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Post Construction Stormwater Management Plan Narrative
Atlantic Sunrise Project

Temporary and Permanent Access Roads
Pine Grove and Eldred Townships
Schuylkill County
Pennsylvania

Prepared For:

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GENERAL INFORMATION

Project Description

The following post construction stormwater management (PCSM) narrative describes the PCSM designs for the permanent access roads to be constructed within Schuylkill 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 Schuylkill County, the main Project improvements that the temporary and permanent access roads will support include installation of a 42-inch-diameter greenfield pipeline referred to as the Central Penn Line (CPL) South 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 to mainline valves (MLVs) and select portions of the pipeline right of way (ROW) not accessible by existing roads, 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/SR BMPs, in accordance with the PADEP's "Pennsylvania Stormwater Best Management Practices Manual," Technical Guidance No. 363-0300-002, as amended and updated (PCSM/SR 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 (**Appendix A of this narrative and Section 2 of the ESCGP-2 NOI**).

Temporary and Permanent Access Road Table

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

Access Road	Mile Post (MP)	Major River Basin	Receiving Water	Designated Use	Impairment	Total Maximum Daily Load
SC-063	MP 67.7	Susquehanna	UNT to Swatara Creek	CWF, MF	None	TMDL, 2003 (metals, pH, suspended solids)
SC-073.5	MP 80.8	Susquehanna	Mahantango Creek	CWF, MF	Agriculture (Siltation); Source Unknown (Pathogens)	TMDL, 2013 (suspended solids)

1.0 COMMON INFORMATION

1.1 Topographic Features

See the **Appendices E through W** for road-specific United States Geological Survey (USGS) 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 South pipeline. The NRCS Custom Soil Resource Report for Columbia County, Lancaster County, Lebanon County, Northumberland County, and Schuylkill County, Pennsylvania and the Soil Association Maps prepared by Wood Group Mustang, Inc. are included in **Appendix C** of the **E&SC Narrative for Susquehanna County included in Section 2 of the ESCGP-2 NOI.** County-specific soil type and use limitations are presented in Table 1.2.1 below.

Table 1.2.1

Soil Type and Use Limitations for Schuylkill 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
Aga	Alvira silt loam	0-3%	X	C/S	X	X		X	X	X	X	X	X	X				X
LeB LeC	Leck Kill Channery Silt Loam	3-8% 8-15%	X	C						X	X	X	X	X				X
MeB	Meckesville Loam	3-8%	X	C/S				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 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 roads are 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 Schuylkill County included in Section 2 of the ESCGP-2 NOI**.

Where vegetated channels are proposed to be installed alongside the permanent access roads, they will be constructed at a minimum depth as possible to maintain existing limiting zones. The PCSM/SR BMPs have been designed to meet the volume and peak flow reduction requirements without accounting for infiltration losses.

Characterization of Land Use

The characterization of land use within the proposed CPL South 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 ROW and field crops; areas of grasses planted for livestock grazing or for the production of hay crops; orchards; and specialty crops, including vineyards, Christmas trees, and fruits and vegetables.

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.

New mainline valvesf will be wholly located within the permanent ROWs for the proposed CPL South pipeline. Construction will primarily occur within the proposed CPL South construction ROWs.

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.

1.4 Project Site Runoff

The E&SC BMPs for the access roads are sized using 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 Schuylkill 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 and not MLVs, 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.

Where applicable, Act 167 Plan names and adoption dates for each access road watershed are included in the road-specific narratives appended to this narrative. ***The proposed permanent access roads located in Schuylkill County are located in watersheds that are not subject to an Act 167 Plan. Therefore, the PCSM MBPs for these roads have been designed to comply with section 25 Pa. Code §§ 102.8(g)(2) & 102.8(g)(3) and using the recommended Control Guideline – 1 (CG-1) form.***

1.5 Surface Water Classification

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

1.6 BMP Description Narrative

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 of tributary areas. Installation and maintenance guidelines, as well as E&SC BMP locations are described in the **E&SC Narrative for Schuylkill 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 Channels: 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 help dissipate energy from the concentrated flow in roadside ditches and channels to prevent erosion of the channel and at the outlet. Check Dams will be earthen check dams with a height of 12 inches, typically.
- Stone Valve Site Void Storage: Runoff from the proposed permanent access roads may be detained in the void space between the stone at the valve 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 provided in Appendices E through W.

- 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/SR 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.
- ***Infiltration Berm*: Runoff from the proposed permanent access roads may be detained behind the infiltration berm areas to attenuate the peak rate of runoff for up to the 100-year design storm event.**

1.7 BMP Installation Sequence Narrative

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 **Appendices J and V**.

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.

1.9 Plan Drawings

Full size copies of the permanent access road E&SC Plans have been provided under separate cover in Section 2 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 Schuylkill 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 restore to design grade; 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 Environmental Construction Plan (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 South 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 South 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 South 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 South 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 South 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 South 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 South 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 deemed to be a potential source of pollution (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 as recommended by the Natural Resources Conservation Service (NRCS).

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 of 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 permanent access roads will be avoided to the maximum extent practicable by implementing the following measures:

- Minimize permanent changes in land cover to only that necessary to construct the required permanent access roads;
- Limit removal of vegetation, especially tree cover, to only that necessary for construction;
- Minimize permanent impervious surfaces;

- Collect runoff from the permanent impervious areas and direct runoff to PCSM/SR BMPs;
- Install a gravel surface for the permanent access roads rather than asphalt;
- Incorporate the use of stone at mainline valves and vegetated swales with stone check dams to provide storage for stormwater runoff; and
- Minimize impacts to existing riparian corridors.

1.14 E&SC Plan and PCSM/SR 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

No access roads within Schuylkill County require a riparian buffer waiver.

1.16 Antidegradation Requirements

No permanent access roads within Schuylkill County are located within a special protection watershed.

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 Schuylkill 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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ROLLMAX™
ROLLED EROSION CONTROL

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™
ROLLED EROSION CONTROL

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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ROLLMAX™
ROLLED EROSION CONTROL

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 Bottom: lighweight photodegradable	3 lbs/1000 sq ft (1.47 kg/100 sm) 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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ROLLMAX™
ROLLED EROSION CONTROL

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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ROLLMAX™
ROLLED EROSION CONTROL

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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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/cm³
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

Tensar

NORTH AMERICAN GREEN®

Tensar International Corporation
2500 Northwinds Parkway
Suite 500
Alpharetta, GA 30009
800-TENSAR-1
tensarcorp.com

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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tensarcorp.com

Tensar International Corporation warrants that at the time of delivery the product furnished hereunder shall conform to the specification stated herein. Any other warranty including merchantability and fitness for a particular purpose, are hereby executed. If the product does not meet specifications on this page and Tensar is notified prior to installation, Tensar will replace the product at no cost to the customer. **This product specification supersedes all prior specifications for the product described above and is not applicable to any products shipped prior to January 1, 2012.**

APPENDIX J

AR-SC-063 Specific Narrative and Calculations

J.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. Worksheet 1. General Site Information
h. Permanent Access Road Summary Sheet (NOI PCSM Table)

ACCESS ROAD: AR-SC-063

ACT 167 PLAN: None

TMDL: 2003 (metals, pH, suspended solids)

NARRATIVE:

AR-SC-063 is a proposed permanent access road (PAR) located in Pine Grove Township, Schuylkill County, Pennsylvania. The intent of this PAR is to provide permanent maintenance and operational access to the proposed Main Line Valve 08 (CS-MLV-08) located on the proposed 42" Central Penn Line South Pipeline. The road begins at Beuchler Lane and terminates at the MLV site at approximate mile post 67.7. The PAR is approximately 950 feet long over relatively hilly terrain. The PAR follows Beuchler Lane with no proposed improvements for the first 750 feet. The final 200 feet of road is proposed new construction over undisturbed ground. There will be a temporary roadway apron constructed to allow access to the gas pipeline by construction vehicles. Upon completion of the construction activities, the temporary construction entrance will be removed and a permanent access road will be constructed. ***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.***

The proposed road will have a cross slope of 2% directing runoff in a southeasterly direction. A vegetated channel for diversion purposes is proposed to divert runoff flowing from the northwest to ***an existing*** cross culvert located at approximate station 2+00. A portion of the road will direct runoff to the proposed MLV site and the remaining portion of the road will direct runoff to the vegetated channel for infiltration with check dams. ***The MLV site will be constructed with a 6-inch thick layer of AASHTO #8 stone on top of nonwoven geotextile and a 12-inch thick layer of AASHTO #57 stone. As summarized in the infiltration calculations added to the bottom of Worksheet #5, the detained water stored in the voids of the MLV stone pad will infiltrate to the surrounding ground over approximately 4 hours and the water detained behind the check dams will infiltrate to the surrounding ground over approximately 3 hours.***

A riprap apron is proposed at the termination of the vegetated channel for infiltration. In addition to the overflow runoff from the vegetated channel for infiltration, the riprap apron has been sized to accommodate the flow from the vegetated channel for diversion purposes. The two vegetated channels will be connected via an existing culvert under the access road. The riprap apron will discharge along the edge of Beuchler Lane. The existing drainage pattern will be modified for approximately 85 feet along Beuchler Lane. However, at approximately Station 3+50, the post-construction drainage pattern matches the

pre-construction drainage pattern and there will be no impacts to areas downstream of this converging point. Williams will observe the area between the riprap apron and the convergence point for signs of erosion and add control measures, such as erosion control blankets, along the drainage path, as necessary.

Water Quality Worksheet #4 was used to complete the ***Control Guidelines 1*** (CG-1) volume analysis for the 2 year ***24-hour*** storm. The storage volume provided by the check dams in the vegetated channels 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 new gravel road to roadside vegetated channels with check dams mitigates the potential impact from the proposed development.

TMDL DISCUSSION:

Receiving surface waters in the location of this access road are subject to a metals, pH and suspended solids TMDL. The rock construction entrance with a wash rack and the proposed erosion and sedimentation control measures to be implemented on this road are ABACT to minimize potential impacts from this road.

MINIMIZED SOIL COMPACTION:

The Project seeks to minimize soils compaction impacts associated with access roads to the maximum extent practicable. AR-SC-063 is a proposed permanent access road for Main Line Valve 08. All construction and operations traffic will utilize the proposed road and existing road. The permanent access road is situated completely within the permanent right of way of the pipeline reducing the area of impact. The roadway width has also been minimized to 14 feet. Additionally, infiltration and evaporation are encouraged in the MLV site pad and in the vegetated channels proposed in the permanent road construction.

THERMAL IMPACT ANALYSIS:

Thermal impacts associated with AR-SC-063 will be avoided to the maximum extent practicable. The following measures have been implemented to minimize thermal impacts:

- ***AR-SC-063 is approximately 950 linear feet; however, it follows an existing gravel road for approximately 750 linear feet. No improvements are necessary to use the existing gravel road. Utilizing the existing gravel road minimizes the potential thermal impact of this road.***

- ***750 linear feet of road follows an existing road. The use of an existing road corridor eliminates the need for additional tree removal. The ability to use this road without the removal of additional trees acts to minimize the thermal impact of this road.***

- ***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.***

- ***Temporary construction phase improvements for this road are limited to equipment mats over an existing pipeline, a driveway apron and rock construction entrance with wash rack. Runoff from these temporary improvements is directed to stabilized, well vegetated areas that will promote infiltration of the runoff. Infiltration of runoff prior to entering of receiving waters allows for runoff to assimilate to ground water temperatures which are minimally influenced by seasonal temperature changes, minimizing the thermal impact of this road.***

- ***Vegetated channels for infiltration with check dams are proposed adjacent to the proposed permanent access road. The vegetated channel 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-SC-063 Soil Acidity Table		
Soil Map Symbol	Soil Name	PH
LeC	Leck kill channery silt loam, 8 to 15 percent slopes	5.7

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.

ROAD SPECIFIC CONSTRUCTION SEQUENCE:

ACCESS ROAD: AR-SC-063:

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

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

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

4. ***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.***

6. ***Locate staging areas and access points including the rock construction entrance with wash rack. Install E&SC BMPs down slope of these areas.***

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

8. ***Install rock construction entrance with wash rack.***

9. ***Remove brush to effectively install perimeter E&SC BMPs.***

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

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

12. ***Proceed with major clearing and grubbing.***

13. Begin construction staking for layout of limits of access road.

14. Strip topsoil; contractor shall haul topsoil off site for storage. Grade the access road as shown on the E&SC Plans (Section 2 of the ESCGP-2 NOI). Excess material shall be hauled off site for storage or disposal in a legal manner.

15. The Compliance Manager shall provide PADEP at least three days' notice prior to installing vegetated channels for infiltration with check dams and placing the stone and geotextile fabric within the MLV pads.

- ***a. Install vegetated channels for infiltration with check dams where specified on the E&SC 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 and paving increase the rate and volume of runoff. (Erosion and sediment control methods shall adhere to the Pennsylvania Department of Environmental Protection's Erosion and Sediment Pollution Control Program Manual, March 2000 or latest edition.)***

- ***b. Rough grade the vegetated channel. Equipment shall avoid excessive compaction and/or land disturbance. Excavating equipment should operate from the side of the vegetated channel and never on the bottom. If excavation leads to substantial compaction of the subgrade (where an infiltration trench is not 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 of topsoil.***

- ***c. Construct check dams, if required.***

- ***d. Fine grade the vegetated channel. Accurate grading is crucial for vegetated 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. Plant the vegetated channel at a time of the year when successful establishment without irrigation is most likely. However, temporary irrigation may be needed in periods*** *of little rain or drought. Vegetation should be established as soon as possible to prevent erosion and scour.*

f. *Once all tributary areas are sufficiently stabilized, remove temporary erosion and sediment controls. It is very important that the vegetated channel be stabilized before receiving upland stormwater flow.*

g. *Follow maintenance guidelines, as discussed below.*

Note: If a vegetated channel is used for runoff conveyance during construction, it should be regraded and reseeded immediately after construction and stabilization has occurred. Any damaged areas should be fully restored to ensure future functionality of the vegetated channel.

16. *Install vegetated channels for infiltration with check dams where specified on the E&SC 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.*

17. *Rough grade the MLV pad. Equipment shall avoid excessive compaction and/or land disturbance. If excavation leads to substantial compaction of the subgrade (where an infiltration trench is not 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.*

18. *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.*

19. *Place the stone and geotextile fabric within the MLV pad as specified on the E&SC 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.*

20. *Immediately stabilize the Site with geotextile and gravel surfacing where indicated in the E&SC Plans.*

21. *Upon temporary cessation of an earth disturbance activity or any stage of an activity where the cessation of earth disturbance activities will exceed four days, the Site shall be immediately seeded, mulched, or otherwise protected from accelerated erosion and sedimentation pending future earth disturbance activities. For an earth disturbance activity or any stage of an activity to be considered temporarily stabilized, the disturbed areas shall*

be covered with one of the following: a minimum uniform coverage of mulch and seed, with a density capable of resisting accelerated erosion and sedimentation, or an acceptable E&SC BMPs, which temporarily minimizes 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).

22. ***Immediately fertilize, seed and stabilize areas at finished grade. Maintain E&SC control devices until Site work is complete and uniform 70% perennial vegetative cover is established.***

23. ***Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for an inspection prior to the removal of the E&SC BMPs. 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.***

24. ***Upon local CCD and Transco approval of stabilization and re-vegetation, remove temporary E&SC BMPs and stabilize areas disturbed by removal including the perimeter sediment barrier and temporary diversions. Properly dispose/recycle E&SC BMPs. Remove orange construction fencing and security fence.***

25. ***Complete access road ROW stabilization, including soil treatment, seed application and mulching in areas disturbed by E&SC BMP removal.***

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

Permanent Access Road Summary Sheet

Access Road Number:	AR-SC-063			
Watershed Name:	Swatara Creek, CWF, MF			
Act 167 Plan Name:	N/A		Date Adopted: N/A	
Design Storm Frequency	2 year	Pre-construction	Post-construction	Net Change
Rainfall Amount	3.12 inches			
Impervious area (acres)		0.362	0.514	0.152
Volume of stormwater runoff (cf) without planned		25,352	26,354	1,002
Volume of stormwater runoff (cf) with planned			23,132	(2,220)

Pre- vs. Post-construction Peak Rate of Flow Summary			
Stormwater discharge rate for the design	Pre-construction	Post-construction	Net Change
1) 1-Year/24-Hour	3.62	3.32	(0.30)
2) 2-Year/24-Hour	5.81	5.75	(0.06)
3) 5-Year/24-Hour	9.57	9.45	(0.12)
4) 10-Year/24-Hour	13.72	13.51	(0.21)
5) 25-Year/24-Hour	19.66	19.33	(0.33)
6) 50-Year/24-Hour	25.92	25.52	(0.40)
7) 100-Year/24-Hour	27.52	27.11	(0.41)

Summary Description of Restoration BMPs - Permanent Access Roads

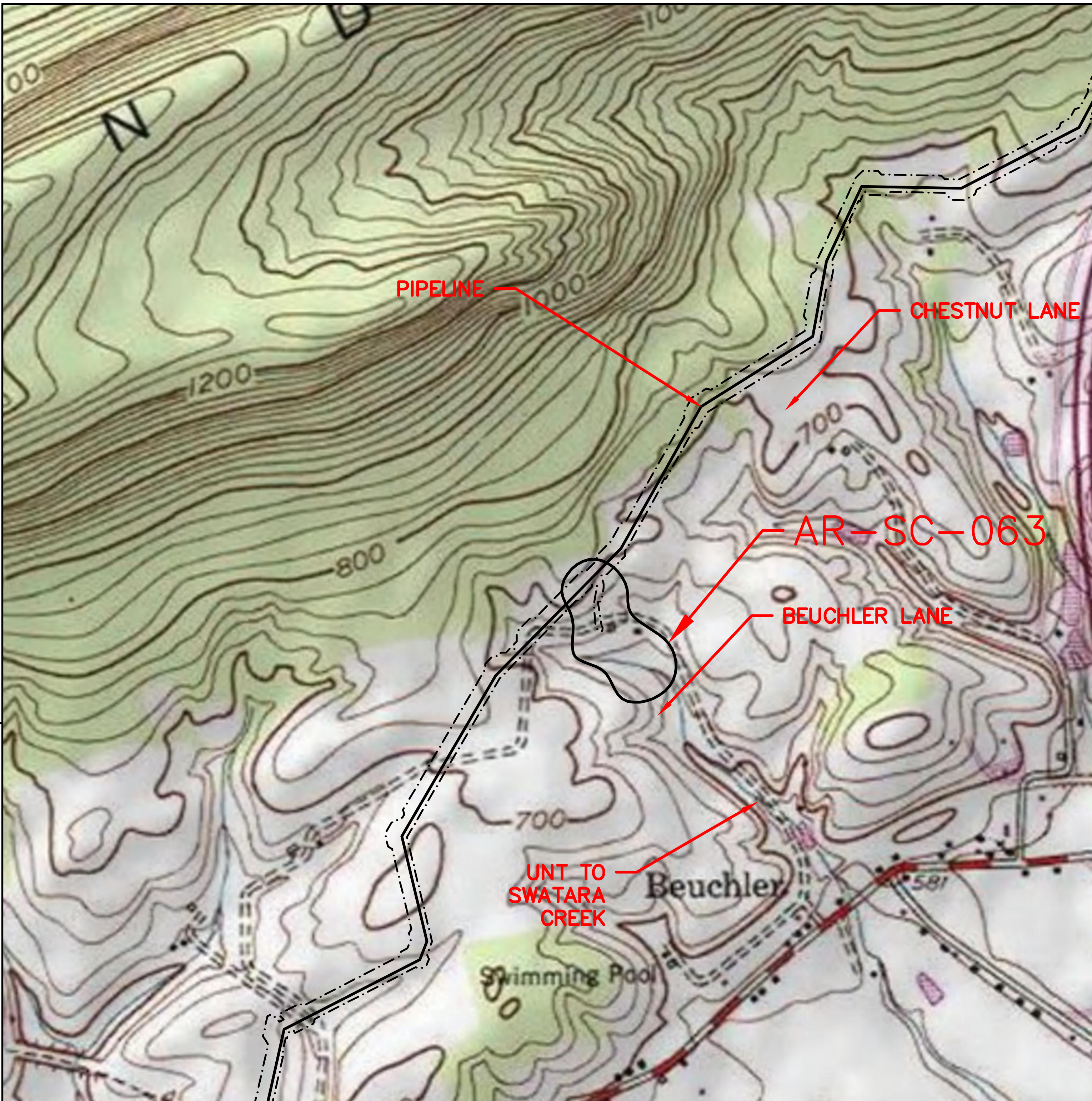
BMP	Function	Volume of stormwater treated (cf)	Acres treated
Natural area conservation: Pre-construction drainage pattern intact	Infiltration/ Recharge/ Storage	0	0
Access road design: Ditches Culverts	Infiltration/ Recharge/ Storage	900 Included in Ditches	0.11 Included in Ditches
Stormwater energy dissipaters: Riprap Aprons	Infiltration/ Recharge/ Storage	0	0
Other: MLV Stone Pad Void Storage	Infiltration/ Recharge/ Storage	2322	0.22

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:	***Swale***	***MLV Pad***
Maximum Impervious Loading Ratio	***2.6 :1 (5:1 Max)***	***1.3 :1 (5:1 Max)***
Maximum Total Loading Ratio	***6.3 :1 (8:1 Max)***	***2.8 :1 (8:1 Max)***

Supporting Areas	***Swale***	***MLV Pad***	***Unit***
Impervious Drainage Area	***0.04***	***0.11***	***Acres***
Infiltration Area	***0.02***	***0.08***	***Acres***
Total Drainage Area	***0.11***	***0.22***	***Acres***

J.2 Location Map



PINE GROVE QUADRANGLE

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

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N

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

ATLANTIC SUNRISE
PROPOSED 30" NATURAL GAS PIPELINE

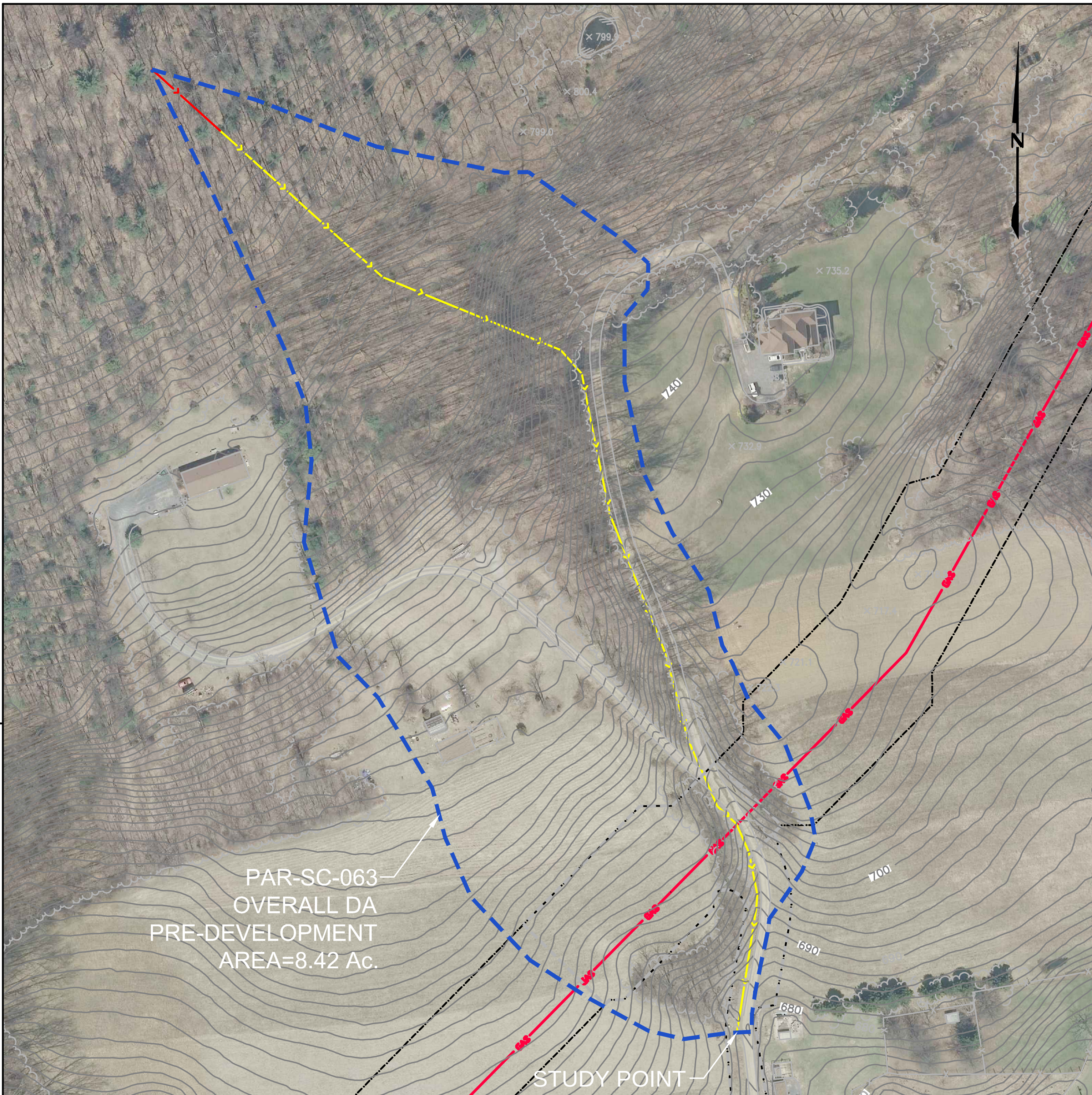
USGS LOCATION MAP
PERMANENT AR-SC-063
PINE GROVE TOWNSHIP
SCHUYLKILL COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	DRAWN BY: CLM	DATE: 11/11/15	ISSUED FOR BID:	SCALE: 1"=1,000'
				1161481			CHECKED BY:	DATE:	ISSUED FOR CONSTRUCTION:	
							APPROVED BY:	DATE:	DRAWING NUMBER: 24-1600-70-28-A/ LL113_9-AR-SC-063	SHEET 1 OF 1
							WO: 1161481			

J.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



ISSUED FOR PERMITTING

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LEGEND

TIME OF CONCENTRATION-SHEET FLOW	
TIME OF CONCENTRATION-SHALLOW CONCENTRATED FLOW	
DRAINAGE AREA	
PROPOSED GAS PIPELINE	GAS GAS

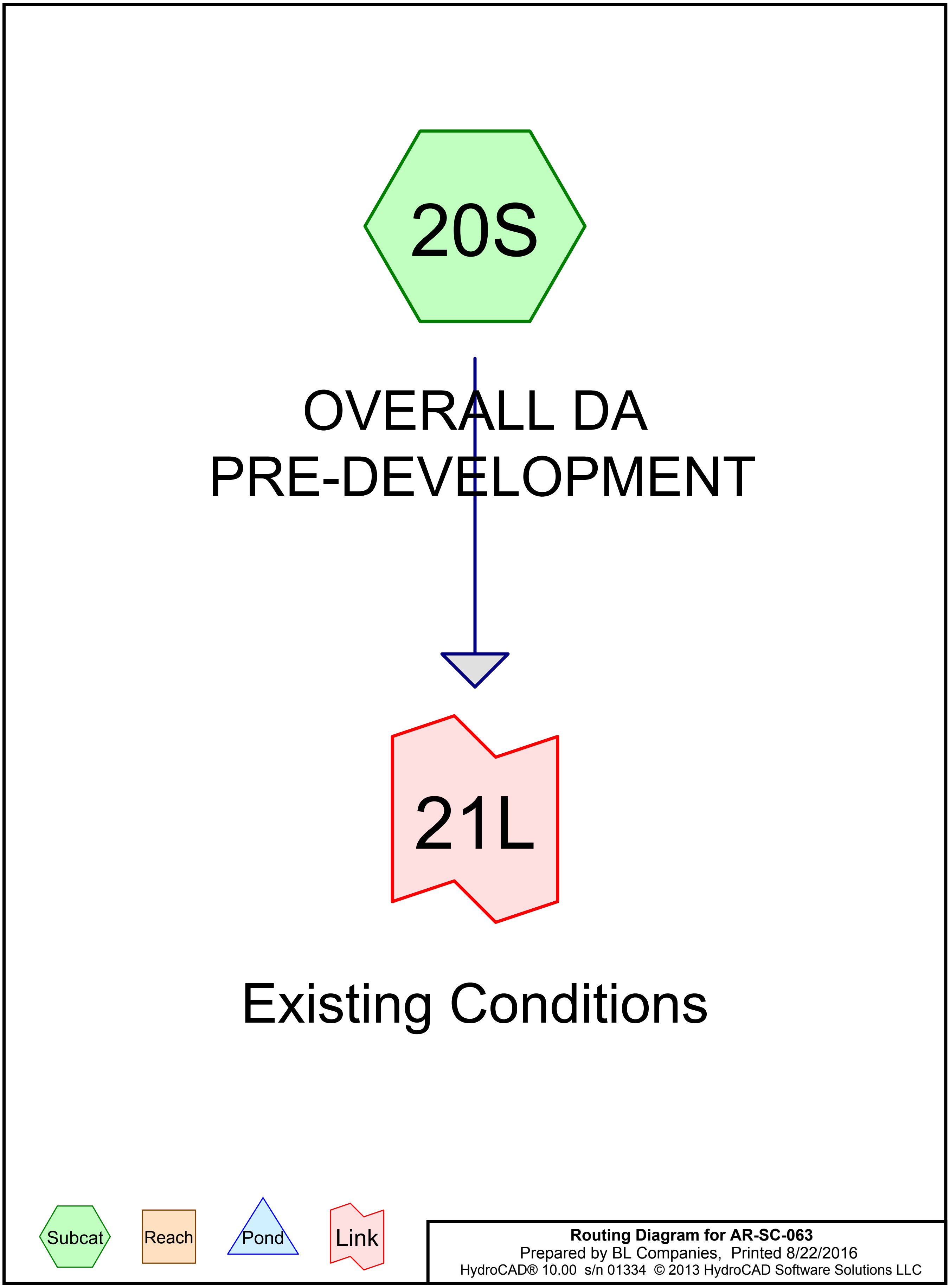
ATLANTIC SUNRISE PROJECT -
CENTRAL PENN LINE SOUTH

PROPOSED 42" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-SC-063 PRE
PINE GROVE TOWNSHIP
SCHUYLKILL COUNTY, PENNSYLVANIA

Williams

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

DRAWN BY: OLC	DATE: 10/26/15	ISSUED FOR BID:	SCALE: 1" = 150'
CHECKED BY: BJP	DATE: 10/26/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: BJP	DATE: 10/26/15	DRAWING NUMBER: AR-SC-063 PRE	
WO:			



Routing Diagram for AR-SC-063
Prepared by BL Companies, Printed 8/22/2016
HydroCAD® 10.00 s/n 01334 © 2013 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.362	89	Gravel roads, HSG C (20S)
3.756	71	Meadow, non-grazed, HSG C (20S)
4.297	70	Woods, Good, HSG C (20S)
8.416	**71**	**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 20S: OVERALL DA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=0.56"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=3.62 cfs 0.395 af

Link 21L: Existing Conditions Inflow=3.62 cfs 0.395 af
Primary=3.62 cfs 0.395 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.395 af Average Runoff Depth = 0.56"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

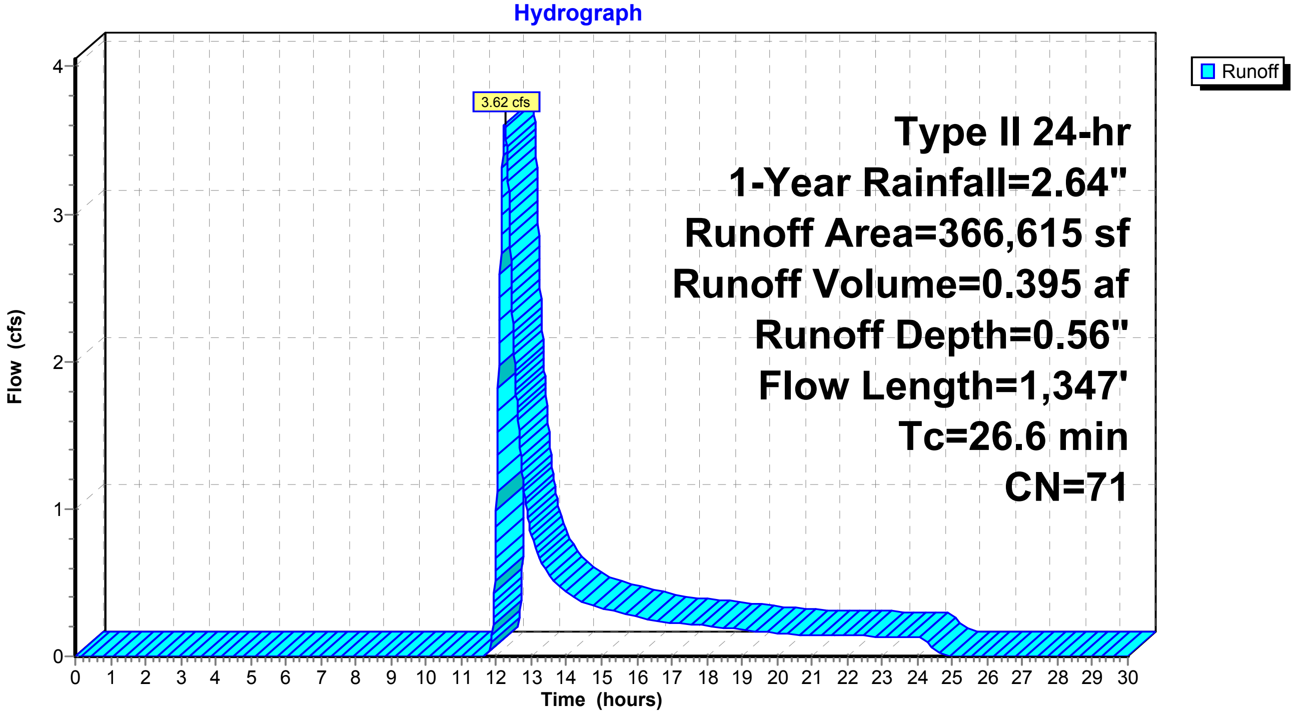
Runoff = 3.62 cfs @ 12.24 hrs, Volume= 0.395 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

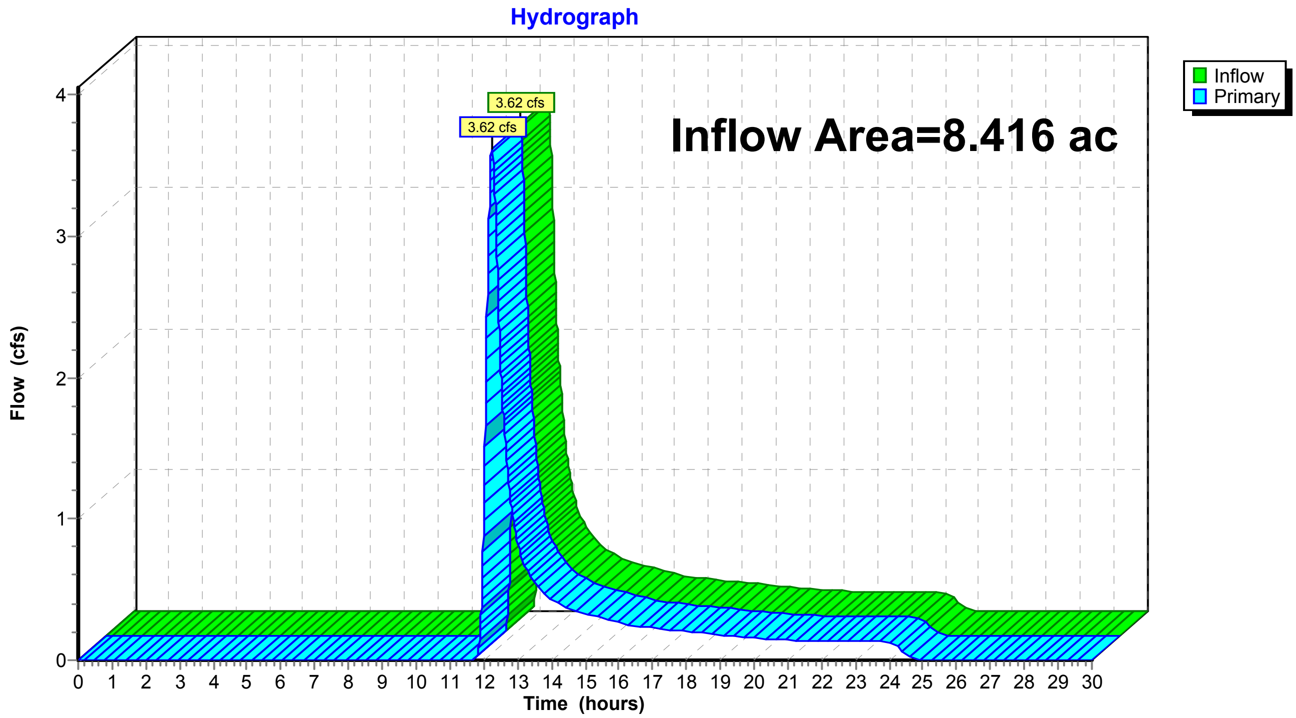


Summary for Link 21L: Existing Conditions

Inflow Area =	8.416 ac,	0.00% Impervious,	Inflow Depth = 0.56"	for 1-Year event	
Inflow =	3.62 cfs @	12.24 hrs, Volume=	0.395 af		
Primary =	3.62 cfs @	12.24 hrs, Volume=	0.395 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment20S: OVERALLDA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=5.81 cfs 0.582 af

Link 21L: Existing Conditions Inflow=5.81 cfs 0.582 af
Primary=5.81 cfs 0.582 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.582 af Average Runoff Depth = 0.83"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

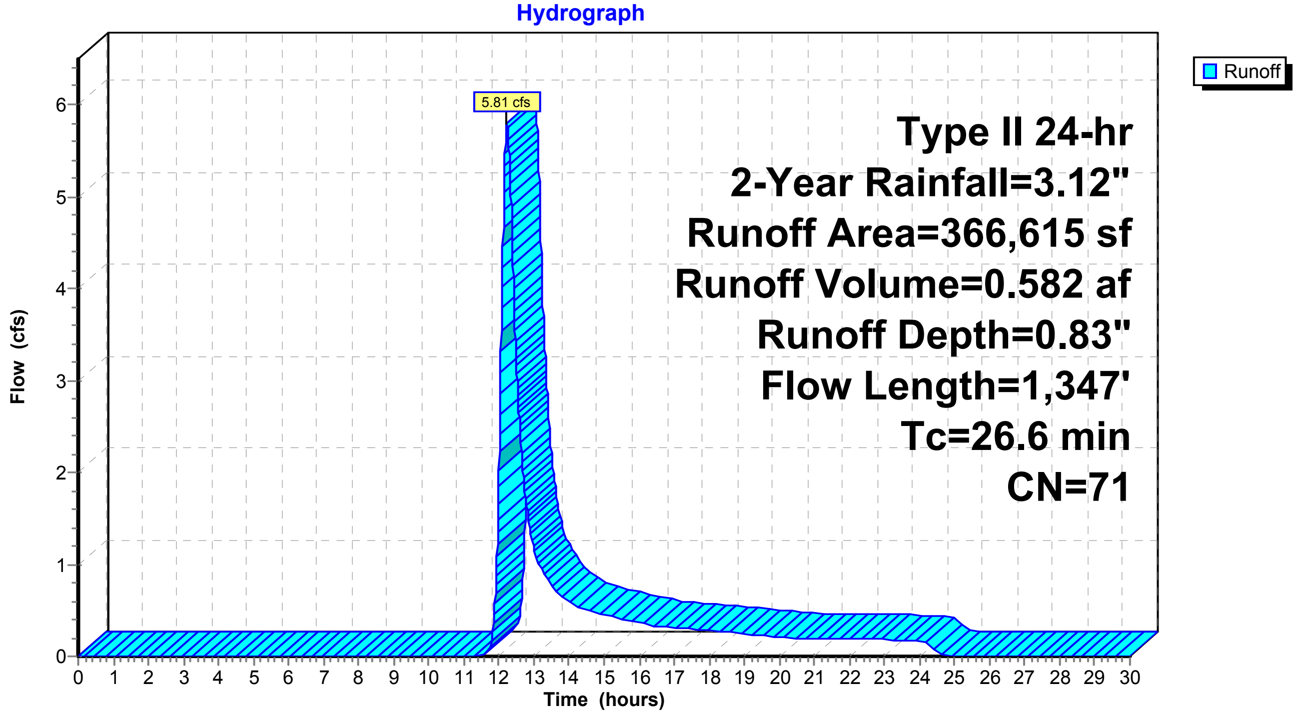
Runoff = 5.81 cfs @ 12.23 hrs, Volume= 0.582 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

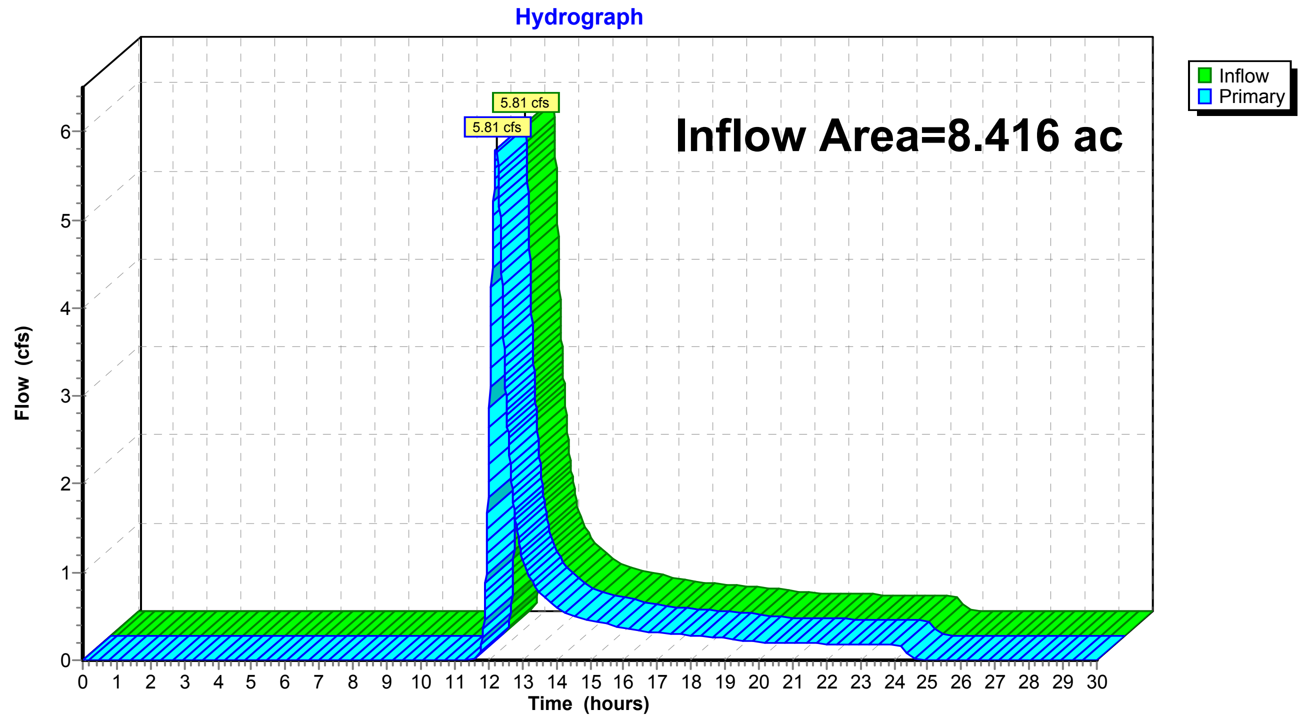


Summary for Link 21L: Existing Conditions

Inflow Area =	8.416 ac,	0.00% Impervious, Inflow Depth = 0.83"	for 2-Year event		
Inflow =	5.81 cfs @	12.23 hrs, Volume=	0.582 af		
Primary =	5.81 cfs @	12.23 hrs, Volume=	0.582 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment20S: OVERALL DA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=9.57 cfs 0.902 af

Link 21L: Existing Conditions Inflow=9.57 cfs 0.902 af
Primary=9.57 cfs 0.902 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.902 af Average Runoff Depth = 1.29"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

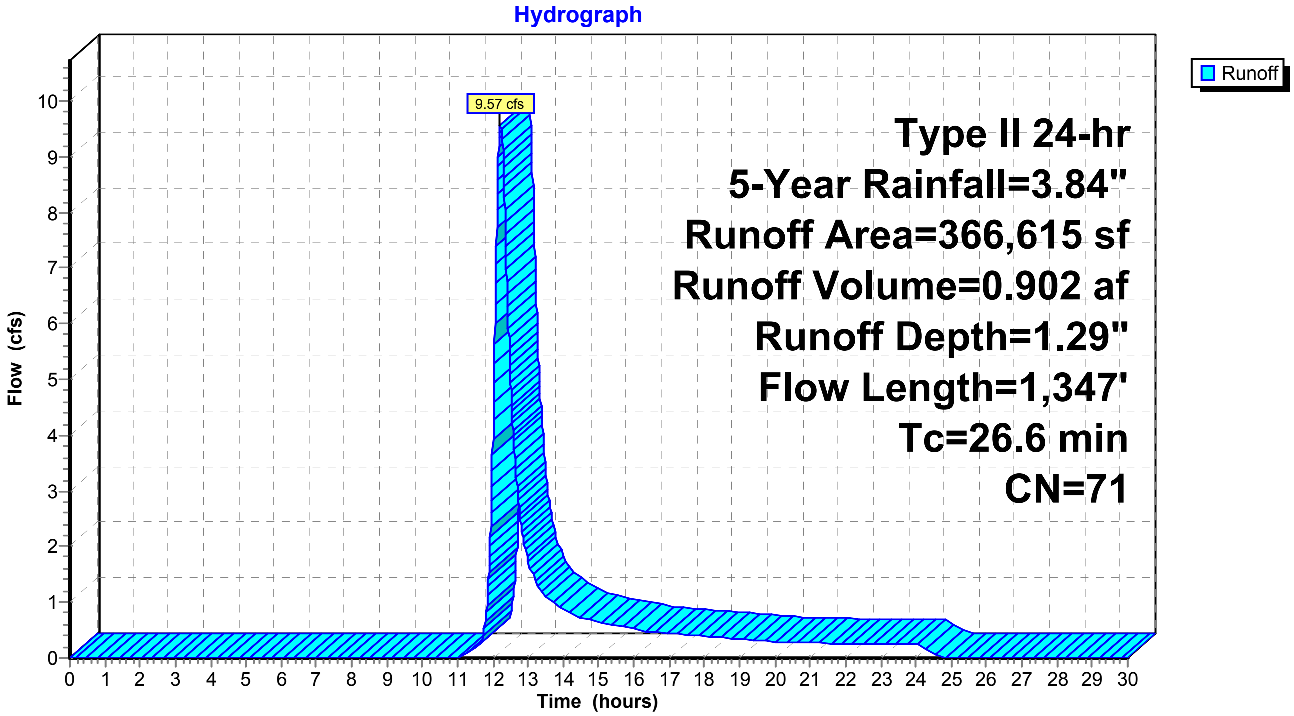
Runoff = 9.57 cfs @ 12.21 hrs, Volume= 0.902 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

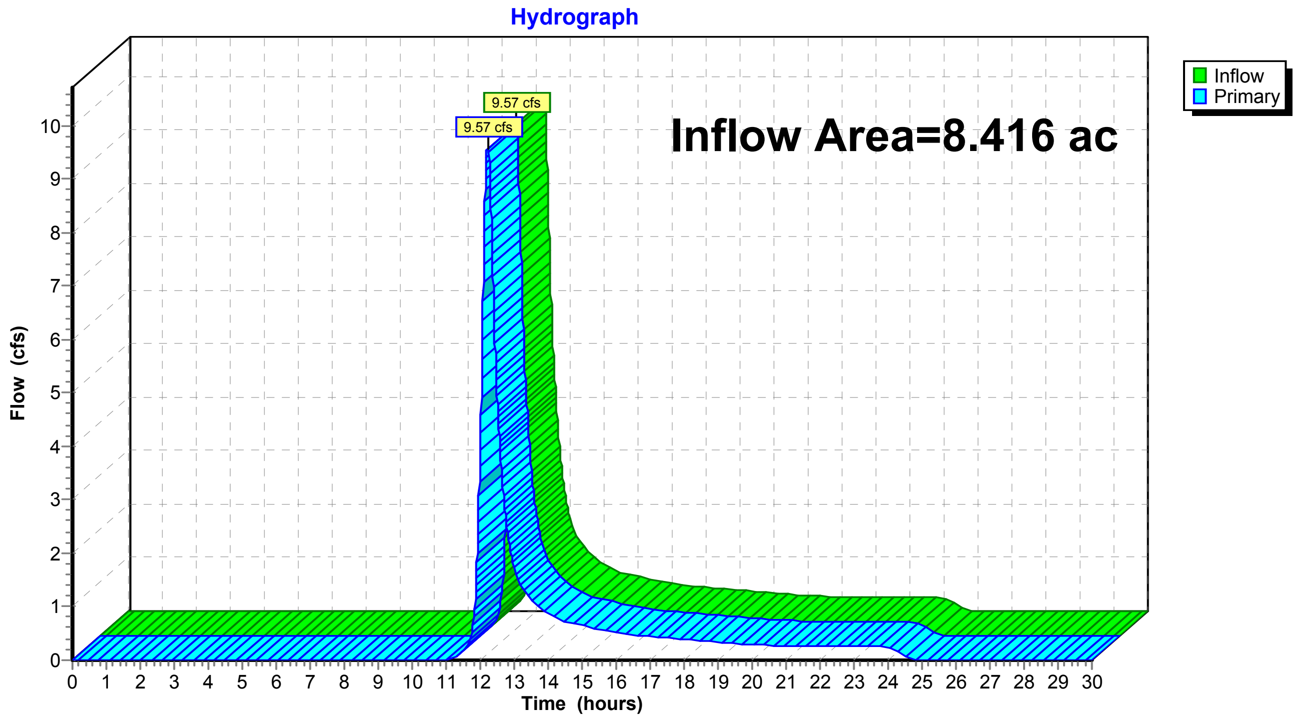


Summary for Link 21L: Existing Conditions

Inflow Area = 8.416 ac, 0.00% Impervious, Inflow Depth = 1.29" for 5-Year event
Inflow = 9.57 cfs @ 12.21 hrs, Volume= 0.902 af
Primary = 9.57 cfs @ 12.21 hrs, Volume= 0.902 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment20S: OVERALLDA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=1.79"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=13.72 cfs 1.255 af

Link 21L: Existing Conditions Inflow=13.72 cfs 1.255 af
Primary=13.72 cfs 1.255 af

Total Runoff Area = 8.416 ac Runoff Volume = 1.255 af Average Runoff Depth = 1.79"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

