Site Area (Limit of Grading)".

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00
	Meadow	47	0.19	0.30	0.08	0.00	0.60	0.00	0.00
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.00	0.00	0.00	0.00	0.00
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surfaces	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.00	0.00	0.12	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	0.12	0.02	2.79	0.01	0.02
						TOTAL LOAD TO THIS BMP TYPE	3.51	0.01	0.02
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE A-4 (%)	**85%**	**85%**	**30%**
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	2.99	0.01	0.01

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	*8.23*	*0.03*	*0.02*
REQUIRED REDUCTION FROM WS12 (LBS)	*5.12*	*0.02*	*0.02*

Remaining Reduction

TSS*** (LBS)	TP*** (LBS)	NO3 (LBS)
-3.11	*-0.01*	*0.00*

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

G.8 Infiltration Information

a. Infiltration Summary
b. Field Observation Report
c. Supplemental Field Observation Report

Infiltration Rate Summary – AR-LU-007.1

Infiltration Test Pit Location	Field Measured Infiltration Rates		
Pit #1 (MLV Pad)	9.563	in/hr	
Pit #2 (MLV Pad)	4.500	in/hr	
Pit #3 (MLV Pad)	4.688	in/hr	
Pit #4 (Channel)	--	in/hr	No test performed
Pit #5 (Channel)	0.500	in/hr	
Pit #6 (Berm)	12.750	in/hr	
Pit #7 (Berm)	1.938	in/hr	

MLV Pad Infiltration Calculations Summary		
Average Measured Infiltration Rate for MLV Pad	6.25	in/hr
Factor of Safety	2.00	
Design Infiltration Rate	3.13	in/hr
Dewatering Time for top 6 inches of MLV Pad	1.92	hours
Depth of AASHTO #57 Section of MLV Pad	18	inches
Dewatering Time for AASHTO #57 Section of MLV Pad	5.76	hours
Total Dewatering Time for MLV Pad	7.68	hours

Check Dam Infiltration Calculations Summary		
Average Measured Infiltration Rate for Swale	0.50	in/hr
Factor of Safety	2.00	
Design Infiltration Rate	0.25	in/hr
Height of Check Dam	12	inches
Dewatering Time for Detained Water in Swale	48.00	hours

Berm Infiltration Calculations Summary		
Average Measured Infiltration Rate for Berm	7.34	in/hr
Factor of Safety	2.00	
Design Infiltration Rate	3.67	in/hr
Height of Infiltration Berm	24	inches
Dewatering Time for Detained Water at Berm	6.54	hours

A factor of safety of 2 is the minimal safety factor for design purposes per page 19 of 21 of "Protocol 1, Site Evaluation and Soil Infiltration Testing, included as Appendix C of the Pennsylvania Stormwater BMP Manual.

Field Observation Report

Project Number:	14C4909 - A		
Project Name:	Atlantic Sunrise Project – **AR-LU-007.1**		
Date of Field Visit:	October 16, 2015		
Weather Conditions:	Sunny and Cloudy	Temperature:	Approx 50-60°F
Prepared By:	Krystal Bealing, APSS and Joseph Kempf		

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

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

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

Three soil pits were excavated by backhoe and described by an Associate Professional Soil Scientist (APSS) to varying depths utilizing the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) *Field Book for Describing and Sampling Soils, Version 3.0* and *Keys to Soil Taxonomy, Twelfth Edition, 2014*. According to the Web Soil Survey, soils within the area of the pits are described by the USDA-NRCS as Lackawanna very stony silt loam, 3-8% slopes.

Test Pit #1, located at N41° 17’ 18.20”, W76° 16’ 57.18”, was observed to have two horizons, with a fragipan observed at 30 inches.

Test Pit #2, located at N41° 17’ 18.02”, W76° 16’ 57.94”, was observed to have three horizons, with a restrictive soil horizon due to bedrock components observed at 53 inches.

Test Pit #3, located at N41° 17’ 17.86”, W76° 16’ 57.46”, was observed to have four horizons, with a fragipan observed at 35 inches.