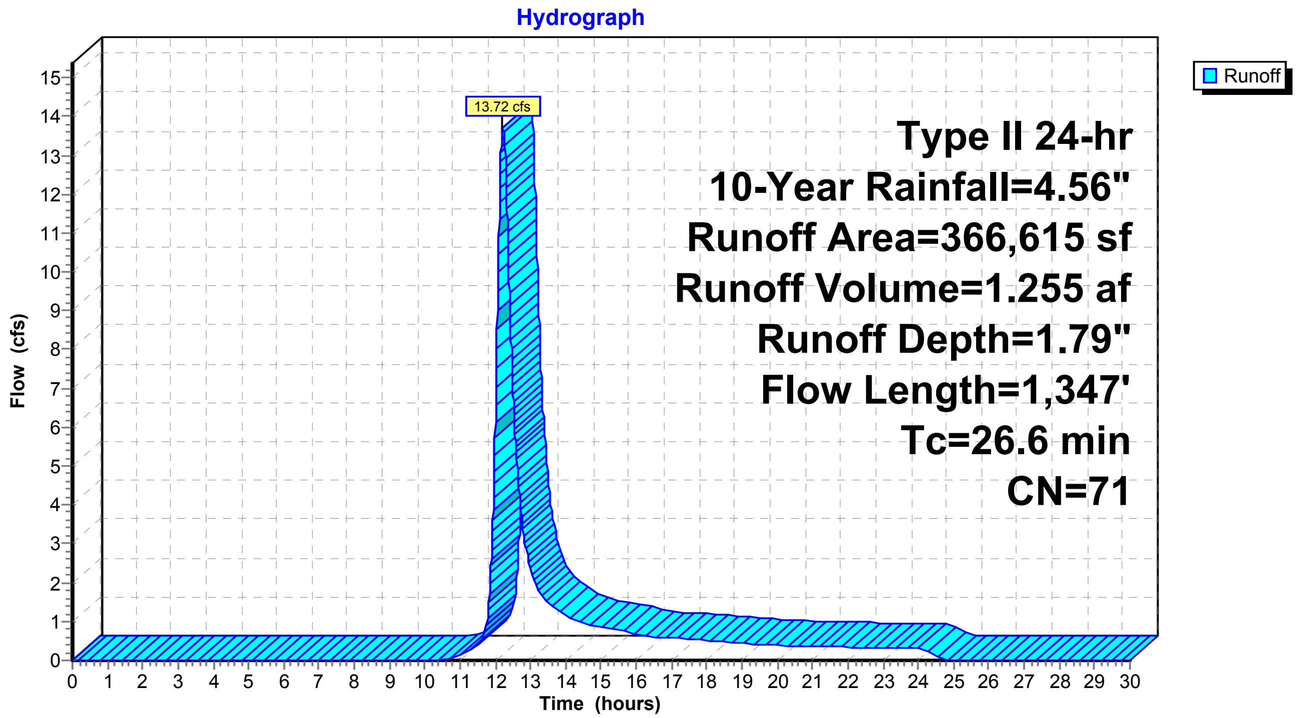
Runoff = 13.72 cfs @ 12.21 hrs, Volume= 1.255 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

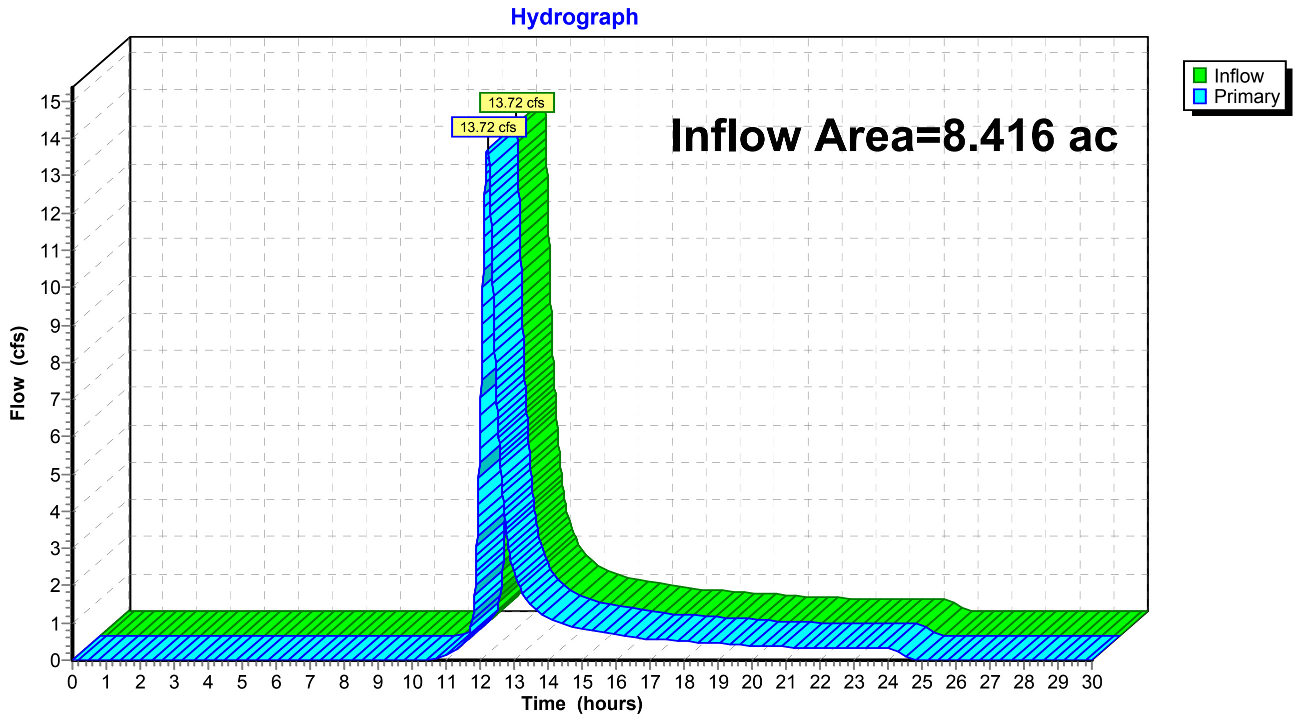


Summary for Link 21L: Existing Conditions

Inflow Area = 8.416 ac, 0.00% Impervious, Inflow Depth = 1.79" for 10-Year event
Inflow = 13.72 cfs @ 12.21 hrs, Volume= 1.255 af
Primary = 13.72 cfs @ 12.21 hrs, Volume= 1.255 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 20S: OVERALL DA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=2.52"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=19.66 cfs 1.765 af

Link 21L: Existing Conditions Inflow=19.66 cfs 1.765 af
Primary=19.66 cfs 1.765 af

Total Runoff Area = 8.416 ac Runoff Volume = 1.765 af Average Runoff Depth = 2.52"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

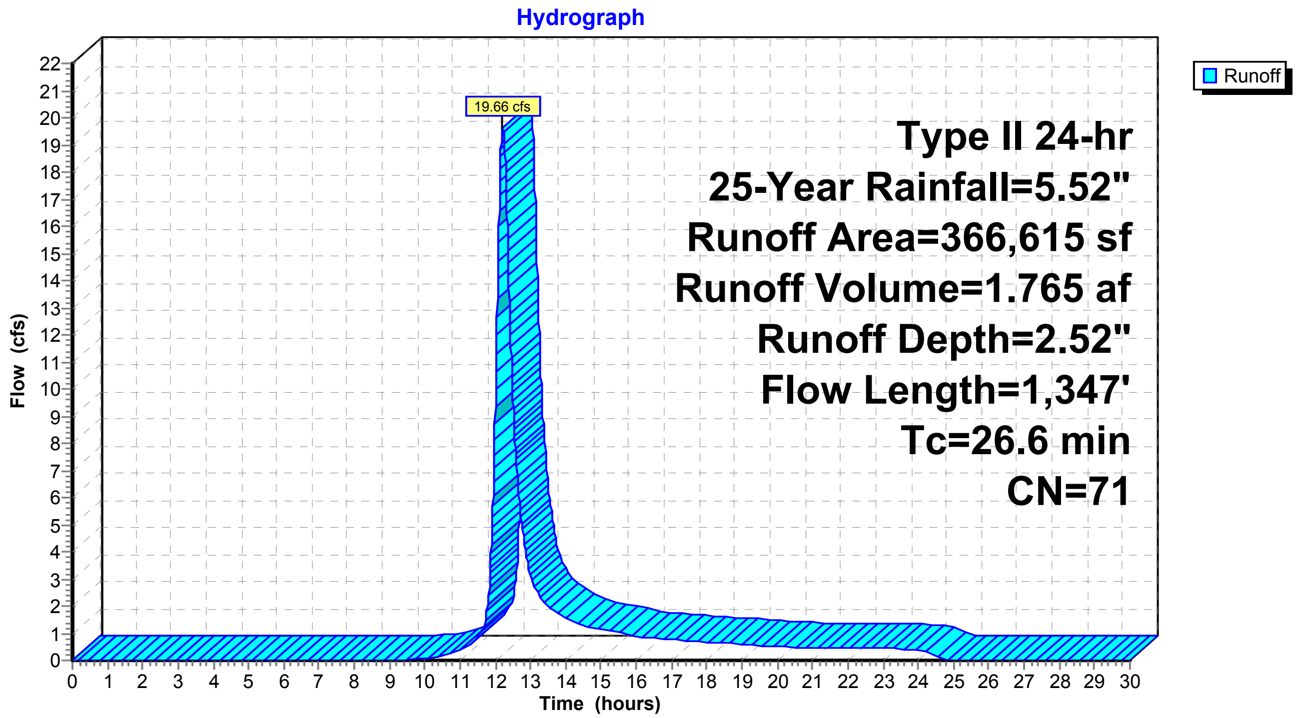
Runoff = 19.66 cfs @ 12.21 hrs, Volume= 1.765 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

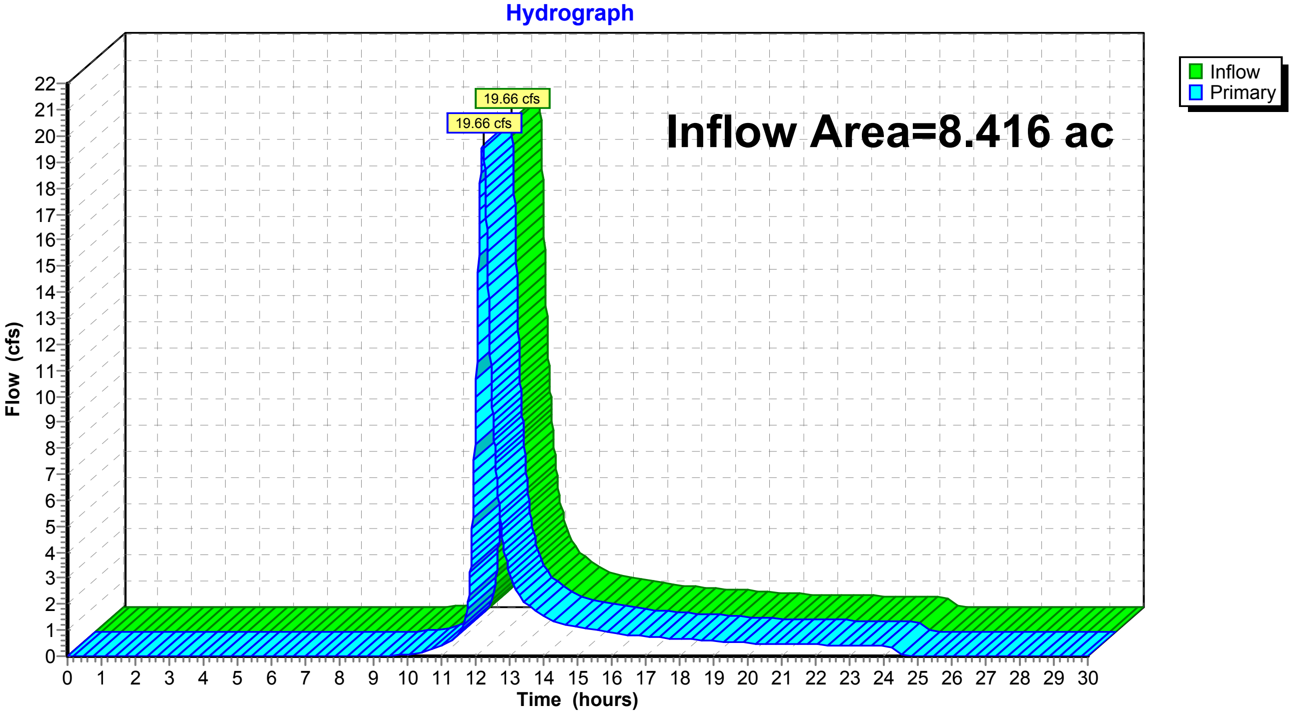


Summary for Link 21L: Existing Conditions

Inflow Area =	8.416 ac,	0.00% Impervious,	Inflow Depth = 2.52"	for 25-Year event	
Inflow =	19.66 cfs @	12.21 hrs,	Volume=	1.765 af	
Primary =	19.66 cfs @	12.21 hrs,	Volume=	1.765 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 20S: OVERALL DA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=3.29"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=25.92 cfs 2.308 af

Link 21L: Existing Conditions Inflow=25.92 cfs 2.308 af
Primary=25.92 cfs 2.308 af

Total Runoff Area = 8.416 ac Runoff Volume = 2.308 af Average Runoff Depth = 3.29"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

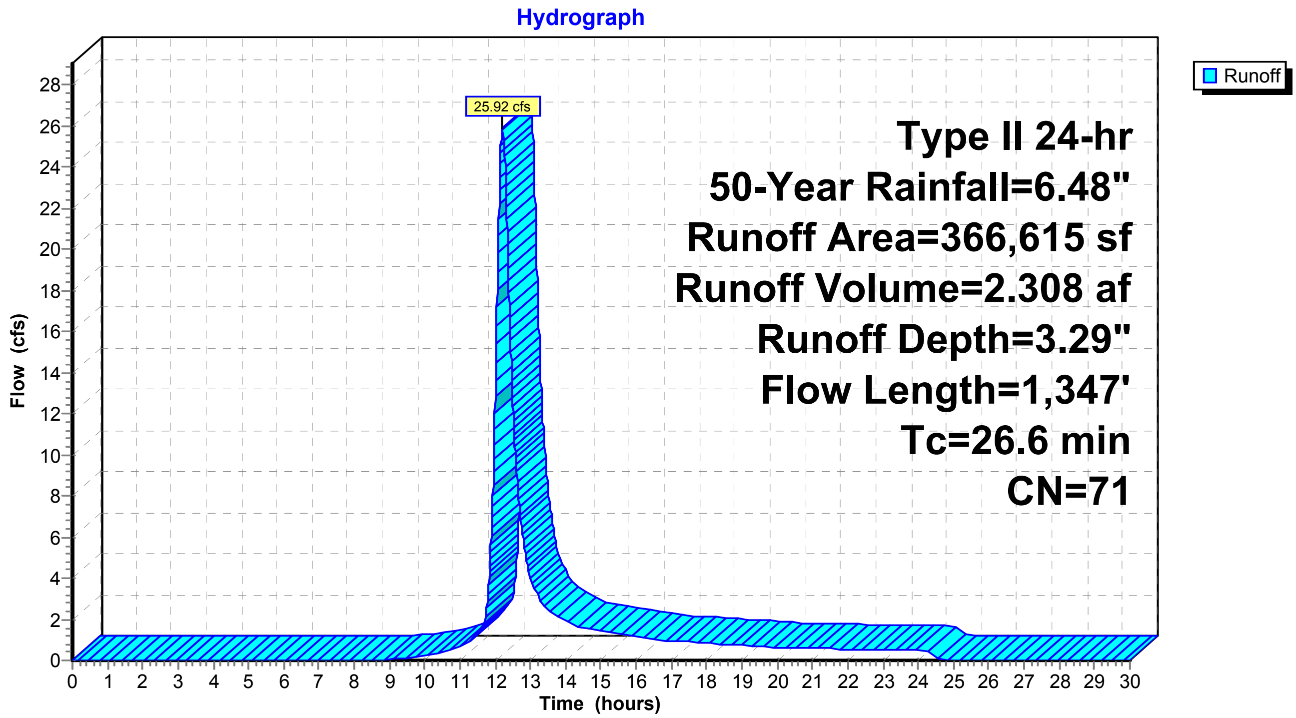
Runoff = 25.92 cfs @ 12.21 hrs, Volume= 2.308 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

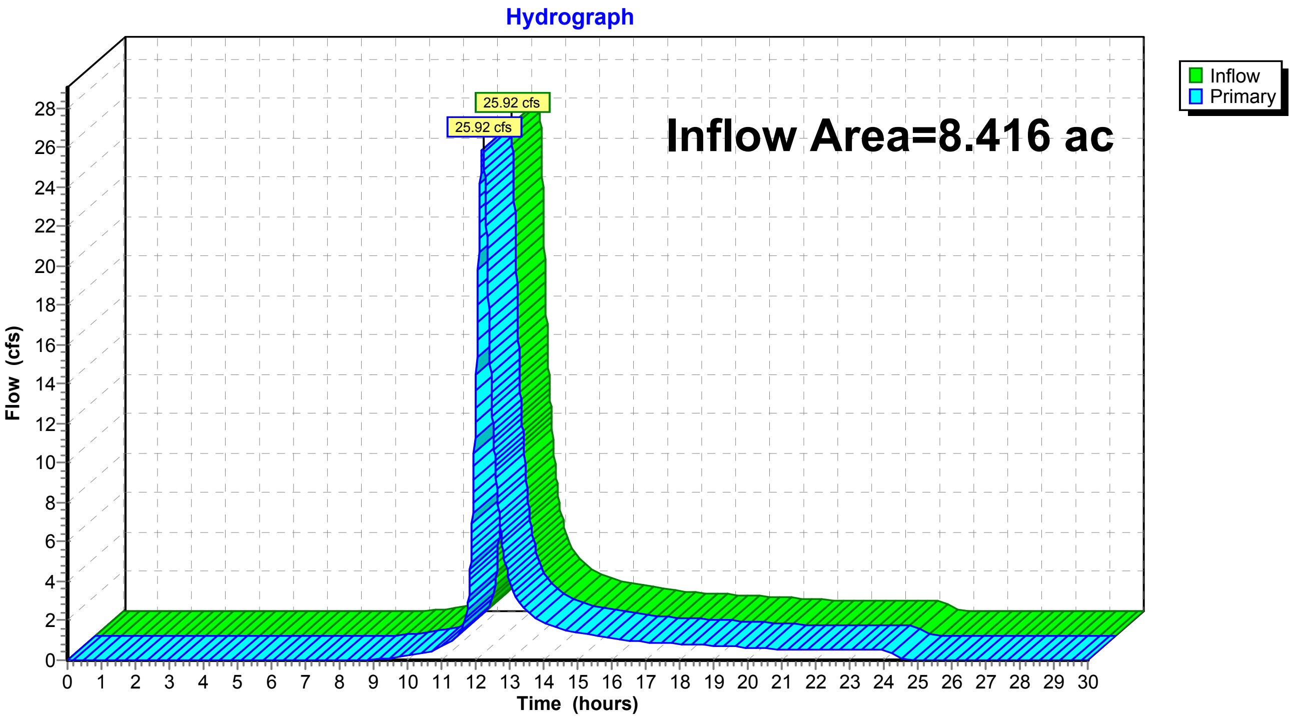


Summary for Link 21L: Existing Conditions

Inflow Area = 8.416 ac, 0.00% Impervious, Inflow Depth = 3.29" for 50-Year event
Inflow = 25.92 cfs @ 12.21 hrs, Volume= 2.308 af
Primary = 25.92 cfs @ 12.21 hrs, Volume= 2.308 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment20S: OVERALLDA Runoff Area=366,615 sf 0.00% Impervious Runoff Depth=3.49"
Flow Length=1,347' Tc=26.6 min CN=71 Runoff=27.52 cfs 2.447 af

Link 21L: Existing Conditions Inflow=27.52 cfs 2.447 af
Primary=27.52 cfs 2.447 af

Total Runoff Area = 8.416 ac Runoff Volume = 2.447 af Average Runoff Depth = 3.49"
100.00% Pervious = 8.416 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

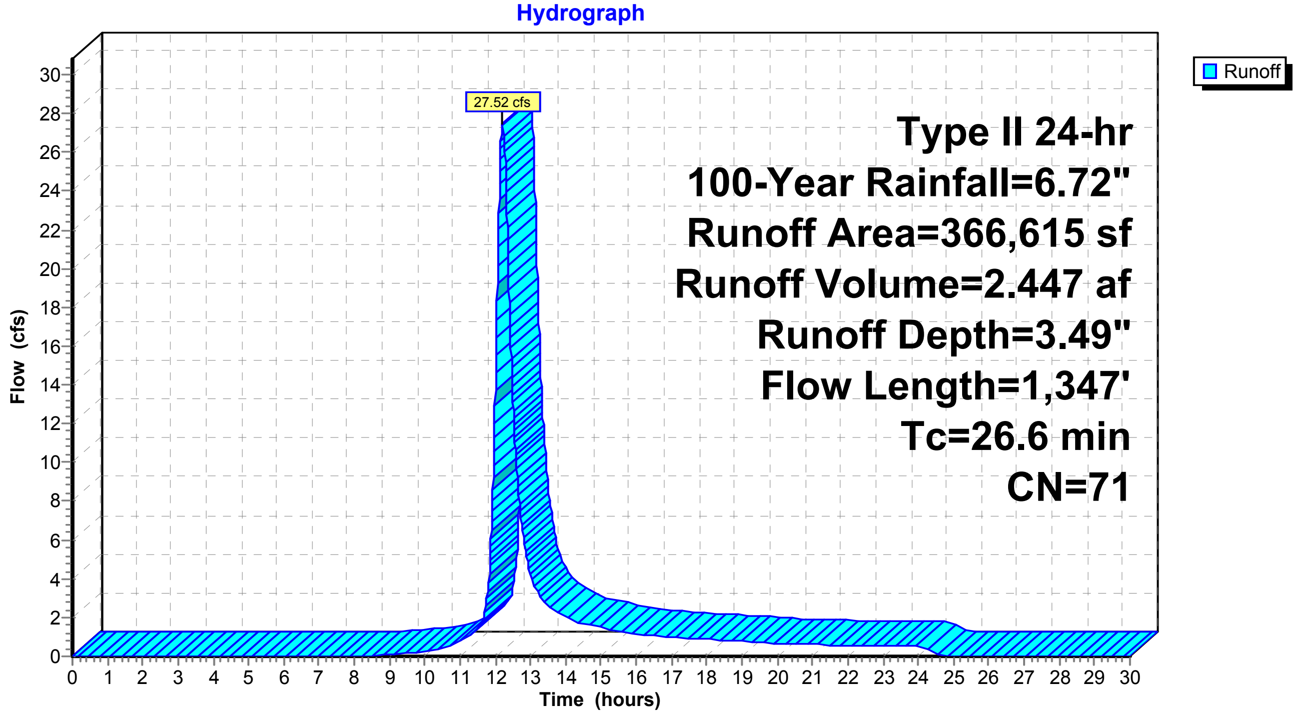
Runoff = 27.52 cfs @ 12.21 hrs, Volume= 2.447 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	15,786	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	187,199	70	Woods, Good, HSG C
	163,630	71	Meadow, non-grazed, HSG C
	366,615	71	Weighted Average
	366,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.4	277	0.0900	11.35	79.45	**Channel Flow, Channel** Area= 7.0 sf Perim= 16.7' r= 0.42' n= 0.022 Earth, clean & straight
26.6	1,347	Total			

Subcatchment 20S: OVERALL DA PRE-DEVELOPMENT

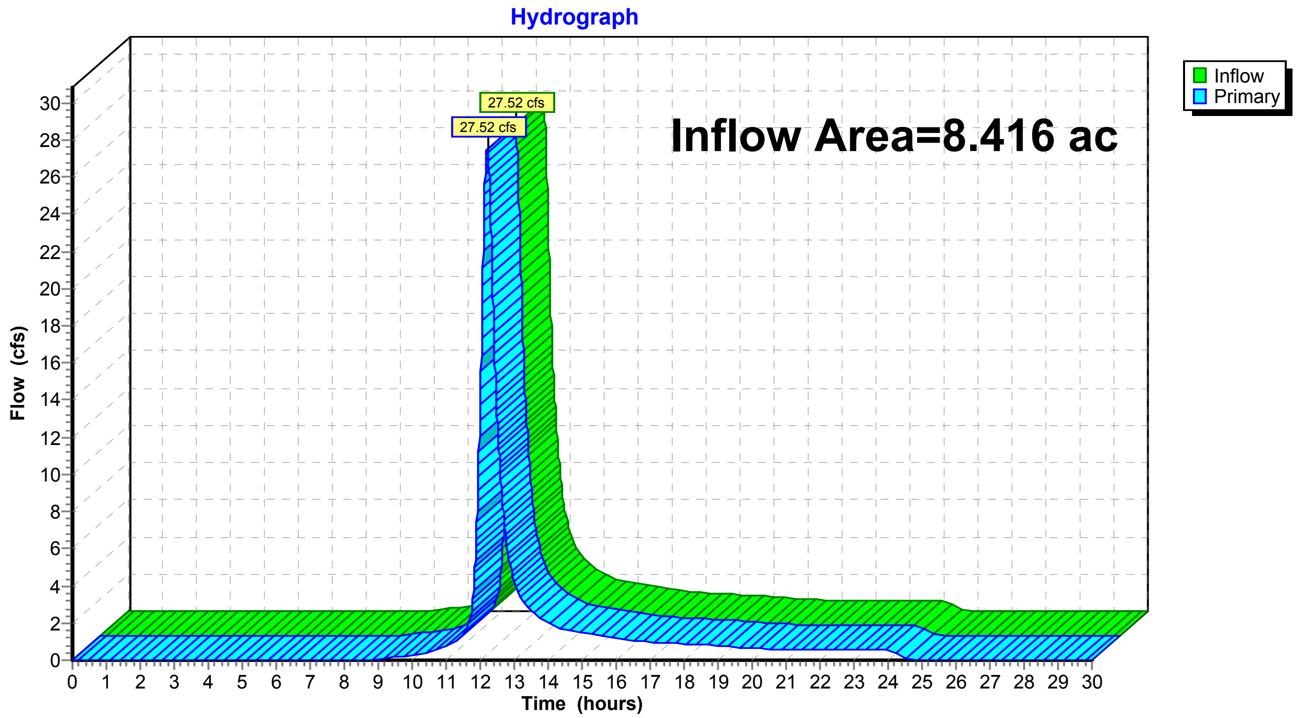


Summary for Link 21L: Existing Conditions

Inflow Area =	8.416 ac,	0.00% Impervious,	Inflow Depth = 3.49"	for 100-Year event	
Inflow =	27.52 cfs @	12.21 hrs,	Volume=	2.447 af	
Primary =	27.52 cfs @	12.21 hrs,	Volume=	2.447 af,	Atten= 0%, Lag= 0.0 min

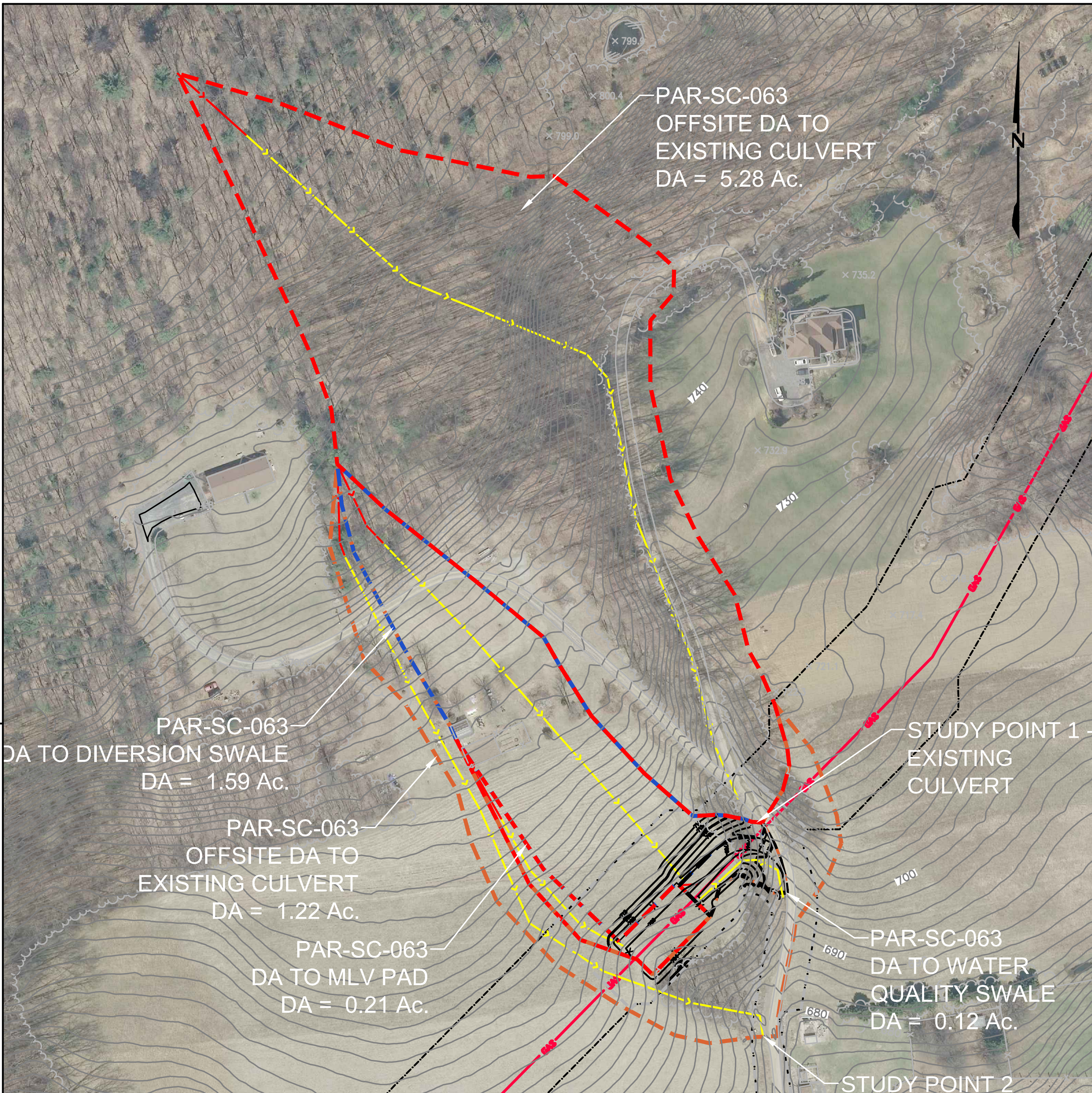
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 21L: Existing Conditions



J.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



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

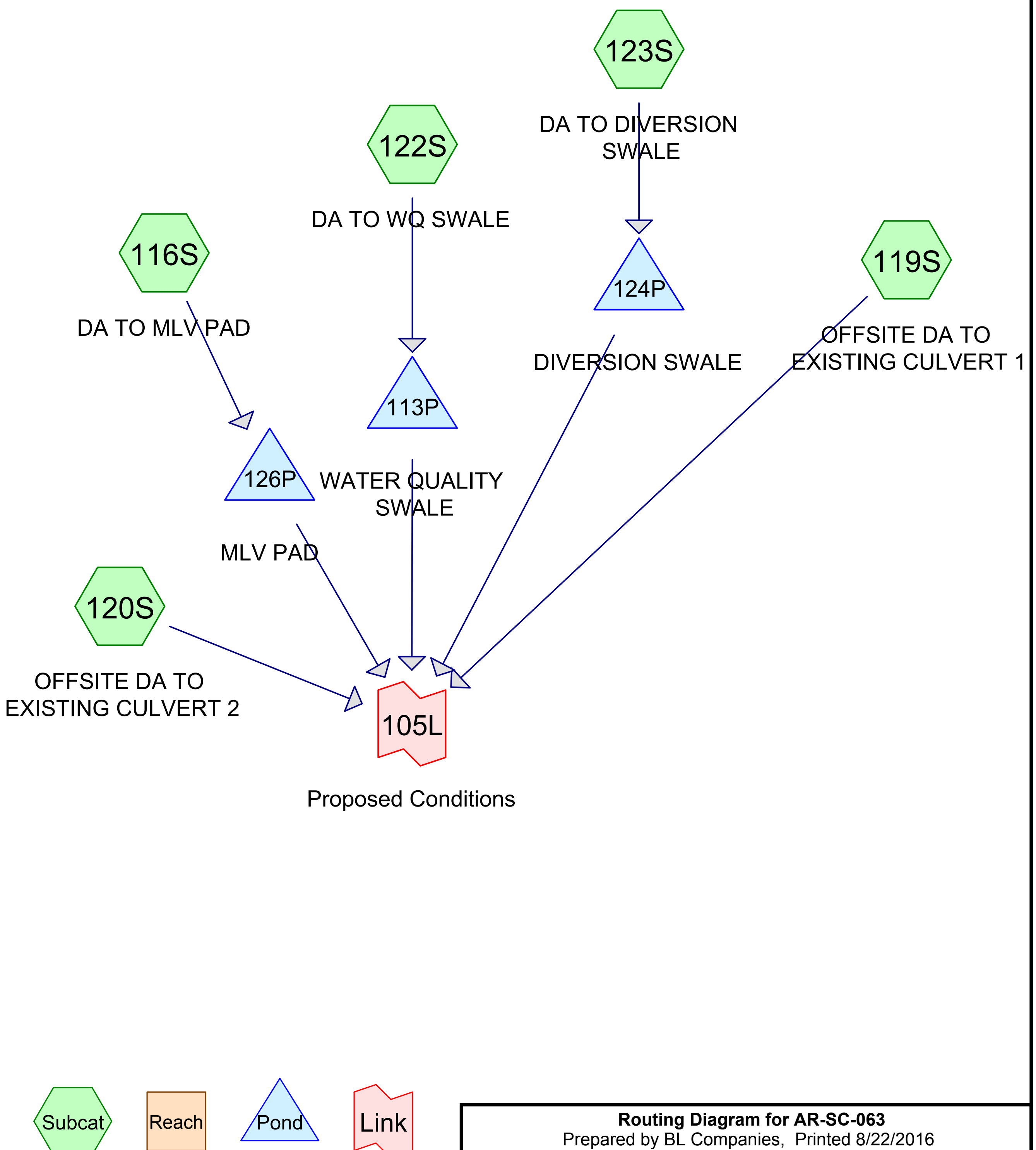
ATLANTIC SUNRISE PROJECT -
CENTRAL PENN LINE SOUTH

PROPOSED 42" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-SC-063 POST
PINE GROVE TOWNSHIP
SCHUYLKILL COUNTY, PENNSYLVANIA

Williams

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

DRAWN BY: OLC	DATE: 10/26/15	ISSUED FOR BID:	SCALE: 1" = 150'
CHECKED BY: BJP	DATE: 10/26/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: BJP	DATE: 10/26/15	DRAWING NUMBER: AR-SC-063 POST	
WO:			



Routing Diagram for AR-SC-063
Prepared by BL Companies, Printed 8/22/2016

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.107	98	Crushed Stone Pad, HSG C (116S)
0.407	89	Gravel roads, HSG C (119S, 120S, 122S, 123S)
3.636	71	Meadow, non-grazed, HSG C (116S, 119S, 120S, 122S, 123S)
4.266	70	Woods, Good, HSG C (119S, 120S, 122S, 123S)
8.416	**72**	**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=1.23"
Flow Length=299' Tc=10.0 min CN=84 Runoff=0.41 cfs 0.022 af

Subcatchment 119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=0.56"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=2.29 cfs 0.247 af

Subcatchment 120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=0.60"
Flow Length=851' Tc=27.1 min CN=72 Runoff=0.57 cfs 0.061 af

Subcatchment 122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=0.88"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.19 cfs 0.009 af

Subcatchment 123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=0.56"
Flow Length=595' Tc=23.3 min CN=71 Runoff=0.75 cfs 0.074 af

Pond 113P: WATER QUALITY SWALE Peak Elev=698.42' Storage=374 cf Inflow=0.19 cfs 0.009 af
Outflow=0.00 cfs 0.000 af

Pond 124P: DIVERSION SWALE Peak Elev=699.09' Storage=706 cf Inflow=0.75 cfs 0.074 af
Outflow=0.63 cfs 0.058 af

Pond 126P: MLV PAD Peak Elev=704.36' Storage=968 cf Inflow=0.41 cfs 0.022 af
Outflow=0.00 cfs 0.000 af

Link 105L: Proposed Conditions Inflow=3.32 cfs 0.367 af
Primary=3.32 cfs 0.367 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.414 af Average Runoff Depth = 0.59"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

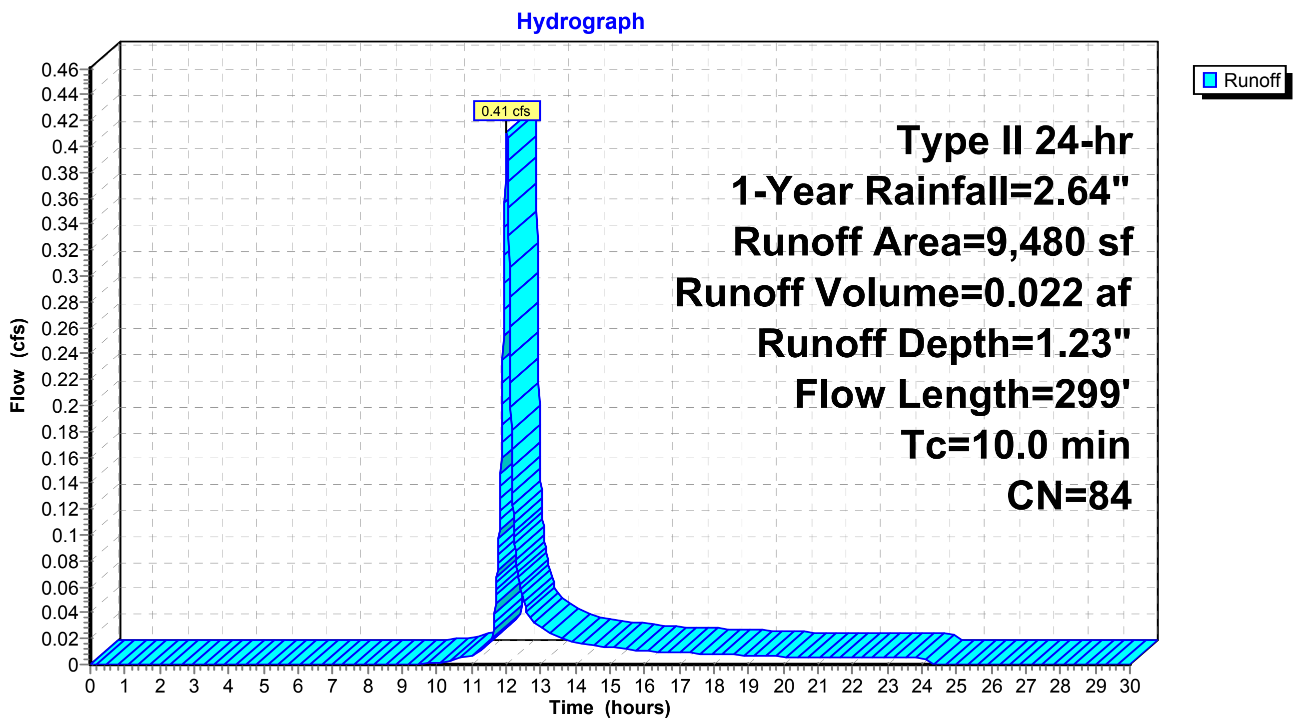
Runoff = 0.41 cfs @ 12.02 hrs, Volume= 0.022 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

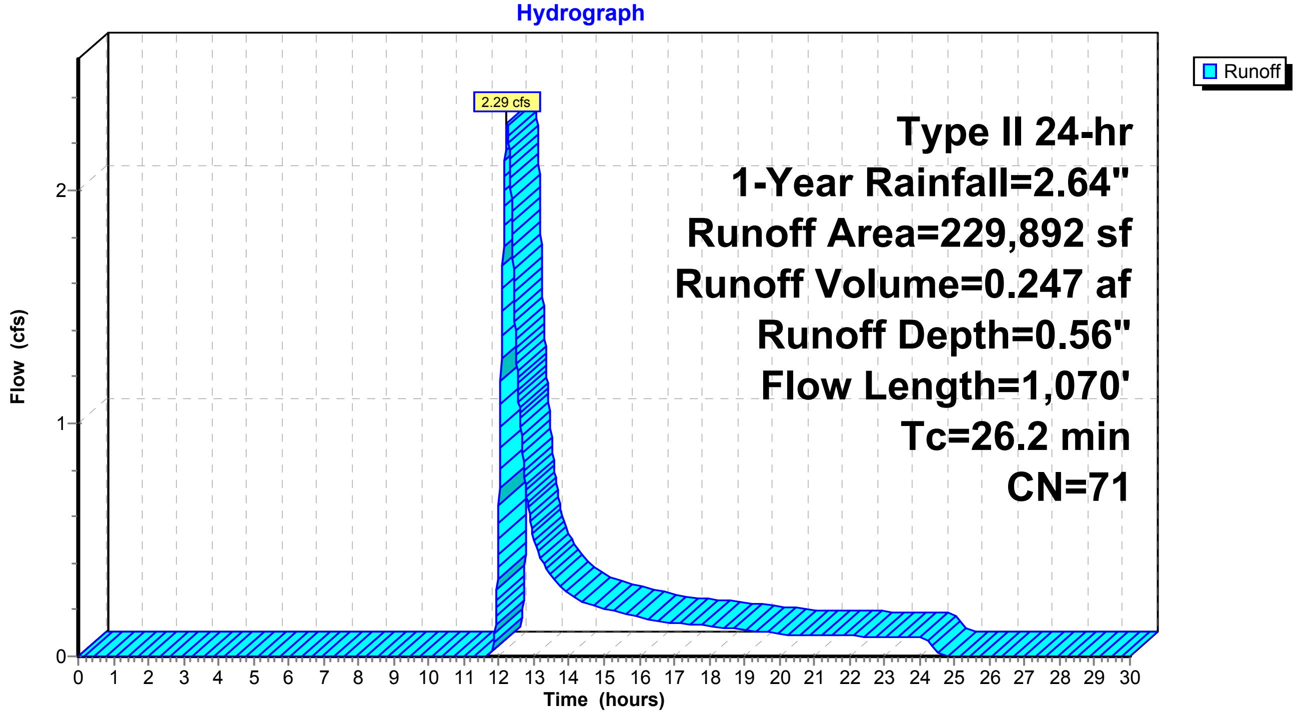
Runoff = 2.29 cfs @ 12.23 hrs, Volume= 0.247 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

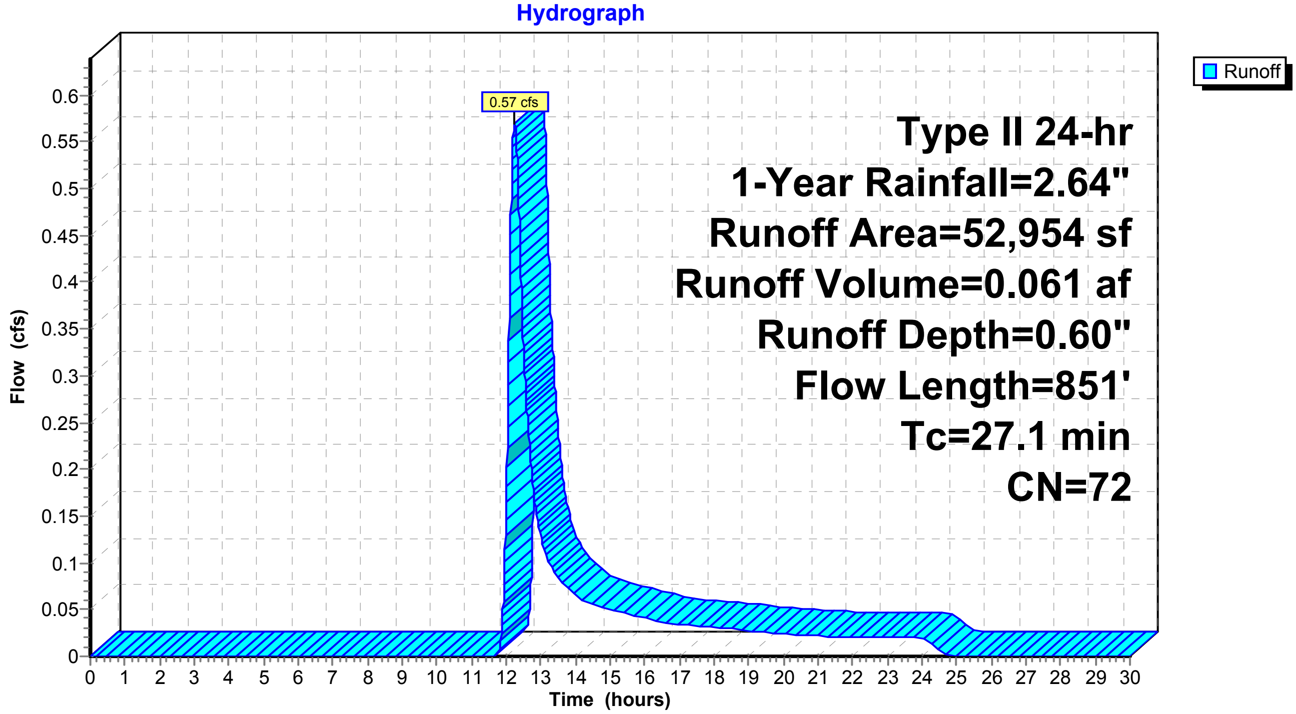
Runoff = 0.57 cfs @ 12.25 hrs, Volume= 0.061 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

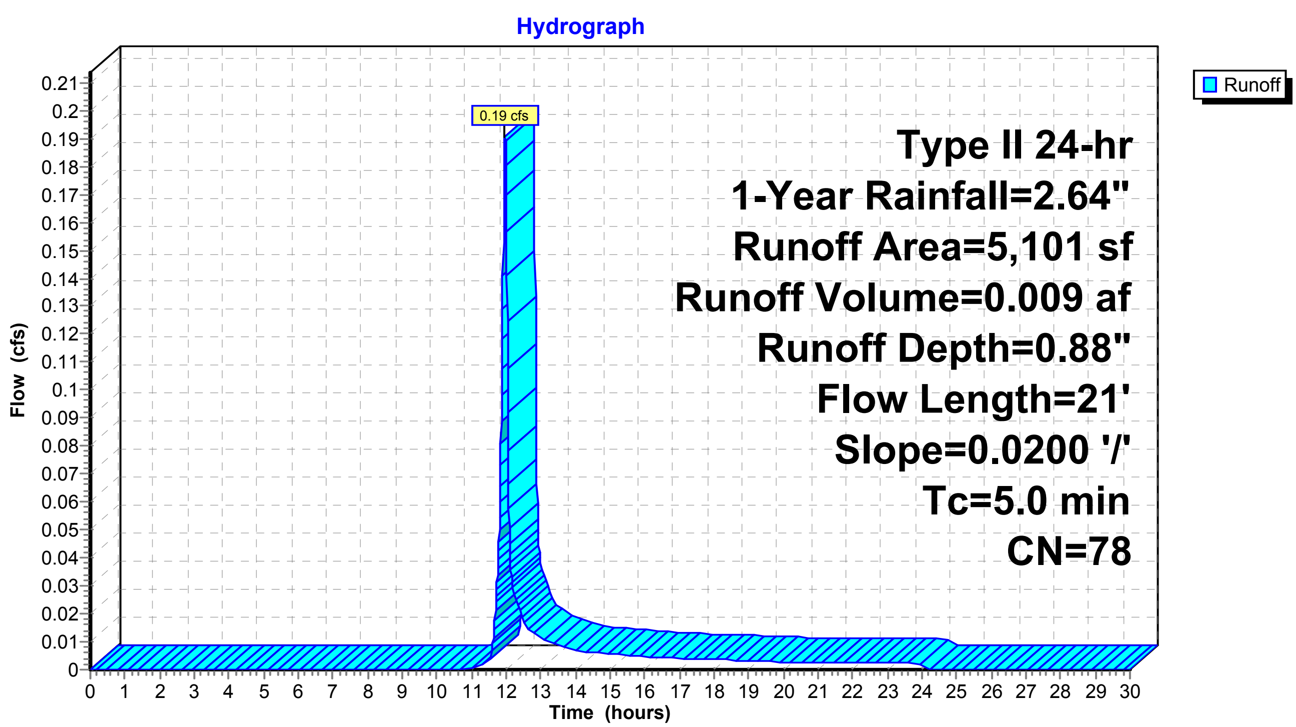
Runoff = 0.19 cfs @ 11.97 hrs, Volume= 0.009 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

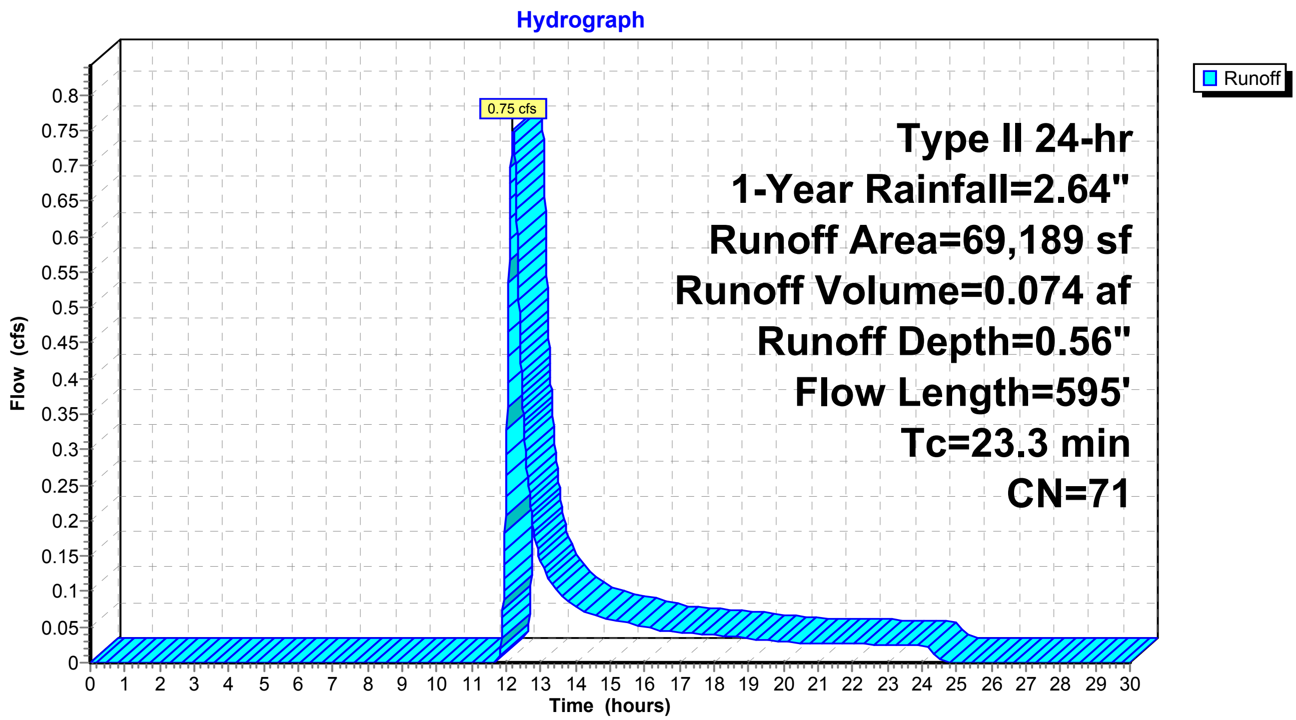
Runoff = 0.75 cfs @ 12.19 hrs, Volume= 0.074 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.64"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 0.88" for 1-Year event
Inflow = 0.19 cfs @ 11.97 hrs, Volume= 0.009 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 698.42' @ 24.29 hrs Surf.Area= 0 sf Storage= 374 cf

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

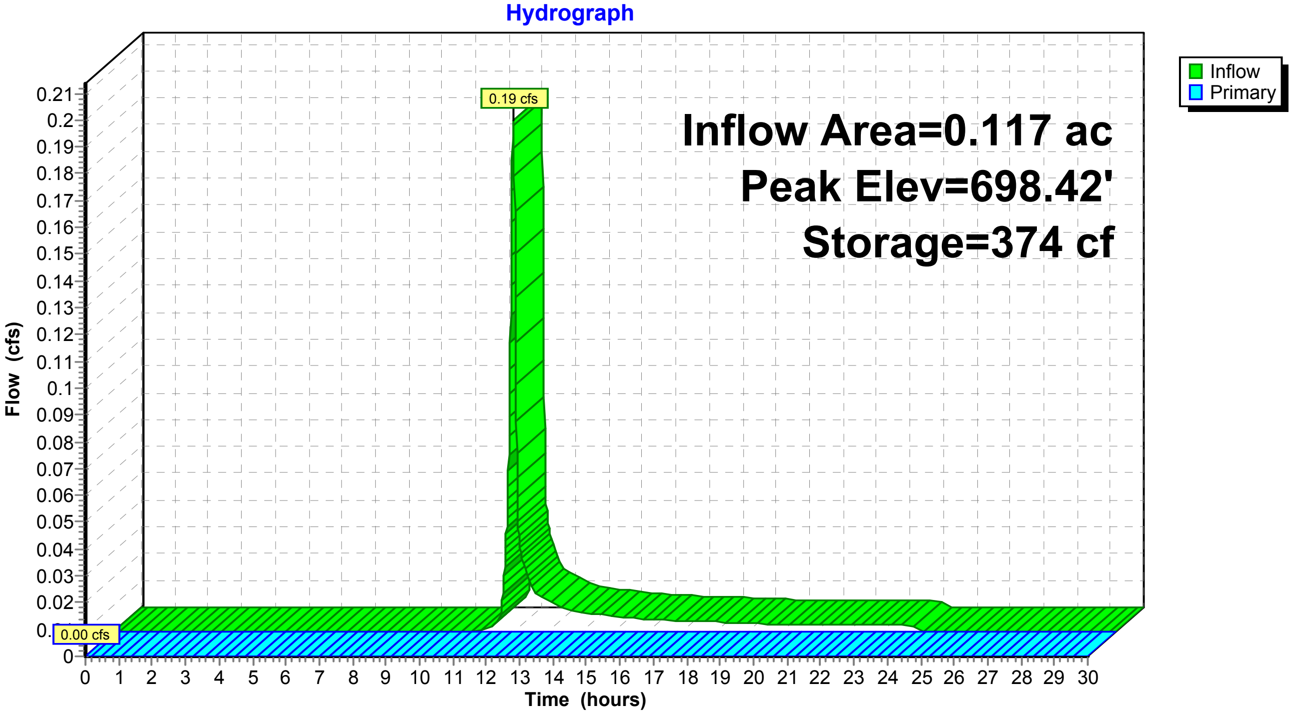
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 0.00 hrs HW=698.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 0.56" for 1-Year event
Inflow = 0.75 cfs @ 12.19 hrs, Volume= 0.074 af
Outflow = 0.63 cfs @ 12.31 hrs, Volume= 0.058 af, Atten= 16%, Lag= 7.0 min
Primary = 0.63 cfs @ 12.31 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.09' @ 12.31 hrs Surf.Area= 0 sf Storage= 706 cf

Plug-Flow detention time= 145.1 min calculated for 0.058 af (78% of inflow)
Center-of-Mass det. time= 48.8 min (949.6 - 900.8)

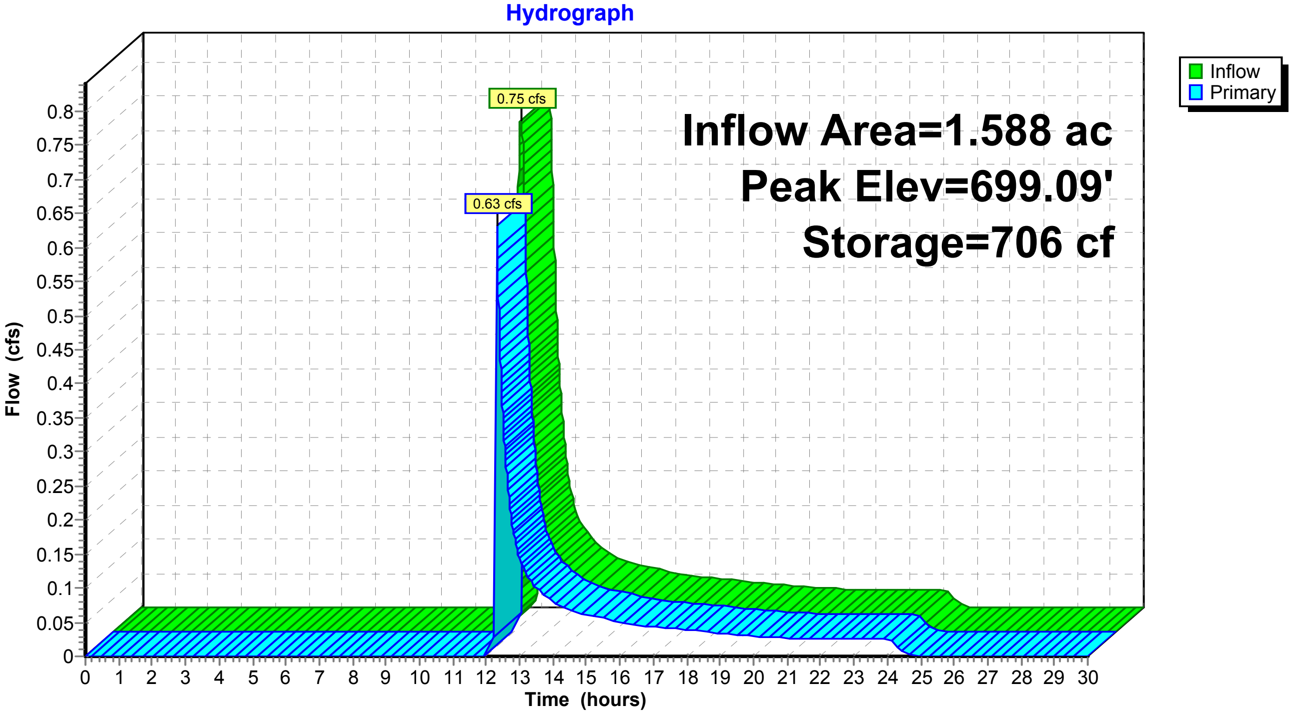
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=0.63 cfs @ 12.31 hrs HW=699.09' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.63 cfs @ 0.75 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 1.23" for 1-Year event
Inflow = 0.41 cfs @ 12.02 hrs, Volume= 0.022 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 704.36' @ 24.57 hrs Surf.Area= 0 sf Storage= 968 cf

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

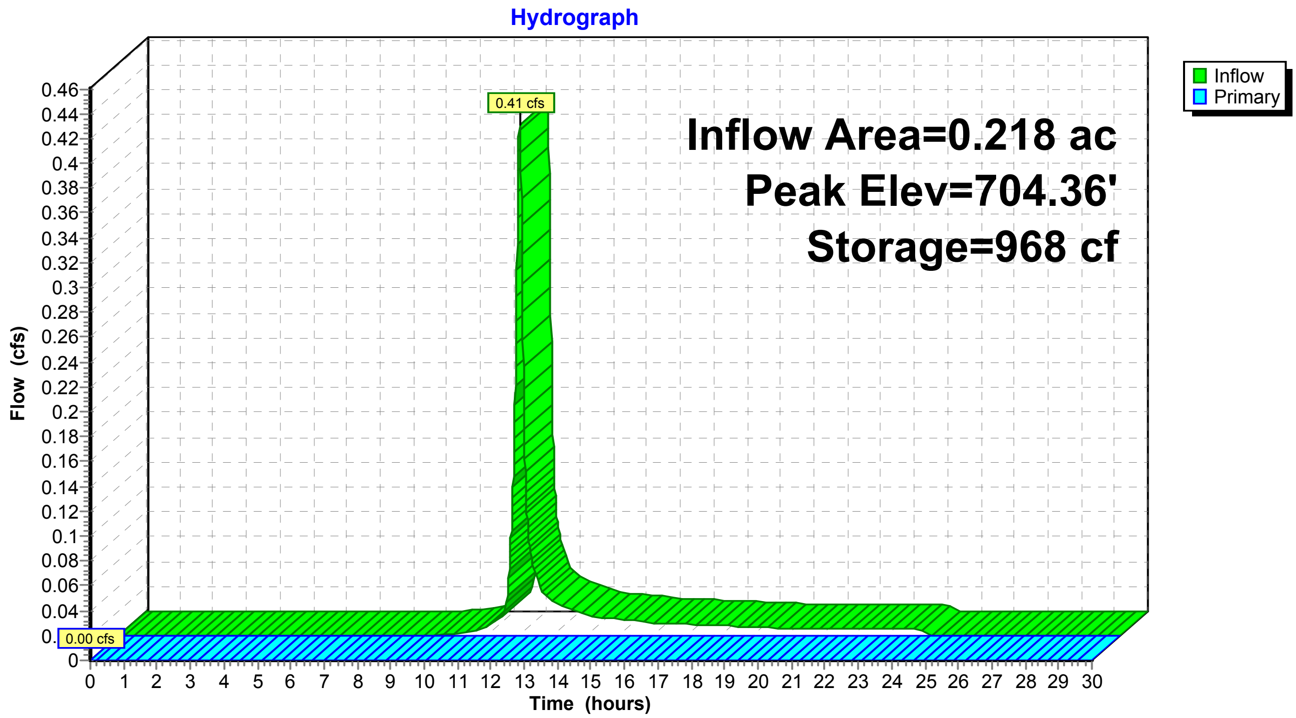
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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 @ 0.00 hrs HW=703.59' (Free Discharge)
└—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 126P: MLV PAD

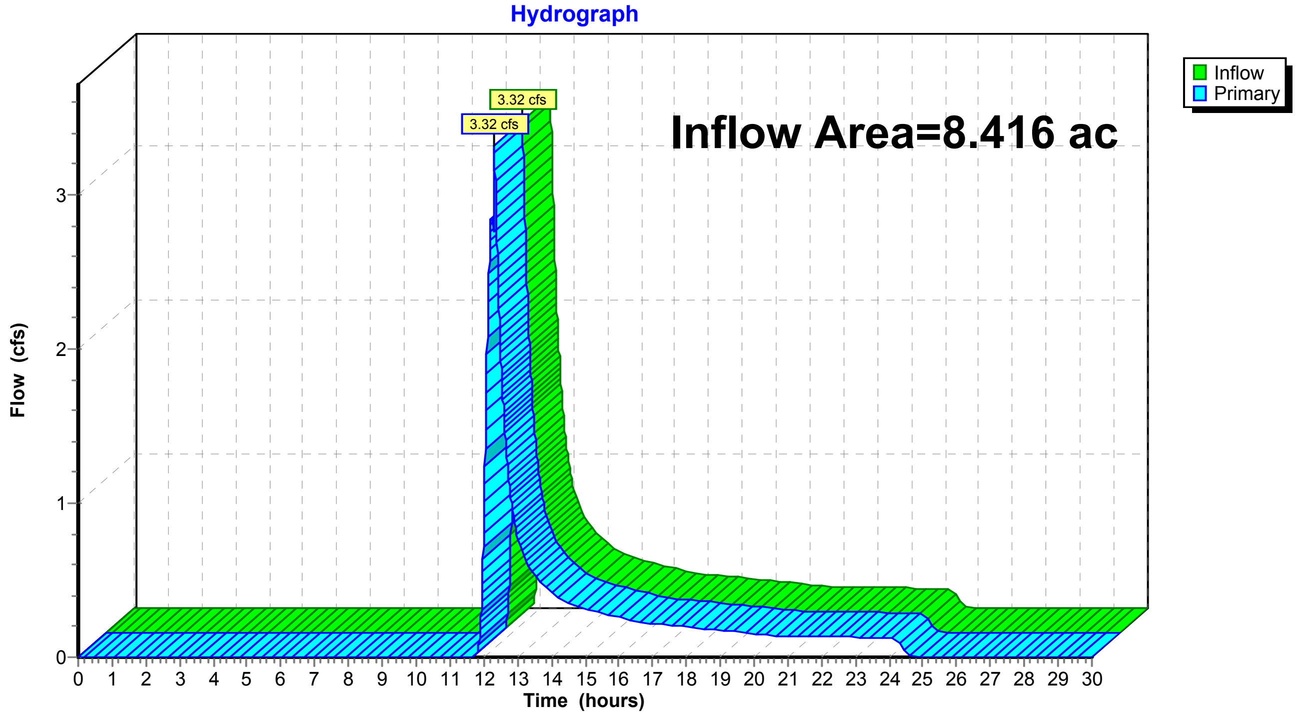


Summary for Link 105L: Proposed Conditions

Inflow Area = 8.416 ac, 1.28% Impervious, Inflow Depth = 0.52" for 1-Year event
Inflow = 3.32 cfs @ 12.31 hrs, Volume= 0.367 af
Primary = 3.32 cfs @ 12.31 hrs, Volume= 0.367 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=1.62"
Flow Length=299' Tc=10.0 min CN=84 Runoff=0.54 cfs 0.029 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=3.68 cfs 0.365 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=0.88"
Flow Length=851' Tc=27.1 min CN=72 Runoff=0.89 cfs 0.089 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=1.22"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.26 cfs 0.012 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=595' Tc=23.3 min CN=71 Runoff=1.20 cfs 0.110 af

Pond 113P: WATER QUALITY SWALE Peak Elev=698.57' Storage=516 cf Inflow=0.26 cfs 0.012 af
Outflow=0.00 cfs 0.000 af

Pond 124P: DIVERSION SWALE Peak Elev=699.15' Storage=706 cf Inflow=1.20 cfs 0.110 af
Outflow=1.22 cfs 0.094 af

Pond 126P: MLV PAD Peak Elev=704.53' Storage=1,276 cf Inflow=0.54 cfs 0.029 af
Outflow=0.00 cfs 0.000 af

Link 105L: Proposed Conditions Inflow=5.75 cfs 0.548 af
Primary=5.75 cfs 0.548 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.605 af Average Runoff Depth = 0.86"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

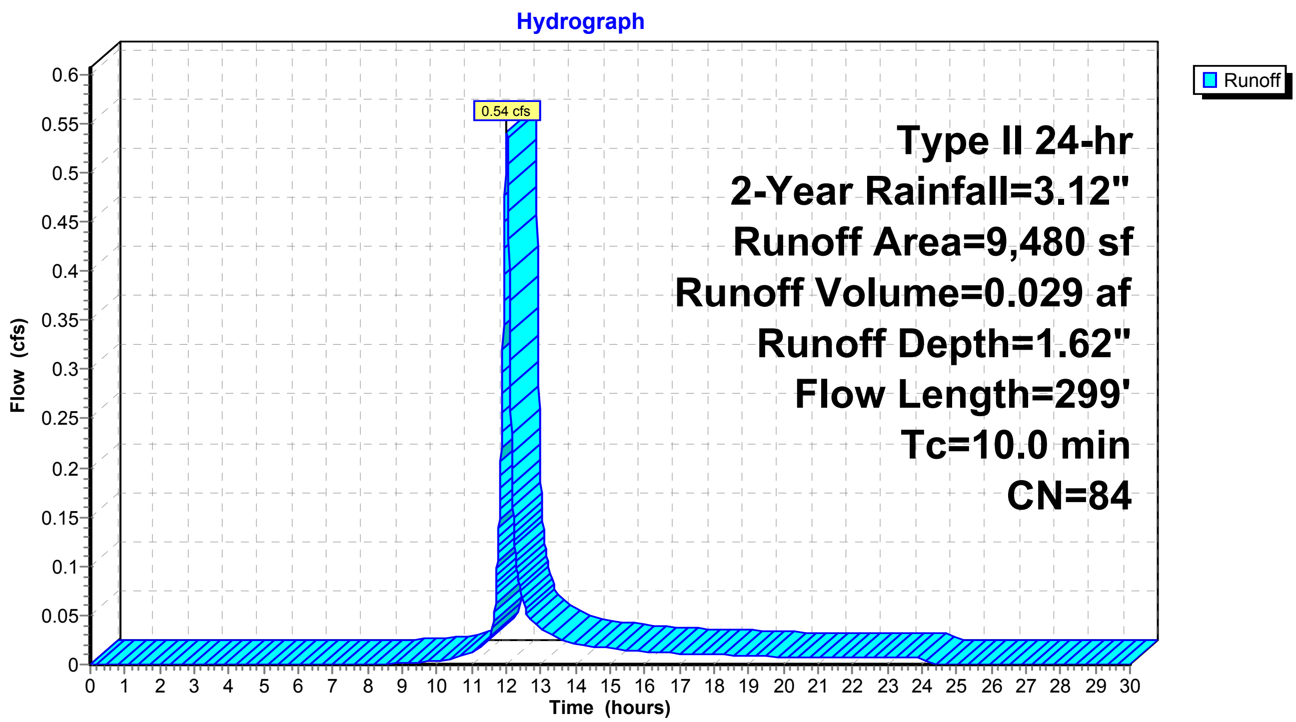
Runoff = 0.54 cfs @ 12.02 hrs, Volume= 0.029 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

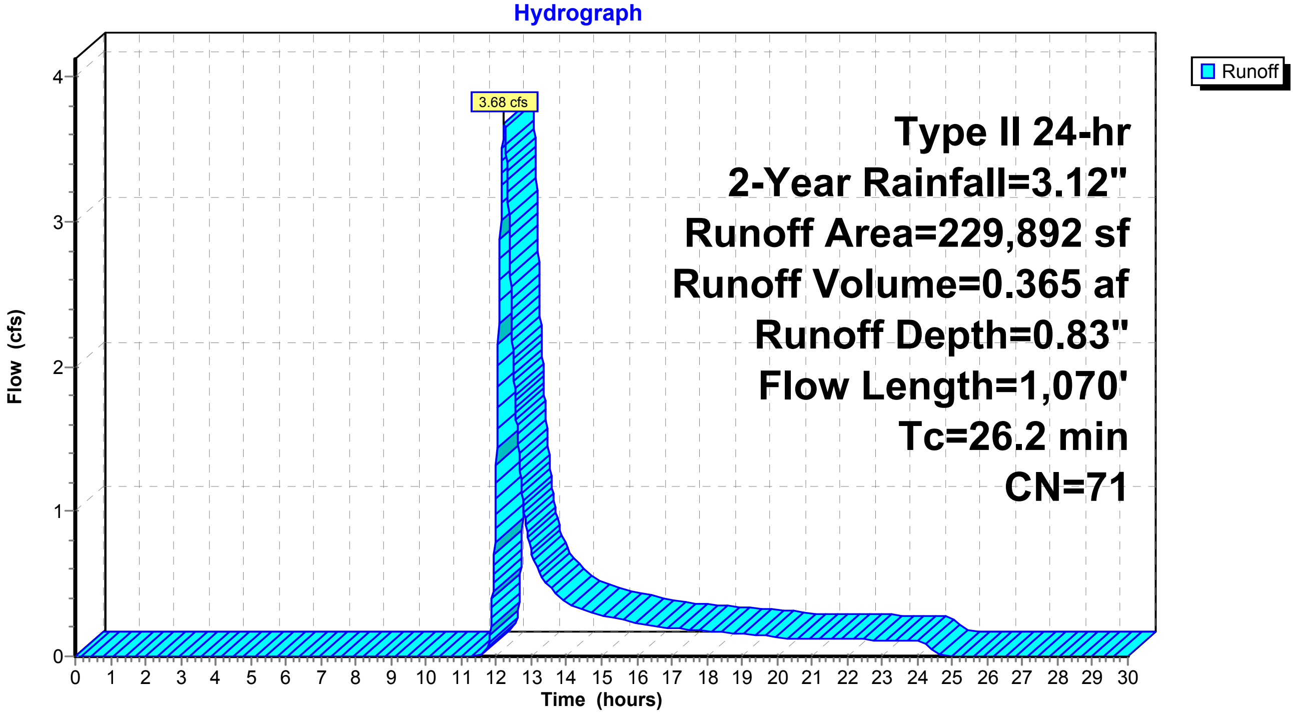
Runoff = 3.68 cfs @ 12.23 hrs, Volume= 0.365 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

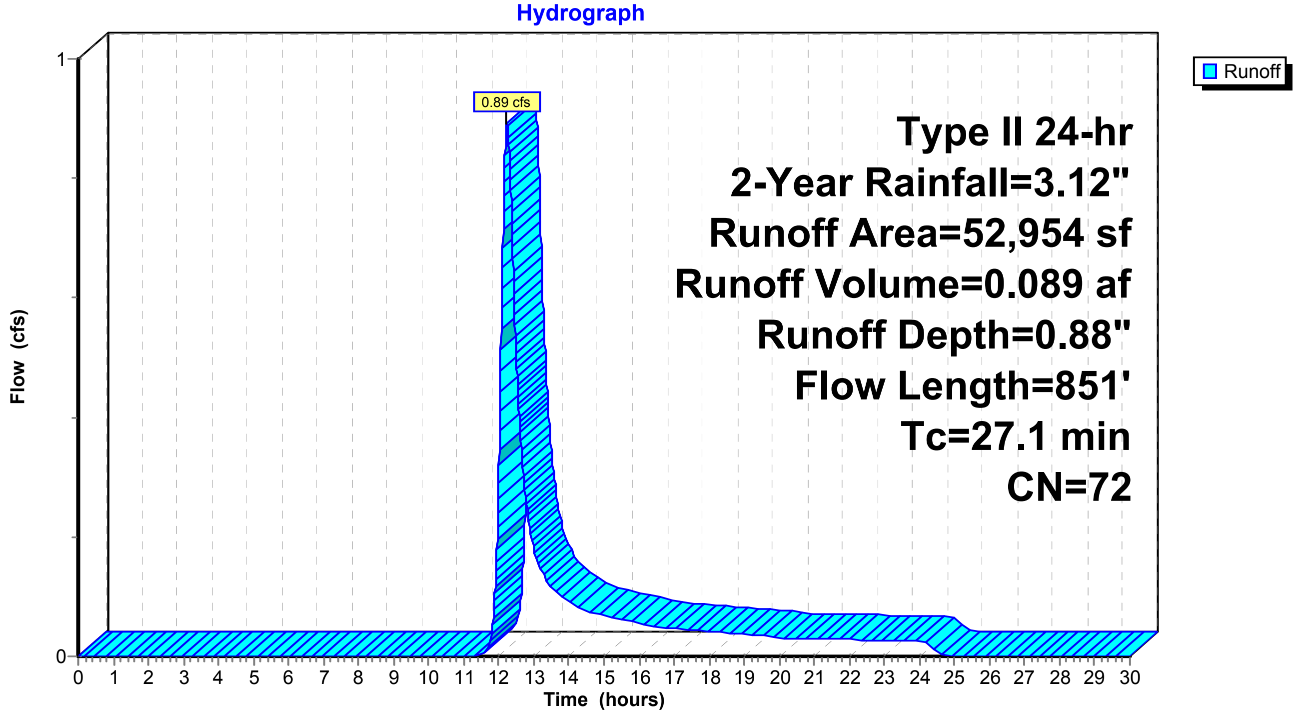
Runoff = 0.89 cfs @ 12.23 hrs, Volume= 0.089 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

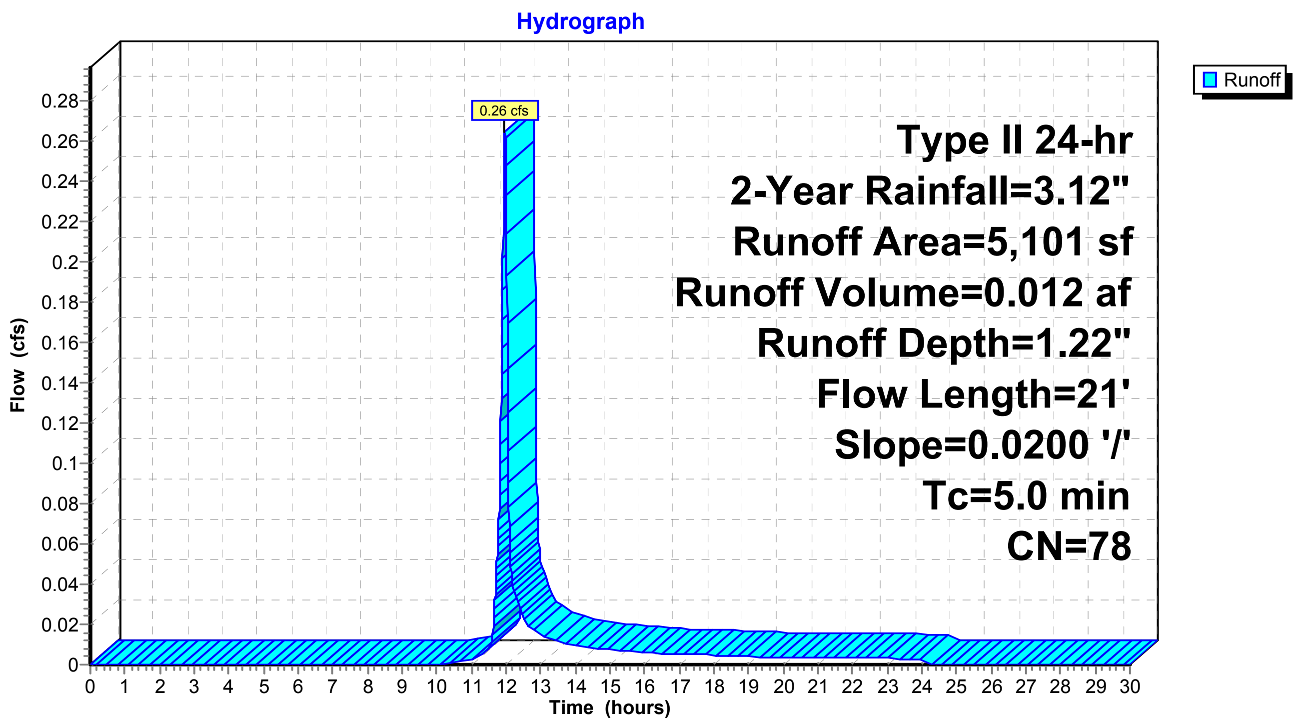
Runoff = 0.26 cfs @ 11.97 hrs, Volume= 0.012 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

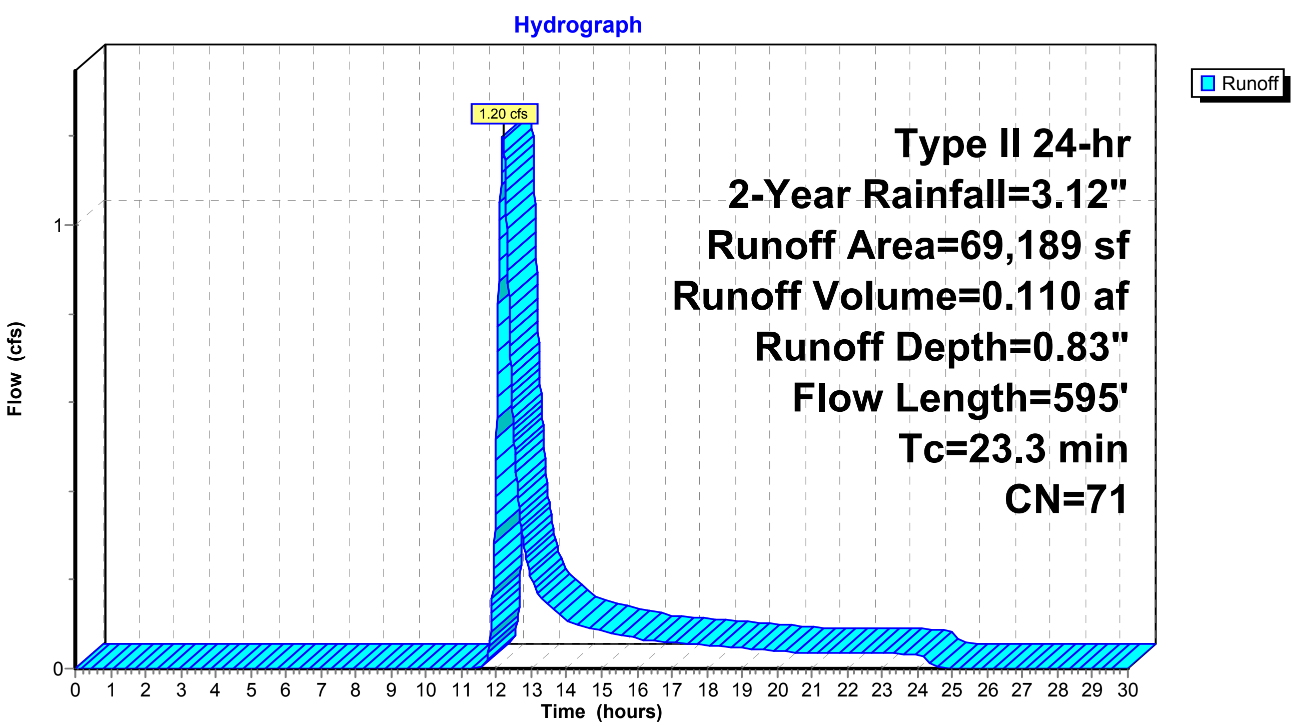
Runoff = 1.20 cfs @ 12.19 hrs, Volume= 0.110 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.12"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 1.22" for 2-Year event
Inflow = 0.26 cfs @ 11.97 hrs, Volume= 0.012 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 698.57' @ 24.29 hrs Surf.Area= 0 sf Storage= 516 cf

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

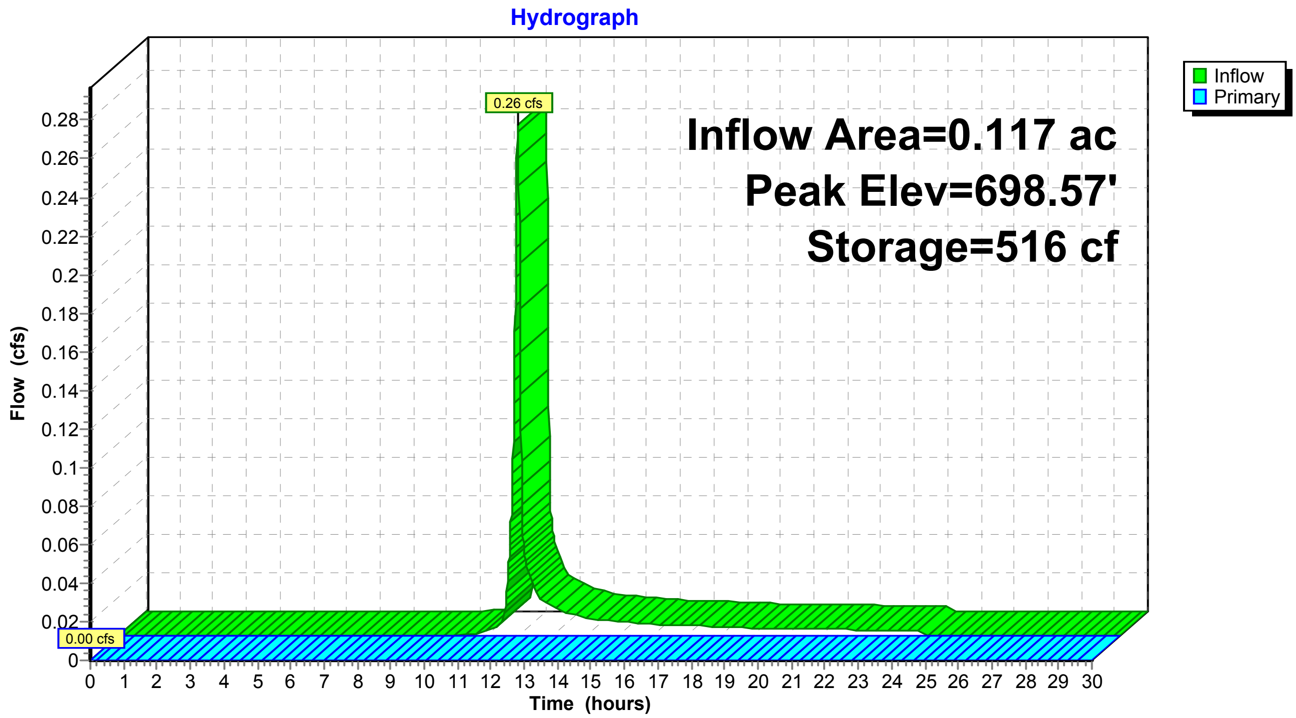
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 0.00 hrs HW=698.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 0.83" for 2-Year event
Inflow = 1.20 cfs @ 12.19 hrs, Volume= 0.110 af
Outflow = 1.22 cfs @ 12.18 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Primary = 1.22 cfs @ 12.18 hrs, Volume= 0.094 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.15' @ 12.18 hrs Surf.Area= 0 sf Storage= 706 cf

Plug-Flow detention time= 98.9 min calculated for 0.094 af (85% of inflow)
Center-of-Mass det. time= 28.5 min (915.4 - 886.9)

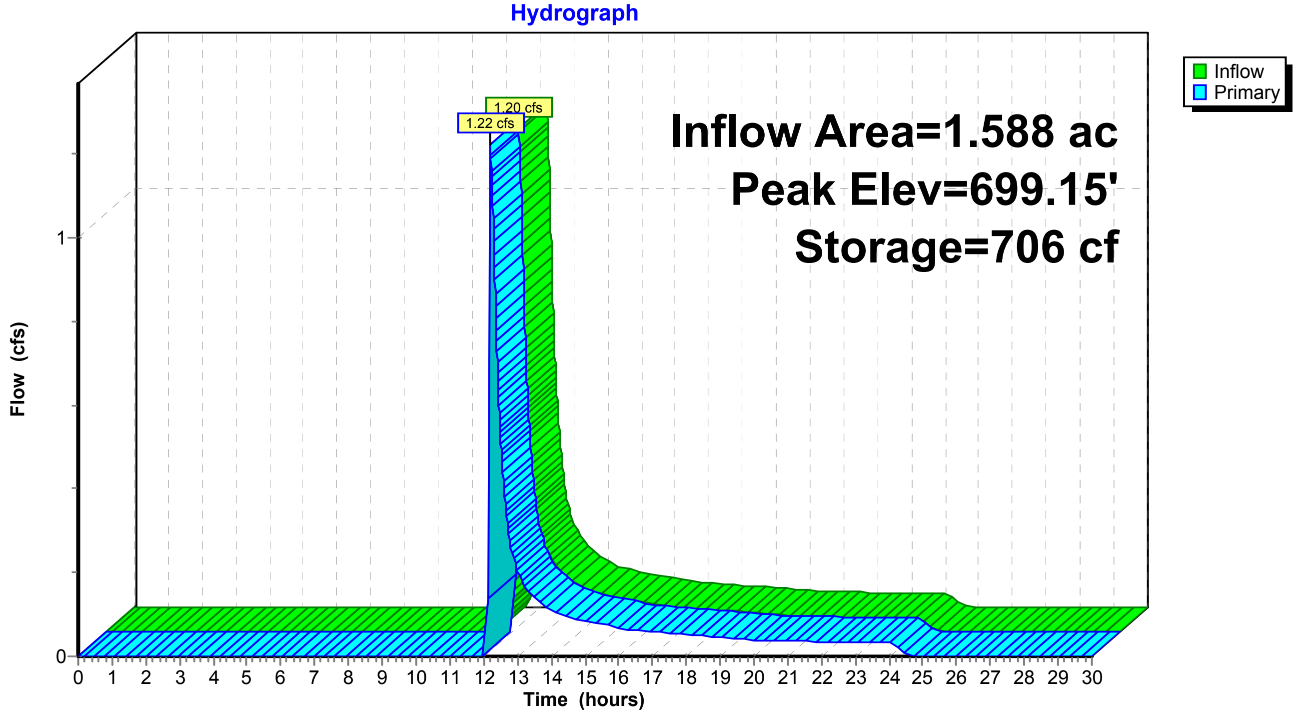
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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 @ 12.18 hrs HW=699.15' (Free Discharge)
└—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.22 cfs @ 0.93 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 1.62" for 2-Year event
Inflow = 0.54 cfs @ 12.02 hrs, Volume= 0.029 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 704.53' @ 24.57 hrs Surf.Area= 0 sf Storage= 1,276 cf

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

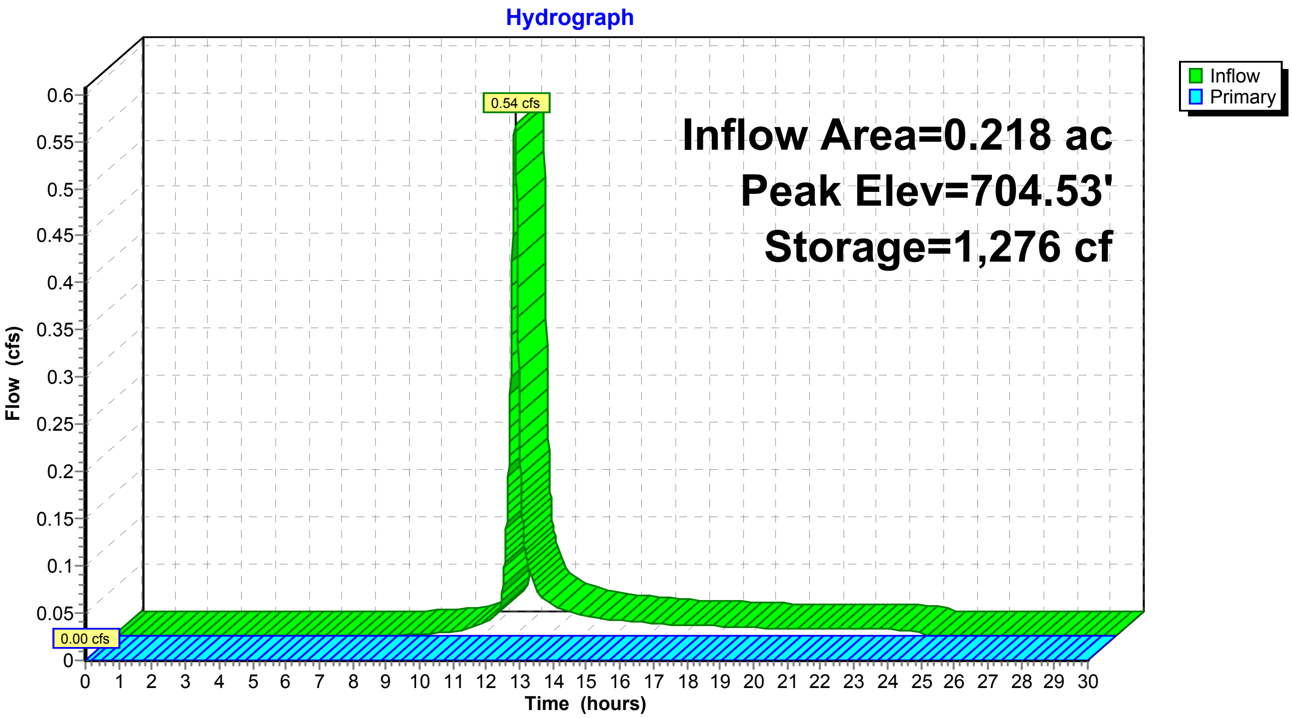
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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 @ 0.00 hrs HW=703.59' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

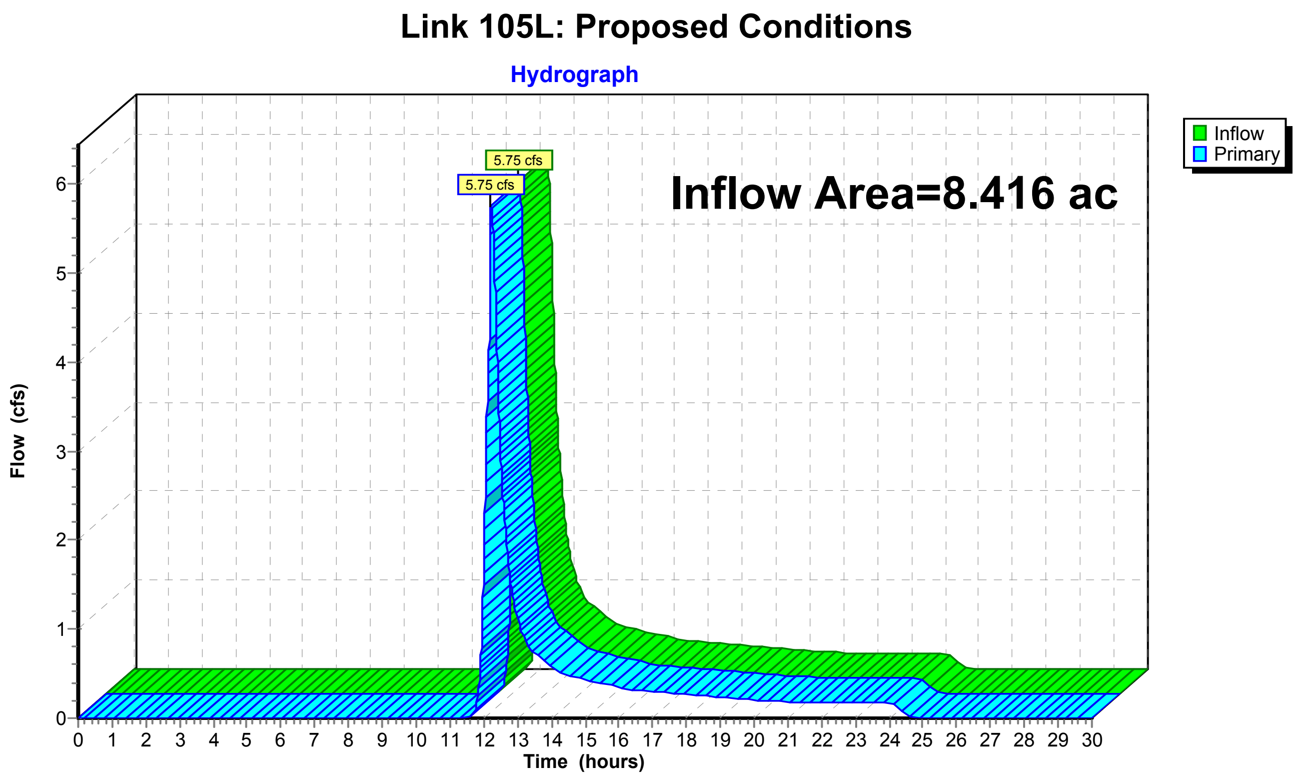
Pond 126P: MLV PAD



Summary for Link 105L: Proposed Conditions

Inflow Area =	8.416 ac,	1.28% Impervious, Inflow Depth = 0.78"	for 2-Year event	
Inflow =	5.75 cfs @	12.22 hrs, Volume=	0.548 af	
Primary =	5.75 cfs @	12.22 hrs, Volume=	0.548 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=2.23"
Flow Length=299' Tc=10.0 min CN=84 Runoff=0.74 cfs 0.040 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=6.06 cfs 0.566 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=1.35"
Flow Length=851' Tc=27.1 min CN=72 Runoff=1.44 cfs 0.137 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=1.76"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.38 cfs 0.017 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=595' Tc=23.3 min CN=71 Runoff=1.97 cfs 0.170 af

Pond 113P: WATER QUALITY SWALE Peak Elev=698.83' Storage=748 cf Inflow=0.38 cfs 0.017 af
Outflow=0.00 cfs 0.000 af

Pond 124P: DIVERSION SWALE Peak Elev=699.20' Storage=706 cf Inflow=1.97 cfs 0.170 af
Outflow=1.97 cfs 0.153 af

Pond 126P: MLV PAD Peak Elev=704.79' Storage=1,762 cf Inflow=0.74 cfs 0.040 af
Outflow=0.00 cfs 0.000 af

Link 105L: Proposed Conditions Inflow=9.45 cfs 0.855 af
Primary=9.45 cfs 0.855 af

Total Runoff Area = 8.416 ac Runoff Volume = 0.930 af Average Runoff Depth = 1.33"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

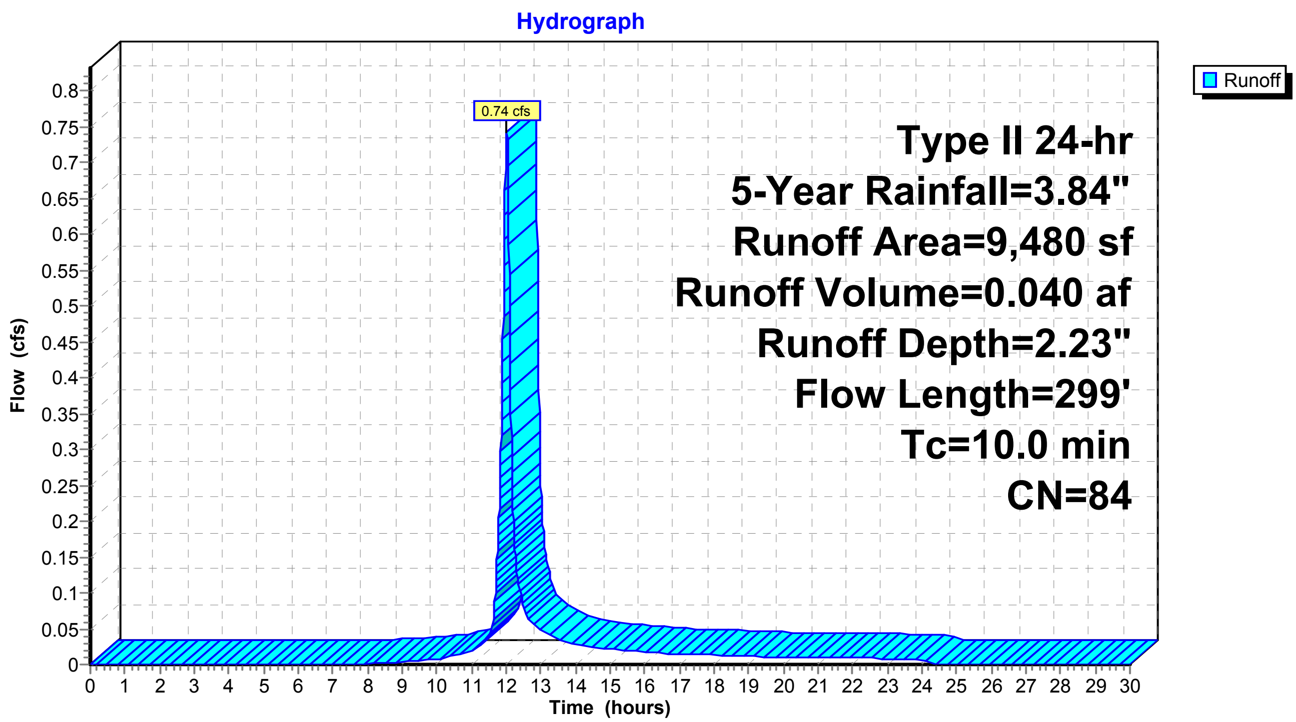
Runoff = 0.74 cfs @ 12.02 hrs, Volume= 0.040 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

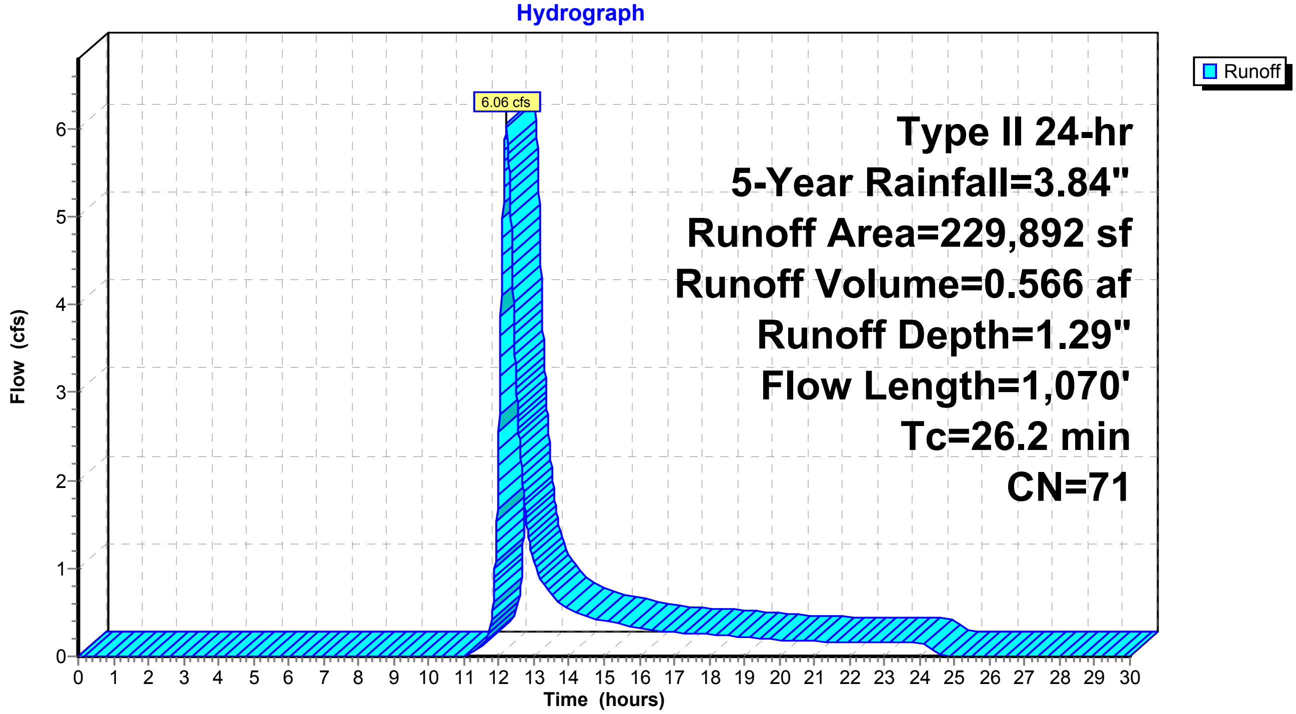
Runoff = 6.06 cfs @ 12.20 hrs, Volume= 0.566 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

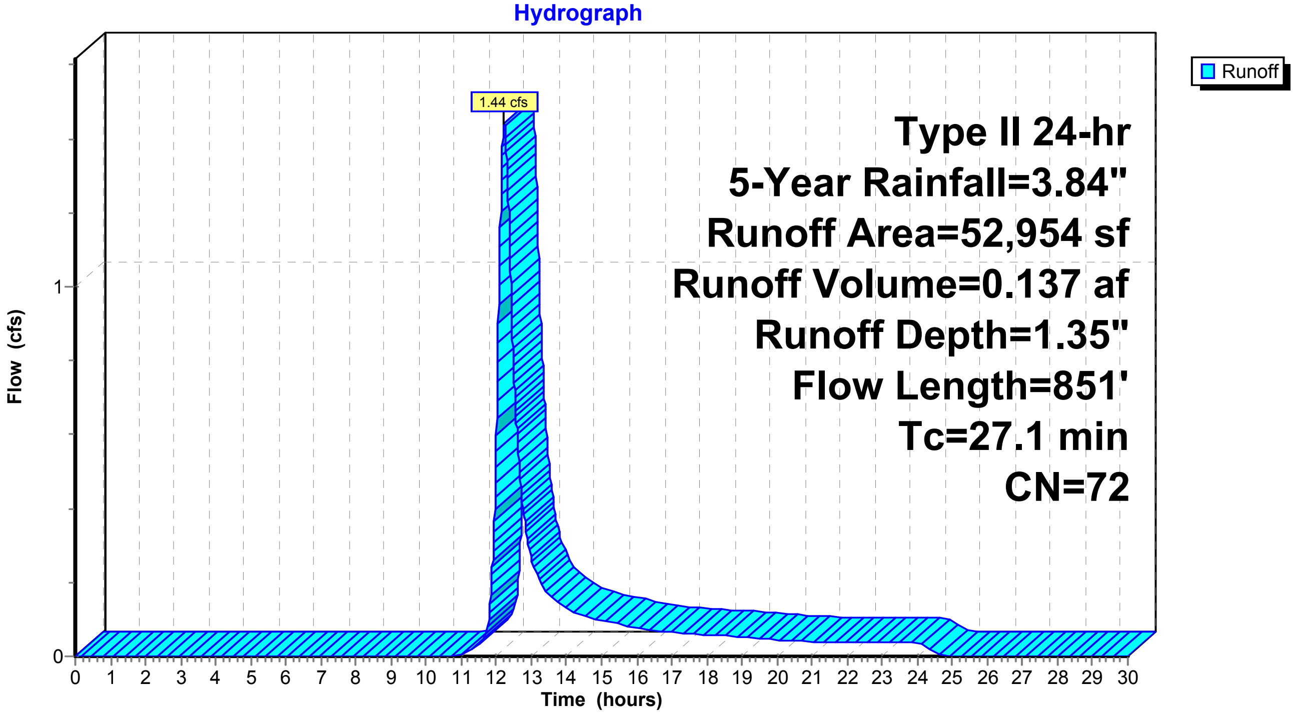
Runoff = 1.44 cfs @ 12.22 hrs, Volume= 0.137 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