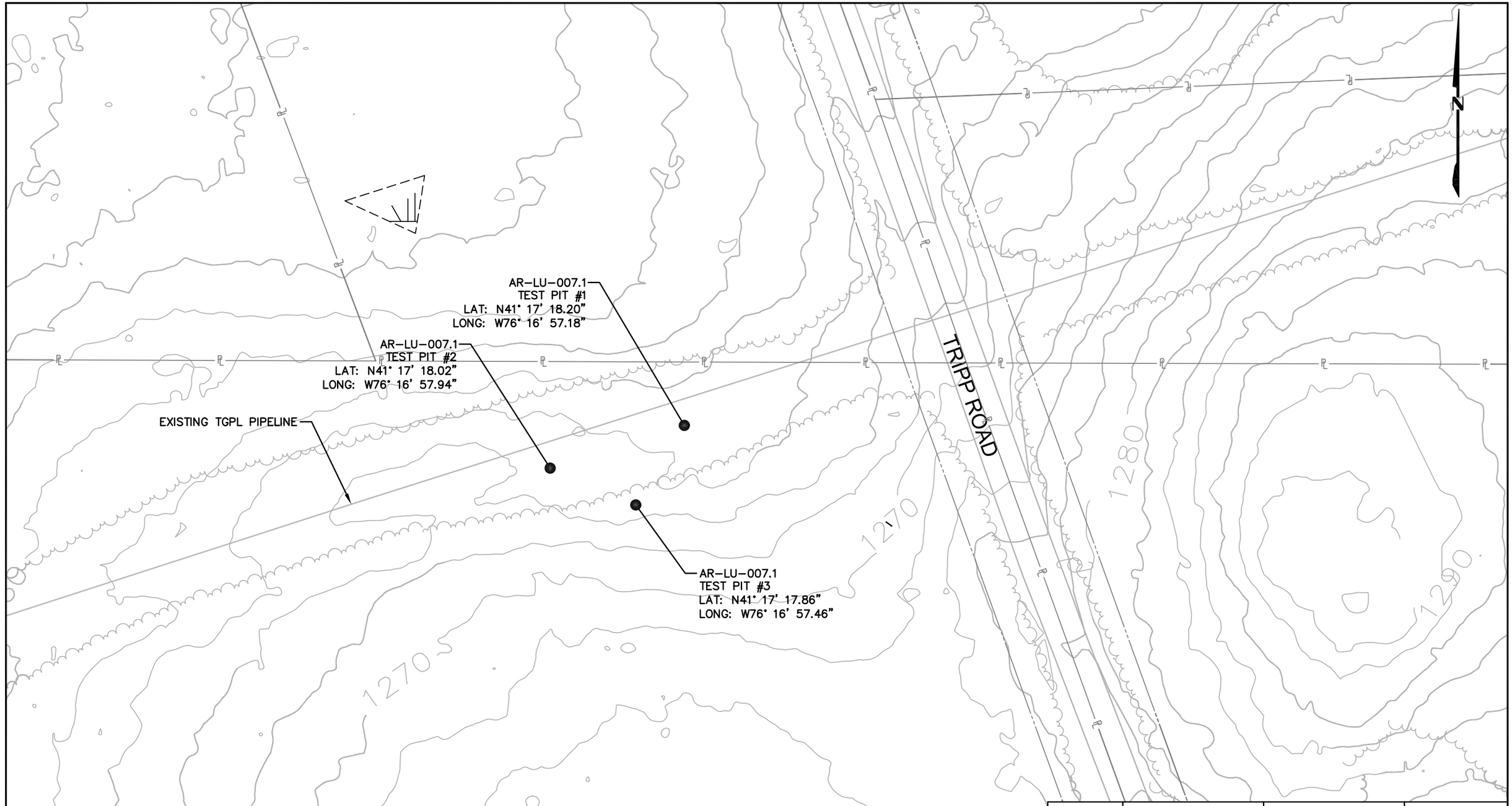
Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at depths ranging from 6 inches below surface to 29 inches below surface. The elevations of the proposed improvements and the existing ground are provided on the infiltration testing location map. If the difference between the existing and proposed elevations is greater

than zero, infiltration was performed at the existing elevation. If the difference between the existing and proposed elevation is between 0 and -5.00 feet, infiltration was conducted at the proposed elevation, or at two feet above the observed limiting layer, whichever was more shallow. If the difference between the existing and proposed elevations is greater than -5.00, infiltration was placed at 5 feet (60 inches) below the existing elevation to adhere to Occupational Safety and Health Administration (OSHA) standards for trenching and excavation safety.

Infiltration testing was conducted within a level testing area at all test pit locations using the double ring infiltrometer method. An infiltrometer containing a 12-inch outer ring and a 6-inch inner ring was driven into the soil a minimum of two inches. Both rings were filled with water to the rim at 30 minute intervals for one hour. If the drop in water level, measured within the center ring, during the last 30 minutes of the presoak is 2 inches or more, measurements are taken in 10-minute intervals. If the water level drop is less than 2 inches, measurements are taken in 30-minute intervals. After each measurement, the rings were refilled to the rim. Each measurement was taken at a fixed reference point. Measurements were taken until the rate of drop stabilized, or eight measurements were taken. A stabilized rate of drop is considered a difference of 0.25-inch or less between the highest and lowest measurements of four consecutive readings. An average of the stabilized rate (i.e., the last four measurements) or the average of eight total measurements if the rate of drop did not stabilize, expressed in inches per hour, represents the infiltration rate. Testing was completed at 6 inches below the surface at Test Pit #1, at 29 inches below the surface at Test Pit #2, and at 11 inches below the surface at Test Pit #3.

The infiltration rate at Test Pit #1 was observed to be 9.563 inches per hour.
The infiltration rate at Test Pit #2 was observed to be 4.500 inches per hour.
The infiltration rate at Test Pit #3 was observed to be 4.688 inches per hour.

The soil profile descriptions, infiltration worksheet, photographs, infiltration testing location map, and USDA-NRCS Soil Survey information are attached.



TEST PIT	EXISTING ELEV.	PROPOSED ELEV.	DIFFERENCE
1	1263.00	1263.50	0.50
2	1265.00	1264.25	−0.75
3	1265.00	1264.25	−0.75

LANDOWNER: KARNS

AR-LU-007.1 INFILTRATION TESTING LOCATIONS

GRAPHIC SCALE
40 20 0 40
SCALE IN FEET

Soil Profile Log

Project	14C4909-A Atlantic Sunrise Project -AR-LU-007.1	**Elevation**	1263 AMSL
Test Pit #	1	**Soil Type**	Lackawanna very stony silt loam, 3-8% slopes
Name	Joe Kempf and Krystal Bealing, APSS	**Geology**	Catskill Formation
Date	October 16, 2015	**Landscape Position/Slope**	Sideslope 0-5%
Weather	50-60°F; Sunny and Cloudy	**Land Use**	Wooded
Equipment	Mini Excavator	**Additional Comments**	

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
A	0	30	SiL	15-35% Channery	10YR 6/4	-	Roots present; Weak, Subangular Blocky	-	-	Very Friable
Bx	30	60+	SiL	35-60% Channery	10YR 6/3	5% 10YR 5/6	Massive	-	-	Friable Limiting Layer - Fragipan

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

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project -AR-LU-007.1
Test Pit # 2
Name Joe Kempf and Krystal Bealing, APSS
Date October 16, 2015
Weather 50-60°F; Sunny and Cloudy
Equipment Mini Excavator

Elevation 1265 AMSL
Soil Type Lackawanna very stony silt loam, 3-8% slopes
Geology Catskill Formation
Landscape Position/Slope Sideslope 0-5%
Land Use Wooded
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
A	0	11	SiL	15-35% Channery	10YR 3/3	-	Roots present; Weak, Subangular Blocky	-	-	Very Friable
Bw	11	53	SiL	35-60% Channery	7.5YR 2/2	-	Weak, Subangular Blocky	-	-	Very Friable
Cr	53	60+	SiL	60-90% Channery	10YR 6/3	-	Massive	-	-	Friable Limiting Layer - Restrictive Soil Horizon due to bedrock components

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

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project -AR-LU-007.1
Test Pit # 3
Name Joe Kempf and Krystal Bealing, APSS
Date October 16, 2015
Weather 50-60°F; Sunny and Cloudy
Equipment Mini Excavator

Elevation 1265 AMSL
Soil Type Lackawanna very stony silt loam, 3-8% slopes
Geology Catskill Formation
Landscape Position/Slope Sideslope 0-5%
Land Use Wooded
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
A	0	11	SiL	-	10YR 3/2	-	Roots present; Weak, Subangular Blocky	-	-	Very Friable
Bw1	11	23	SiL	-	10YR 5/6	-	Weak, Subangular Blocky	-	-	Very Friable
Bw2	23	35	SiL	15-35% Channery	10YR 5/6	-	Moderate, Subangular Blocky	-	-	Friable
Bx	35	60+	SiL	35-60% Channery	10YR 6/2	3% 10YR 4/6	Massive	-	-	Friable Limiting Layer - Fragipan