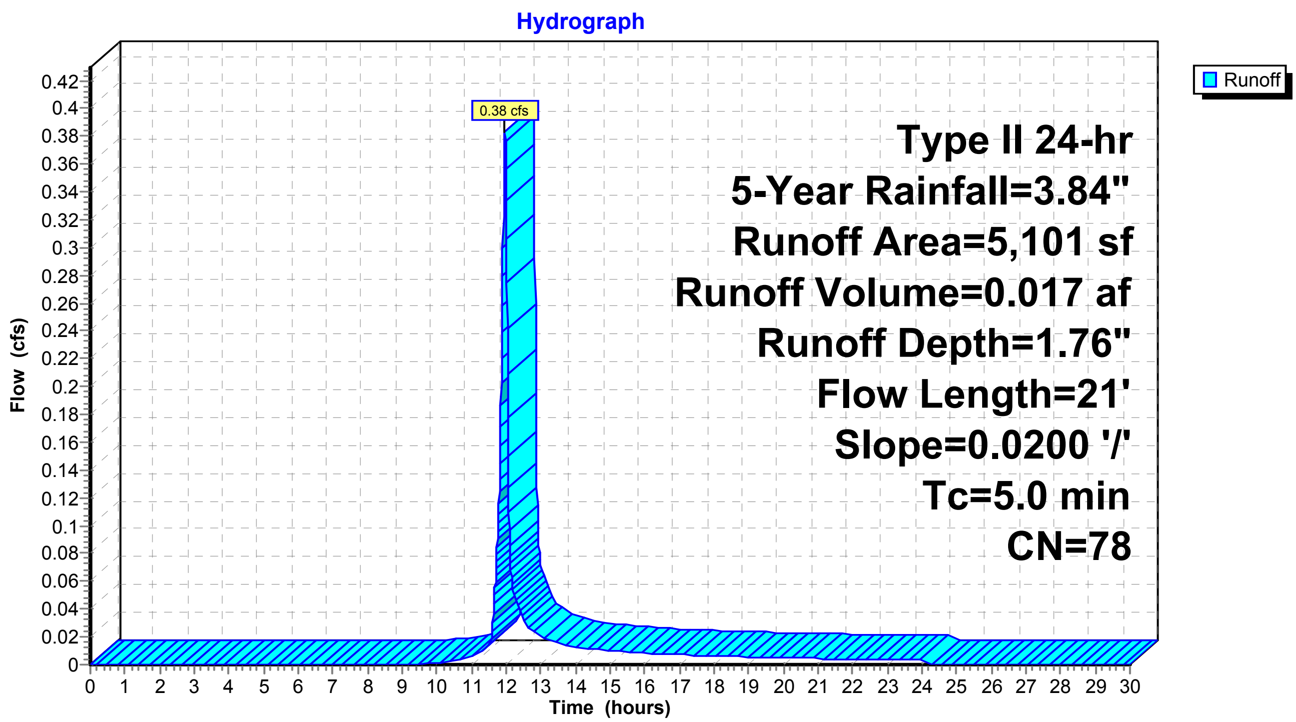
Runoff = 0.38 cfs @ 11.96 hrs, Volume= 0.017 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

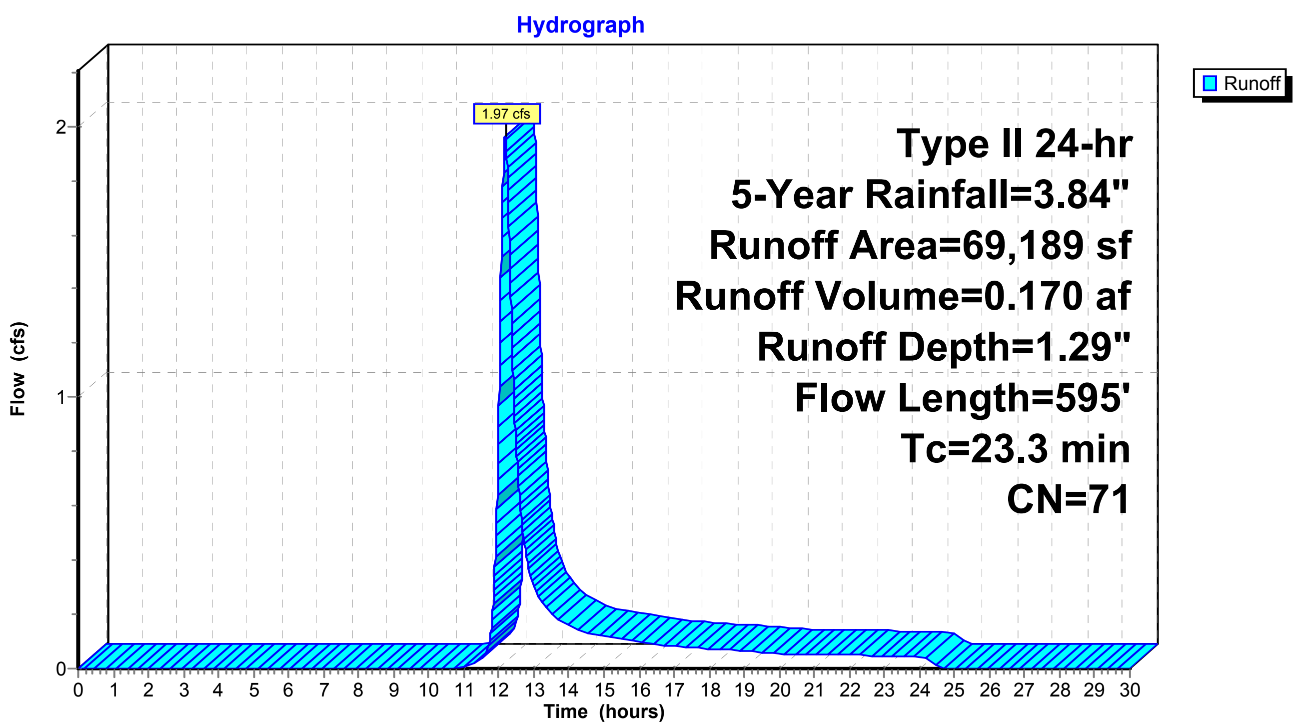
Runoff = 1.97 cfs @ 12.19 hrs, Volume= 0.170 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.84"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 1.76" for 5-Year event
Inflow = 0.38 cfs @ 11.96 hrs, Volume= 0.017 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 698.83' @ 24.29 hrs Surf.Area= 0 sf Storage= 748 cf

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

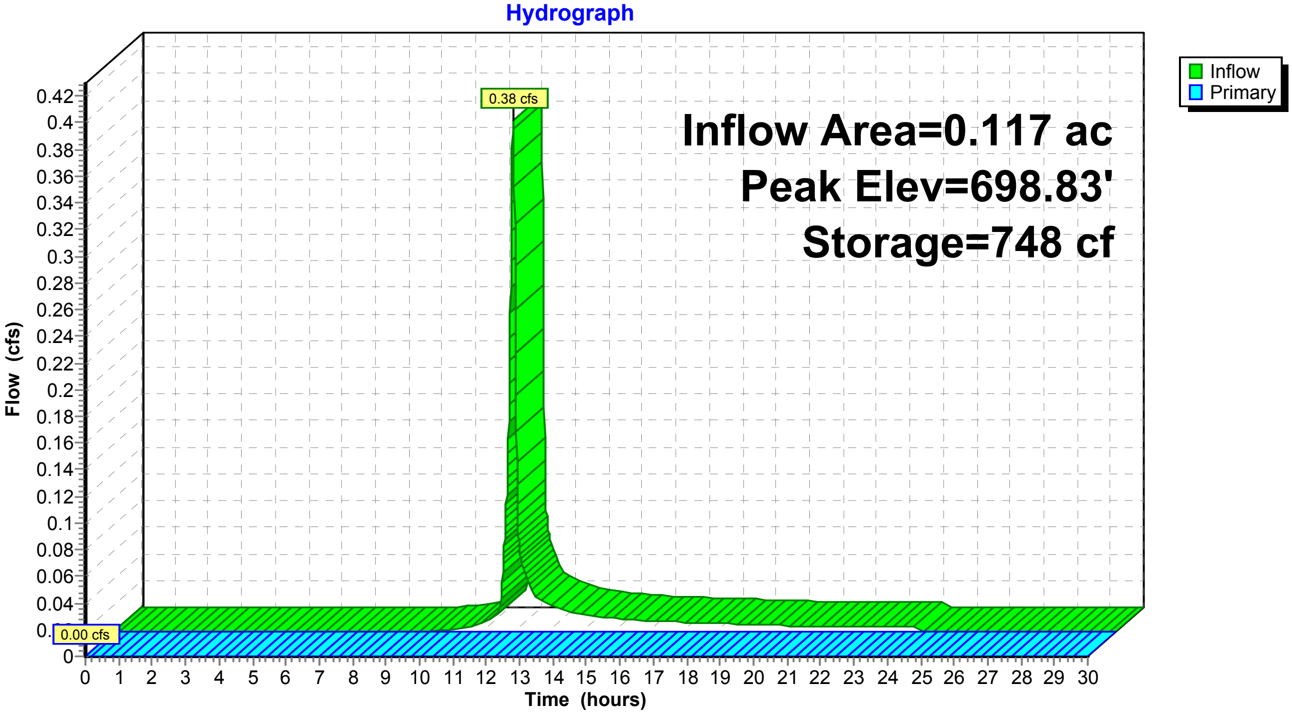
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 0.00 hrs HW=698.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 1.29" for 5-Year event
Inflow = 1.97 cfs @ 12.19 hrs, Volume= 0.170 af
Outflow = 1.97 cfs @ 12.19 hrs, Volume= 0.153 af, Atten= 0%, Lag= 0.0 min
Primary = 1.97 cfs @ 12.19 hrs, Volume= 0.153 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.20' @ 12.19 hrs Surf.Area= 0 sf Storage= 706 cf

Plug-Flow detention time= 68.2 min calculated for 0.153 af (90% of inflow)
Center-of-Mass det. time= 17.4 min (890.2 - 872.8)

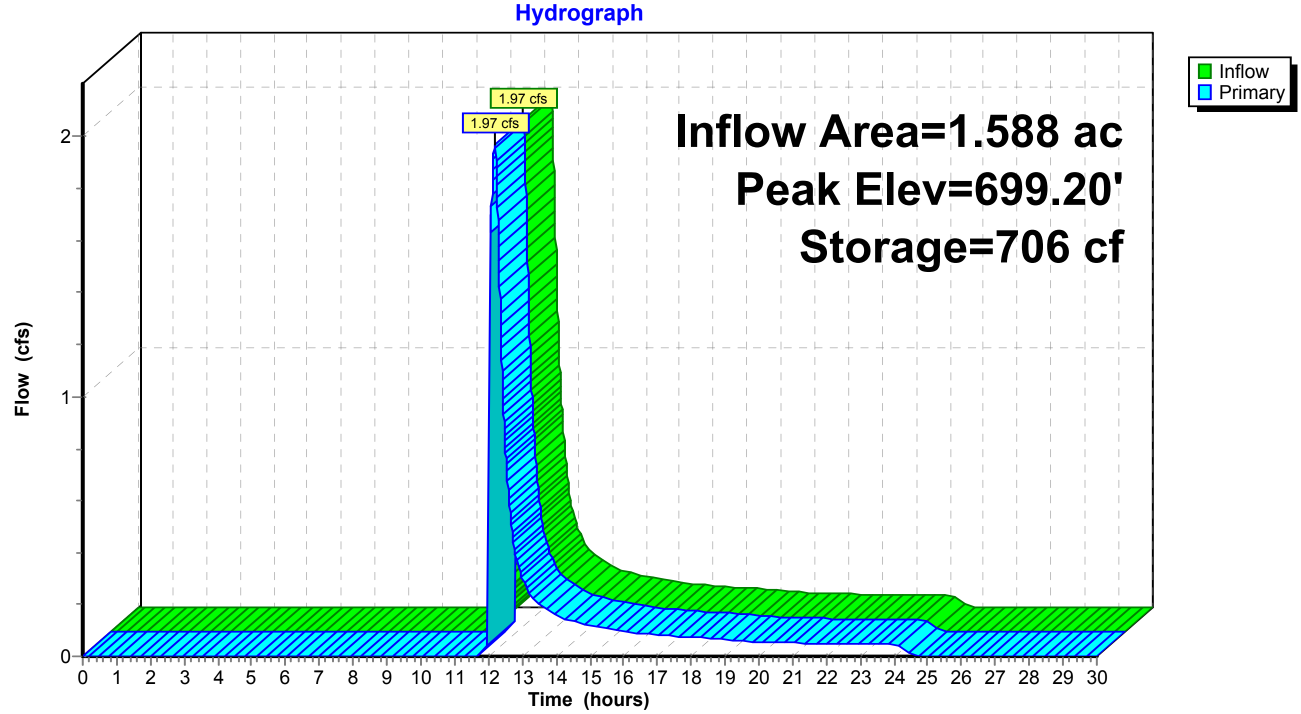
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=1.97 cfs @ 12.19 hrs HW=699.20' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 1.97 cfs @ 1.09 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 2.23" for 5-Year event
Inflow = 0.74 cfs @ 12.02 hrs, Volume= 0.040 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 704.79' @ 24.57 hrs Surf.Area= 0 sf Storage= 1,762 cf

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

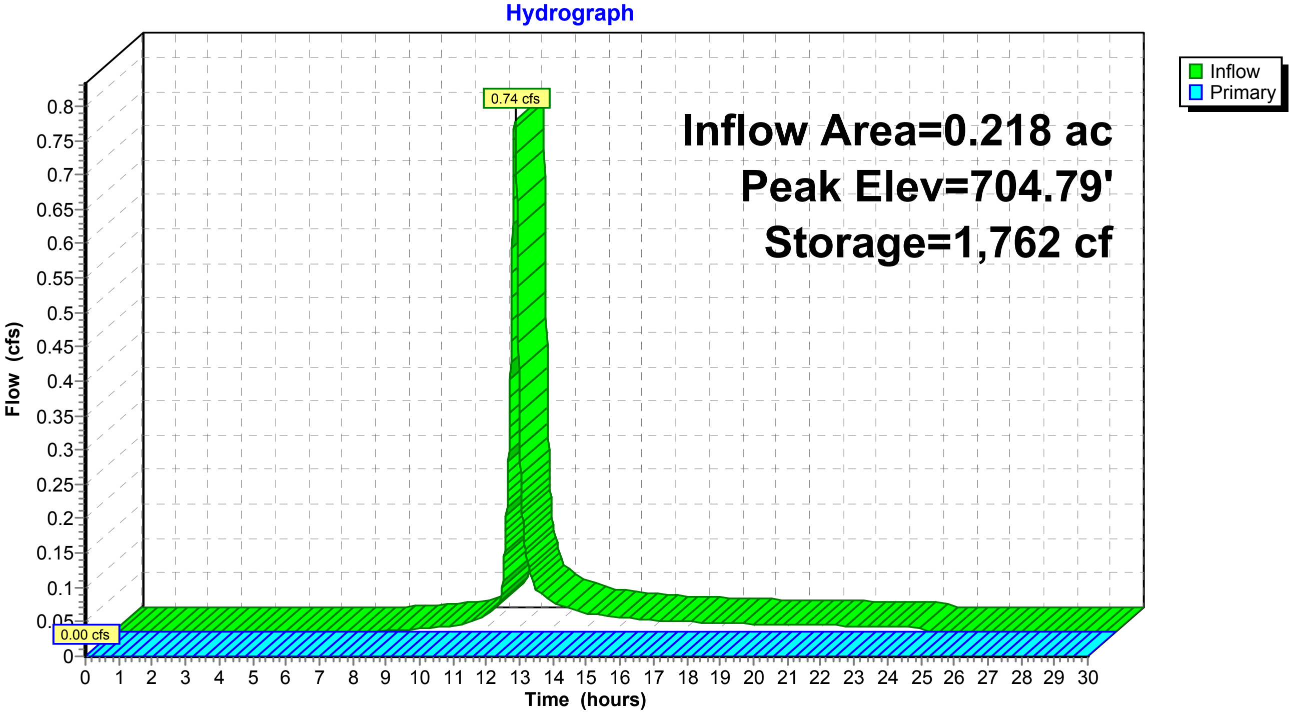
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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 @ 0.00 hrs HW=703.59' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 126P: MLV PAD

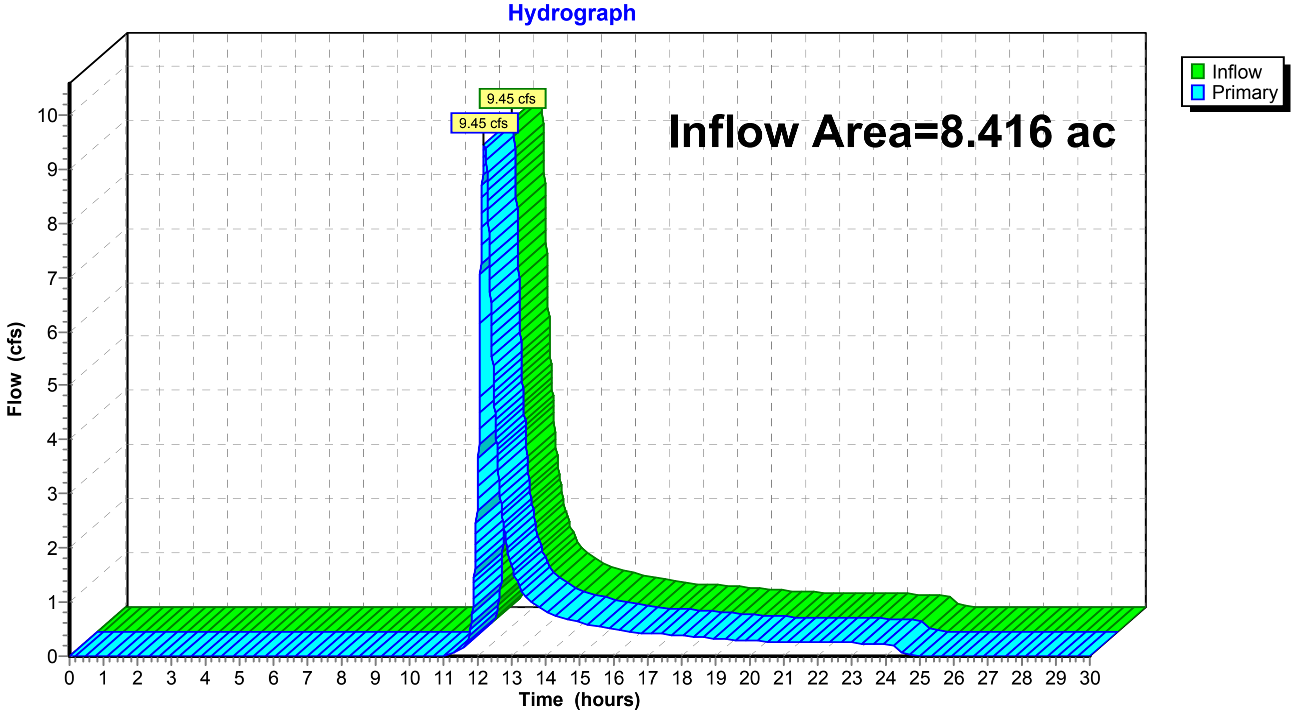


Summary for Link 105L: Proposed Conditions

Inflow Area = 8.416 ac, 1.28% Impervious, Inflow Depth = 1.22" for 5-Year event
Inflow = 9.45 cfs @ 12.20 hrs, Volume= 0.855 af
Primary = 9.45 cfs @ 12.20 hrs, Volume= 0.855 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=2.87"
Flow Length=299' Tc=10.0 min CN=84 Runoff=0.95 cfs 0.052 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=1.79"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=8.69 cfs 0.787 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=1.86"
Flow Length=851' Tc=27.1 min CN=72 Runoff=2.05 cfs 0.189 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=2.34"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.51 cfs 0.023 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=1.79"
Flow Length=595' Tc=23.3 min CN=71 Runoff=2.81 cfs 0.237 af

Pond 113P: WATER QUALITY SWALE Peak Elev=699.00' Storage=900 cf Inflow=0.51 cfs 0.023 af
Outflow=0.01 cfs 0.002 af

Pond 124P: DIVERSION SWALE Peak Elev=699.25' Storage=707 cf Inflow=2.81 cfs 0.237 af
Outflow=2.81 cfs 0.220 af

Pond 126P: MLV PAD Peak Elev=705.06' Storage=2,268 cf Inflow=0.95 cfs 0.052 af
Outflow=0.00 cfs 0.000 af

Link 105L: Proposed Conditions Inflow=13.51 cfs 1.199 af
Primary=13.51 cfs 1.199 af

Total Runoff Area = 8.416 ac Runoff Volume = 1.288 af Average Runoff Depth = 1.84"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

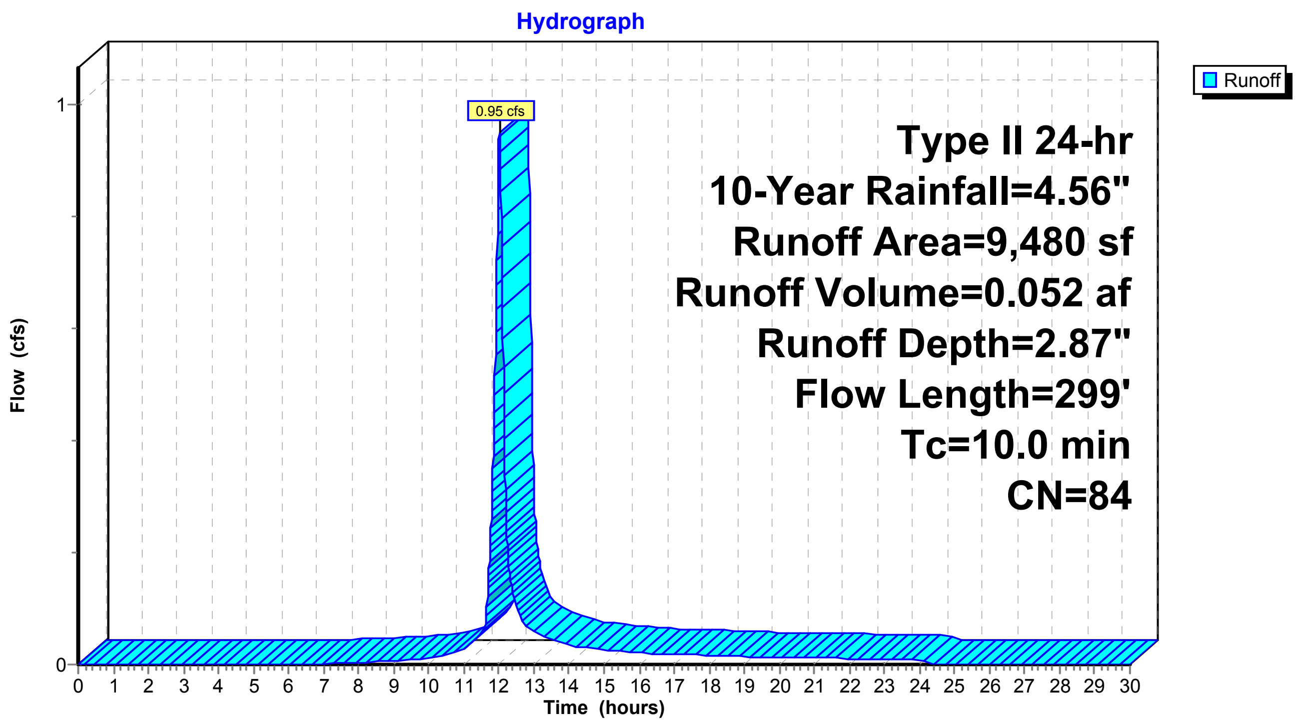
Runoff = 0.95 cfs @ 12.01 hrs, Volume= 0.052 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

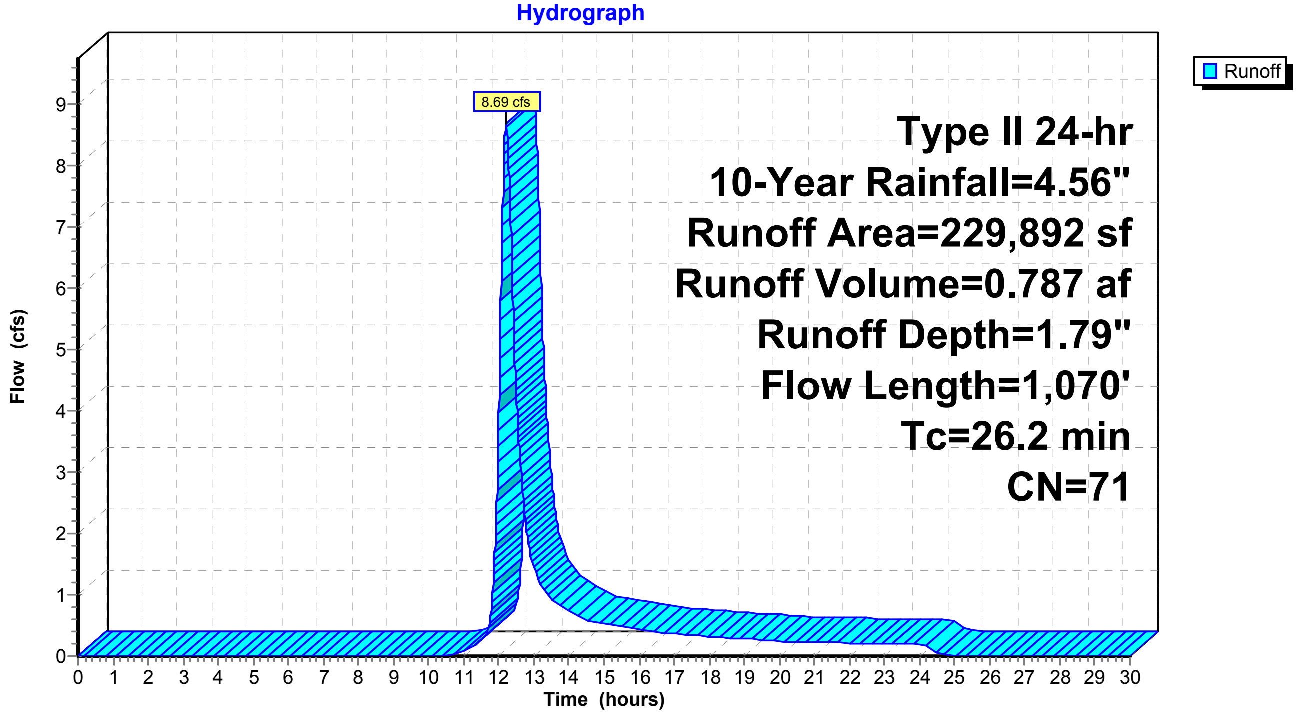
Runoff = 8.69 cfs @ 12.20 hrs, Volume= 0.787 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

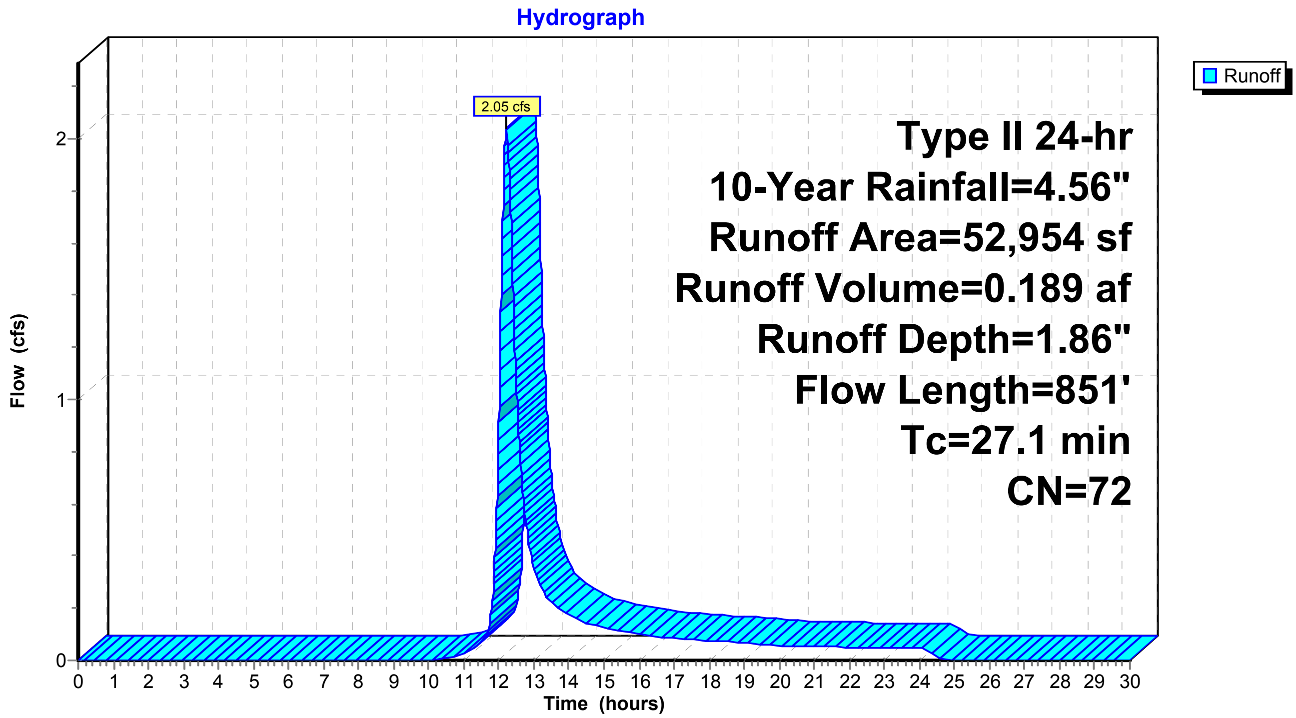
Runoff = 2.05 cfs @ 12.22 hrs, Volume= 0.189 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

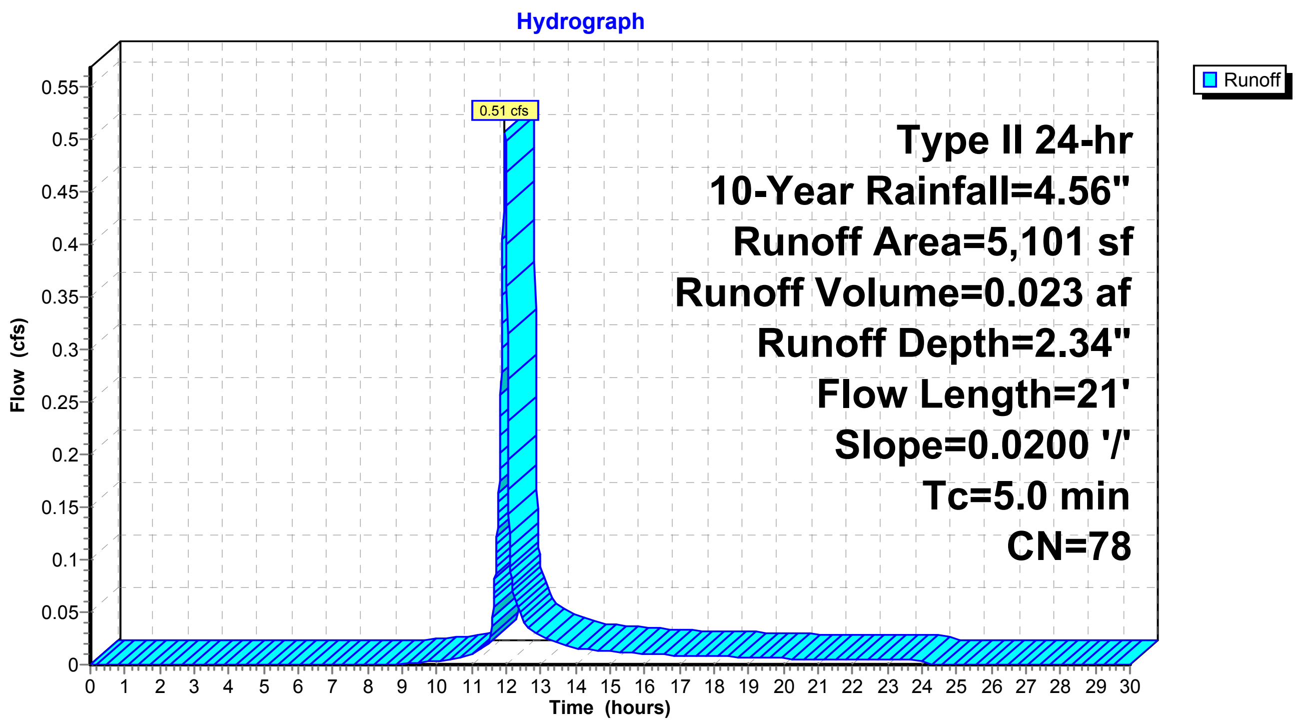
Runoff = 0.51 cfs @ 11.96 hrs, Volume= 0.023 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

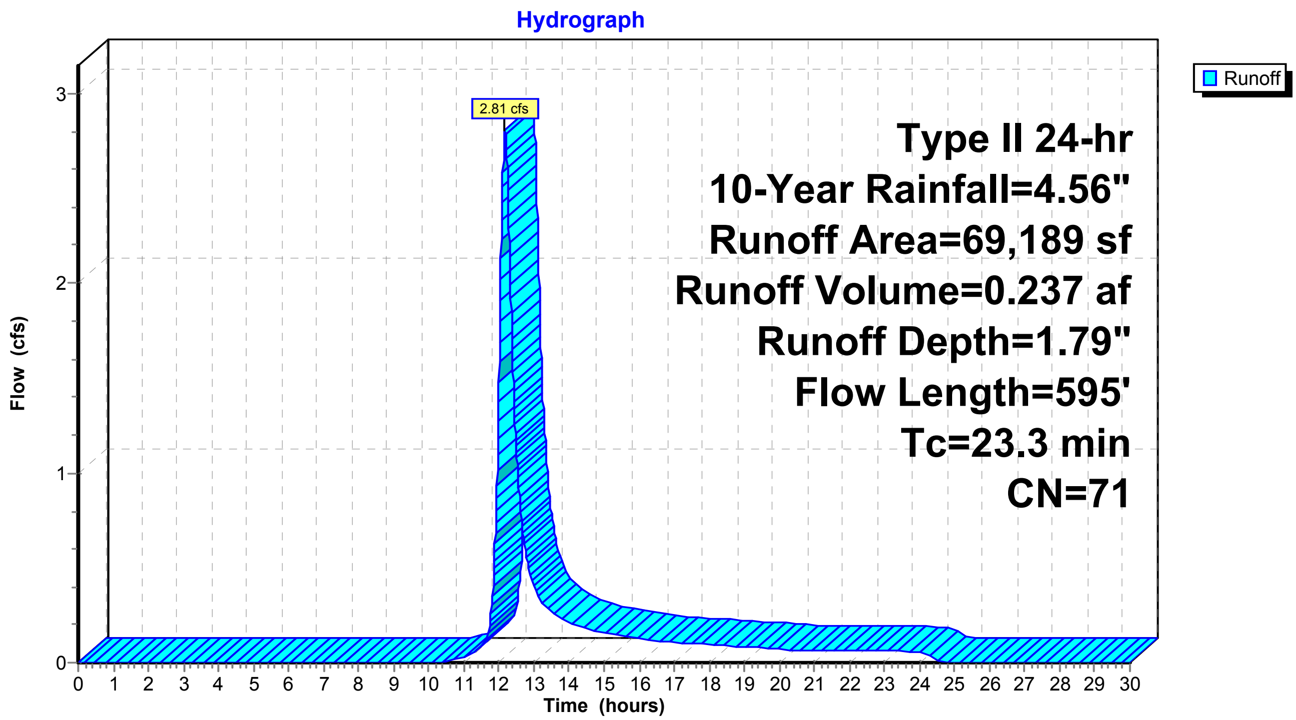
Runoff = 2.81 cfs @ 12.17 hrs, Volume= 0.237 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.56"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 2.34" for 10-Year event
Inflow = 0.51 cfs @ 11.96 hrs, Volume= 0.023 af
Outflow = 0.01 cfs @ 19.22 hrs, Volume= 0.002 af, Atten= 98%, Lag= 435.7 min
Primary = 0.01 cfs @ 19.22 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 699.00' @ 19.22 hrs Surf.Area= 0 sf Storage= 900 cf

Plug-Flow detention time= 625.8 min calculated for 0.002 af (10% of inflow)
Center-of-Mass det. time= 465.4 min (1,292.6 - 827.2)

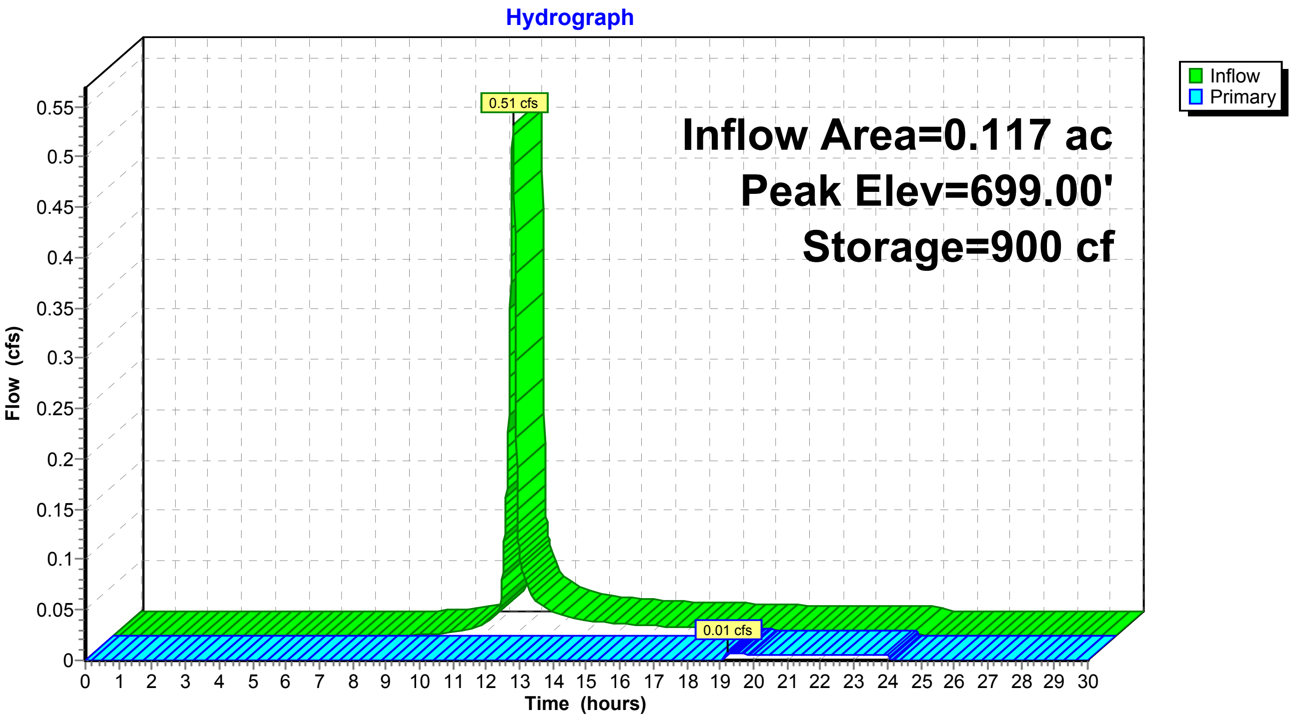
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 19.22 hrs HW=699.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.01 cfs @ 0.15 fps)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 1.79" for 10-Year event
Inflow = 2.81 cfs @ 12.17 hrs, Volume= 0.237 af
Outflow = 2.81 cfs @ 12.17 hrs, Volume= 0.220 af, Atten= 0%, Lag= 0.0 min
Primary = 2.81 cfs @ 12.17 hrs, Volume= 0.220 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.25' @ 12.17 hrs Surf.Area= 0 sf Storage= 707 cf

Plug-Flow detention time= 49.3 min calculated for 0.220 af (93% of inflow)
Center-of-Mass det. time= 11.9 min (874.7 - 862.8)

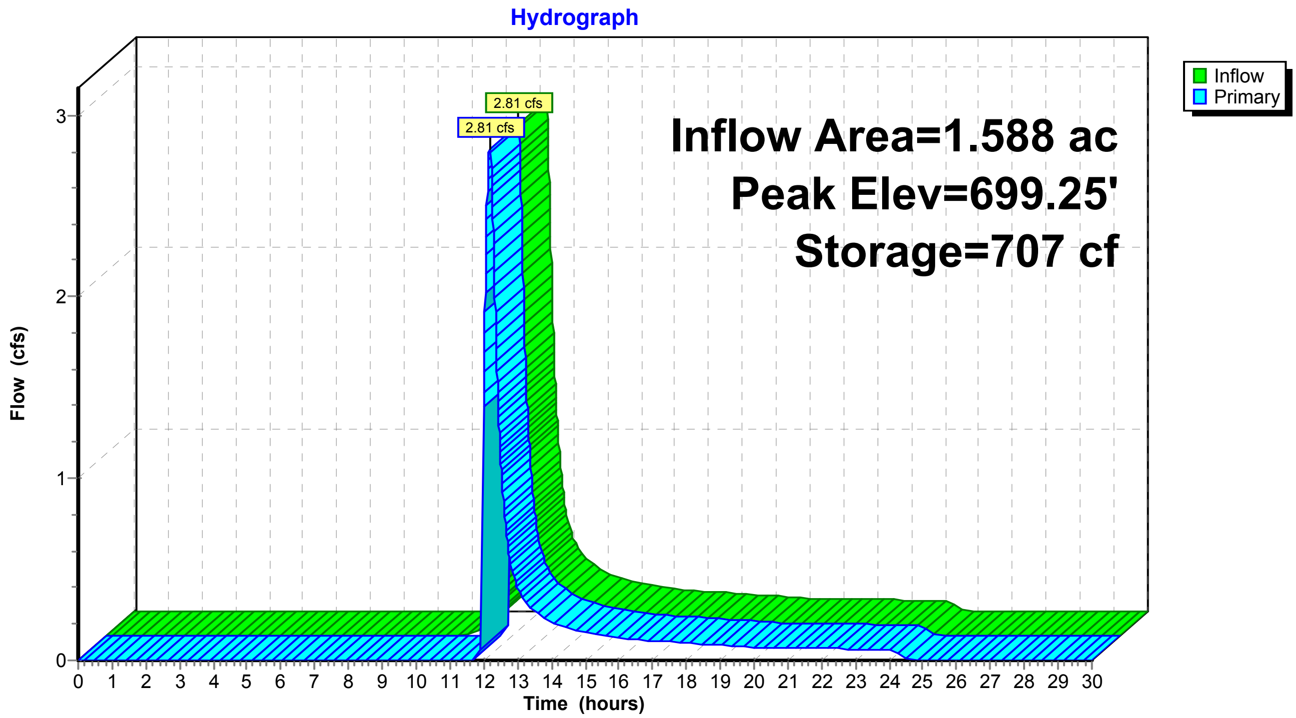
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=2.81 cfs @ 12.17 hrs HW=699.25' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 2.81 cfs @ 1.24 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 2.87" for 10-Year event
Inflow = 0.95 cfs @ 12.01 hrs, Volume= 0.052 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 705.06' @ 24.57 hrs Surf.Area= 0 sf Storage= 2,268 cf

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

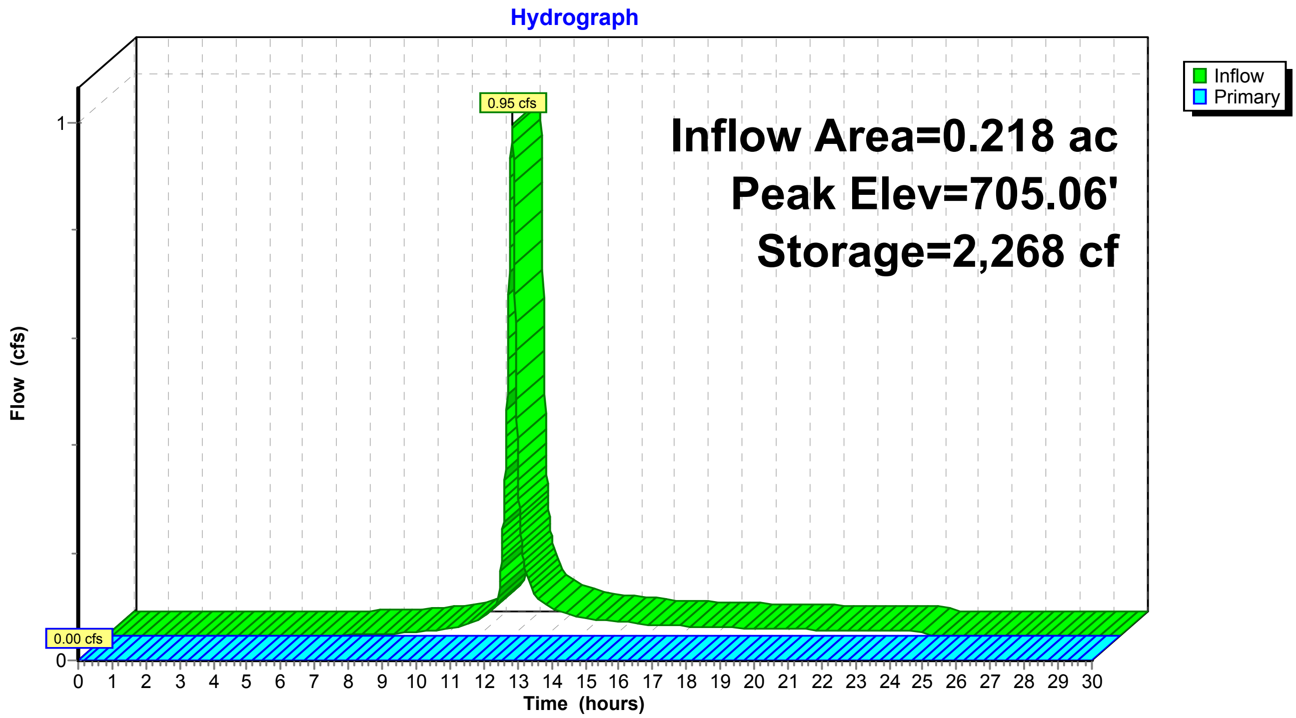
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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 @ 0.00 hrs HW=703.59' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 126P: MLV PAD

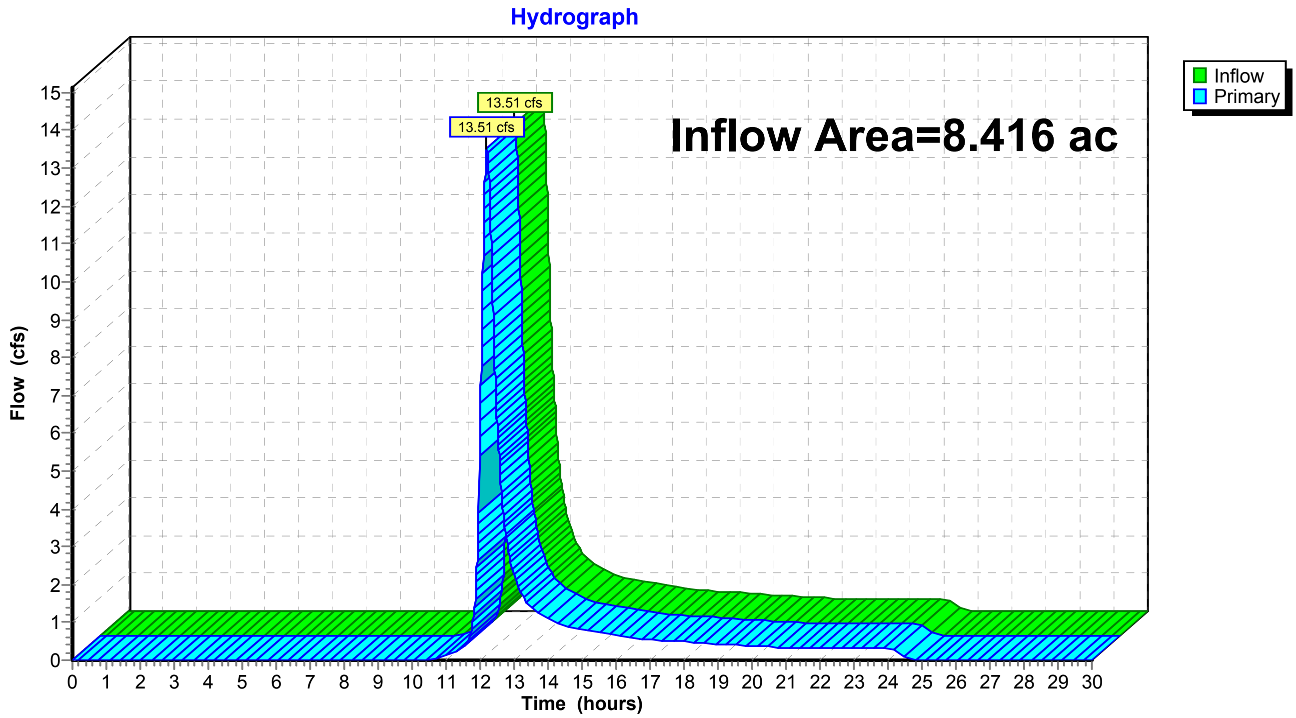


Summary for Link 105L: Proposed Conditions

Inflow Area = 8.416 ac, 1.28% Impervious, Inflow Depth = 1.71" for 10-Year event
Inflow = 13.51 cfs @ 12.20 hrs, Volume= 1.199 af
Primary = 13.51 cfs @ 12.20 hrs, Volume= 1.199 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=3.75"
Flow Length=299' Tc=10.0 min CN=84 Runoff=1.23 cfs 0.068 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=2.52"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=12.46 cfs 1.107 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=2.61"
Flow Length=851' Tc=27.1 min CN=72 Runoff=2.91 cfs 0.264 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.68 cfs 0.031 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=2.52"
Flow Length=595' Tc=23.3 min CN=71 Runoff=4.02 cfs 0.333 af

Pond 113P: WATER QUALITY SWALE Peak Elev=699.01' Storage=900 cf Inflow=0.68 cfs 0.031 af
Outflow=0.03 cfs 0.010 af

Pond 124P: DIVERSION SWALE Peak Elev=699.32' Storage=707 cf Inflow=4.02 cfs 0.333 af
Outflow=4.02 cfs 0.317 af

Pond 126P: MLV PAD Peak Elev=705.09' Storage=2,321 cf Inflow=1.23 cfs 0.068 af
Outflow=0.06 cfs 0.016 af

Link 105L: Proposed Conditions Inflow=19.33 cfs 1.714 af
Primary=19.33 cfs 1.714 af