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

ATLANTIC SUNRISE PROJECT - AR-LU-007.1													
SOIL INFILTRATION WORKSHEET - DOUBLE RING INFILTROMETER METHOD													
Hole Number	Drop >2 inches after 30 minute presoak?[1]	Reading Interval (minutes)	Reading 1 (Inches of Drop)	Reading 2 (Inches of Drop)	Reading 3 (Inches of Drop)	Reading 4 (Inches of Drop)	Reading 5 (Inches of Drop)	Reading 6 (Inches of Drop)	Reading 7 (Inches of Drop)	Reading 8 (Inches of Drop)	Average Stabilized Reading[2] (Inches of Drop)	Infiltration Rate[3] (in/hr)	Comments
1	Yes	10	2.250	2.375	1.500	1.500	1.750	1.625			1.594	9.563	55-60°F, sunny and cloudy. Test done at 6 inches below surface.
2	Yes	10	0.750	0.750	0.750	0.750					0.750	4.500	55-60°F, sunny and cloudy. Test done at 29 inches below surface.
3	Yes	10	0.625	0.750	0.875	0.875					0.781	4.688	55-60°F, sunny and cloudy. Test done at 11 inches below surface.

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

[2]Calculated as the average of the last four stabilized (less than 0.25-inch difference overall) readings, or an overall average in the case of eight total readings.

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

View of Pit #1.

View of Pit #2.

View of Pit #3.

Luzerne County, Pennsylvania

LcB—Lackawanna very stony silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9ygp
Elevation: 1,100 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Lackawanna and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lackawanna

Setting

Landform: Hillslopes, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 8 inches: channery silt loam
Bw - 8 to 25 inches: channery loam
Bx - 25 to 60 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 3.0 percent
Depth to restrictive feature: 21 to 36 inches to fragipan
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 21 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C

Data Source Information

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 6, Sep 19, 2014

Field Observation Report

Project Number:	14C4909-A		
Project Name:	Atlantic Sunrise Project – AR-LU-007.1		
Date of Field Visit:	April 5, 2017		
Weather Conditions:	Sunny	Temperature:	Approx. 40-65°F
Prepared By:	Sagan Simko, CPSS, PWS and Jon Libbon		

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

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

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

Four soil pits were excavated by a mini excavator and described by a Certified Professional Soil Scientist (CPSS) to varying depths utilizing the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) *Field Book for Describing and Sampling Soils, Version 3.0* and *Keys to Soil Taxonomy, Twelfth Edition, 2014*. According to the Web Soil Survey, soils within the area of the pits are described by the USDA-NRCS as Lackawanna channery silt loam, 3-8% slopes, extremely stony.

Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at varying depths below surface. The elevations of the proposed improvements and the existing ground are provided on the infiltration testing location map. If the difference between the existing and proposed elevations is greater than zero, infiltration was performed at the existing elevation. If the difference between the existing and proposed elevation is between 0 and -5.00 feet, infiltration was conducted at the proposed elevation, or at two feet above the observed limiting layer, whichever was more shallow. If the difference between the existing and proposed elevations is greater than -5.00, infiltration was placed at 5 feet (60 inches) below the existing elevation to adhere to Occupational Safety and Health Administration (OSHA) standards for trenching and excavation safety.

Infiltration testing was conducted within a level testing area at all test pit locations. An infiltrometer containing a 12-inch outer ring and a 6-inch inner ring was driven into the soil a minimum of two inches. Both rings were filled with water to a marked line at 30 minute intervals for one hour. If the drop in water level, measured within the center ring, during the last 30 minutes of the presoak

is 2 inches or more, measurements are taken in 10-minute intervals. If the water level drop is less than 2 inches, measurements are taken in 30-minute intervals. After each measurement, the rings were refilled to the marked line. Each measurement was taken at a fixed reference point. Measurements were taken until the rate of drop stabilized, or eight measurements were taken. A stabilized rate of drop is considered a difference of 0.25-inch or less between the highest and lowest measurements of four consecutive readings. An average of the stabilized rate (i.e., the last four measurements) or the average of eight total measurements if the rate of drop did not stabilize, expressed in inches per hour, represents the infiltration rate.