Total Runoff Area = 8.416 ac Runoff Volume = 1.803 af Average Runoff Depth = 2.57"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

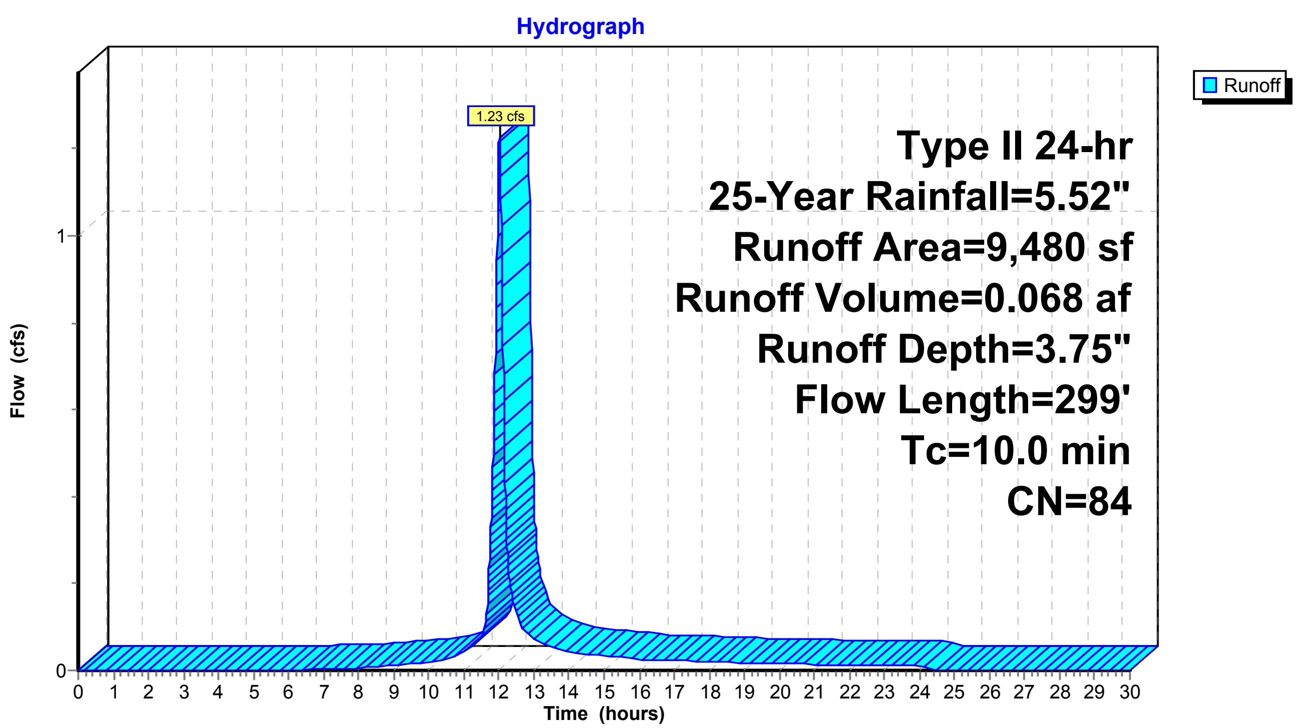
Runoff = 1.23 cfs @ 12.01 hrs, Volume= 0.068 af, Depth= 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

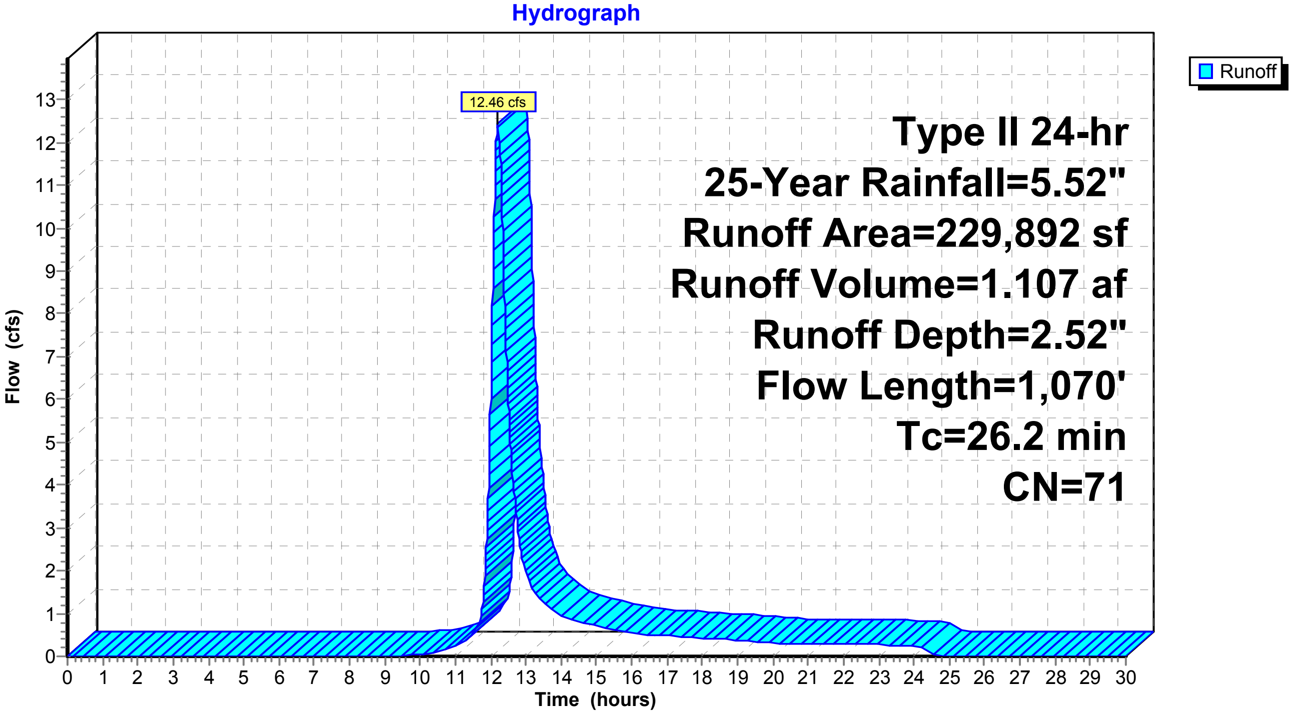
Runoff = 12.46 cfs @ 12.20 hrs, Volume= 1.107 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

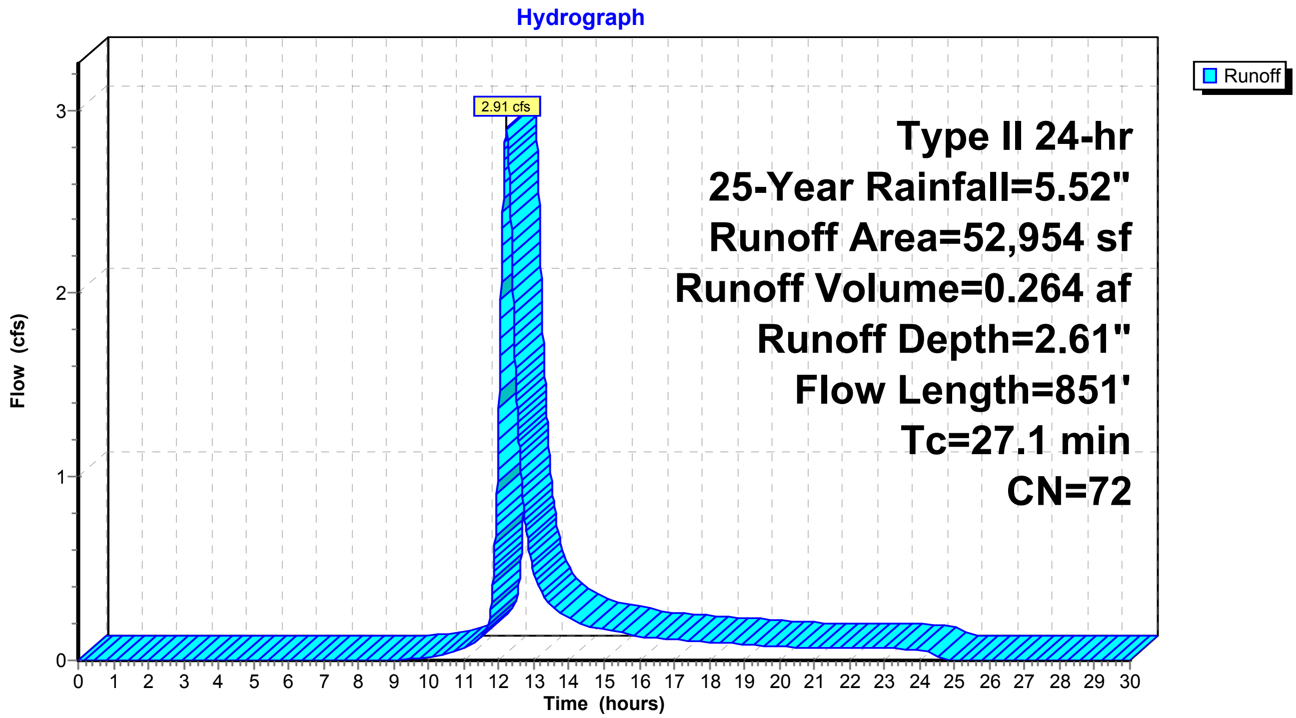
Runoff = 2.91 cfs @ 12.20 hrs, Volume= 0.264 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

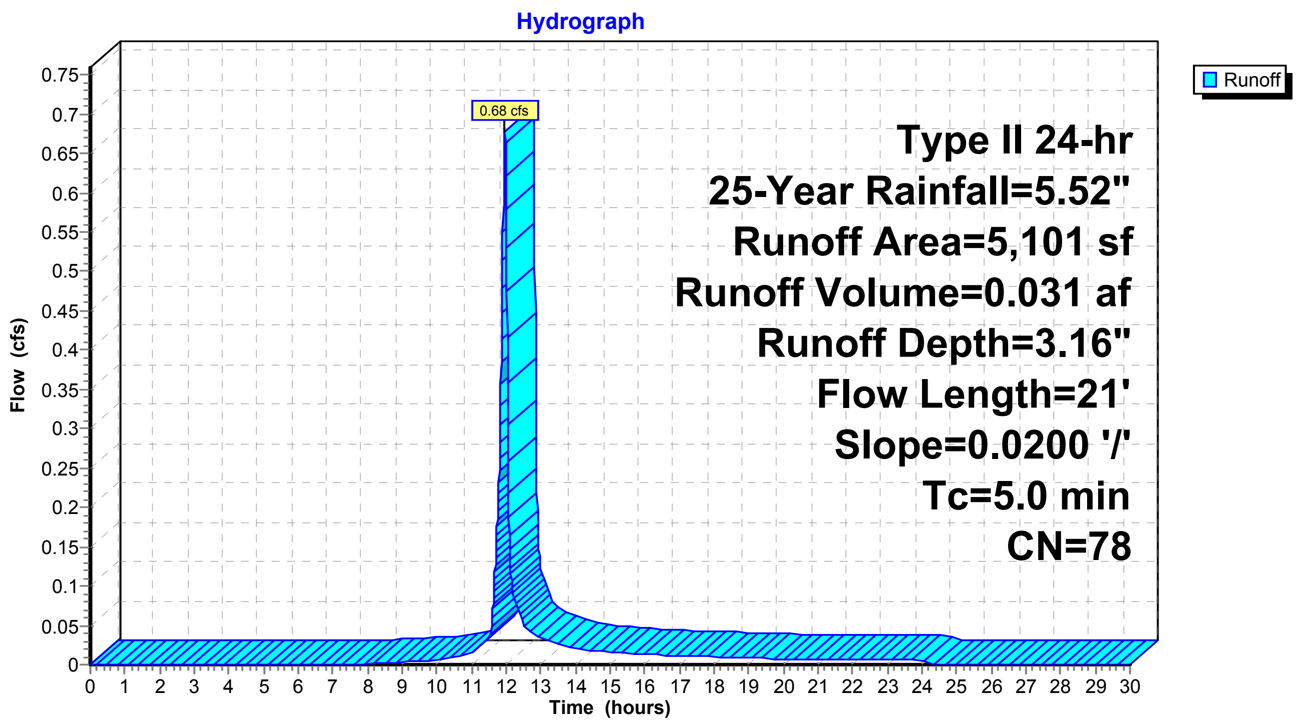
Runoff = 0.68 cfs @ 11.96 hrs, Volume= 0.031 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

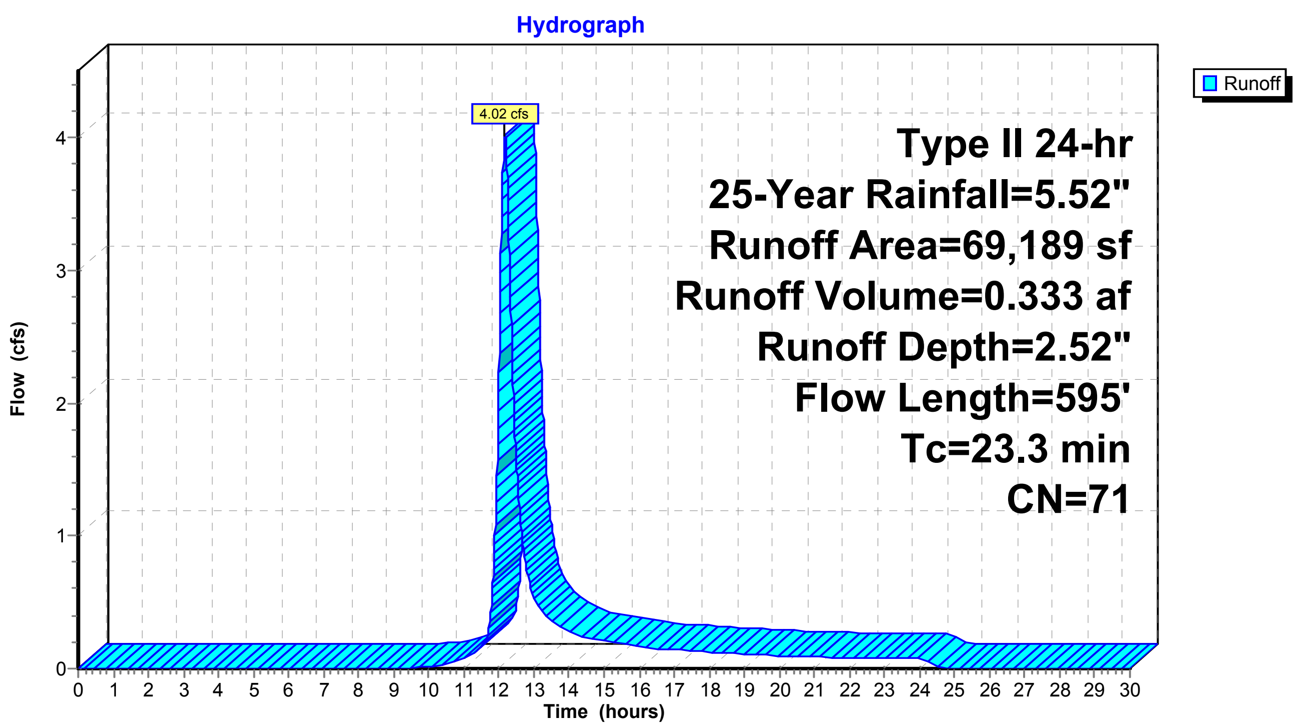
Runoff = 4.02 cfs @ 12.17 hrs, Volume= 0.333 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.52"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 0.68 cfs @ 11.96 hrs, Volume= 0.031 af
Outflow = 0.03 cfs @ 13.30 hrs, Volume= 0.010 af, Atten= 96%, Lag= 80.4 min
Primary = 0.03 cfs @ 13.30 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 699.01' @ 13.30 hrs Surf.Area= 0 sf Storage= 900 cf

Plug-Flow detention time= 342.5 min calculated for 0.010 af (33% of inflow)
Center-of-Mass det. time= 215.8 min (1,034.5 - 818.7)

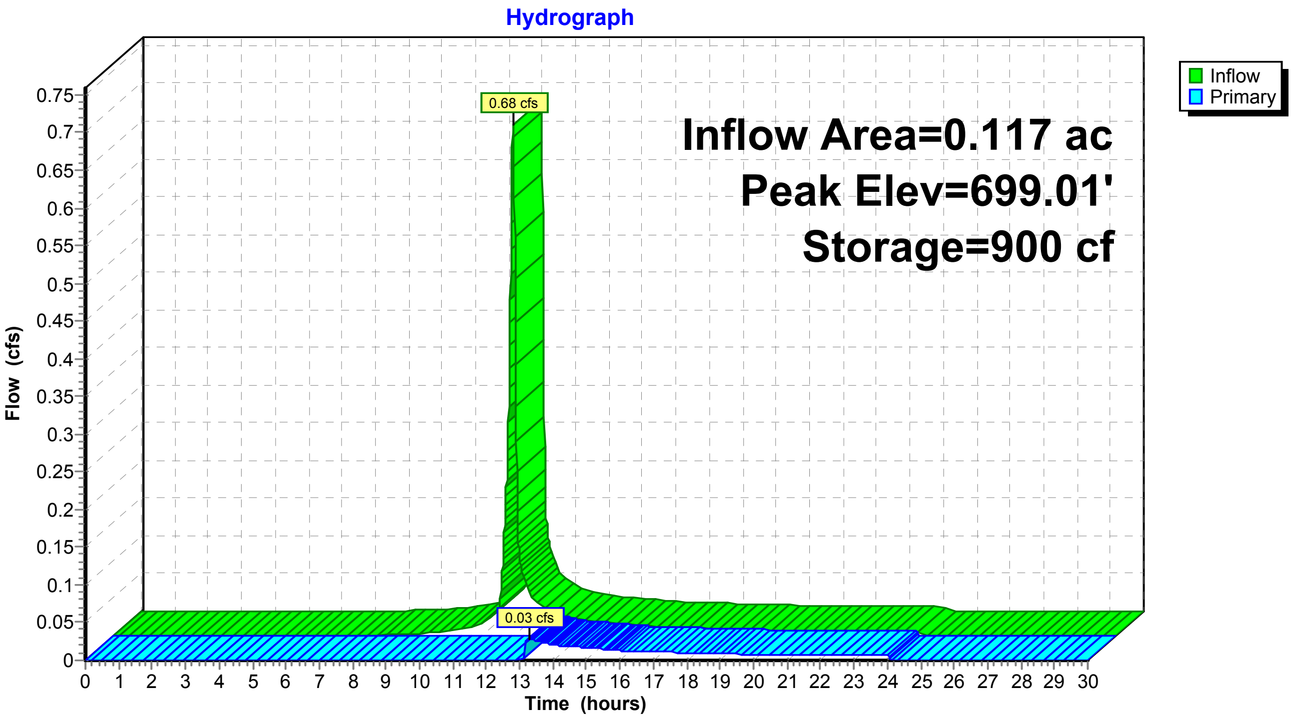
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 13.30 hrs HW=699.01' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir**(Weir Controls 0.02 cfs @ 0.23 fps)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 2.52" for 25-Year event
Inflow = 4.02 cfs @ 12.17 hrs, Volume= 0.333 af
Outflow = 4.02 cfs @ 12.17 hrs, Volume= 0.317 af, Atten= 0%, Lag= 0.0 min
Primary = 4.02 cfs @ 12.17 hrs, Volume= 0.317 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.32' @ 12.17 hrs Surf.Area= 0 sf Storage= 707 cf

Plug-Flow detention time= 36.3 min calculated for 0.317 af (95% of inflow)
Center-of-Mass det. time= 9.0 min (861.7 - 852.8)

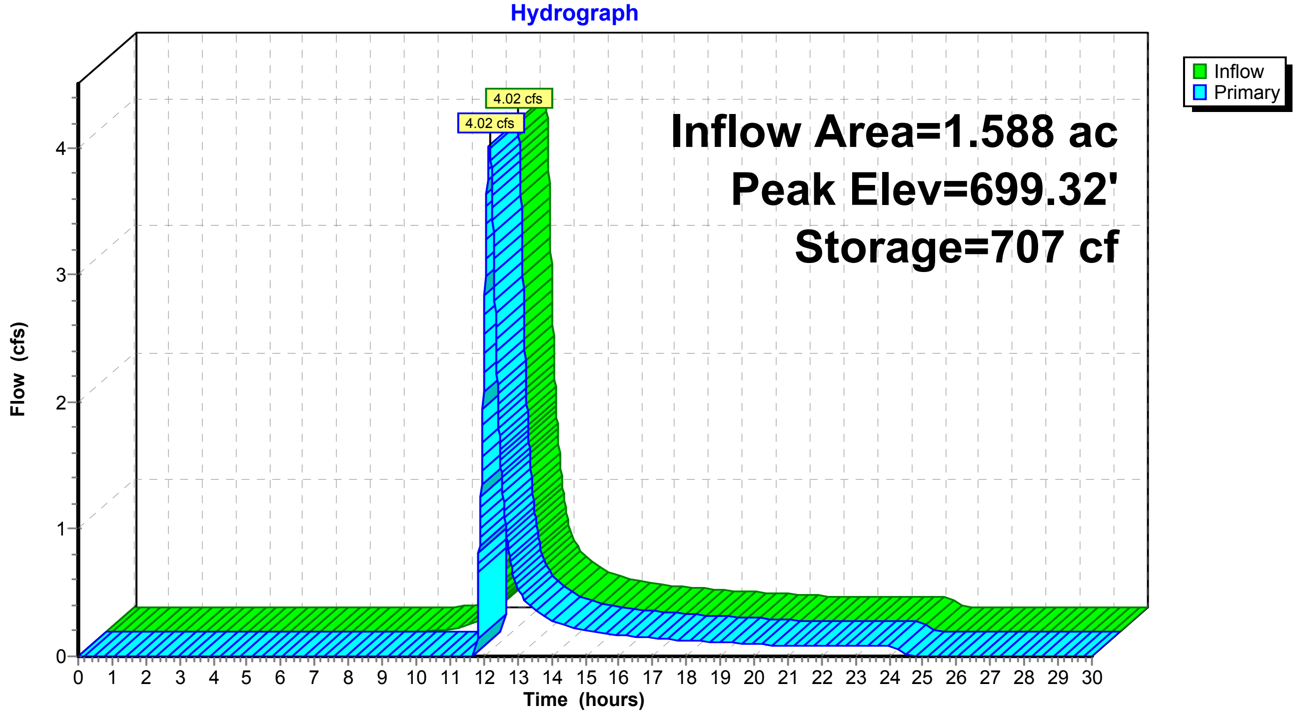
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=4.02 cfs @ 12.17 hrs HW=699.32' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 4.02 cfs @ 1.42 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 3.75" for 25-Year event
Inflow = 1.23 cfs @ 12.01 hrs, Volume= 0.068 af
Outflow = 0.06 cfs @ 14.72 hrs, Volume= 0.016 af, Atten= 95%, Lag= 162.4 min
Primary = 0.06 cfs @ 14.72 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 705.09' @ 14.72 hrs Surf.Area= 0 sf Storage= 2,321 cf

Plug-Flow detention time= 440.7 min calculated for 0.016 af (23% of inflow)
Center-of-Mass det. time= 295.3 min (1,102.6 - 807.3)

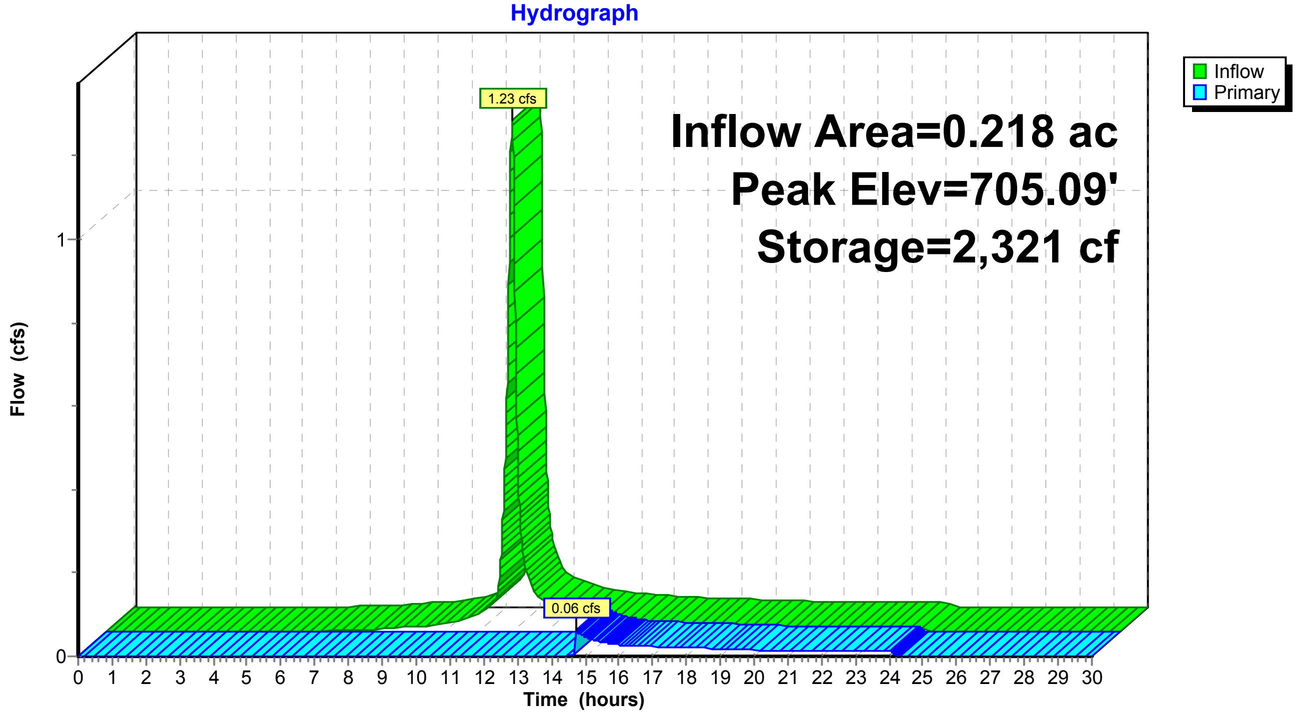
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage**Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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 @ 14.72 hrs HW=705.09' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.02 cfs @ 0.11 fps)

Pond 126P: MLV PAD

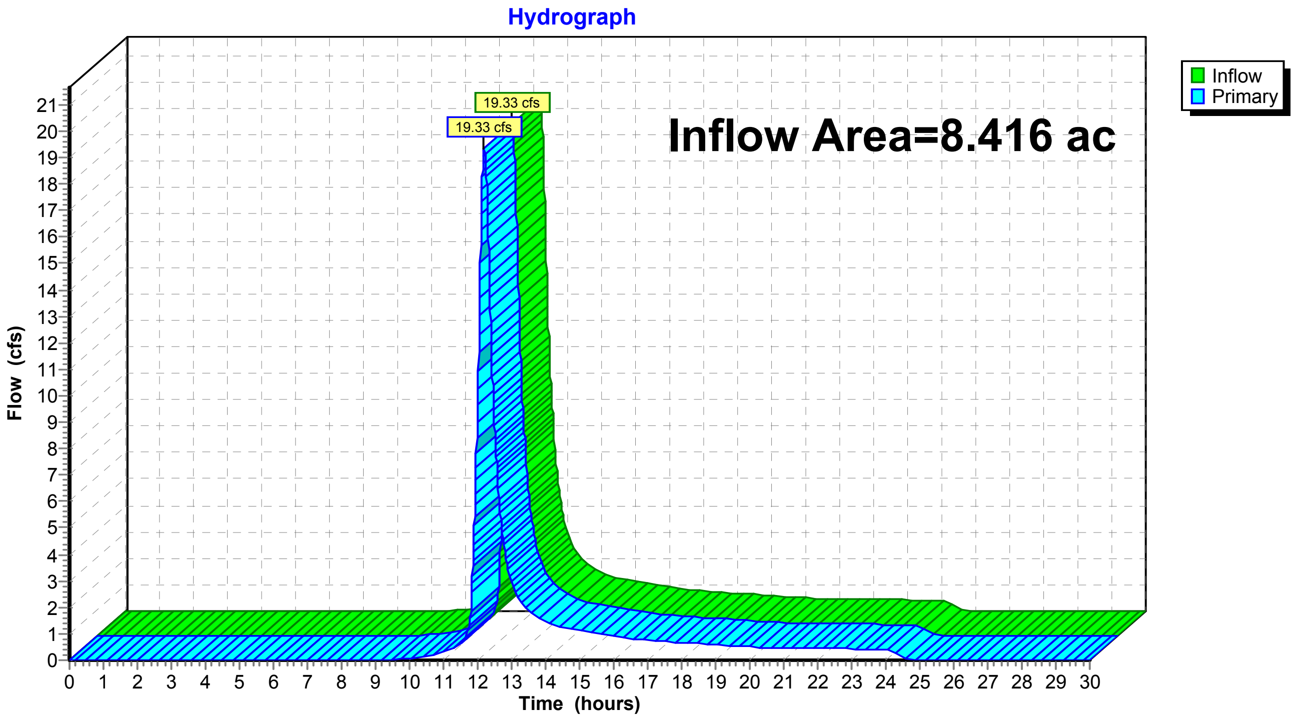


Summary for Link 105L: Proposed Conditions

Inflow Area = 8.416 ac, 1.28% Impervious, Inflow Depth = 2.44" for 25-Year event
Inflow = 19.33 cfs @ 12.20 hrs, Volume= 1.714 af
Primary = 19.33 cfs @ 12.20 hrs, Volume= 1.714 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=4.65"
Flow Length=299' Tc=10.0 min CN=84 Runoff=1.51 cfs 0.084 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=3.29"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=16.42 cfs 1.447 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=3.39"
Flow Length=851' Tc=27.1 min CN=72 Runoff=3.81 cfs 0.343 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=4.01"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.85 cfs 0.039 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=3.29"
Flow Length=595' Tc=23.3 min CN=71 Runoff=5.30 cfs 0.435 af

Pond 113P: WATER QUALITY SWALE Peak Elev=699.02' Storage=900 cf Inflow=0.85 cfs 0.039 af
Outflow=0.09 cfs 0.018 af

Pond 124P: DIVERSION SWALE Peak Elev=699.38' Storage=707 cf Inflow=5.30 cfs 0.435 af
Outflow=5.30 cfs 0.419 af

Pond 126P: MLV PAD Peak Elev=705.10' Storage=2,321 cf Inflow=1.51 cfs 0.084 af
Outflow=0.23 cfs 0.033 af

Link 105L: Proposed Conditions Inflow=25.52 cfs 2.261 af
Primary=25.52 cfs 2.261 af

Total Runoff Area = 8.416 ac Runoff Volume = 2.349 af Average Runoff Depth = 3.35"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

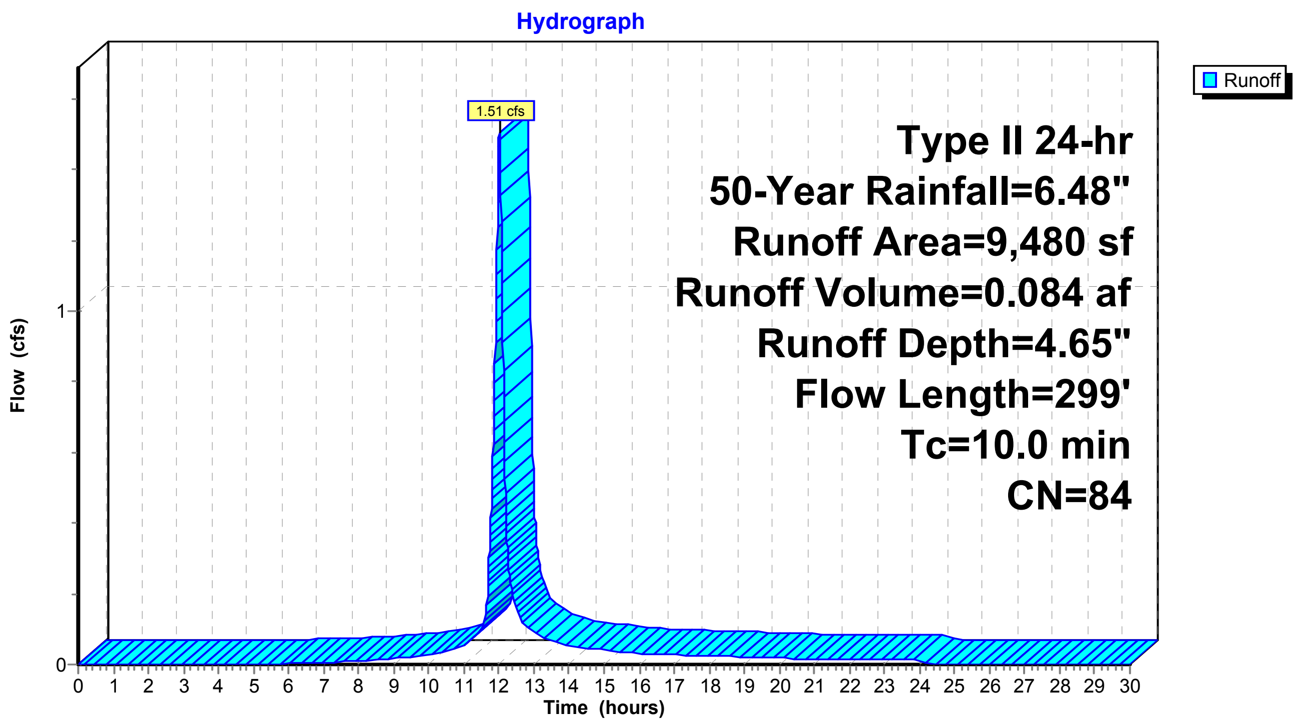
Runoff = 1.51 cfs @ 12.01 hrs, Volume= 0.084 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

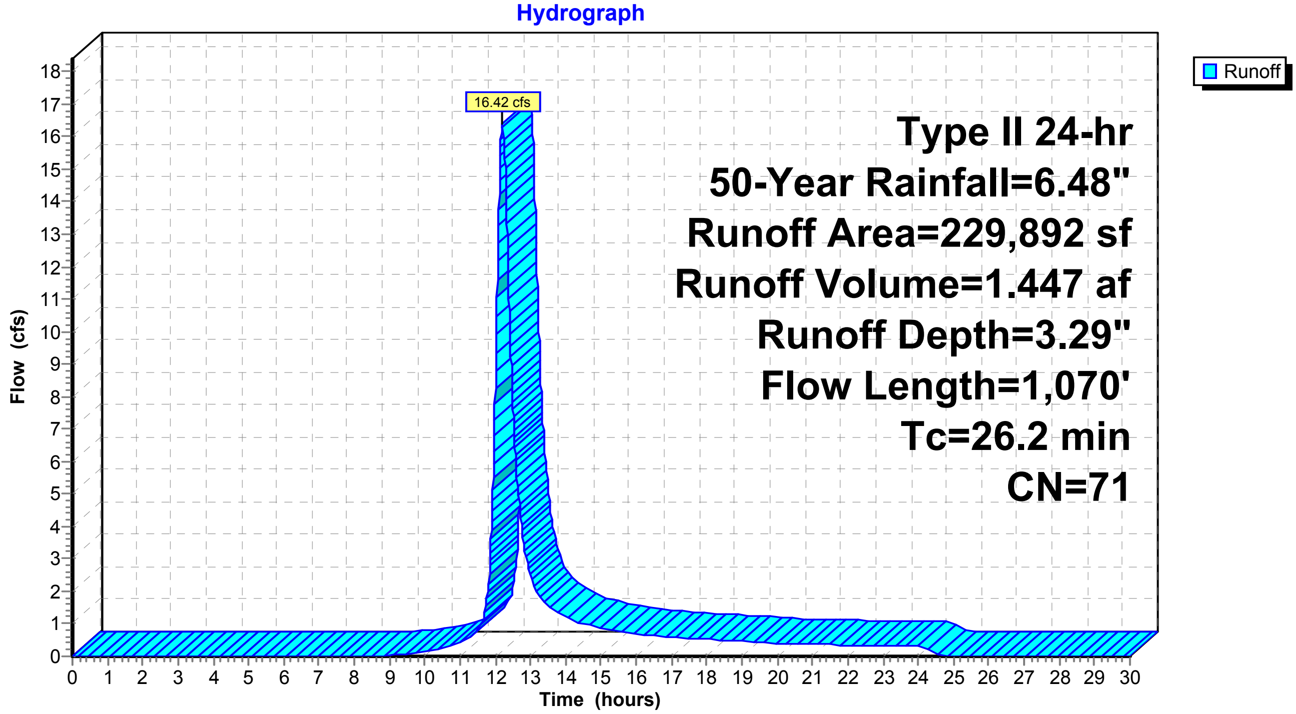
Runoff = 16.42 cfs @ 12.20 hrs, Volume= 1.447 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

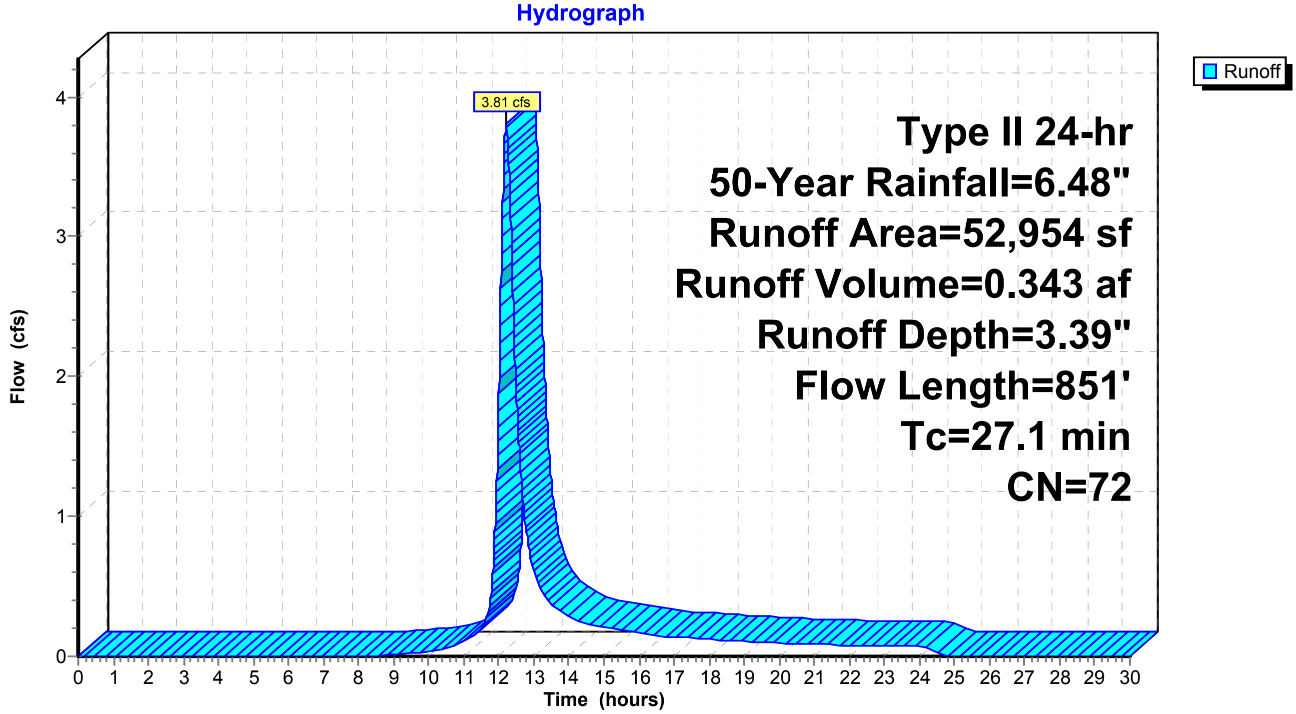
Runoff = 3.81 cfs @ 12.20 hrs, Volume= 0.343 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

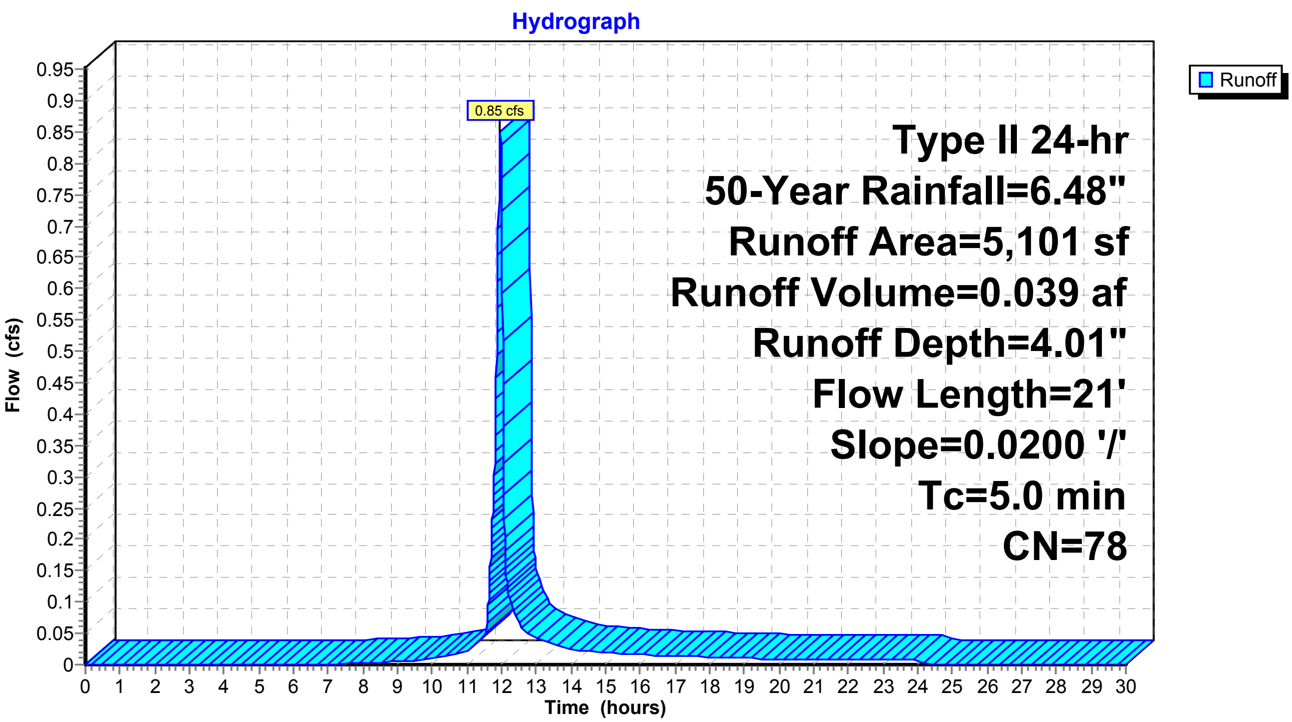
Runoff = 0.85 cfs @ 11.96 hrs, Volume= 0.039 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

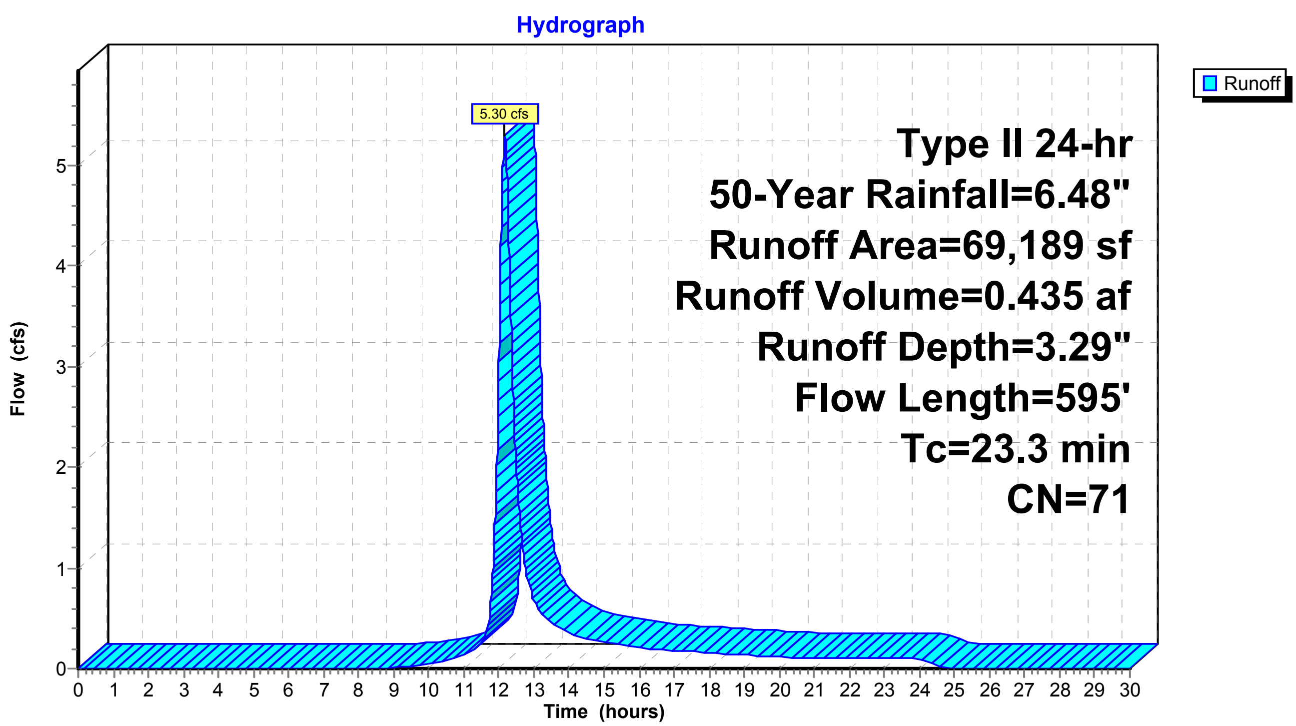
Runoff = 5.30 cfs @ 12.17 hrs, Volume= 0.435 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.48"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 4.01" for 50-Year event
Inflow = 0.85 cfs @ 11.96 hrs, Volume= 0.039 af
Outflow = 0.09 cfs @ 12.29 hrs, Volume= 0.018 af, Atten= 90%, Lag= 19.8 min
Primary = 0.09 cfs @ 12.29 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 699.02' @ 12.29 hrs Surf.Area= 0 sf Storage= 900 cf

Plug-Flow detention time= 256.6 min calculated for 0.017 af (45% of inflow)
Center-of-Mass det. time= 138.7 min (950.6 - 811.9)

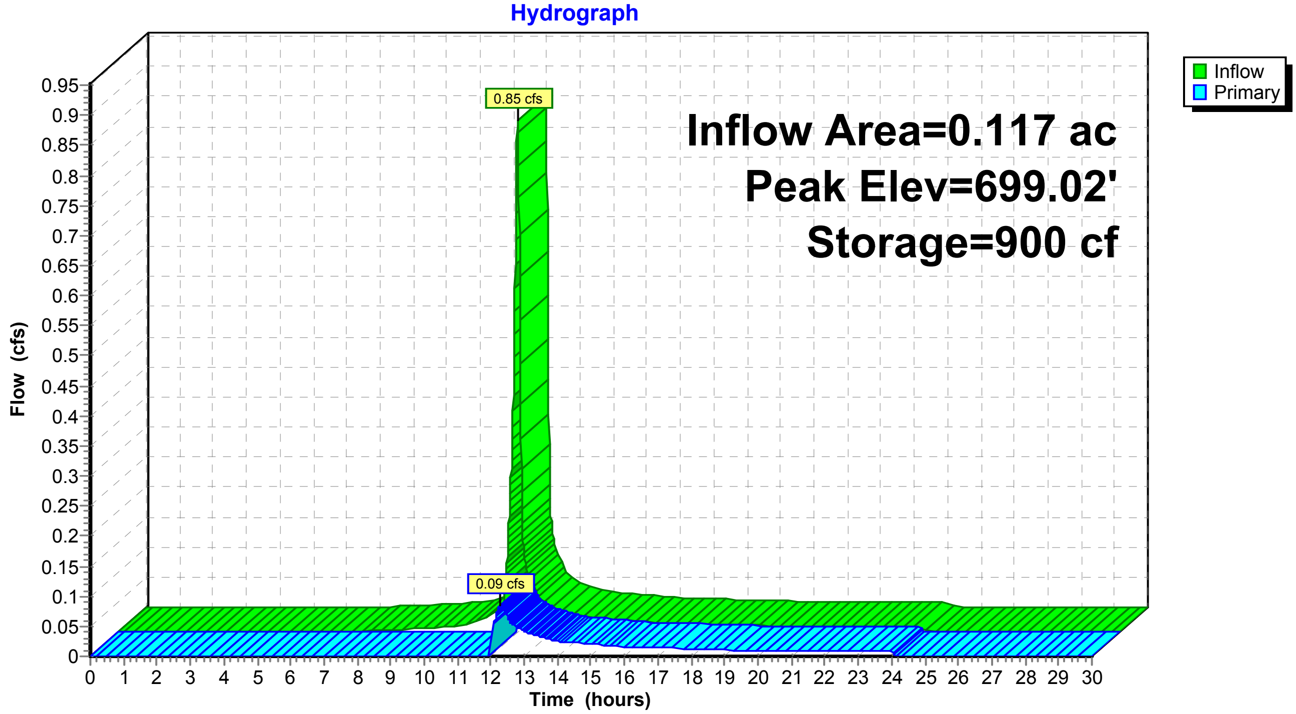
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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 @ 12.29 hrs HW=699.02' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.35 fps)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 3.29" for 50-Year event
Inflow = 5.30 cfs @ 12.17 hrs, Volume= 0.435 af
Outflow = 5.30 cfs @ 12.17 hrs, Volume= 0.419 af, Atten= 0%, Lag= 0.0 min
Primary = 5.30 cfs @ 12.17 hrs, Volume= 0.419 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.38' @ 12.17 hrs Surf.Area= 0 sf Storage= 707 cf

Plug-Flow detention time= 29.3 min calculated for 0.419 af (96% of inflow)
Center-of-Mass det. time= 7.8 min (852.8 - 845.1)

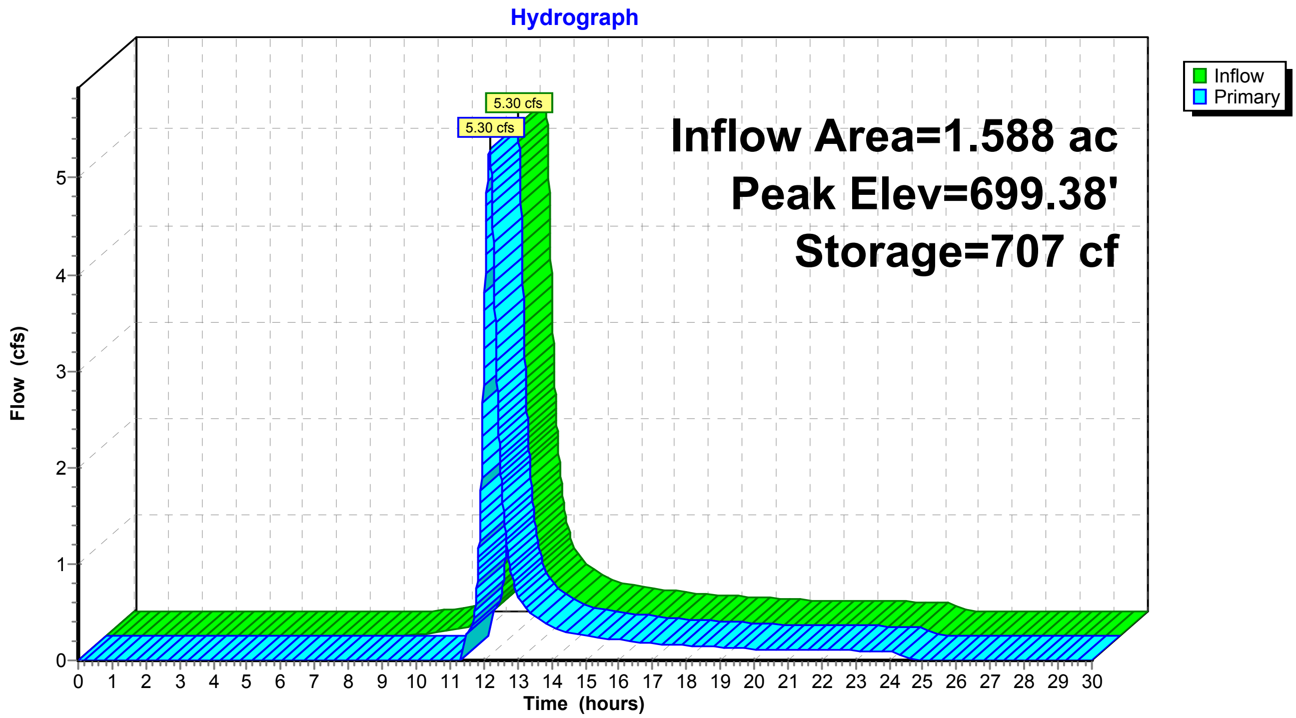
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=5.29 cfs @ 12.17 hrs HW=699.37' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 5.29 cfs @ 1.57 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 4.65" for 50-Year event
Inflow = 1.51 cfs @ 12.01 hrs, Volume= 0.084 af
Outflow = 0.23 cfs @ 12.48 hrs, Volume= 0.033 af, Atten= 85%, Lag= 28.0 min
Primary = 0.23 cfs @ 12.48 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 705.10' @ 12.48 hrs Surf.Area= 0 sf Storage= 2,321 cf

Plug-Flow detention time= 285.9 min calculated for 0.033 af (40% of inflow)
Center-of-Mass det. time= 163.4 min (964.6 - 801.2)

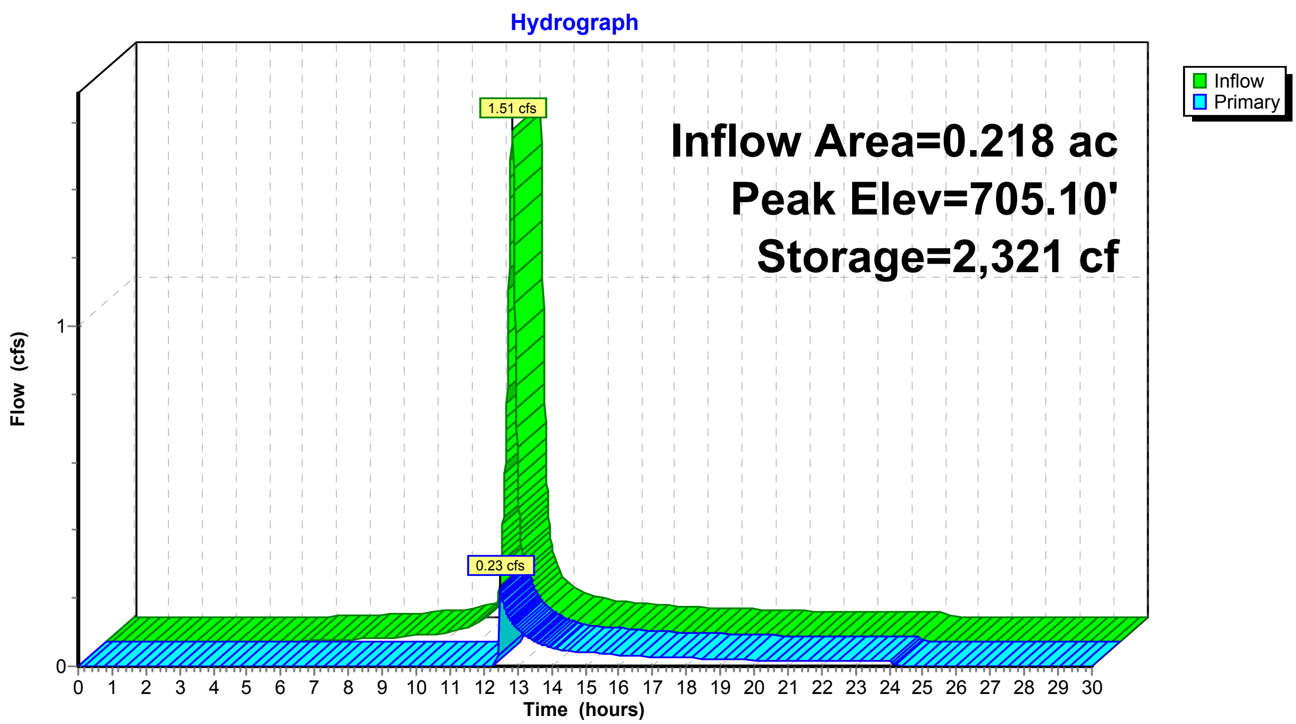
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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=0.14 cfs @ 12.48 hrs HW=705.10' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.14 cfs @ 0.21 fps)

Pond 126P: MLV PAD

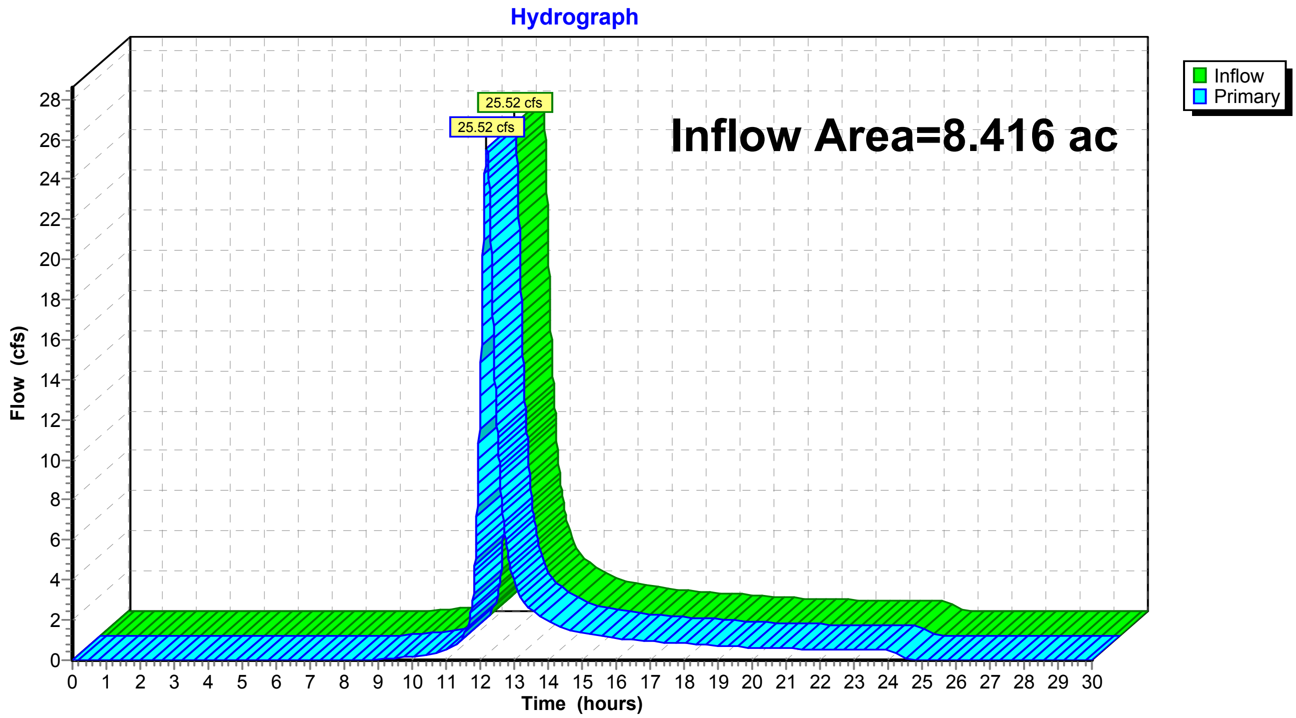


Summary for Link 105L: Proposed Conditions

Inflow Area = 8.416 ac, 1.28% Impervious, Inflow Depth = 3.22" for 50-Year event
Inflow = 25.52 cfs @ 12.20 hrs, Volume= 2.261 af
Primary = 25.52 cfs @ 12.20 hrs, Volume= 2.261 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment116S: DA TO MLV PAD Runoff Area=9,480 sf 49.37% Impervious Runoff Depth=4.87"
Flow Length=299' Tc=10.0 min CN=84 Runoff=1.58 cfs 0.088 af

Subcatchment119S: OFFSITE DA TO Runoff Area=229,892 sf 0.00% Impervious Runoff Depth=3.49"
Flow Length=1,070' Tc=26.2 min CN=71 Runoff=17.43 cfs 1.534 af

Subcatchment120S: OFFSITE DA TO Runoff Area=52,954 sf 0.00% Impervious Runoff Depth=3.59"
Flow Length=851' Tc=27.1 min CN=72 Runoff=4.04 cfs 0.364 af

Subcatchment122S: DA TO WQ SWALE Runoff Area=5,101 sf 0.00% Impervious Runoff Depth=4.22"
Flow Length=21' Slope=0.0200 '/' Tc=5.0 min CN=78 Runoff=0.89 cfs 0.041 af

Subcatchment123S: DA TO DIVERSION Runoff Area=69,189 sf 0.00% Impervious Runoff Depth=3.49"
Flow Length=595' Tc=23.3 min CN=71 Runoff=5.62 cfs 0.462 af

Pond 113P: WATER QUALITY SWALE Peak Elev=699.05' Storage=900 cf Inflow=0.89 cfs 0.041 af
Outflow=0.32 cfs 0.020 af

Pond 124P: DIVERSION SWALE Peak Elev=699.39' Storage=707 cf Inflow=5.62 cfs 0.462 af
Outflow=5.62 cfs 0.446 af

Pond 126P: MLV PAD Peak Elev=705.10' Storage=2,321 cf Inflow=1.58 cfs 0.088 af
Outflow=0.26 cfs 0.034 af

Link 105L: Proposed Conditions Inflow=27.11 cfs 2.398 af
Primary=27.11 cfs 2.398 af

Total Runoff Area = 8.416 ac Runoff Volume = 2.490 af Average Runoff Depth = 3.55"
98.72% Pervious = 8.309 ac 1.28% Impervious = 0.107 ac

Summary for Subcatchment 116S: DA TO MLV PAD

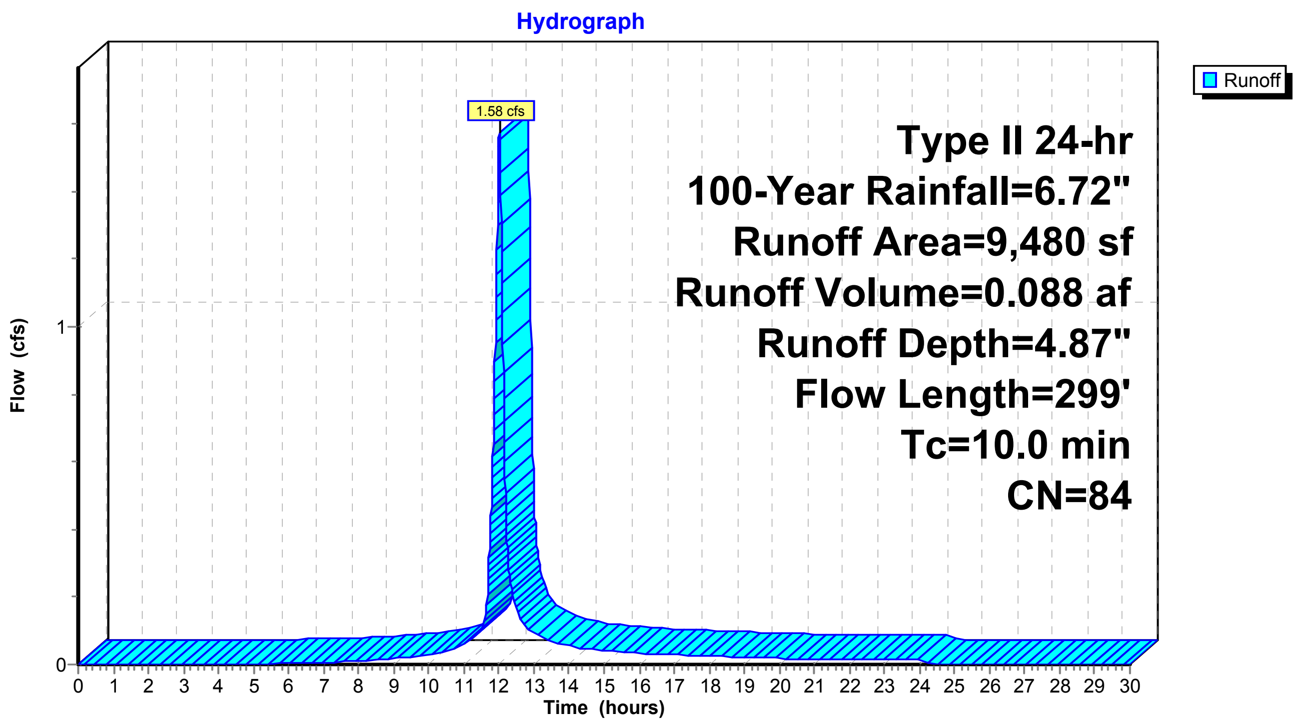
Runoff = 1.58 cfs @ 12.01 hrs, Volume= 0.088 af, Depth= 4.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	0	89	Gravel roads, HSG C
*	4,680	98	Crushed Stone Pad, HSG C
	0	70	Woods, Good, HSG C
	4,800	71	Meadow, non-grazed, HSG C
	9,480	84	Weighted Average
	4,800		50.63% Pervious Area
	4,680		49.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0700	0.19		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 3.12"
1.2	199	0.1500	2.71		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
10.0	299	Total			

Subcatchment 116S: DA TO MLV PAD



Summary for Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1

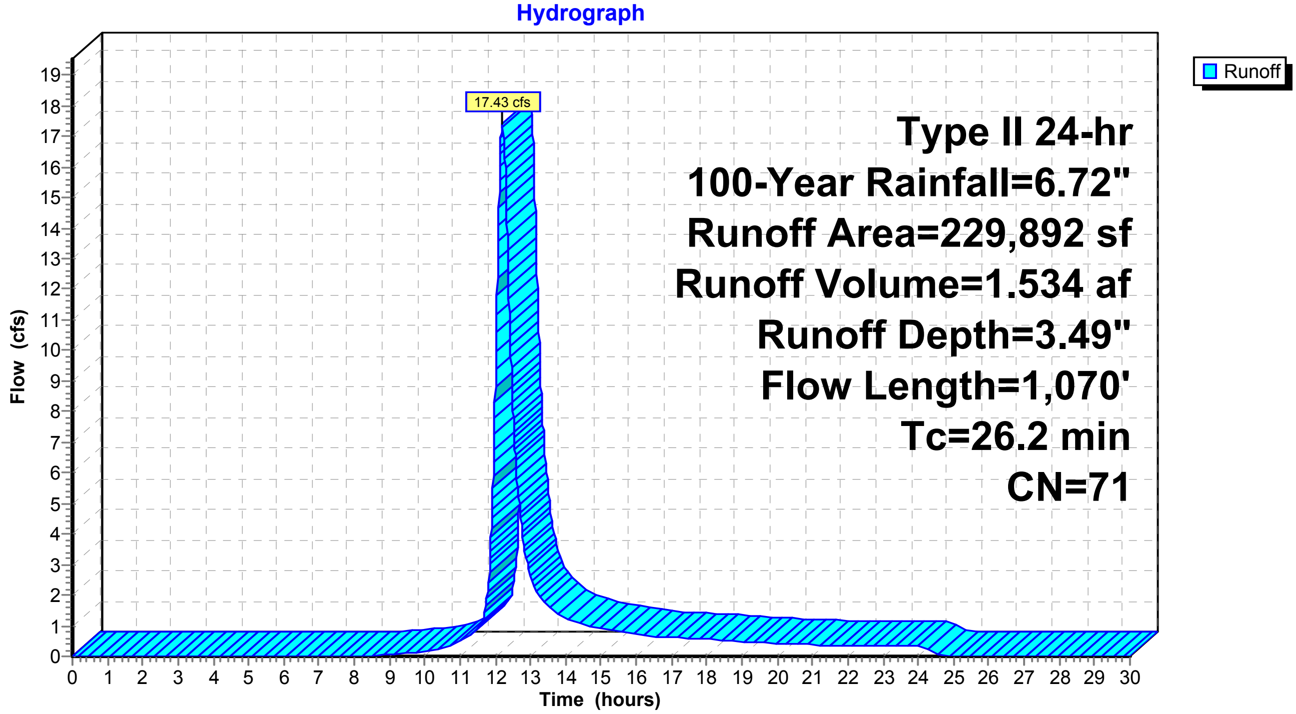
Runoff = 17.43 cfs @ 12.20 hrs, Volume= 1.534 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	11,983	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	165,033	70	Woods, Good, HSG C
	52,876	71	Meadow, non-grazed, HSG C
	229,892	71	Weighted Average
	229,892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1250	0.09		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
3.2	342	0.1250	1.77		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.8	132	0.3200	2.83		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	465	0.0800	1.98		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	31	0.0800	4.55		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
26.2	1,070	Total			

Subcatchment 119S: OFFSITE DA TO EXISTING CULVERT 1



Summary for Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2

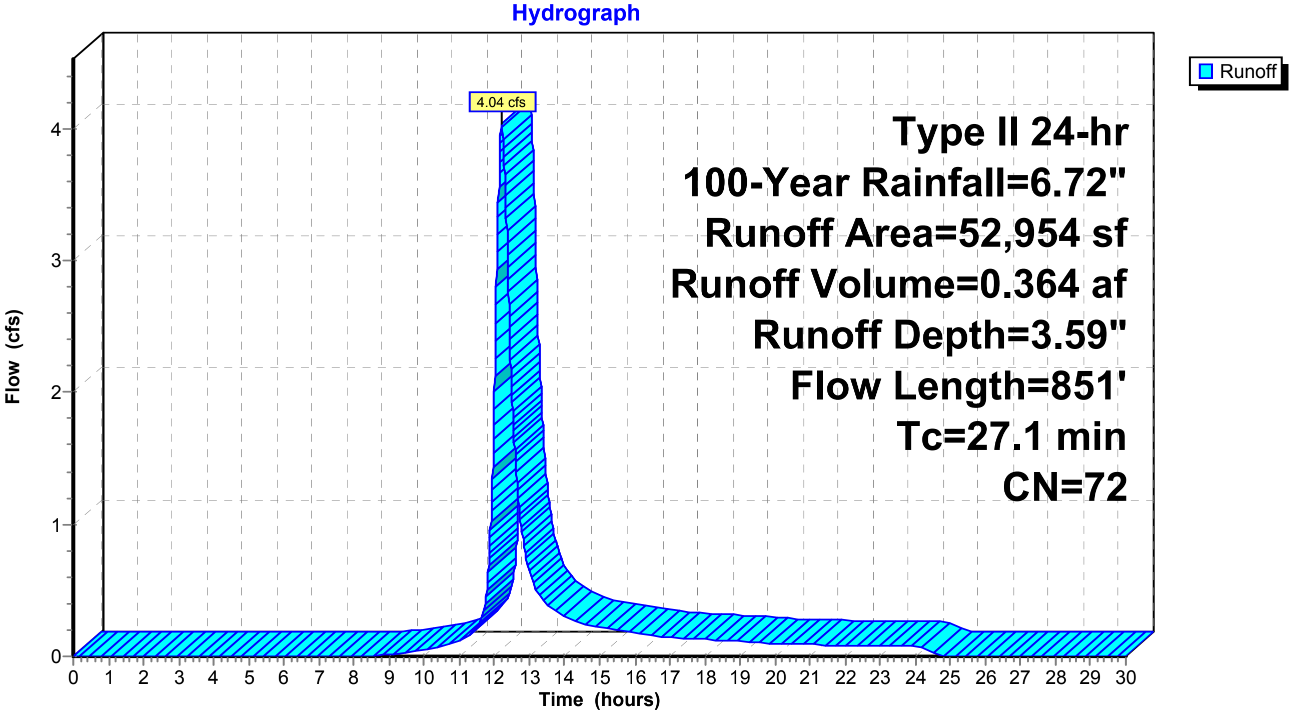
Runoff = 4.04 cfs @ 12.20 hrs, Volume= 0.364 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	2,897	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	13,655	70	Woods, Good, HSG C
	36,402	71	Meadow, non-grazed, HSG C
	52,954	72	Weighted Average
	52,954		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.7	100	0.0800	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.4	47	0.1700	2.06		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.9	564	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
0.8	101	0.1800	2.12		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.3	39	0.1000	2.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
27.1	851	Total			

Subcatchment 120S: OFFSITE DA TO EXISTING CULVERT 2



Summary for Subcatchment 122S: DA TO WQ SWALE

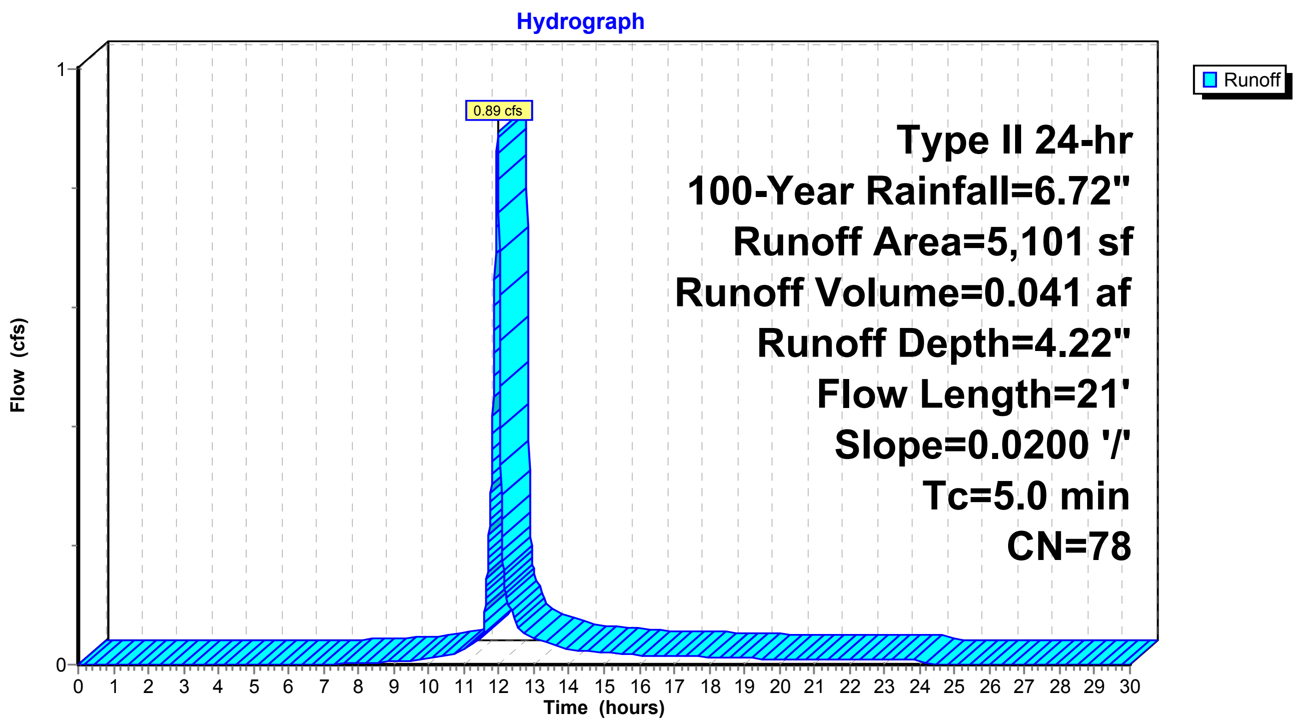
Runoff = 0.89 cfs @ 11.96 hrs, Volume= 0.041 af, Depth= 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	1,962	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	96	70	Woods, Good, HSG C
	3,043	71	Meadow, non-grazed, HSG C
	5,101	78	Weighted Average
	5,101		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	21	0.0200	0.99		**Sheet Flow, Sheet** Smooth surfaces n= 0.011 P2= 3.12"
0.4	21	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 122S: DA TO WQ SWALE



Summary for Subcatchment 123S: DA TO DIVERSION SWALE

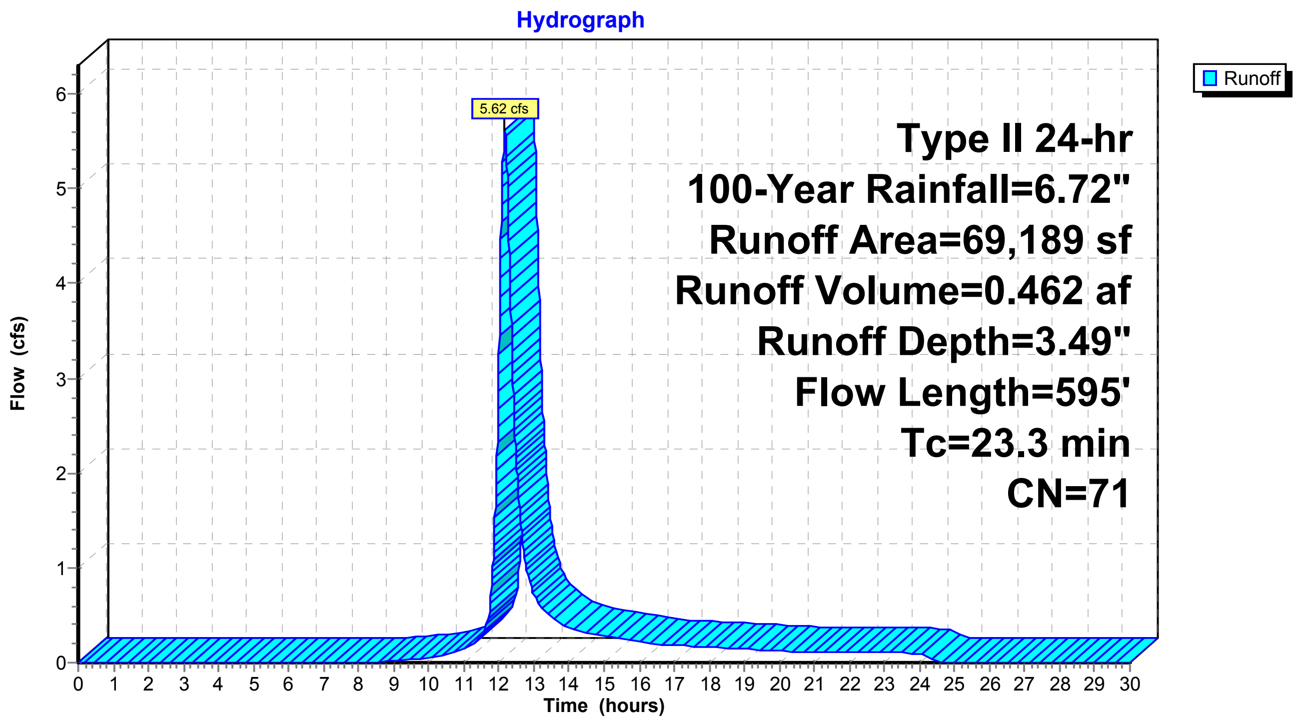
Runoff = 5.62 cfs @ 12.17 hrs, Volume= 0.462 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=6.72"

	Area (sf)	CN	Description
	0	98	Paved parking, HSG C
	906	89	Gravel roads, HSG C
*	0	98	Crushed Stone Pad, HSG C
	7,030	70	Woods, Good, HSG C
	61,253	71	Meadow, non-grazed, HSG C
	69,189	71	Weighted Average
	69,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.1000	0.08		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 3.12"
0.3	42	0.2600	2.55		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.1	453	0.1200	2.42		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
23.3	595	Total			

Subcatchment 123S: DA TO DIVERSION SWALE



Summary for Pond 113P: WATER QUALITY SWALE

Inflow Area = 0.117 ac, 0.00% Impervious, Inflow Depth = 4.22" for 100-Year event
Inflow = 0.89 cfs @ 11.96 hrs, Volume= 0.041 af
Outflow = 0.32 cfs @ 12.05 hrs, Volume= 0.020 af, Atten= 65%, Lag= 5.6 min
Primary = 0.32 cfs @ 12.05 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 699.05' @ 12.05 hrs Surf.Area= 0 sf Storage= 900 cf

Plug-Flow detention time= 240.9 min calculated for 0.020 af (48% of inflow)
Center-of-Mass det. time= 124.8 min (935.2 - 810.4)

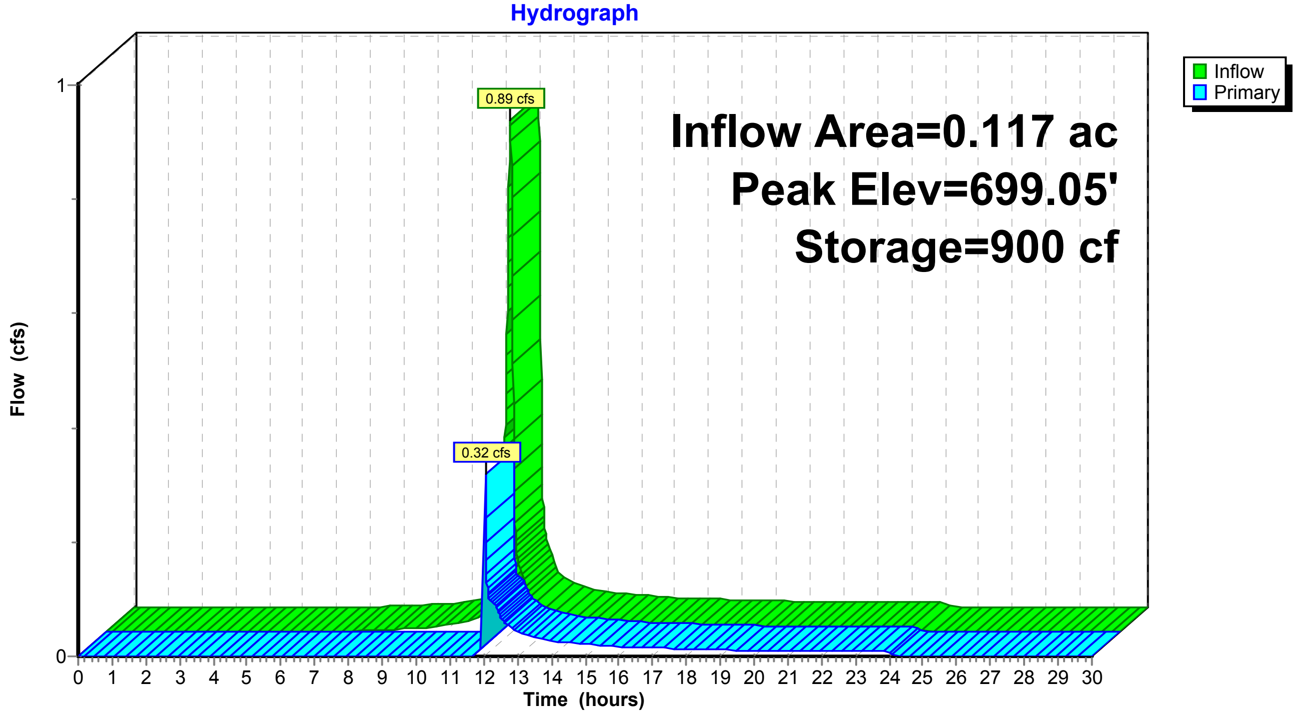
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	901 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	450
699.00	900
699.50	901

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**12.0' 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=0.28 cfs @ 12.05 hrs HW=699.04' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.28 cfs @ 0.51 fps)

Pond 113P: WATER QUALITY SWALE



Summary for Pond 124P: DIVERSION SWALE

Inflow Area = 1.588 ac, 0.00% Impervious, Inflow Depth = 3.49" for 100-Year event
Inflow = 5.62 cfs @ 12.17 hrs, Volume= 0.462 af
Outflow = 5.62 cfs @ 12.17 hrs, Volume= 0.446 af, Atten= 0%, Lag= 0.0 min
Primary = 5.62 cfs @ 12.17 hrs, Volume= 0.446 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 9
Peak Elev= 699.39' @ 12.17 hrs Surf.Area= 0 sf Storage= 707 cf

Plug-Flow detention time= 27.7 min calculated for 0.446 af (96% of inflow)
Center-of-Mass det. time= 7.5 min (850.9 - 843.4)

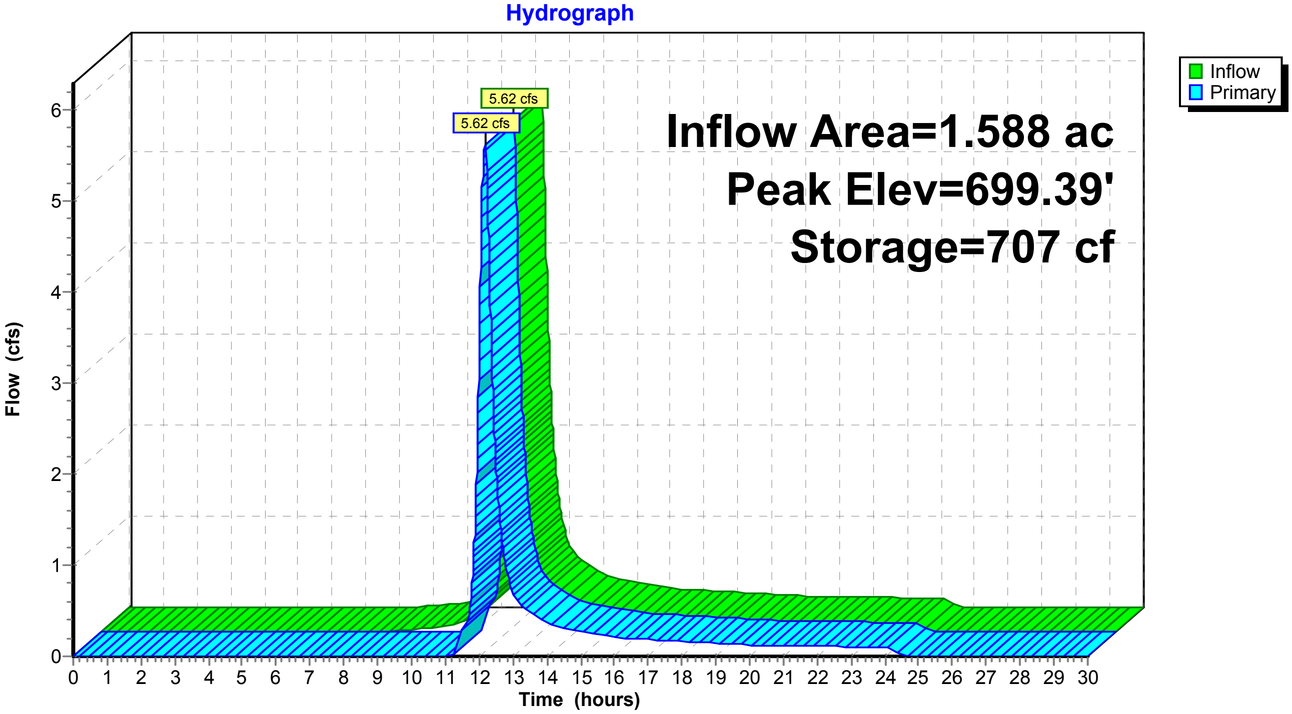
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	707 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
698.00	0
698.50	353
699.00	706
699.50	707

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**9.0' 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=5.62 cfs @ 12.17 hrs HW=699.39' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 5.62 cfs @ 1.60 fps)

Pond 124P: DIVERSION SWALE



Summary for Pond 126P: MLV PAD

Inflow Area = 0.218 ac, 49.37% Impervious, Inflow Depth = 4.87" for 100-Year event
Inflow = 1.58 cfs @ 12.01 hrs, Volume= 0.088 af
Outflow = 0.26 cfs @ 12.32 hrs, Volume= 0.034 af, Atten= 83%, Lag= 18.7 min
Primary = 0.26 cfs @ 12.32 hrs, Volume= 0.034 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 705.10' @ 12.32 hrs Surf.Area= 0 sf Storage= 2,321 cf

Plug-Flow detention time= 287.6 min calculated for 0.034 af (39% of inflow)
Center-of-Mass det. time= 164.1 min (964.0 - 799.9)

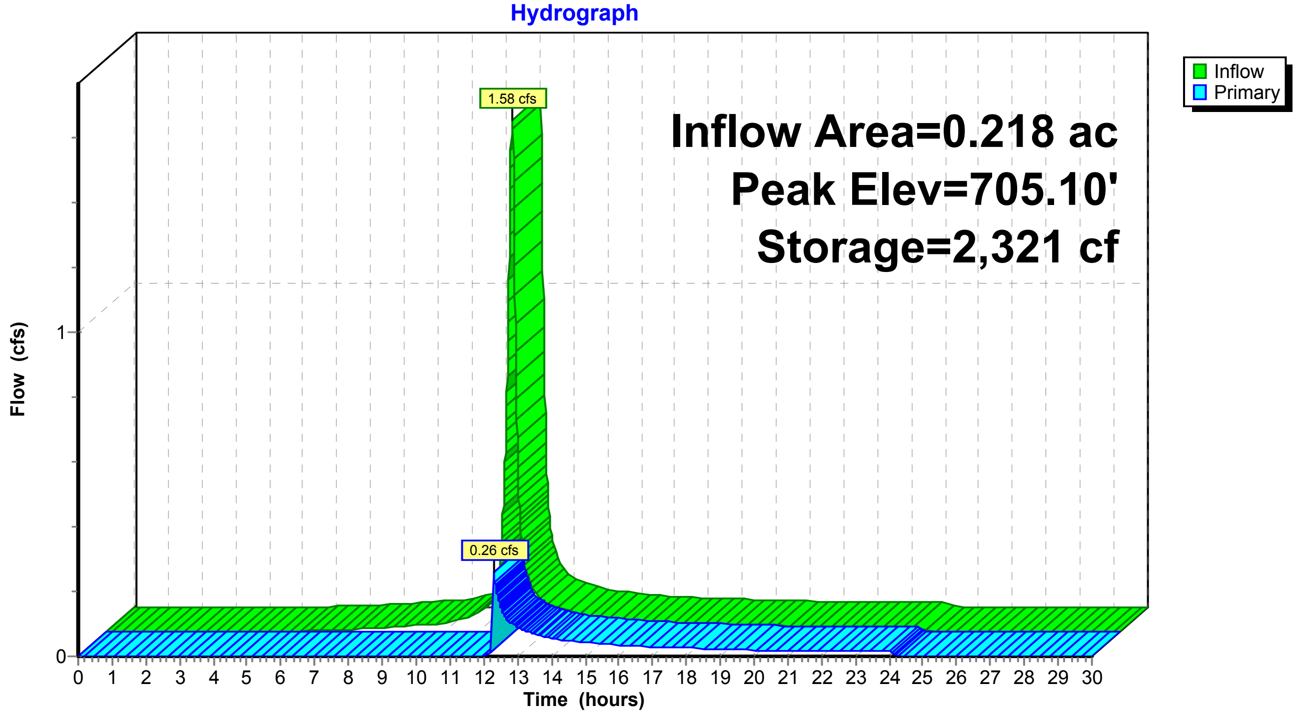
Volume	Invert	Avail.Storage	Storage Description
#1	703.59'	2,322 cf	**Stone Pad Void Storage** Listed below 5,805 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
703.59	0
704.00	756
704.50	3,042
705.00	5,382
705.09	5,803
705.59	5,805

Device	Routing	Invert	Outlet Devices
#1	Primary	705.09'	**90.0' 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=0.14 cfs @ 12.32 hrs HW=705.10' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.14 cfs @ 0.21 fps)

Pond 126P: MLV PAD

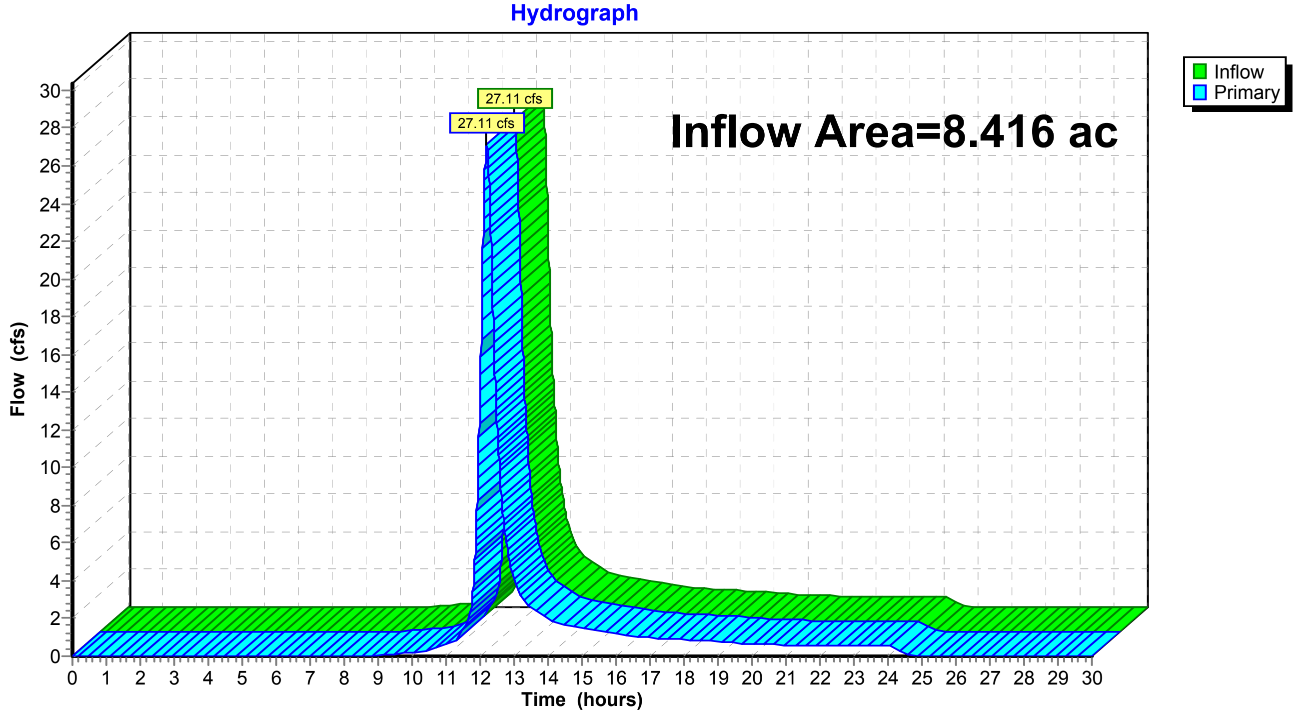


Summary for Link 105L: Proposed Conditions

Inflow Area =	8.416 ac,	1.28% Impervious, Inflow Depth = 3.42"	for 100-Year event	
Inflow =	27.11 cfs @	12.20 hrs, Volume=	2.398 af	
Primary =	27.11 cfs @	12.20 hrs, Volume=	2.398 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 105L: Proposed Conditions



J.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-SC-063 Diversion Swale

PREPARED BY: OLC DATE: 7/26/16

CHECKED BY: BJP DATE: 7/26/16

CHANNEL OR CHANNEL SECTION		AR-SC-063 LINING (MIN)	AR-SC-063 GRASS (MIN)			
TEMPORARY OR PERMANENT?	(T OR P)	P	P			
DESIGN STORM	(2, 5, OR 10 YR)	10	10			
ACRES	(AC)	1.61	1.61			
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	-	-			
Qr (REQUIRED CAPACITY)	(CFS)	0.51	0.51			
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.46	0.52			
PROTECTIVE LINING[2]		SC250	SC250 REINFORCED VEGATATION			
n (MANNING'S COEFFICIENT)[2]		0.04	0.25			
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A			
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.49	0.50			
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.50	8.00			
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.28	0.90			
CHANNEL BOTTOM WIDTH	(FT)	6	6			
CHANNEL SIDE SLOPES	(H:V)	3	3			
D (TOTAL DEPTH)	(FT)	1.5	1.5			
CHANNEL TOP WIDTH @ D	(FT)	15	15			
d (CALCULATED FLOW DEPTH)	(FT)	0.05	0.16			
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	6.30	6.96			
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	120.00	37.50			
d50 STONE SIZE	(IN)	N/A	N/A			
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.31	1.04			
R (HYDRAULIC RADIUS)		0.05	0.15			
S (BED SLOPE)[3]	(FT/FT)	0.09	0.09			
Sc (CRITICAL SLOPE)	(FT/FT)	0.064	1.734			
.7Sc	(FT/FT)	0.045	1.214			
1.3Sc	(FT/FT)	0.083	2.254			
STABLE FLOW?	(Y/N)	Y	Y			
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.01	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			

1. Use 1.6 for Temporary Channels; 2.25 for Temporary Channels in Special Protection (HQ or EV) Watersheds; 2.75 for Permanent Channels. For Rational Method, enter "N/A" and attach E&S Worksheets 9 and 10. For TR-55 enter "N/A" and attach appropriate Worksheets.
2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or ¼ Total Channel Depth, whichever is greater
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Atlantic Sunrise

LOCATION: AR-SC-063 Water Quality Swale

PREPARED BY: JMS DATE: 5/01/15

CHECKED BY: BJP DATE: 5/01/15

CHANNEL OR CHANNEL SECTION		AR-SC-063 LINING (MIN)	AR-SC-063 GRASS (MIN)			
TEMPORARY OR PERMANENT?	(T OR P)	P	P			
DESIGN STORM	(2, 5, OR 10 YR)	10	10			
ACRES	(AC)	0.12	0.12			
MULTIPLIER[1]	(1.6, 2.25, or 2.75)[1]	-	-			
Qr (REQUIRED CAPACITY)	(CFS)	0.51	0.51			
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	0.51	0.58			
PROTECTIVE LINING[2]		SC250	SC250 REINFORCED VEGETATION			
n (MANNING'S COEFFICIENT)[2]		0.04	0.25			
Va (ALLOWABLE VELOCITY)	(FPS)	N/A	N/A			
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.96	0.62			
τa (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	2.50	8.00			
τd (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	0.45	1.40			
CHANNEL BOTTOM WIDTH	(FT)	3	3			
CHANNEL SIDE SLOPES	(H:V)	3	3			
D (TOTAL DEPTH)	(FT)	3.0	3.0			
CHANNEL TOP WIDTH @ D	(FT)	21	21			
d (CALCULATED FLOW DEPTH)	(FT)	0.08	0.25			
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	3.48	4.50			
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	37.50	12.00			
d50 STONE SIZE	(IN)	N/A	N/A			
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	0.26	0.94			
R (HYDRAULIC RADIUS)		0.07	0.20			
S (BED SLOPE)[3]	(FT/FT)	0.09	0.09			
Sc (CRITICAL SLOPE)	(FT/FT)	0.056	1.572			
.7Sc	(FT/FT)	0.039	1.100			
1.3Sc	(FT/FT)	0.073	2.044			
STABLE FLOW?	(Y/N)	Y	Y			
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.01	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			

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.

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5401 St. Wendel-Cynthiana Road
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Tel. 800.772.2040
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www.nagreen.com

Erosion Control Materials Design Software
Version 5.0

Project Name: ASR Access Roads
Project Number: 63544
Channel Name: AR-SC-063 Diversion Swale

Discharge	2.81
Peak Flow Period	24
Channel Slope	0.09
Channel Bottom Width	3
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

SC250 - 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
SC250 Unvegetated	Straight	2.81 cfs	3.56 ft/s	0.22 ft	0.04	2.5 lbs/ft2	1.21 lbs/ft2	2.06	STABLE	E
SC250 Reinforced Vegetation	Straight	2.81 cfs	1.73 ft/s	0.39 ft	0.115	8 lbs/ft2	2.19 lbs/ft2	3.66	STABLE	E
Underlying Substrate	Straight	2.81 cfs	1.73 ft/s	0.39 ft	--	0.8 lbs/ft2	0.066 lbs/ft2	12.04	STABLE	--

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Poseyville, Indiana 47633
Tel. 800.772.2040
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www.nagreen.com

Erosion Control Materials Design Software
Version 5.0

Project Name: ASR Access Roads
Project Number: 63544
Channel Name: AR-SC-063 WQS

Discharge	0.51
Peak Flow Period	24
Channel Slope	0.09
Channel Bottom Width	6
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

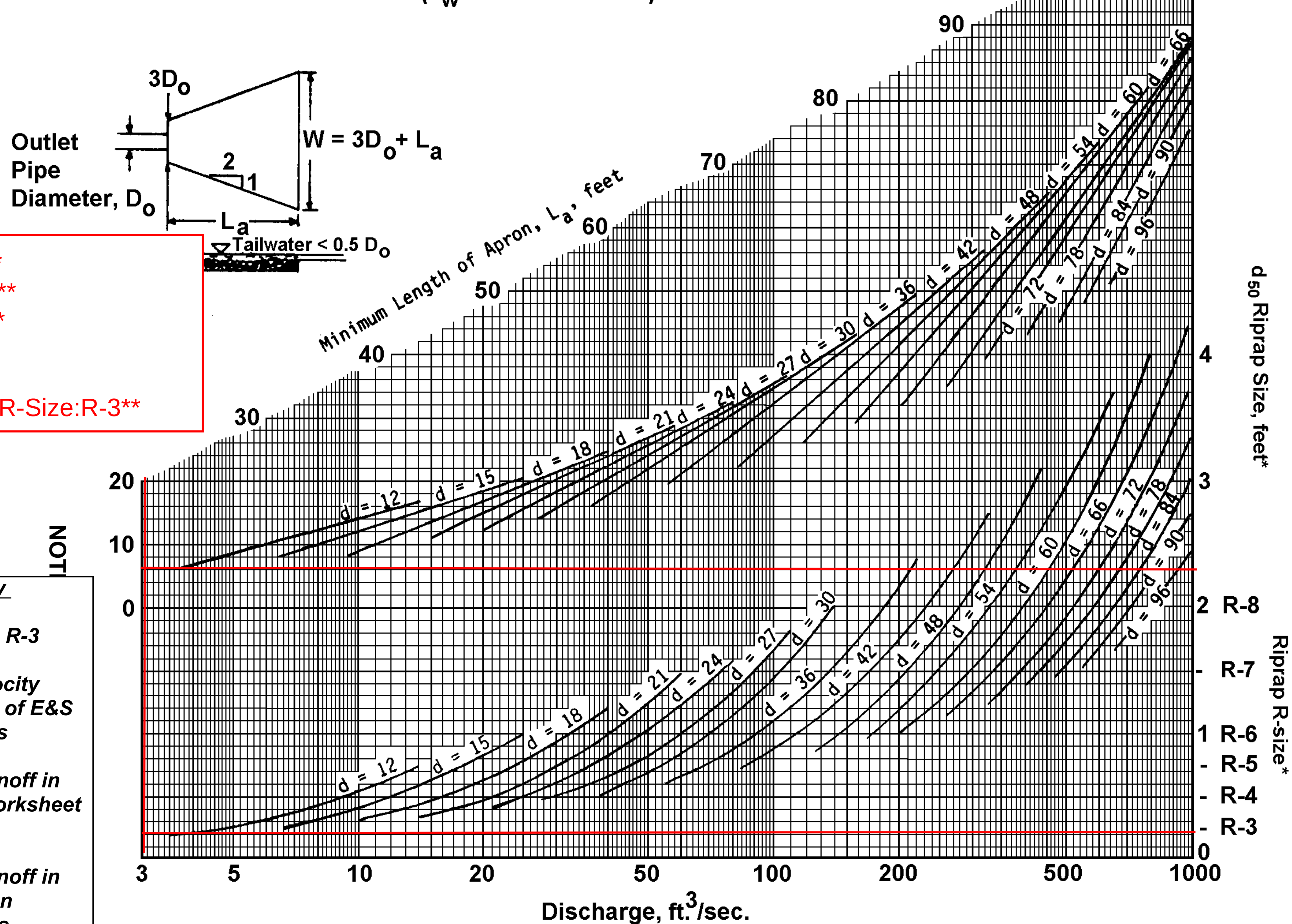
SC250 - Class C - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
SC250 Unvegetated	Straight	0.51 cfs	1.55 ft/s	0.05 ft	0.04	2.5 lbs/ft2	0.3 lbs/ft2	8.34	STABLE	E
SC250 Reinforced Vegetation	Straight	0.51 cfs	0.5 ft/s	0.16 ft	0.25	8 lbs/ft2	0.89 lbs/ft2	8.97	STABLE	E
Underlying Substrate	Straight	0.51 cfs	0.5 ft/s	0.16 ft	--	0.8 lbs/ft2	0.006 lbs/ft2	140.39	STABLE	--

TAR-SC-063 VCD
Q(10)= 4.29 cfs, 12" pipe

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition

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**

NOT[...]
[...]d for Box Cu[...]