Pit Number	Pit Location (Decimal Degrees)	Observed Limiting Layer	Infiltration Test Depth (inches below the surface)	Infiltration Rate (inches/hour)
Test Pit #4	41.288551, -76.282483	25 inches, Seasonal High Water Table	Test could not be conducted due to the presence of large coarse fragments.	--
Test Pit #5	41.288239, -76.282644	48 inches, Bedrock	24	0.500
Test Pit #6	41.288242, -76.282488	48 inches, Bedrock	Surface	12.750
Test Pit #7	41.288290, -76.282277	48 inches, Bedrock	Surface	1.938

A test pit location map, soil profile logs, infiltration worksheet, photographs, and USDA-NRCS Soil Survey information are attached.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-LU-007.1
Test Pit # 4
Name Sagan Simko, CPSS, PWS
Date April 5th, 2017
Weather Partly Sunny, 40°-65° F
Equipment Mini Excavator

Elevation 1263.25 feet AMSL
Soil Type Lackawanna channery silt loam, 3-8% slopes, extremely stony
Geology Catskill Formation
Landscape Position/Slope Hillslope
Land Use Agriculture
Additional Notes

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
Oa	0-9	Sapric	Boulders on Surface; 15% Gravel	10YR 3/2	-	-	-	Friable	Smooth, Gradual	90% Roots	-	-
A	9-19	Silt Loam	15% Gravel	10YR 3/3	-	-	Granualar, Weak	Friable	Smooth, Gradual	30% Roots	-	-
Bw1	19-25	Silty Clay Loam	30% Gravel	7.5YR 4/6	-	-	Subangular Blocky, Weak	Friable	Wavy, Gradual	5% Roots	-	-
Bw2	25-48	Silty Clay Loam	25% Gravel	7.5YR 5/6	-	40% 10YR 7/1	Subangular Blocky, Weak	Firm	Smooth, Abrupt	-	-	25 inches
R	48+	-	Solid Bedrock	-	-	-	-	-	-	-	48 inches	-

Comments: Limiting layer observed at 25 inches due to the presence of seeps (seasonal high water table).

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-LU-007.1
Test Pit # 5
Name Sagan Simko, CPSS, PWS
Date April 5th, 2017
Weather Partly Sunny, 40°-65° F
Equipment Mini Excavator

Elevation 1268.00 feet AMSL
Soil Type Lackawanna channery silt loam, 3-8% slopes, extremely stony
Geology Catskill Formation
Landscape Position/Slope Hillslope
Land Use Agriculture
Additional Notes

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
O	0-2	Silt Loam	15% Gravel	10YR 3/2	-	-	-	Friable	Smooth, Gradual	90% Roots	-	-
A	2-7	Silt Loam	30% Gravel	10YR 3/3	-	-	Granualar, Weak	Friable	Smooth, Gradual	20% Roots	-	-
Bw1	7-24	Silty Clay Loam	30% Gravel	7.5YR 4/6	-	-	Subangular Blocky, Weak	Friable	Wavy, Gradual	-	-	-
Bw2	24-48	Silty Clay Loam	25% Gravel	7.5YR 5/3	-	-	Subangular Blocky, Weak	Friable to Firm	Smooth, Abrupt	-	-	-
R	48+	-	Solid Bedrock	-	-	-	-	-	-	-	48 inches	-

Comments: Limiting layer observed at 48 inches due to the presence of bedrock.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-LU-007.1
Test Pit # 6
Name Sagan Simko, CPSS, PWS
Date April 5th, 2017
Weather Partly Sunny, 40°-65° F
Equipment Mini Excavator

Elevation 1270.00 feet AMSL
Soil Type Lackawanna channery silt loam, 3-8% slopes, extremely stony
Geology Catskill Formation
Landscape Position/Slope Hillslope
Land Use Agriculture
Additional Notes

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
O	0-2	Silt Loam	15% Gravel	10YR 3/2	-	-	-	Friable	Smooth, Gradual	90% Roots	-	-
A	2-7	Silt Loam	30% Gravel	10YR 3/3	-	-	Granualar, Weak	Friable	Smooth, Gradual	20% Roots	-	-
Bw1	7-24	Silty Clay Loam	30% Gravel	7.5YR 4/6	-	-	Subangular Blocky, Weak	Friable	Wavy, Gradual	-	-	-
Bw2	24-48	Silty Clay Loam	25% Gravel	7.5YR 5/3	-	-	Subangular Blocky, Weak	Friable to Firm	Smooth, Abrupt	-	-	-
R	48+	-	Solid Bedrock	-	-	-	-	-	-	-	48 inches	-

Comments: Limiting layer observed at 48 inches due to the presence of bedrock.

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-LU-007.1
Test Pit # 7
Name Sagan Simko, CPSS, PWS
Date April 5th, 2017
Weather Partly Sunny, 40°-65° F
Equipment Mini Excavator

Elevation 1270.00 feet AMSL
Soil Type Lackawanna channery silt loam, 3-8% slopes, extremely stony
Geology Catskill Formation
Landscape Position/Slope Hillslope
Land Use Agriculture
Additional Notes

Horizon	Depth (inches)	Texture	Coarse Fragments	Matrix Color	Color Patterns	Redoximorphic Features	Structure	Consistency	Boundary Strike/Dip	Roots/ Pores	Depth to Bedrock	Depth to Water
O	0-2	Silt Loam	15% Gravel	10YR 3/2	-	-	-	Friable	Smooth, Gradual	90% Roots	-	-
A	2-7	Silt Loam	30% Gravel	10YR 3/3	-	-	Granualar, Weak	Friable	Smooth, Gradual	30% Roots	-	-
Bw1	7-24	Silty Clay Loam	30% Gravel	7.5YR 4/6	-	-	Subangular Blocky, Weak	Friable	Wavy, Gradual	-	-	-
Bw2	24-48	Silty Clay Loam	25% Gravel	7.5YR 5/6	-	-	Subangular Blocky, Weak	Friable to Firm	Smooth, Abrupt	-	-	-
R	48+	-	Solid Bedrock	-	-	-	-	-	-	-	48 inches	-

Comments: Limiting layer observed at 48 inches due to the presence of bedrock.

ATLANTIC SUNRISE PROJECT - AR-LU-007.1													
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**
Test Pit #4	N/A	N/A	N/A	N/A	N/A	N/A					0.000	0.000	40-65°F, partly sunny. Test could not be conducted due to the presence of large coarse fragments.
Test Pit #5	No	30	0.500	0.250	0.250	0.250					0.250	0.500	40-65°F, partly sunny. Test conducted at 24 inches below the surface.
Test Pit #6	Yes	10	2.250	2.000	2.000	2.250					2.125	12.750	40-65°F, partly sunny. Test conducted at the surface.
Test Pit #7	No	30	1.000	0.875	1.000	1.000					0.969	1.938	40-65°F, partly sunny. Test conducted at the surface.

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

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

View of Test Pit #4.

View of Test Pit #5.

View of Test Pit #6.

View of Test Pit #7.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Luzerne County, Pennsylvania

April 7, 2017

Preface

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

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

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

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

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

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

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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 Scale: 1:521 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 9, Sep 19, 2016

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

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

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

Map Unit Legend

Luzerne County, Pennsylvania (PA079)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
LcB	Lackawanna channery silt loam, 3 to 8 percent slopes, extremely stony	0.7	100.0%
Totals for Area of Interest		**0.7**	**100.0%**

Map Unit Descriptions

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

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

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

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

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Luzerne County, Pennsylvania

LcB—Lackawanna channery silt loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w09m
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Lackawanna, Extremely Stony

Setting

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

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 7.0 percent
Depth to restrictive feature: 17 to 36 inches to fragipan
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 16 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

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

Minor Components

Wellsboro, extremely stony

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

Morris, extremely stony

Percent of map unit: 3 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Oquaga, rubbly

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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G.9 Off-Site Discharge Analysis

a. Adequacy of Off-Site Discharge

ACCESS ROAD: AR-LU-007.1 - Adequacy of Off-Site Discharge

AR-LU-007.1 is a proposed permanent access road (PAR) located in Fairmount Township, Luzerne County, Pennsylvania. The intent of this PAR is to provide permanent maintenance and operational access to the proposed Main Line Valve 02 (CN-MLV-02) located on the proposed 30" Central Penn Line North Pipeline. The PAR is approximately 100 feet long over relatively hilly terrain. The PAR begins at Tripp Road and terminates at the MLV site at approximate milepost 6.7. The PAR will be entirely located within the pipeline permanent right of way.

The PAR will have a width of 14 feet and a cross slope of 2% that will direct runoff in a northerly direction to the northern vegetated channel for infiltration (VCI-1) with check dams. The southern vegetated channel for infiltration (VCI-2) with check dams will be constructed on the south side of the proposed road and MLV pad to capture and divert uphill runoff. A small portion of runoff from the disturbed site will be directed to the proposed MLV site. The MLV site will be constructed with a 6-inch thick layer of AASHTO #8 stone over an 18-inch thick layer of AASHTO #57 stone.