Adapted from USDA - NRCS

* 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

Check Velocity

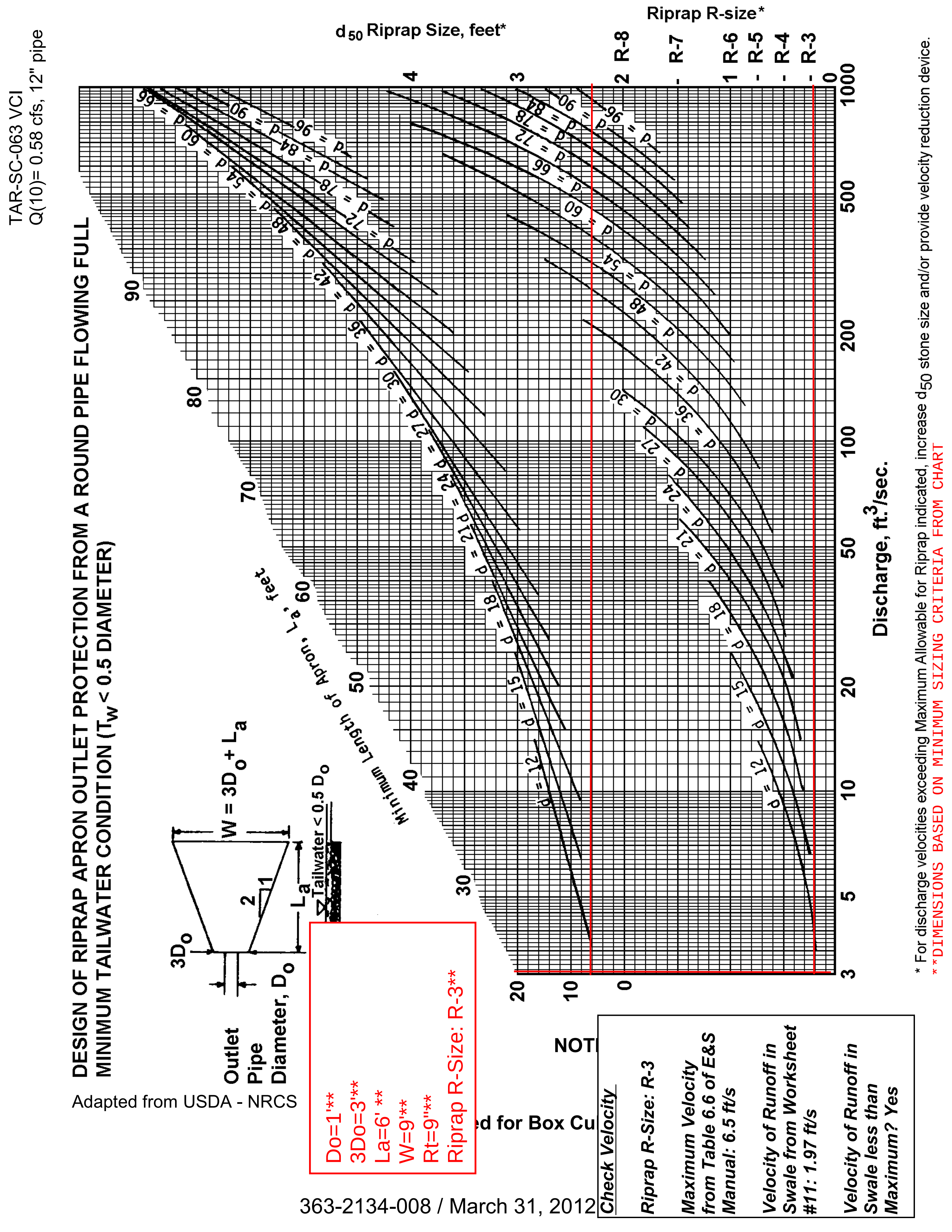
Riprap R-Size: R-3

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

Velocity of Runoff in Swale from Worksheet #11: 3.56 ft/s

Velocity of Runoff in Swale less than Maximum? Yes

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



J.6 PCSM BMP Calculations

a. Check Dam Volume Calculations

ATLANTIC SUNRISE NATURAL GAS PIPELINE PROJECT
(ACCESS ROAD) VEGETATED CHANNEL FOR INFILTRATION CHECKDAM VOLUME
AR-SC-063

7/25/2016

TOTAL REACH VOLUME = 900 CF Width (W_B): 6 FT. Depth (H): 1 FT.

VEGETATED CHANNEL FOR INFILTRATION PAR-SC-063

ROAD STA 1+15 to 1+85

Input data

S =	0.005	ft/ft
H =	1	ft
W_B =	6	
z_1 =	3	
z_2 =	3	

Output data

$L_{storage}$=	200	ft
W_T =	12	ft
$W_T + W_B$ =	18	ft
V =	900	cf
$L_{spacing}$ =	203	
No. of rock filters =	1	
Subreach Volume =	900	CF

Infiltration(Q_i)

Infiltration Area =	510	sf
Field Q_i =	4.3	in/hr
Factor of Safety =	2.0	
Reduced Q_i =	2.1	in/hr
Dewatering Time =	5.61	hr
Less than 72 hours?	YES	

VEGETATED CHANNEL FOR INFILTRATION PAR-SC-063

ROAD STA 1+85 to 2+20

Input data

S =	0.170	ft/ft
H =	1	ft
W_B =	6	
z_1 =	3	
z_2 =	3	

Output data

$L_{storage}$=	6	ft
W_T =	12	ft
$W_T + W_B$ =	18	ft
V =	26	cf
$L_{spacing}$ =	9	
No. of rock filters =	0	(>6%)
Subreach Volume =	0	CF

ATLANTIC SUNRISE NATURAL GAS PIPELINE PROJECT
(ACCESS ROAD) VEGETATED CHANNEL FOR DIVERSION CHECKDAM VOLUME
AR-SC-063

7/25/2016

TOTAL REACH VOLUME = 635 CF Width (W_B): 3 FT. Depth (H): 1 FT.

VEGETATED CHANNEL FOR DIVERSION PAR-SC-063

ROAD STA 1+15 to 1+85

Input data

$S =$ 0.005 ft/ft
$H =$ 1 ft
$W_B =$ 3
$z_1 =$ 3
$z_2 =$ 3

Output data

$L_{storage} =$ 200 ft
$W_T =$ 9 ft
$W_T + W_B =$ 12 ft
$V =$ 600 cf
$L_{spacing} =$ 203
No. of rock filters = 1
Subreach Volume = 600 CF

Infiltration(Q_i)

Infiltration Area = 255 sf
Field $Q_i =$ 4.3 in/hr
Factor of Safety = 2.0
Reduced $Q_i =$ 2.1 in/hr
Dewatering Time = 5.61 hr
Less than 72 hours? YES

VEGETATED CHANNEL FOR DIVERSION PAR-SC-063

ROAD STA 1+85 to 2+00

Input data

$S =$ 0.170 ft/ft
$H =$ 1 ft
$W_B =$ 3
$z_1 =$ 3
$z_2 =$ 3

Output data

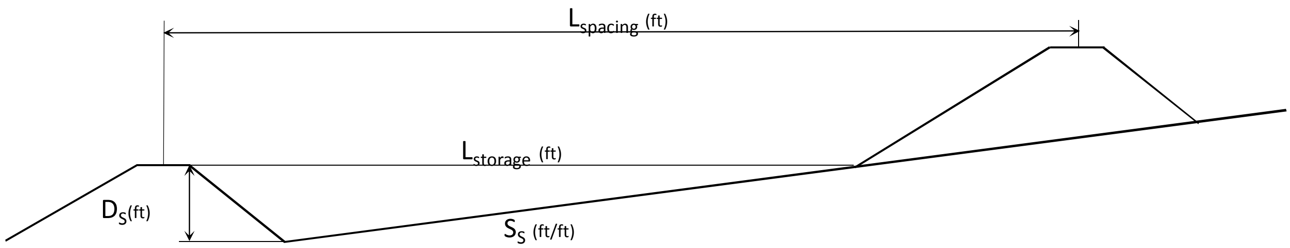
$L_{storage} =$ 6 ft
$W_T =$ 9 ft
$W_T + W_B =$ 12 ft
$V =$ 18 cf
$L_{spacing} =$ 9
No. of rock filters = 2
Subreach Volume = 35 CF

Infiltration(Q_i)

Infiltration Area = 255 sf
Field $Q_i =$ 4.3 in/hr
Factor of Safety = 2.0
Reduced $Q_i =$ 2.1 in/hr
Dewatering Time = 5.61 hr
Less than 72 hours? YES

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

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

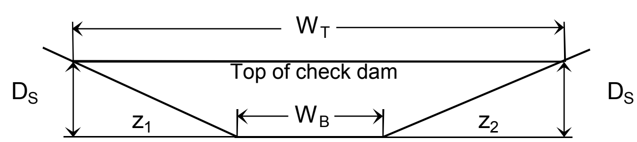
Where: $L_{spacing}$ = Check Dam Spacing

$L_{storage}$ = 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

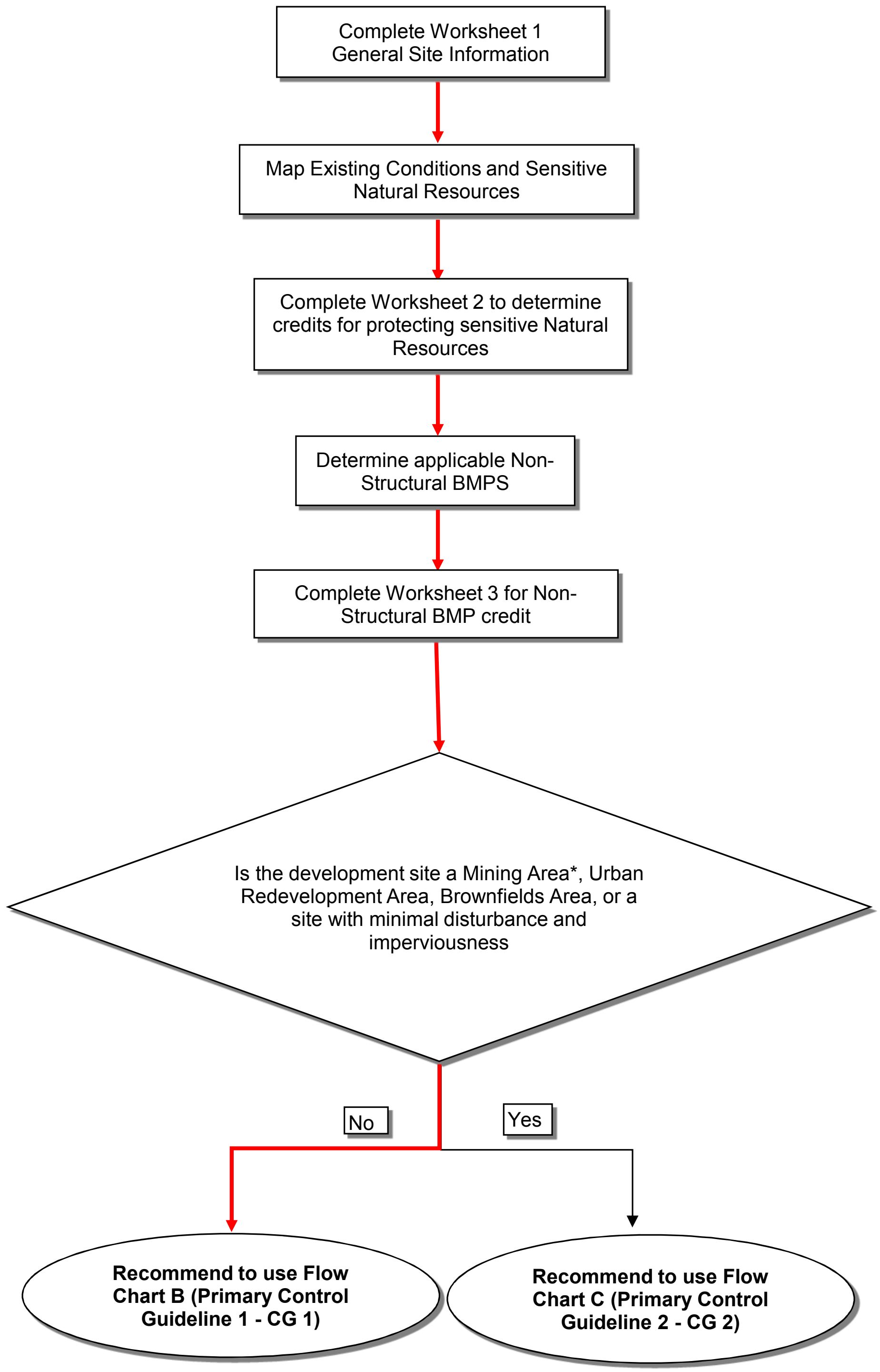
z_1 = side slope

z_2 = side slope

J.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

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: 26-Jul-16

Project Name: Atlantic Sunrise Pipeline AR-SC-063

Municipality: Pine Grove Township

County: Schuylkill

Total Area (acres): 1.18

Major River Basin: Susquehanna

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

Watershed: Swatara Creek

Sub-Basin: Lower Susquehanna

Nearest Surface Water(s) to Receive Runoff: UNT to Swatara Creek

Chapter 93 - Designated Water Use: CWF, MF

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

Impaired according to Chapter 303(d) List? Yes [ ] No [X]

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

List Causes of Impairment:

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes [ ] No [X]

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

Existing or planned drinking water supply? Yes [ ] No [X]

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes [ ] No [X]

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

Existing River Conservation Plan? Yes [X] No [ ]

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

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		
Floodplains	N/A		
Riparian Areas	N/A		
Wetlands	N/A		
Woodlands	Y	0.16	0.00
Natural Drainage Ways*	Y	0.02	0.00
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		0.18	0.00

*Overlapping areas from this sensitive natural resource are counted as another resource

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	0.40	Ac.
TOTAL	0.40	Ac.

Site Area	minus	Protected Area	=	Stormwater Management Area
1.18	-	0.40	=	0.78

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		ft^2	x 1"	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 1/3"	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

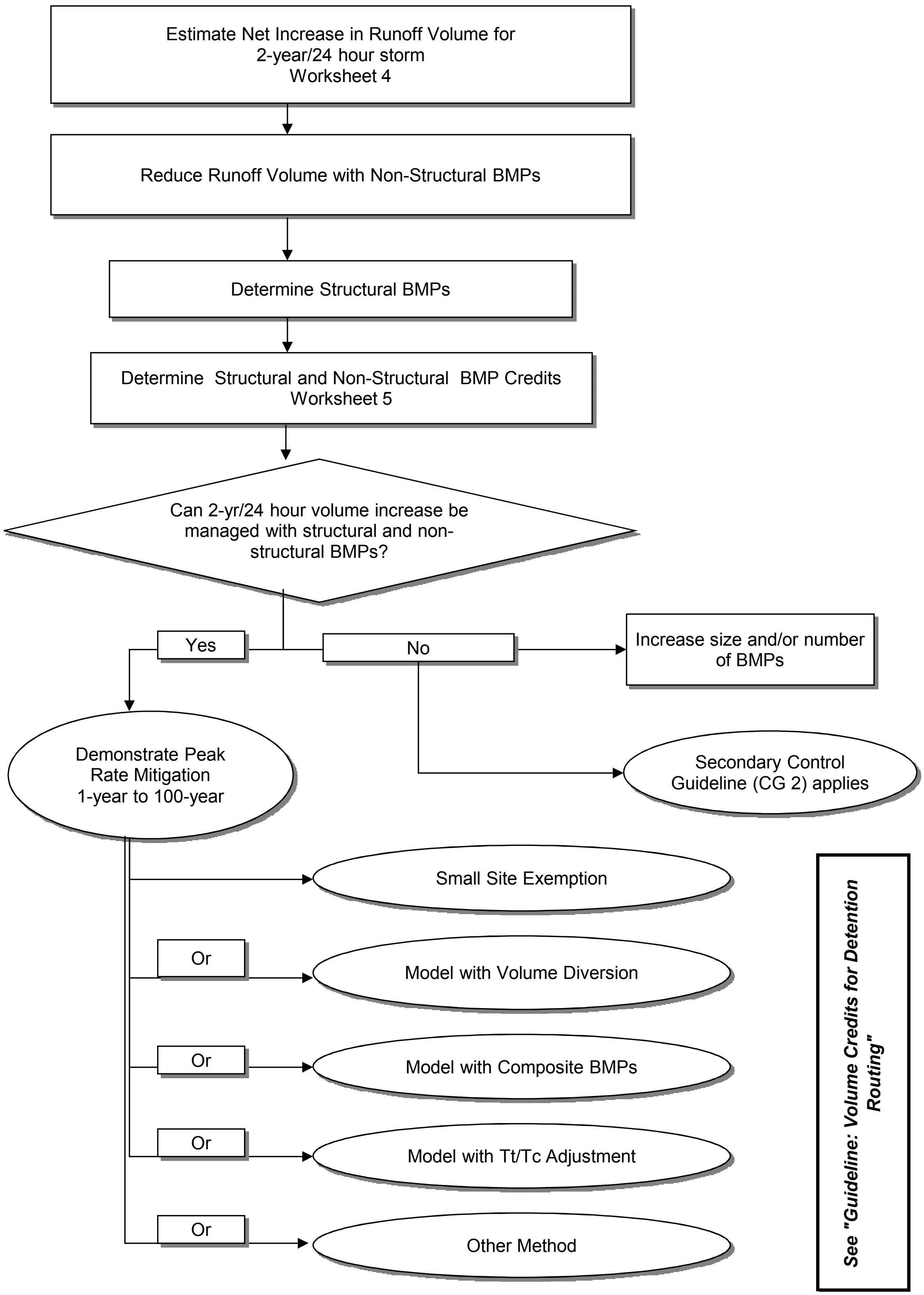
For all other disconnected non-roof areas

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-SC-063**

2-Year Rainfall: 3.12 **in**

Total Site Area: 1.18 **acres**
Protected Site Area: 0.40 **acres**
Managed Area 0.78 **acres**

Existing Conditions:

Cover Type	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Gravel Roads[3]	C	12,629	0.290	89	1.24	0.25	2.49	2,618
"Meadow"[3]	C	3,157	0.072	71	4.08	0.82	1.41	370
Crushed Stone Pad	C	-	-	98	0.20	0.04	3.01	-
Woods	C	187,199	4.297	70	4.29	0.86	1.35	20,989
Meadow	C	163,630	3.756	71	4.08	0.82	1.41	19,167
TOTAL:		366,615	8.416					43,144

Developed Conditions:

Cover Type	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Gravel Roads	C	17,748	0.407	89	1.24	0.25	2.49	3,679
Crushed Stone Pad	C	4,680	0.107	98	0.20	0.04	3.01	1,173
Woods	C	185,814	4.266	70	4.29	0.86	1.35	20,834
Meadow	C	158,374	3.636	71	4.08	0.82	1.41	18,552
TOTAL:		366,616	8.416					44,238

2-Year Volume Increase (ft^3)	**1,093**

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.

3. Twenty (20) percent of existing impervious area, when present, shall be considered meadow (good condition) in the model for existing conditions for redevelopment per Volume Control Guideline 1.
(For Existing Condition: Impervious Area + "Meadow" = Total Impervious Area)

WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

PROJECT: Atlantic Sunrise Pipeline AR-SC-063
SUB-BASIN: Lower Susquehanna

Required Control Volume (ft^3) - *from Worksheet 4*:	1,093
Non-structural Volume Credit (ft^3) - *from Worksheet 3*:	- 0
Structural Volume Reqmt (ft^3)	1,093
(Required Control Volume minus Non-structural Credit)	

	Proposed BMP	Area (ft^2)	Storage Volume (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Check dams in Vegetated Channels		900
	Storage in 18" stone MLV Pad		2,322

Total Structural Volume (ft^3):	3,222
Structural Volume Requirement (ft^3):	1,093
DIFFERENCE	2,129

MLV Pad Infiltration Calculations Summary		
Average Measured Infiltration Rate for MLV Pad	***8.41***	***in/hr***
Factor of Safety	***2.00***	
Design Infiltration Rate	***4.21***	***in/hr***
Dewatering Time for top 6 inches of MLV Pad	***1.43***	***hours***
Depth of AASHTO #57 Section of MLV Pad	***12***	***inches***
Dewatering Time for AASHTO #57 Section of MLV Pad	***2.85***	***hours***
Total Dewatering Time for MLV Pad	***4.28***	***hours***

Check Dam Infiltration Calculations Summary		
Average Measured Infiltration Rate for Swale	***8.56***	***in/hr***
Factor of Safety	***2.00***	
Design Infiltration Rate	***4.28***	***in/hr***
Height of Check Dam	***12***	***inches***
Dewatering Time for Detained Water in Swale	***2.80***	***hours***

****A factor of safety of 2 is the minimal safety factor for design purposes per pager 19 of 21 of "Protocol 1, Site Evaluation and Soil Infiltration Testing, included as Appendix C of the Pennsylvania Stormwater BMP Manual.***

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

<u>PRIMARY BMPs FOR NITRATE:</u>

	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

<u>SECONDARY BMPs FOR NITRATE:</u>

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention		
Structural BMP 6.4.8 - Vegetated Swale		
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration		

J.8 Infiltration Data

a. Infiltration Report

Companies

Field Observation Report

Project Number: 14C4909 - A

Project Name: Atlantic Sunrise Project – **AR-SC-063**

Date of Field Visit: October 23, 2015

Weather Conditions: Sunny   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

Seven soil pits were excavated by backhoe and described to varying depths.

Soils within the area of the pits are described by the USDA-NRCS as Leck kill channery silt loam, 8-15% slopes.

Test Pit #1, located at N40° 33’ 23.50”, W76° 26’ 38.25”, was observed to have four horizons, with a restrictive soil horizon due to bedrock components observed at 24 inches.

Test Pit #2, located at N40° 33’ 23.28”, W76° 26’ 38.95”, was observed to have five horizons, with no observed limiting layer.

Test Pit #3, located at N40° 33’ 23.84”, W76° 26’ 38.54”, was observed to have five horizons, with bedrock observed at 39 inches.

Test Pit #4, located at N40° 33’ 23.55”, W76° 26’ 39.13”, was observed to have four horizons, with a restrictive soil horizon due to bedrock components observed at 30 inches.

Test Pit #5 located at N40° 33’ 23.04”, W76° 26’ 39.45”, was observed to have four horizons, with a restrictive soil horizon due to bedrock components observed at 56 inches.

Field Observation Report

Test Pit #6 located at N40° 33' 22.66", W76° 26' 40.00", was observed to have three horizons, with a restrictive soil horizon due to bedrock components observed at 32 inches.

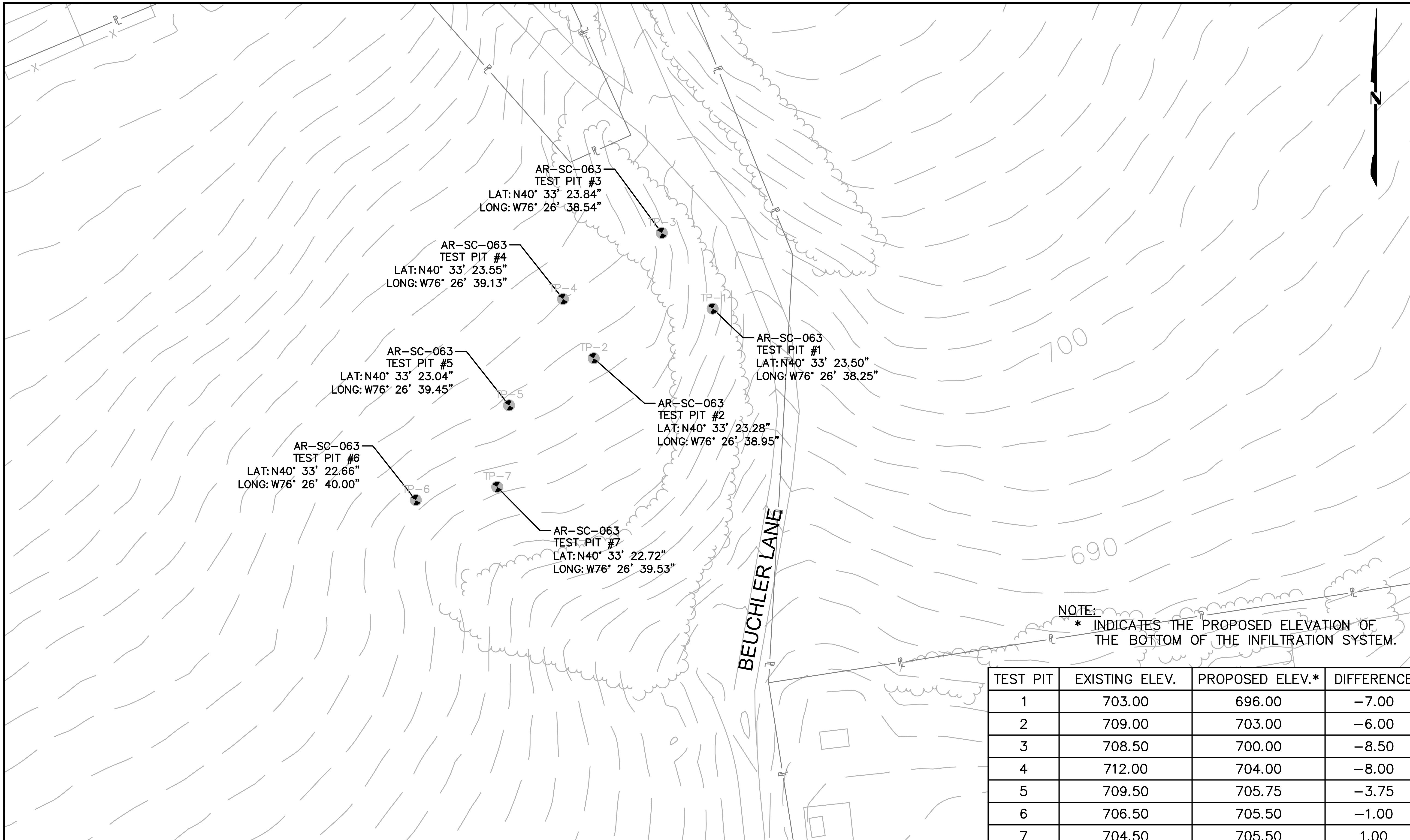
Test Pit #7 located at N40° 33' 22.72", W76° 26' 39.53", was observed to have three horizons, with a restrictive soil horizon due to bedrock components observed at 30 inches.

Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at depths ranging from the surface (0 inches) to 60 inches below surface.

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 the surface at Test Pit #1, at 6 inches below the surface at Test Pits #4 and #7, at 8 inches below the surface at Test Pit #6, at 15 inches below the surface at Test Pit #3, at 32 inches below the surface at Test Pit #5, and at 60 inches below the surface at Test Pit #2.

The infiltration rate at Test Pit #1 was observed to be 7.784 inches per hour.
The infiltration rate at Test Pit #2 was observed to be 3.001 inches per hour.
The infiltration rate at Test Pit #3 was observed to be 13.500 inches per hour.
The infiltration rate at Test Pit #4 was observed to be 9.938 inches per hour.
The infiltration rate at Test Pit #5 was observed to be 5.063 inches per hour.
The infiltration rate at Test Pit #6 was observed to be 13.125 inches per hour.
The infiltration rate at Test Pit #7 was observed to be 7.032 inches per hour.

The soil profile descriptions, infiltration worksheet, photographs, test pit location map, and USDA-NRCS Soil Survey information are attached.



NOTE:
* INDICATES THE PROPOSED ELEVATION OF THE BOTTOM OF THE INFILTRATION SYSTEM.

TEST PIT	EXISTING ELEV.	PROPOSED ELEV.*	DIFFERENCE
1	703.00	696.00	−7.00
2	709.00	703.00	−6.00
3	708.50	700.00	−8.50
4	712.00	704.00	−8.00
5	709.50	705.75	−3.75
6	706.50	705.50	−1.00
7	704.50	705.50	1.00

LANDOWNER: TYLER HALDEMAN KUTZ

AR-SC-063 INFILTRATION TESTING LOCATIONS

GRAPHIC SCALE
40 20 0 40
SCALE IN FEET

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 1
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
Ap	0-10	ChSiL	5YR 3/3	-	-	Very Friable	Weak, Subangular blocky	-	-	Roots observed
Bw	10-18	ChSiL	5YR 4/3	-	-	Friable	Weak, Subangular blocky	-	-	Roots observed
C	18-24	VChSiL	5YR 4/6	-	-	Friable	Weak, Subangular blocky	-	-	
Cr	24-60+	EChL	5YR 3/3	-	-	Friable	Massive	-	-	Limiting Layer - Restrictive soil horizon due to bedrock components

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 2
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
Ap	0-10	SiL	7.5YR 3/3	-	-	Very Friable	Weak, Granular	-	-	Roots observed
Bw1	10-26	SiL	5YR 4/3	-	-	Friable	Weak, Subangular Blocky	-	-	Roots observed
Bw2	26-60	SiL	5YR 3/3	-	-	Friable	Weak, Subangular Blocky	-	-	
C1	60-71	VChSiL	5YR 3/3	-	-	Friable	Massive	-	-	
C2	71-84+	VChL	5YR 3/3	-	-	Friable	Massive	-	-	

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 3
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
A	0-9	ChSiL	5YR 3/4	-	-	Very Friable	Weak, Granular	-	-	Roots observed
Bw	9-19	ChSiL	5YR 4/3	-	-	Friable	Weak, Subangular Blocky	-	-	
C1	19-30	VChSiL	5YR 5/4	-	-	Firm	Massive	-	-	
C2	30-39	VChSiL	5YR 4/4	-	-	Firm	Massive	39	-	
R	39-43+	-	-	-	-	-	-	-	-	Limiting Layer - Bedrock

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 4
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
A	0-9	ChSiL	5YR 4/3	-	-	Friable	Weak, Subangular blocky	-	-	Roots observed
Bw1	9-20	ChSiL	2.5YR 4/3	-	-	Friable	Weak, Subangular blocky	-	-	Roots observed
Bw2	20-30	VChSiL	2.5YR 4/3	-	-	Friable	Weak, Subangular blocky	-	-	
Cr	30-50+	EChSiL	5YR 4/4	-	-	Friable	Massive	-	-	Limiting Layer - Restrictive soil horizon due to bedrock components

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 5
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
A	0-13	SiL	7.5YR 3/3	-	-	Friable	Weak, Subangular blocky	-	-	Roots observed
Bw1	13-32	ChSiL	5YR 4/4	-	-	Friable	Weak, Subangular blocky	-	-	Roots observed
Bw2	32-56	VChSiL	5YR 4/4	-	-	Friable	Weak, Subangular blocky	-	-	
Cr	56-60+	EChL	7.5YR 4/6	-	-	Firm	Massive	-	-	Limiting Layer - Restrictive soil horizon due to bedrock components

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 6
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
Ap	0-10	ChSiL	5YR 3/3	-	-	Friable	Weak, Subangular Blocky	-	-	Roots observed
Bw	10-32	VChSiL	5YR 4/4	-	-	Friable	Moderate, Subangular Blocky	-	-	
Cr	32-60+	EChL	5YR 4/4	-	-	Friable	Massive	-	-	Limiting Layer - Restrictive soil horizon due to bedrock components

Soil Profile Description Form

Project 14C4909-A Atlantic Sunrise Project - AR-SC-063
Test Pit # 7
Name Joe Kempf and Krystal Bealing, APSS
Date October 23, 2015

Weather 50-60°F; Sunny
Landscape Position Sideslope
Slope 5-15%
Additional Notes

Horizon	Boundary Limits (inches)	Texture	Matrix Color	Depletions (%, Color)	Concentrations (%, Color)	Moisture Consistency	Structure (Grade, Shape)	Depth to Bedrock	Depth to Water	Notes
Ap	0-13	ChSiL	7.5YR 3/4	-	-	Friable	Weak, Subangular Blocky	-	-	Roots observed
Bw	13-30	VChSiL	7.5YR 4/4	-	-	Friable	Moderate, Subangular Blocky	-	-	
Cr	30-60+	EChL	5YR 4/4	-	-	Friable	Massive	-	-	Limiting Layer - Restrictive soil horizon due to bedrock components

ATLANTIC SUNRISE PROJECT - AR-SC-063													
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	1.875	1.750	1.313	1.313	1.375	1.188			1.297	7.784	50-60°F, sunny. Test done at the surface.
2	Yes	10	0.438	0.438	0.625	0.500					0.500	3.001	50-60°F, sunny. Test done at 60 inches below the surface.
3	Yes	10	2.125	2.250	2.375	2.250					2.250	13.500	50-60°F, sunny. Test done at 15 inches below the surface.
4	Yes	10	1.500	1.750	1.750	1.625					1.656	9.938	50-60°F, sunny. Test done at 6 inches below the surface.
5	Yes	10	0.813	0.688	0.875	1.000					0.844	5.063	50-60°F, sunny. Test done at 32 inches below the surface.
6	Yes	10	2.875	2.250	2.250	2.000	2.250				2.188	13.125	50-60°F, sunny. Test done at 8 inches below the surface.

ATLANTIC SUNRISE PROJECT - AR-SC-063

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
7	Yes	10	1.250	1.250	1.125	1.063					1.172	7.032	50-60°F, sunny. Test done at 6 inches below 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 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.

View of Pit #4.

View of Pit #5.

View of Pit #6.

View of Pit #7.

J.9 Off-Site Discharge Analysis

a. Adequacy of Off-Site Discharge

ACCESS ROAD: AR-SC-063- Adequacy of Off-Site Discharge

AR-SC-063 is a proposed permanent access road (PAR) located in Pine Grove Township, Schuylkill County, Pennsylvania. The intent of this PAR is to provide permanent maintenance and operational access to the proposed Main Line Valve 08 (CS-MLV-08) located on the proposed 42" Central Penn Line South Pipeline. The road begins at Beuchler Lane and terminates at the MLV site at approximate mile post 67.7. The PAR is approximately 950 feet long over relatively hilly terrain. The TAR follows Beuchler Lane with no proposed improvements for the first 750 feet. The final 200 feet of road is proposed new construction over undisturbed existing pasture (As seen in the picture below). The proposed improvements have been designed to have no anticipated impacts or changes to downhill properties as a result of construction the MLV site.

The proposed permanent access road and the MLV site has been designed to reduce overall disturbance to the maximum extent practicable. The PAR and MLV site has been constructed with stone rather than pavement to further help with keeping with the existing conditions. As mentioned above, the road follows the existing path were practical for most of the length and will maintain a new minimal width of only 14 feet wide. The width is only slightly larger than the existing gravel travel way. The MLV site has also been design to minimum the footprint to the maximum extent practical for the operation and maintenance requirements.

As for any development, the road and MLV site has been designed to match or reduce peak stormwater runoff from the design areas to an off-site discharge point where stormwater runoff is conveyed. (See the enclosed Pre and Post drainage area maps and calculations in Appendix J.3 and J.4 for details) In the case of this design, we were able to achieve a reduced peek runoff for all storm events, as shown in the Pre-vs. Post- Construction Peak Rate of Flow Summary for The Study Point chart below. The reduction was achieved by utilizing Vegetated Channel for Diversions (VCD), Vegetated Channel for Infiltration (VCI), and utilizing the MLV pad itself as a retention area. All these Stormwater BMP measures are used to slow down the stormwater runoff, infiltrate and release at a slower and reduced rate to existing land.

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	3.62	3.32	(0.30)
2) 2-Year/24-Hour	5.81	5.75	(0.06)
3) 5-Year/24-Hour	9.57	9.45	(0.12)
4) 10-Year/24-Hour	13.72	13.51	(0.21)
5) 25-Year/24-Hour	19.66	19.33	(0.33)
6) 50-Year/24-Hour	25.92	25.52	(0.40)
7) 100-Year/24-Hour	27.52	27.11	(0.41)

The VCD is proposed to the north and west of the MLV site and access road. This VCD is 3-feet wide and 1.5-feet-deep and conveys flows from abutting properties away from the MLV and access road to a rip rap apron prior to its preconstruction discharge point. The VCD is equipped with multiple check dams to slow down flow and create small retention areas throughout the run in order to promote infiltration. These measures allow for some of the stormwater to pond during storm events and infiltrate into the ground, which reduces flows. A rip rap apron is proposed at the end of the channel to further slowdown stormwater runoff and dissipate energy.

The VCI is located on the southeast side of the MLV site and access road. The VCI is 6-feet wide and 1.5-feet deep and collects runoff from the access drive and areas between the drive and the existing pasture at the limit of disturbance. The VCI is equipped with multiple check dams to slow down flow and creates small retention areas throughout the channel to promote infiltration. A rip rap apron is proposed at the end of the channel to further slowdown stormwater runoff and dissipate energy.

The final measure used to ensure reduced peak stormwater runoff is the MLV pad itself. The pad is a flat area constructed of a top layer of 6” of AASHTO #8 aggregate, on a non-woven geotextile fabric, and a bottom layer of 12” AASHTO #57 stone. This 12-inch-deep area will detain and infiltrate the foot print of the MLV pad, plus a small area around the pad to the East.

After being conveyed through one of the three stormwater PCSM BMP’s above, the runoff from the northern swale will flow approximately 50 feet south and converge with the runoff from the southern swale, approximately 90 feet northeast of the MLV site. At this point the runoff follows pre-construction conditions until ultimately outletting into an unnamed tributary to Swatara Creek, approximately 930 feet southeast of the MLV Site.

The flow path from the MLV site crosses the following soil types:

- AgA – Alvira silt loam, 0 to 3 percent slopes.
- LeC – Leck kill channery silt loam, 8 to 15 percent slopes.

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:

- AgA – 0.43
- LeC – 0.20

The post-construction runoff travels approximately 490 feet thru soils with an erodibility factor of greater than 0.37. Since the pre- and post-construction flow paths match, there is no concern that the construction of the MLV site have a negative impact on down slope properties.

In addition to the stormwater flow reduction and soil data above, the VCI, VCD and MLV pad has reduced the proposed stormwater velocity as it leaves the design points. The velocities at both points are such that they are slower than 2 fps, as see in the Stormwater Velocity Rate Chart. Based on Table G.1 in the Pennsylvania DEP erosion and Sediment Pollution Control Program Manual "Allowable Velocities for Downslope covers for Channeled Flows" (shown below), The maximum allowable velocity for mulch is 2 fps. The velocity of the runoff from the proposed improvements is less than the maximum allowable velocity listed in the table, and is an allowable velocity for the area that we are discharging too.

Stormwater Velocity Rate Chart for the design frequency storm (fps)	VCD Pad Velocities (fps)	VCI Pad Velocities (fps)	MLV Pad Velocities (fps)
1) 1-Year/24-Hour	0.75	0.00	0.00
2) 2-Year/24-Hour	0.93	0.00	0.00
3) 5-Year/24-Hour	1.09	0.00	0.00
4) 10-Year/24-Hour	1.24	0.15	0.00
5) 25-Year/24-Hour	1.42	0.23	0.11
6) 50-Year/24-Hour	1.57	0.35	0.21
7) 100-Year/24-Hour	1.60	0.51	0.21

Table G.1. Allowable Velocities for Downslope Covers for Channeled Flows

Ground Cover	Allowable Velocity
Grass*	4 fps
Gravel	5 fps
Mulch	1-2 fps

* See E&S Manual for more information on permissible velocities for grass and other cover types. Allowable velocities for grass can vary from 2.5 fps to as much as 8 fps. 4 fps has been selected as a conservative figure for design purposes.

(Table from the 2012 PDEP E&S PCPM)

In conclusion, based on the designed measures discussed above, and the soil and velocity data provided for this MLV site and access road, there are no anticipated impacts or changes to downhill properties as a result of construction the MLV site.

Down Slope Property Owners:

- Robert O. Tyler, AKA Robert Ogden Tyler & Cheryl L. Tyler, AKA Cheryl Lynn Kutz (PA-SC-022.000)

J.10 Storage Volume Analysis

a. Storage Volume Analysis

ACCESS ROAD: SC-063 – Storage Volume Analysis

Stormwater detention is provided in the void space between the AASHTO #57 stone layer at the MLV pad. The void space between the 6" AASHTO #8 stone at the surface of the pad is excluded from the detention, or 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.

The void space between the AASHTO #57 stone provides the storage volume for the MLV pad. The void space between the 6" AASHTO #8 stone at the surface of the pad is excluded from the volume calculations.

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 simply be 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 was designed to minimize these impacts by mimicking the existing grade. An actual storage volume was calculated based on the elevation of the low point of the pad (minus the 6" AASHTO #8 cover), since that is the highest runoff could be stored without overtopping the AASHTO #57 stone. Two scenarios apply to all of the main line valve pads on the project: low side pads and low corner pads. Since many of the volumes can only be obtained using calculus to determine the total storage the water surface elevation and base of the pad, AutoCAD Civil 3D was used to determine the storage volumes. To determine volumes in Civil 3D, surfaces representing the bottom of the pad and water surface elevation were built and combined into a volumetric surface; an earthwork analysis was run on the volumetric surface to determine the total volume between the two. The volume of low side pads can be checked using simple volumetric formulas for triangular (steeper grades, shallower pads) or trapezoidal (more gradual grades, deeper pads) prisms, with the cross sectional wetted area multiplied by the length of the low side of the pad. AR-SC-063 is a low-side pad. Finally, the calculated storage volume was reduced by 60% to determine the available storage volume with 40% voids.

The detained stormwater will infiltrate the ground. The dewatering time for the stormwater detained in the void space of the MLV pad rock is provided at the bottom of Worksheet #5 included in Appendix J.4.

APPENDIX V

AR-SC-073.5 Specific Narrative and Calculations

V.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)

V.2 Location Map

V.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

V.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

V.5 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. Worksheet4. 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

V.6 Infiltration Information
  a. Field Observation Report

V.7 Off-Site Discharge Analysis
  a. Adequacy of Off-Site Discharge

V.8 Storage Volume Analysis
  a. Storage Volume Analysis

V.9 Sediment Barrier Table
  a. E&S Worksheet 1

V.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-SC-073.5

ACT 167 PLAN: None

TMDL: 2013 (suspended solids)

NARRATIVE:

AR-SC-073.5 is a proposed permanent access road (PAR) located in Eldred Township, Schuylkill County Pennsylvania. The intent of this PAR is to provide maintenance and operations access to Main Line Valve - 09 (MLV-09) located on the proposed 42" Central Penn Line South Pipeline. The road begins at Ranch Road and terminates at MLV-09 at approximate mile post 80.8. The proposed road is approximately 135 feet long over relatively hilly terrain. There will be a temporary ***rock construction entrance with wash rack and driveway*** apron constructed to allow access to the gas pipeline by construction vehicles. ***The wash rack is proposed due to the watershed siltation impairment.*** Upon completion of the construction activities, the temporary construction entrance ***and driveway apron*** will be removed and a permanent access road will be constructed. ***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.***

The proposed road will have a cross slope of 2% directing runoff in an easterly direction. ***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 added to the bottom of Worksheet #5, the detained water stored in the voids of the MLV stone pad will infiltrate to the surrounding ground over approximately 12 hours and the water detained behind the check dams will infiltrate to the surrounding ground over approximately 4 hours.***

Water Quality Worksheet #4 was used to complete the ***Control Guidelines 1*** (CG-1) volume analysis for the 2 year ***24-hour*** storm.

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

TMDL DISCUSSION:

Receiving surface waters in the location of this access road are subject to a siltation TMDL. The rock construction entrance with wash rack is to minimize potential impacts from this road.

MINIMIZED SOIL COMPACTION:

The Project seeks to minimize soils compaction impacts associated with access roads to the maximum extent practicable. AR-SC-073.5 is a proposed permanent access road for Main Line Valve 09. All construction and operations traffic will utilize the proposed road. The permanent access road is situated completely within the permanent right of way of the pipeline reducing the area of impact. The roadway width has also been minimized to 14 feet. Additionally, infiltration and evaporation are encouraged in the MLV site pad.

THERMAL IMPACT ANALYSIS:

Thermal impacts associated with AR-SC-073.5 will be avoided to the maximum extent practicable. The following measures have been implemented to minimize thermal impacts:

- ***AR-SC-073.5 is approximately 135 linear feet, minimizing the total length of necessary temporary construction and, therefore, minimizing thermal impact of the road.***
- ***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.***

ACIDIC SOIL MANAGEMENT PLAN:

AR-SC-073.5 Soil Acidity Table		
Soil Map Symbol	Soil Name	PH
LeB	Leck kill channery silt loam, 3 to 8 percent slopes	5.7
MeB	Meckesville loam, 3 to 8 percent slopes	4.7

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.

ROAD SPECIFIC CONSTRUCTION SEQUENCE:
ACCESS ROAD: AR-SC-073.5

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

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

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

4. ***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.***

6. ***Locate staging areas and access points including the rock construction entrance with wash rack. Install E&SC BMPs down slope of these areas.***

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

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

9. ***Remove brush to effectively install perimeter E&SC BMPs.***

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

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

12. ***Proceed with major clearing and grubbing.***

13. ***Begin construction staking for layout of access road.***

14. ***Grade the access road as shown on the E&SC Plans (Section 2 of the ESCGP-2 NOI).***

15. ***Immediately stabilize the Site with geotextile and gravel surfacing where indicated in the E&SC Plans.***

16. ***The Compliance Manager shall provide PADEP at least three days' notice prior to placing the stone and geotextile fabric within the MLV pads.***

17. ***Rough grade the MLV pad. Equipment shall avoid excessive compaction and/or land disturbance. If excavation leads to substantial compaction of the subgrade (where an infiltration trench is not 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.***

18. ***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.***

19. ***Place the stone and geotextile fabric within the MLV pad as specified on the E&SC 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.***

20. ***Upon temporary cessation of an earth disturbance activity or any stage of an activity where the cessation of earth disturbance activities will exceed four days, the Site shall be immediately seeded, mulched, or otherwise protected from accelerated erosion and sedimentation pending future earth disturbance activities. For an earth disturbance activity or any stage of an activity to be considered temporarily stabilized, the disturbed areas shall be covered with one of the following: a minimum uniform coverage of mulch and seed, with a density capable of resisting accelerated erosion and sedimentation, or an acceptable E&SC BMPs, which temporarily minimizes 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).***

21. ***Once the temporary improvements to the permanent access road are no longer necessary; remove all gravel and geotextile fabric from the***

temporarily improved sections outside of permanent access road areas and dispose of the materials at a suitable disposal or recycling site in compliance with local, state, and federal regulations. Restore pre-construction grades. Immediately seed and stabilize disturbed areas, including areas used to stockpile topsoil. E&SC BMPs will remain in place and functional.