Downhill of the MLV site, VCI-1, and VCI-2, the runoff flows northwest to the convergence point with the existing pre-construction flow path through existing wood lands to Beaver Pond (WB-T02-15020), approximately 1290 feet west of the MLV Site. The adjacent picture shows the existing ground cover at the discharge point.

The PAR, MLV pad, and vegetated channels are designed to reduce the overall disturbance to the maximum extent practicable. The proposed detention is designed so the post-construction stormwater peak rate of runoff is less than or equal to the pre-construction stormwater peak rate of runoff. Pre- and post-construction drainage area maps and model results are provided in Appendix G.3 and G.4, respectively. The pre- and post-construction peak rate of runoff and the discharge velocity for the design storm events are summarized below:

Pre- vs. Post-Construction Peak Rate of Flow Summary for The Study Point			
Stormwater discharge rate for the design frequency storm (cfs)	Pre-construction	Post-construction	Net Change
1) 1-Year/24-Hour	0.70	0.20	(0.50)
2) 2-Year/24-Hour	1.20	0.45	(0.75)
3) 5-Year/24-Hour	2.01	1.00	(1.01)
4) 10-Year/24-Hour	2.79	1.72	(1.07)
5) 25-Year/24-Hour	4.07	2.28	(1.79)
6) 50-Year/24-Hour	5.29	3.36	(1.93)
7) 100-Year/24-Hour	6.76	4.87	(1.89)

Pre- and Post-construction Discharge Velocity	MLV Pad (fps)	VCI-1 (fps)	VCI-2 (fps)
1) 1-Year/24-Hour	0.00	0.22	0.14
2) 2-Year/24-Hour	0.10	0.55	0.22
3) 5-Year/24-Hour	0.20	0.60	0.57
4) 10-Year/24-Hour	0.37	0.65	0.75
5) 25-Year/24-Hour	0.67	0.72	0.83
6) 50-Year/24-Hour	0.84	0.77	0.90
7) 100-Year/24-Hour	0.95	0.82	0.97

The MLV pad and riprap apron discharge to grassy areas. Based on Table G.1. Allowable Velocities for Downslope Covers for Channeled Flows in the Pennsylvania DEP Erosion and Sediment Pollution Control Program Manual, the maximum allowable velocity for grass ground cover is 4 fps. The discharge velocity from the MLV pad and riprap apron is less than 4 fps for all design storm events. Therefore, no erosion is anticipated between the MLV pad and vegetated channels and Beaver Pond.

The flow path from the MLV site crosses the following soil types:

- LcB – Lackawanna channery silt loam, 3 to 8 percent slopes, extremely stony.
- MsB – Morris channery silt loam, 0 to 8 percent slopes, extremely stony
- WmB – Wellsboro channery silt loam, 3 to 8 percent slopes, extremely stony.

The PADEP E&S Manual defines erosion resistant soils as soils having an erodibility “K” factor less than or equal to 0.37. The K factor for the soil types, according to the National Resources Conservation Service (NRCS) website http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, crossed by the flow path are summarized below:

- LcB – No value specified by NRCS
- MsB – No value specified by NRCS
- WmB – No value specified by NRCS

All soils crossed by the flow path are considered erosion resistant soils.

There is no change between pre- and post-construction stormwater volume, rate of runoff or velocity downstream of the MLV pad and vegetated channels due to the provided detention. The soils crossed by the runoff are considered to be erosion resistant. Therefore, there are no downstream off-site impacts due to installing the proposed improvements.

Down Slope Property Owners:

- Carol J. Bonham (PA-LU-013.000)
- Michael D. Karns & Jennifer Karns (PA-LU-012.000)
- Unknown Property Owner (PA-LU-010.000)
- Unknown Property Owner (PA-LU-011.000)

G.10 Storage Volume Analysis

a. Storage Volume Analysis

ACCESS ROAD: LU-007.1 – Storage Volume Analysis

Stormwater detention is provided behind the check dams in the vegetated channel and in the void space between the AASHTO #57 stone at the MLV pad. The void space between the 6" AASHTO #8 stone at the surface of the pad is excluded from the storage volume calculations. The required storage volume is calculated through an iterative process of increasing the storage volume in the HydroCAD model until the post-construction stormwater runoff rate is less than or equal to the pre-construction runoff rate for the 1, 2, 5, 10, 25, 50 and 100 year 24-hour storm events.

Vegetated channel storage is created by installing check dams along the channel. The "Earthen Check Dam Infiltration Volume and Spacing" exhibit provided in Appendix G.6 illustrates how the storage volume behind each check dam is calculated. The number of check dams required is dependent on the channel cross-sectional dimensions, slope of channel, and required storage volume.

The storage volume of the MLV pad is dependent on the slope of the MLV pad. If the pad were graded at 0% in all directions, the storage volume would be equal to the area of the pad multiplied by the depth. However, due to site topography, a 0% grade would result in large quantities of earth movement, fill at the infiltration interface, or cut too close to the ground water table. Instead, the pad is designed to minimize these terrain impacts by mimicking the existing contours as close as possible. The actual storage volume is calculated based on the elevation of the low point of the pad (minus the 6" AASHTO #8 cover), since that is the highest elevation runoff can be stored without overtopping the AASHTO #57 stone.

Due to the complexity of the MLV pad geometry, AutoCAD Civil 3D was used to determine the storage volume. Surfaces representing the bottom of the pad and water surface elevation were built at 0.5 feet intervals and combined into a TIN volume surface. An earthwork analysis was run on the TIN volume surface to determine the total volume between surfaces. This storage volume was reduced by 60% to determine the available storage volume between the AASHTO #57 stone, estimated to be 40% voids.

The maximum available storage volume within the voids of the AASHTO #57 layer of the MLV pad is 2,128 cubic feet. This volume is required to attenuate the anticipated flow for the 100-year, 24-hour design storm event. However, the design storage volume for the 2-year, 24-hour storm event is 1,202 cubic feet as calculated in the post-development HydroCAD model. The 2-year, 24-hour storm event storage volume is used in the calculations in Worksheet 5 provided in Appendix G.7.

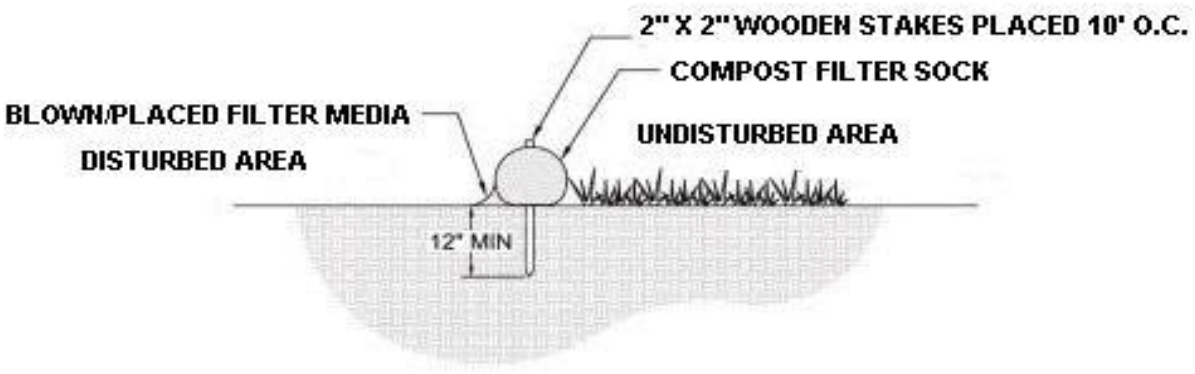
The detained stormwater will infiltrate the ground. The dewatering time for the stormwater detained behind the check dams and in the void space of the MLV pad is provided at the beginning of Appendix G.8, Infiltration Information.

G.11 Sediment Barrier Table

a. E&S Worksheet #1

E&S WORKSHEET #1
Compost Filter Sock

PROJECT NAME: Atlantic Sunrise
LOCATION: AR-LU-007.1
PREPARED BY: EAW DATE: 4/20/17
CHECKED BY: SMK DATE: 4/20/17



SOCK NO.	Dia. In.	LOCATION	SLOPE PERCENT	SLOPE LENGTH ABOVE BARRIER (FT)	SOCK LENGTH
1	***18***	STA 1+90 to STA 2+00	-	(WASH RACK)	12
STOCKPILE					
SP-1	12	PIPELINE ROW	-	-	75

SOURCE: Pennsylvania Erosion and Sediment Pollution Control Manual, Page 372