22. ***Loosen and de-compact topsoil throughout the temporarily improved sections of the access road and grade the access road so finish grades and drainage patterns match preconstruction conditions. Immediately fertilize, seed and stabilize areas at finished grade. Maintain E&SC control devices until Site work is complete and uniform 70% perennial vegetative cover is established.***

23. ***Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the Owner and/or Operators shall contact the local CCD for an inspection prior to the removal of the E&SC BMPs. 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.***

24. ***Upon local CCD and Transco approval of stabilization and re-vegetation, remove temporary E&SC BMPs and stabilize areas disturbed by removal including the perimeter sediment barrier and temporary diversions. Properly dispose/recycle E&SC BMPs. Remove orange construction fencing and security fence.***

25. ***Complete access road limit of disturbance stabilization, including soil treatment, seed application and mulching in areas disturbed by E&SC BMP removal.***

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

Permanent Access Road Summary Sheet

Access Road Number:	AR-SC-073.5			
Watershed Name:	Mahantango-Wiconisco Creeks, CWF, MF			
Act 167 Plan Name:			Date Adopted:	
Design Storm Frequency	2 year	Pre-construction	Post-construction	Net Change
Rainfall Amount	3.07 inches			
Impervious area (acres)		0	0.18	0.18
Volume of stormwater runoff (cf) without planned		4,454	5,557	1,103
Volume of stormwater runoff (cf) with planned			796	(3,658)

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	1.22	-	(1.22)
2) 2-Year/24-Hour	1.97	0.07	(1.90)
3) 5-Year/24-Hour	3.18	0.31	(2.87)
4) 10-Year/24-Hour	4.31	1.68	(2.63)
5) 25-Year/24-Hour	6.20	5.25	(0.95)
6) 50-Year/24-Hour	8.03	7.40	(0.63)
7) 100-Year/24-Hour	10.23	9.48	(0.75)

Summary Description of Restoration BMPs - Permanent Access Roads			
BMP	Function	Volume of stormwater treated (cf)	Acres treated
Natural area conservation:		0	0.00
Access road design: Ditches Culverts	Infiltration/ Recharge/Storage		
Stormwater energy dissipaters: Infiltration Basin	Infiltration/ Recharge/Storage	4311	0.39
Other: MLV Stone Pad Void Storage	Infiltration/ Recharge/Storage	450	1.21

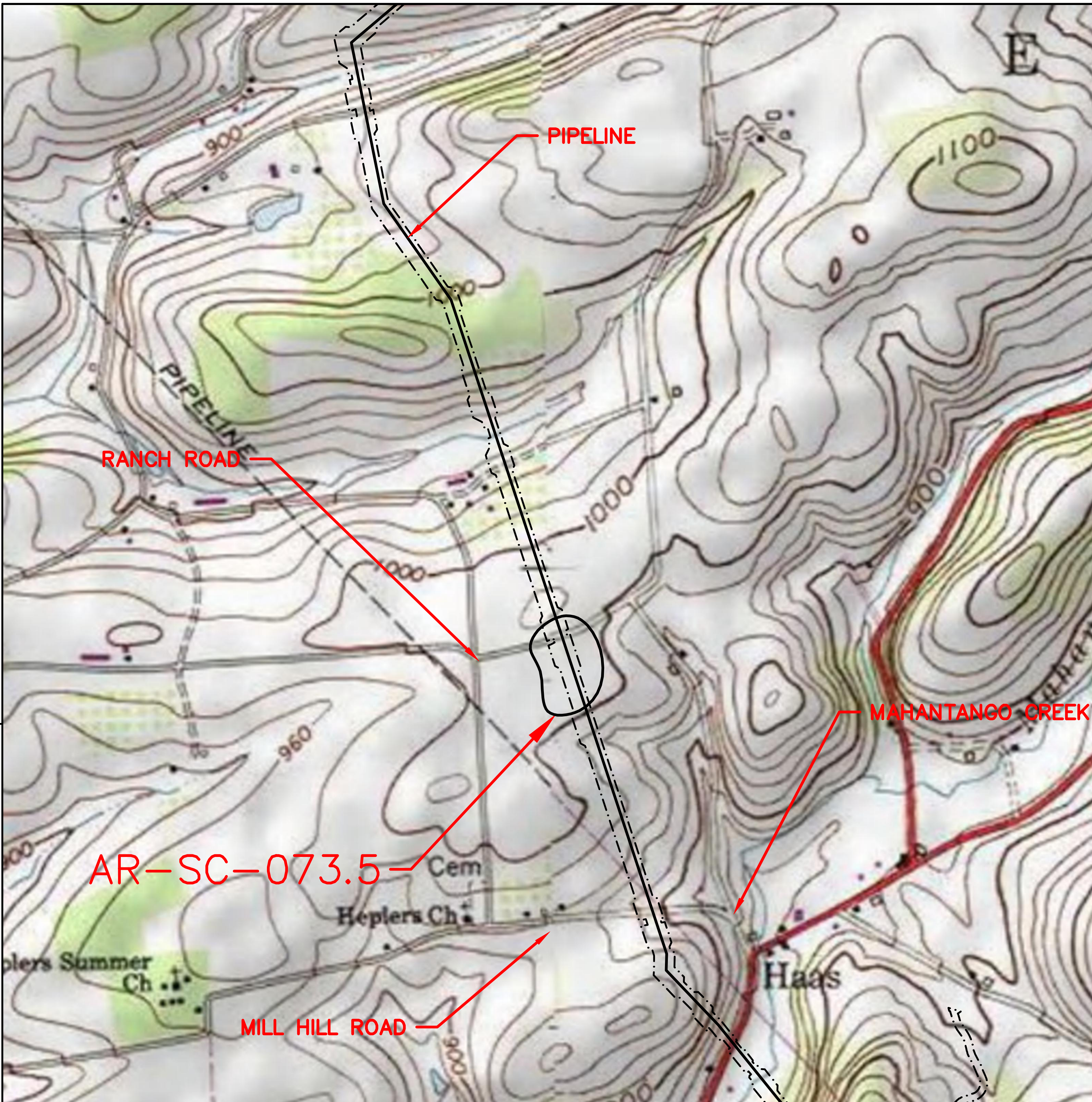
Off-site Discharge Analysis:

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:	***Basin/MLV Pad***	***MLV Pad***
Maximum Impervious Loading Ratio	***0.7 :1 (5:1 Max)***	***1.0 :1 (5:1 Max)***
Maximum Total Loading Ratio	***7.6 :1 (8:1 Max)***	***11.7 :1* (8:1 Max)***

Supporting Areas	***Basin/MLV Pad***	***MLV Pad***	***Unit***
Impervious Drainage Area	***0.16***	***0.11***	***Acres***
Infiltration Area	***0.21***	***0.10***	***Acres***
Total Drainage Area	***1.60***	***1.21***	***Acres***

V.2 Location Map



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ENVIRONMENTAL
LAND SURVEYING

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

ATLANTIC SUNRISE
PROPOSED 30" NATURAL GAS PIPELINE
USGS LOCATION MAP
PERMANENT AR-SC-073.5
ELDRED TOWNSHIP
SCHUYLKILL 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: 24-1600-70-28-A/ LL113_9-AR-SC-073.5	SHEET 1 OF 1
WO: 1161481			

V.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

100 50 100

SCALE IN FEET

ISSUED FOR PERMITTING

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LEGEND

TIME OF CONCENTRATION-SHEET FLOW	(red arrow line)
TIME OF CONCENTRATION-SHALLOW CONCENTRATED FLOW	(yellow arrow line)
DRAINAGE AREA	(blue dashed line)
PROPOSED GAS PIPELINE	GAS GAS

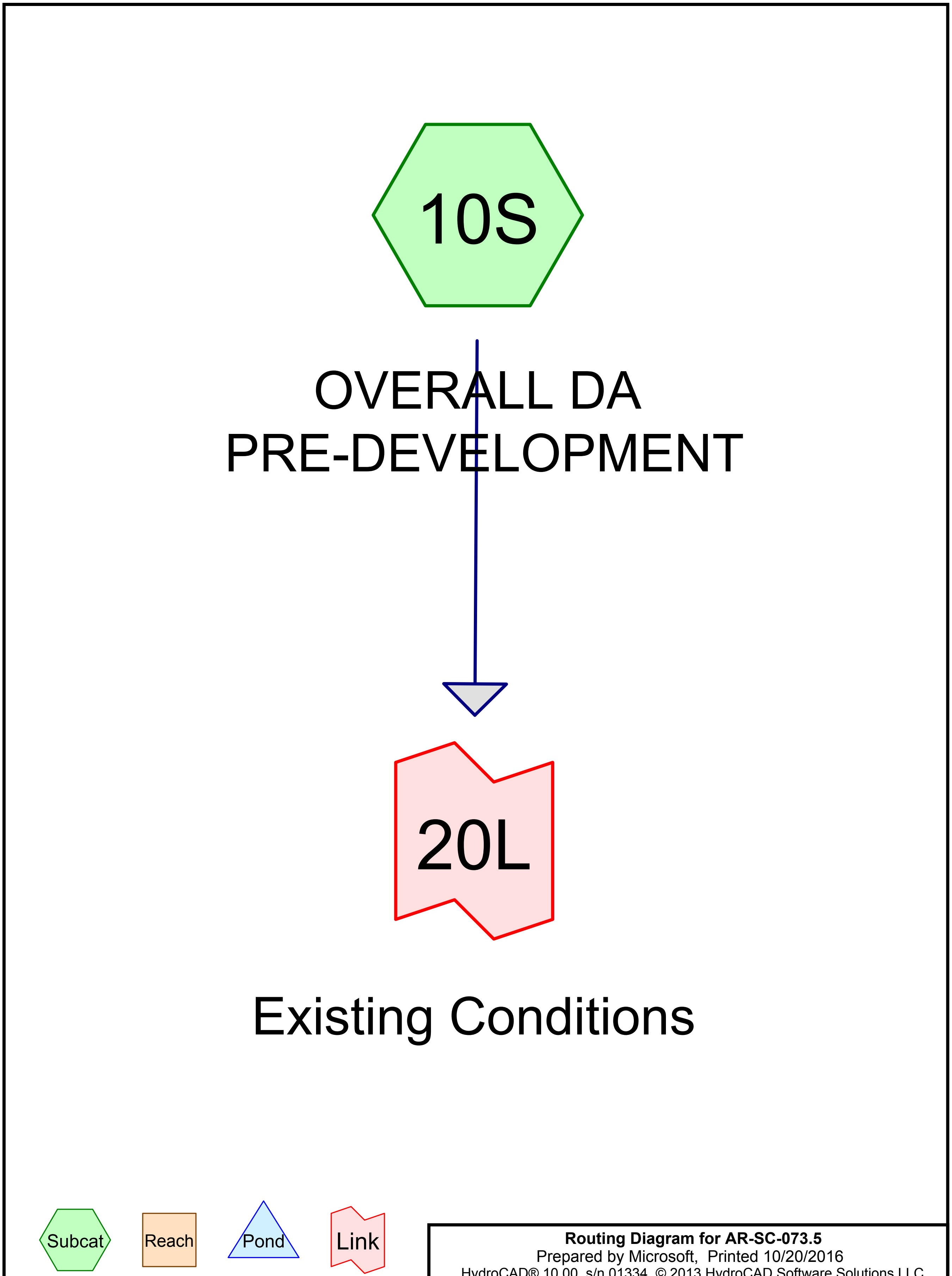
ATLANTIC SUNRISE PROJECT - CENTRAL PENN LINE SOUTH

PROPOSED 42" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-SC-073.5 PRE
ELDRED TOWNSHIP
SCHYULKILL COUNTY, PENNSYLVANIA

Williams

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

DRAWN BY: OLC	DATE: 10/26/15	ISSUED FOR BID:	SCALE: 1" = 100'
CHECKED BY: BJP	DATE: 10/26/15	ISSUED FOR CONSTRUCTION:	
APPROVED BY: BJP	DATE: 10/26/15	DRAWING NUMBER: AR-SC-073.5 PRE	
WO:			



Routing Diagram for AR-SC-073.5
Prepared by Microsoft, Printed 10/20/2016
HydroCAD® 10.00 s/n 01334 © 2013 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.053	87	Dirt roads, HSG C (10S)
1.551	71	Meadow, non-grazed, HSG C (10S)
1.604	**72**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.604	HSG C	10S
0.000	HSG D	
0.000	Other	
1.604		**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment10S: OVERALLDA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=0.56"
Flow Length=409' Tc=10.5 min CN=72 Runoff=1.22 cfs 0.075 af

Link 20L: Existing Conditions Inflow=1.22 cfs 0.075 af
Primary=1.22 cfs 0.075 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.075 af Average Runoff Depth = 0.56"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

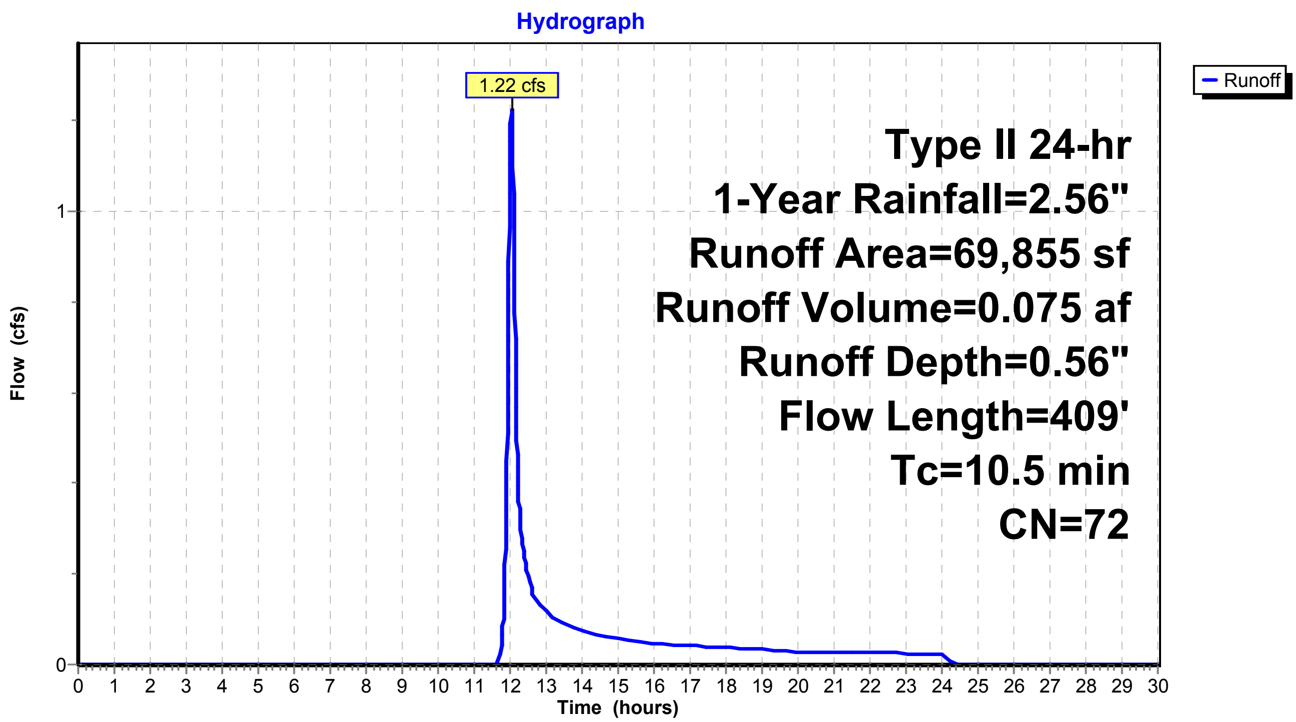
Runoff = 1.22 cfs @ 12.04 hrs, Volume= 0.075 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.56"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

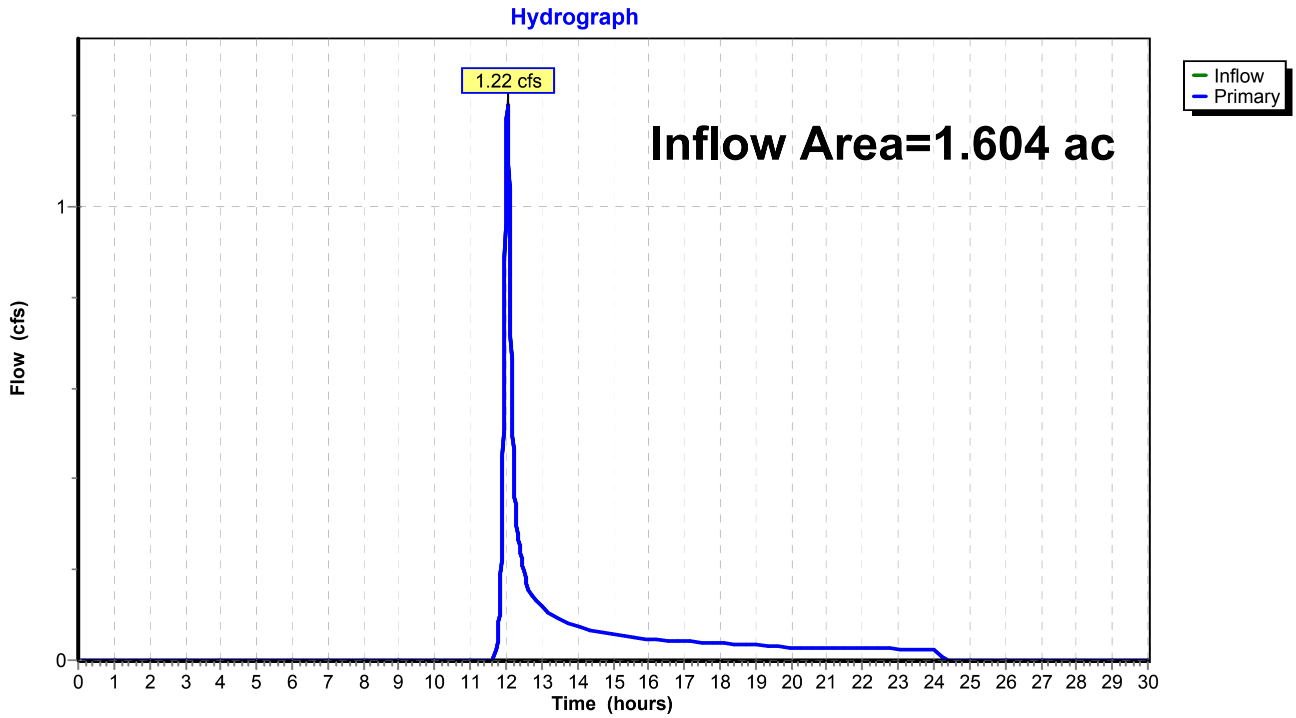


Summary for Link 20L: Existing Conditions

Inflow Area = 1.604 ac, 0.00% Impervious, Inflow Depth = 0.56" for 1-Year event
Inflow = 1.22 cfs @ 12.04 hrs, Volume= 0.075 af
Primary = 1.22 cfs @ 12.04 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=0.85"
Flow Length=409' Tc=10.5 min CN=72 Runoff=1.97 cfs 0.114 af

Link 20L: Existing Conditions Inflow=1.97 cfs 0.114 af
Primary=1.97 cfs 0.114 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.114 af Average Runoff Depth = 0.85"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

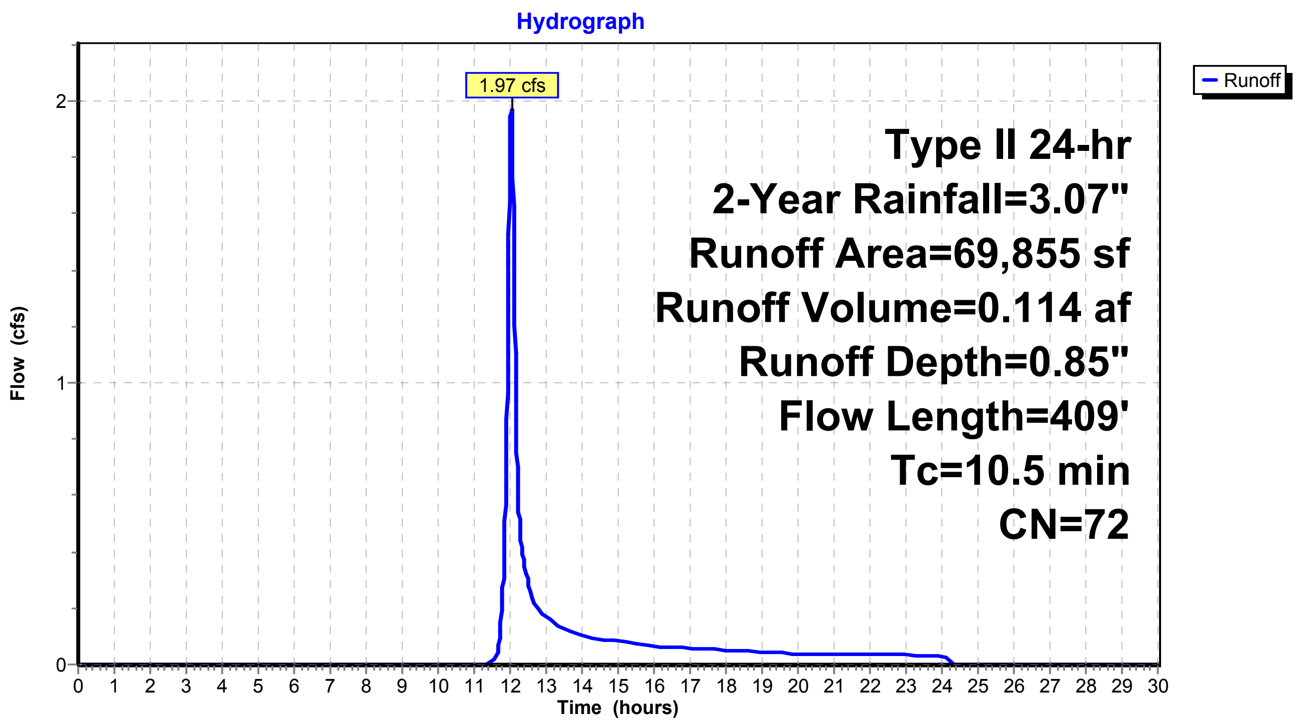
Runoff = 1.97 cfs @ 12.03 hrs, Volume= 0.114 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.07"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

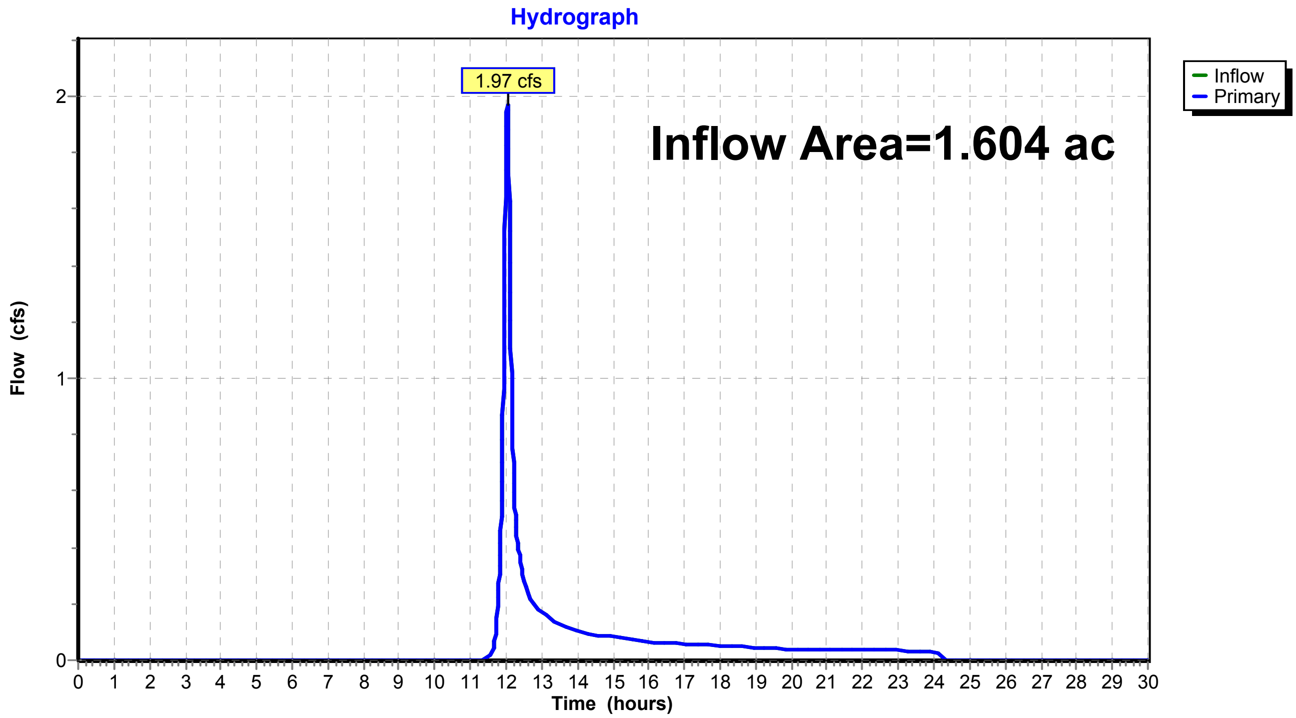


Summary for Link 20L: Existing Conditions

Inflow Area =	1.604 ac,	0.00% Impervious, Inflow Depth = 0.85"	for 2-Year event
Inflow =	1.97 cfs @	12.03 hrs, Volume=	0.114 af
Primary =	1.97 cfs @	12.03 hrs, Volume=	0.114 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=1.33"
Flow Length=409' Tc=10.5 min CN=72 Runoff=3.18 cfs 0.178 af

Link 20L: Existing Conditions Inflow=3.18 cfs 0.178 af
Primary=3.18 cfs 0.178 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.178 af Average Runoff Depth = 1.33"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

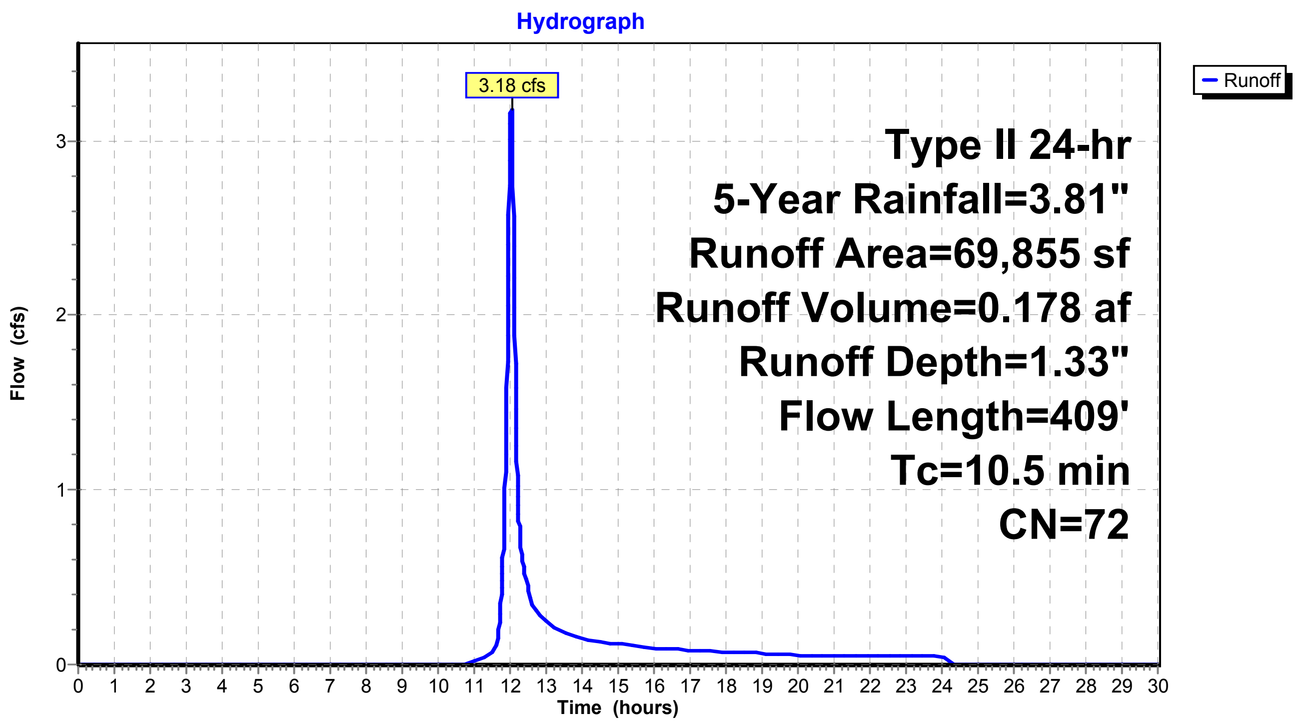
Runoff = 3.18 cfs @ 12.03 hrs, Volume= 0.178 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.81"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

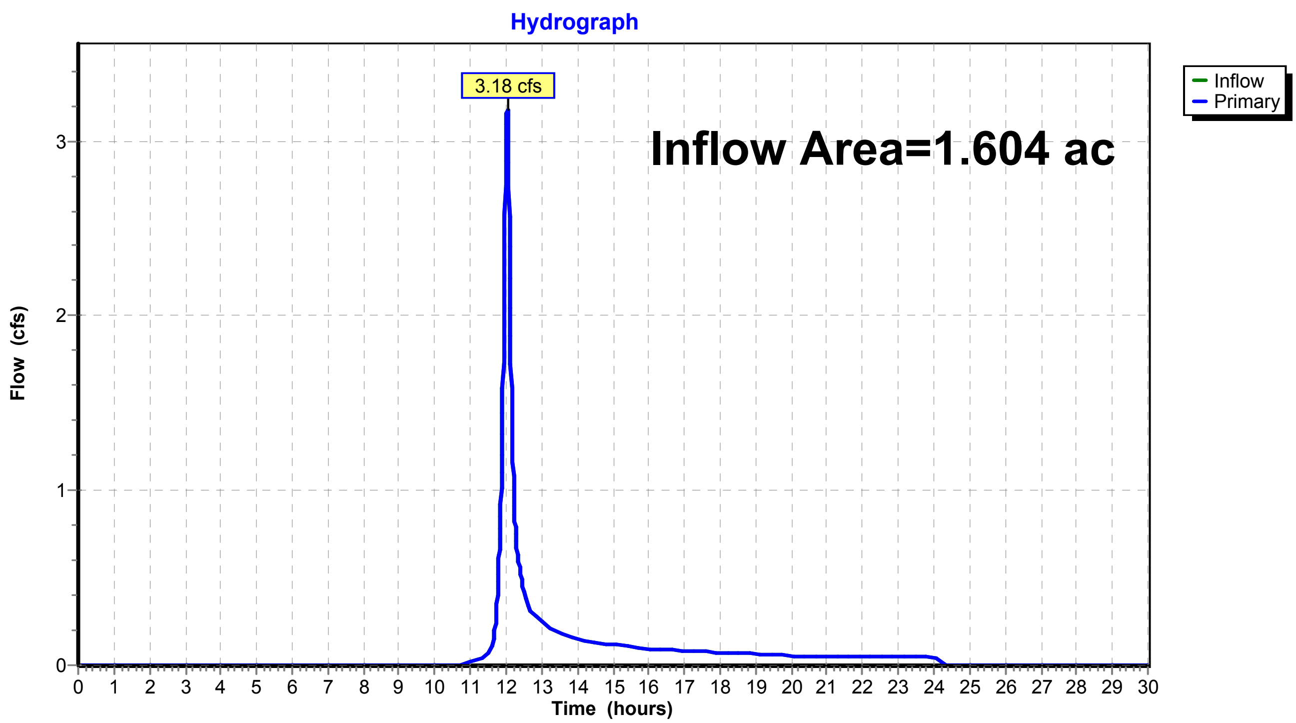


Summary for Link 20L: Existing Conditions

Inflow Area = 1.604 ac, 0.00% Impervious, Inflow Depth = 1.33" for 5-Year event
Inflow = 3.18 cfs @ 12.03 hrs, Volume= 0.178 af
Primary = 3.18 cfs @ 12.03 hrs, Volume= 0.178 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=1.78"
Flow Length=409' Tc=10.5 min CN=72 Runoff=4.31 cfs 0.238 af

Link 20L: Existing Conditions Inflow=4.31 cfs 0.238 af
Primary=4.31 cfs 0.238 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.238 af Average Runoff Depth = 1.78"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

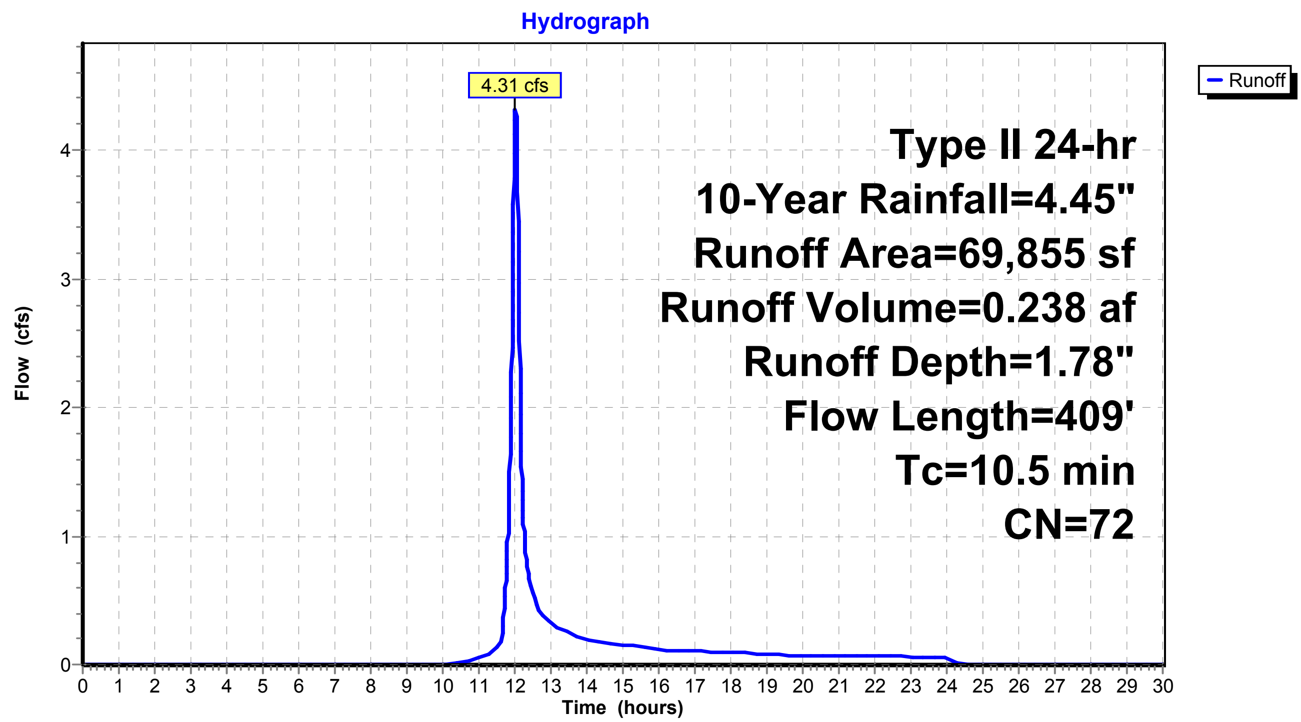
Runoff = 4.31 cfs @ 12.03 hrs, Volume= 0.238 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.45"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

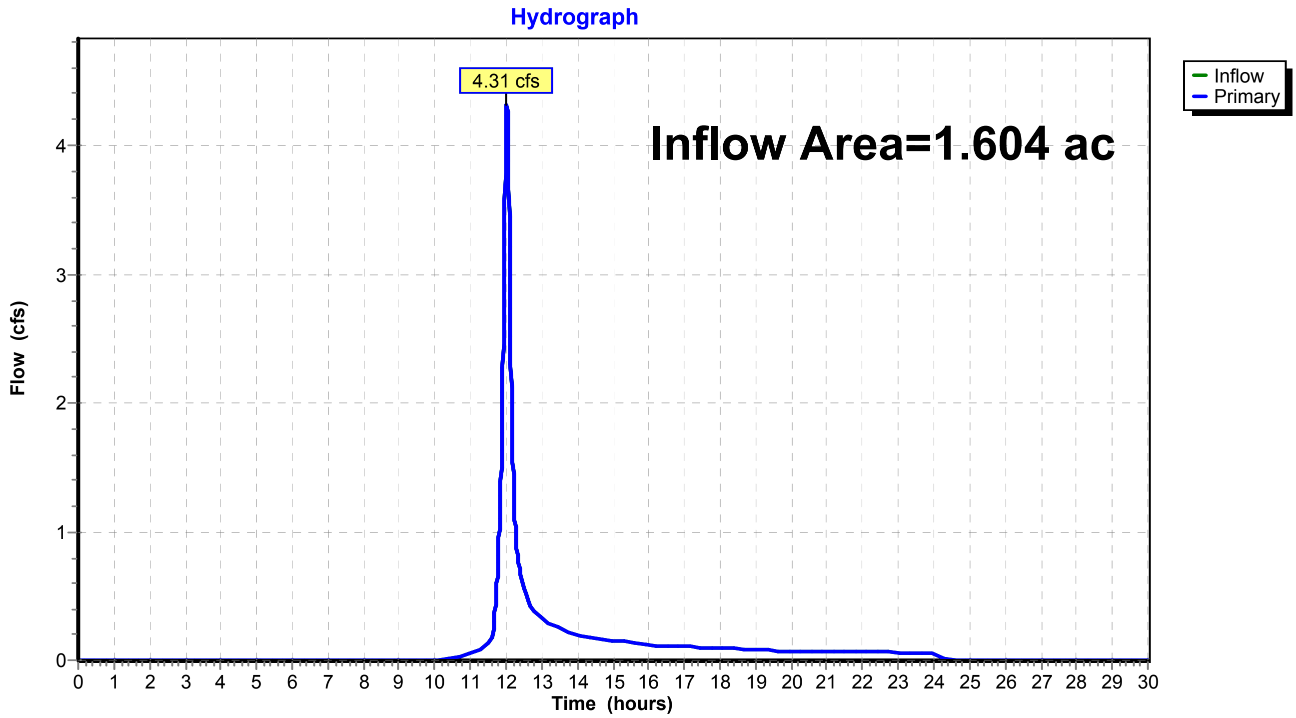


Summary for Link 20L: Existing Conditions

Inflow Area = 1.604 ac, 0.00% Impervious, Inflow Depth = 1.78" for 10-Year event
Inflow = 4.31 cfs @ 12.03 hrs, Volume= 0.238 af
Primary = 4.31 cfs @ 12.03 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=409' Tc=10.5 min CN=72 Runoff=6.20 cfs 0.341 af

Link 20L: Existing Conditions Inflow=6.20 cfs 0.341 af
Primary=6.20 cfs 0.341 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.341 af Average Runoff Depth = 2.55"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

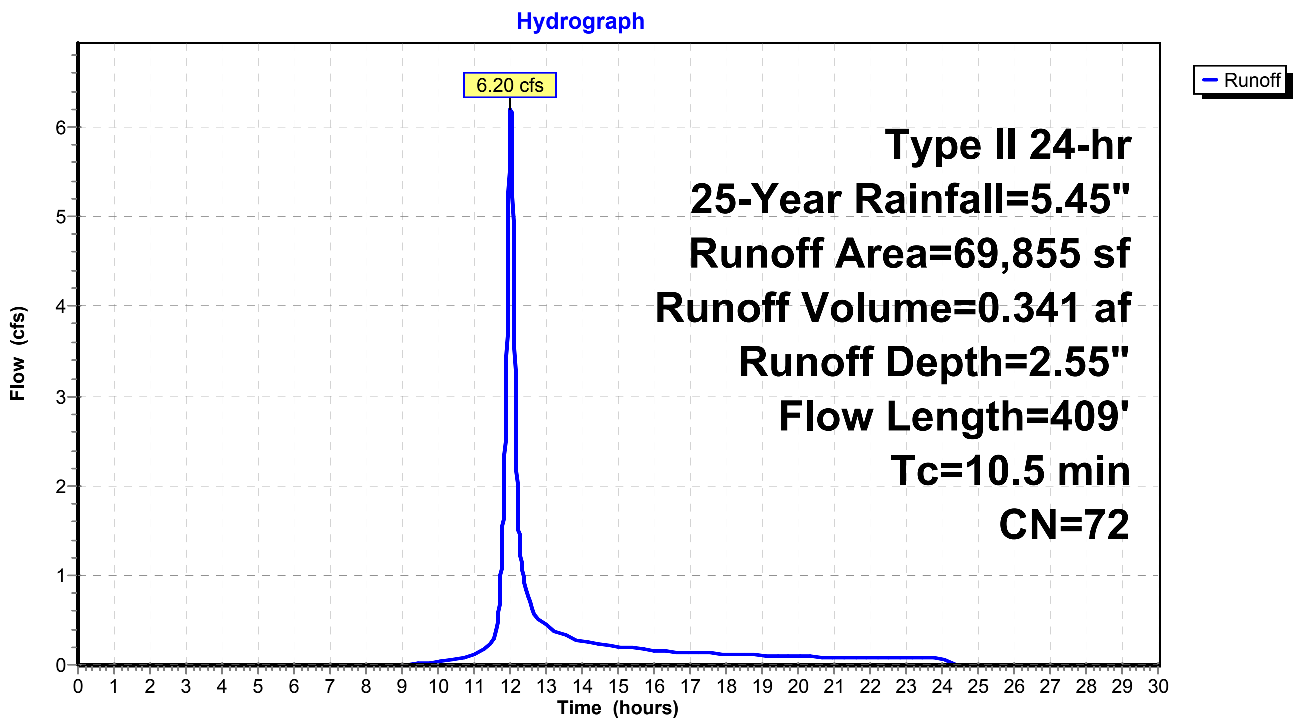
Runoff = 6.20 cfs @ 12.03 hrs, Volume= 0.341 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.45"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

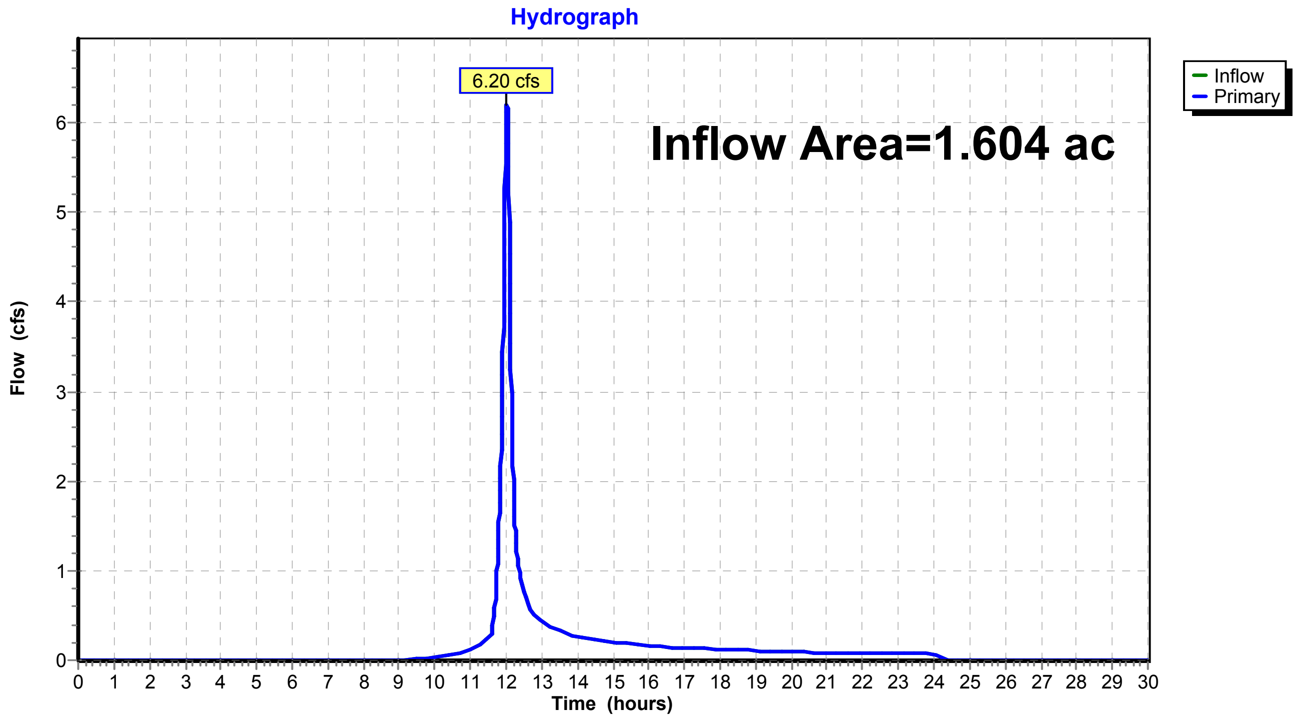


Summary for Link 20L: Existing Conditions

Inflow Area = 1.604 ac, 0.00% Impervious, Inflow Depth = 2.55" for 25-Year event
Inflow = 6.20 cfs @ 12.03 hrs, Volume= 0.341 af
Primary = 6.20 cfs @ 12.03 hrs, Volume= 0.341 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=3.31"
Flow Length=409' Tc=10.5 min CN=72 Runoff=8.03 cfs 0.442 af

Link 20L: Existing Conditions Inflow=8.03 cfs 0.442 af
Primary=8.03 cfs 0.442 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.442 af Average Runoff Depth = 3.31"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

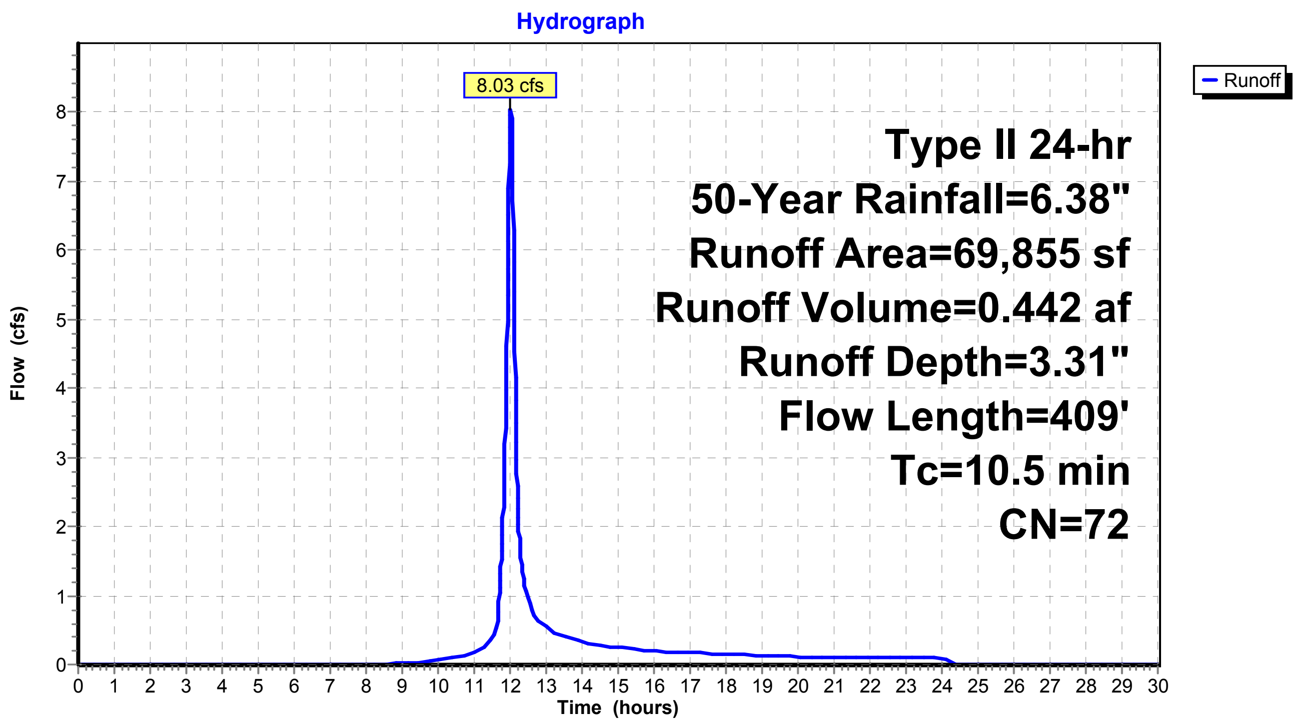
Runoff = 8.03 cfs @ 12.02 hrs, Volume= 0.442 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.38"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

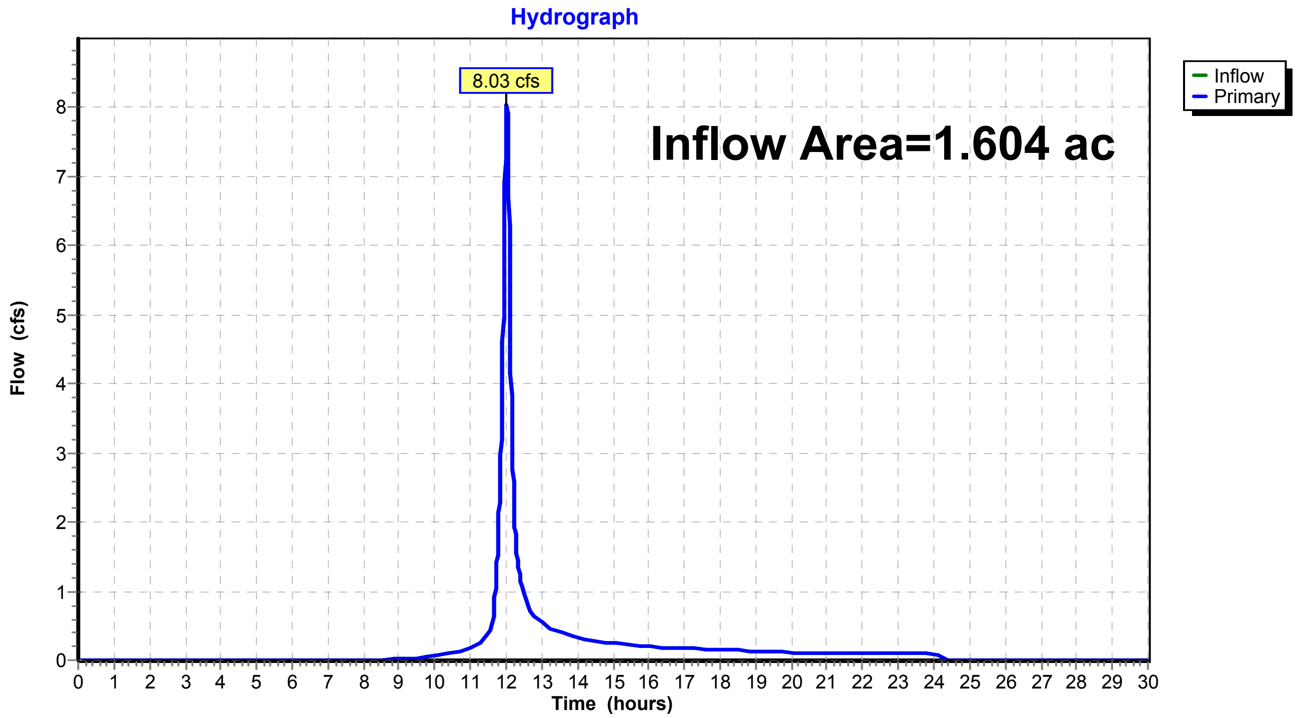


Summary for Link 20L: Existing Conditions

Inflow Area =	1.604 ac,	0.00% Impervious, Inflow Depth = 3.31"	for 50-Year event	
Inflow =	8.03 cfs @	12.02 hrs, Volume=	0.442 af	
Primary =	8.03 cfs @	12.02 hrs, Volume=	0.442 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: OVERALL DA Runoff Area=69,855 sf 0.00% Impervious Runoff Depth=4.23"
Flow Length=409' Tc=10.5 min CN=72 Runoff=10.23 cfs 0.566 af

Link 20L: Existing Conditions Inflow=10.23 cfs 0.566 af
Primary=10.23 cfs 0.566 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.566 af Average Runoff Depth = 4.23"
100.00% Pervious = 1.604 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

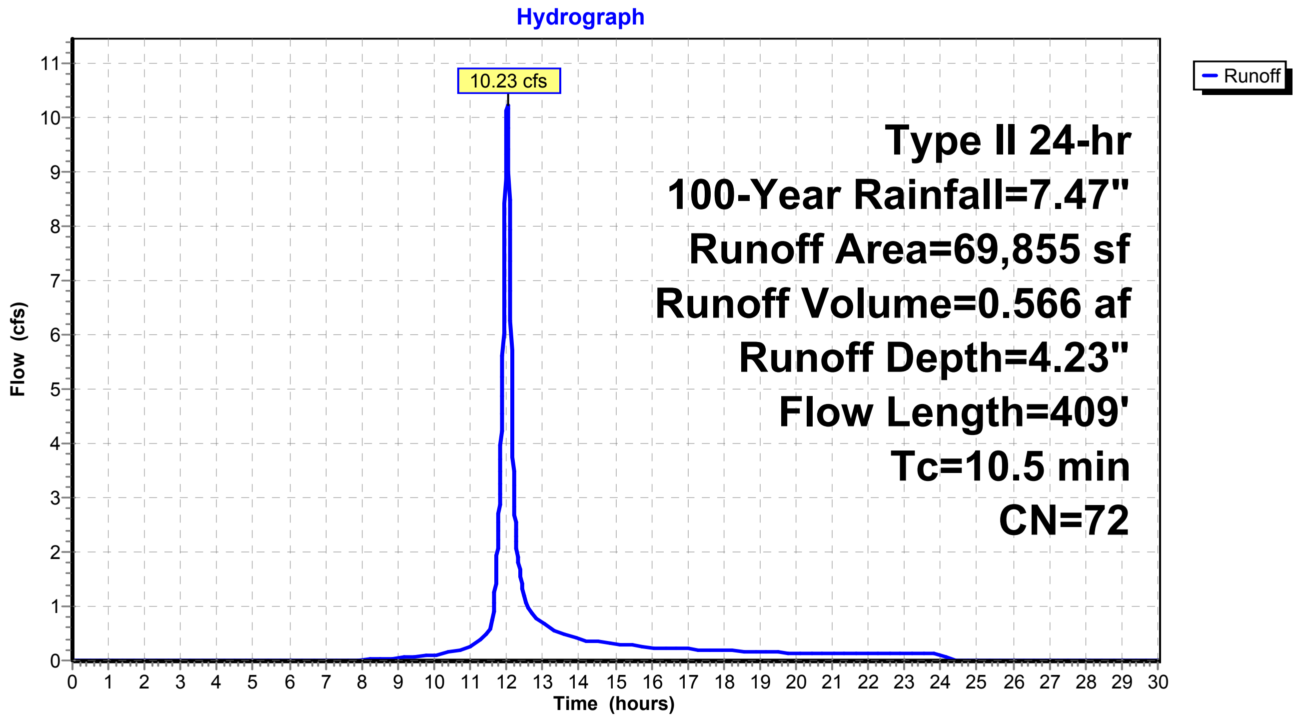
Runoff = 10.23 cfs @ 12.02 hrs, Volume= 0.566 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=7.47"

Area (sf)	CN	Description
67,554	71	Meadow, non-grazed, HSG C
2,301	87	Dirt roads, HSG C
69,855	72	Weighted Average
69,855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0500	0.24		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 3.07"
3.1	242	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.0650	4.10		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.5	58	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
10.5	409	Total			

Subcatchment 10S: OVERALL DA PRE-DEVELOPMENT

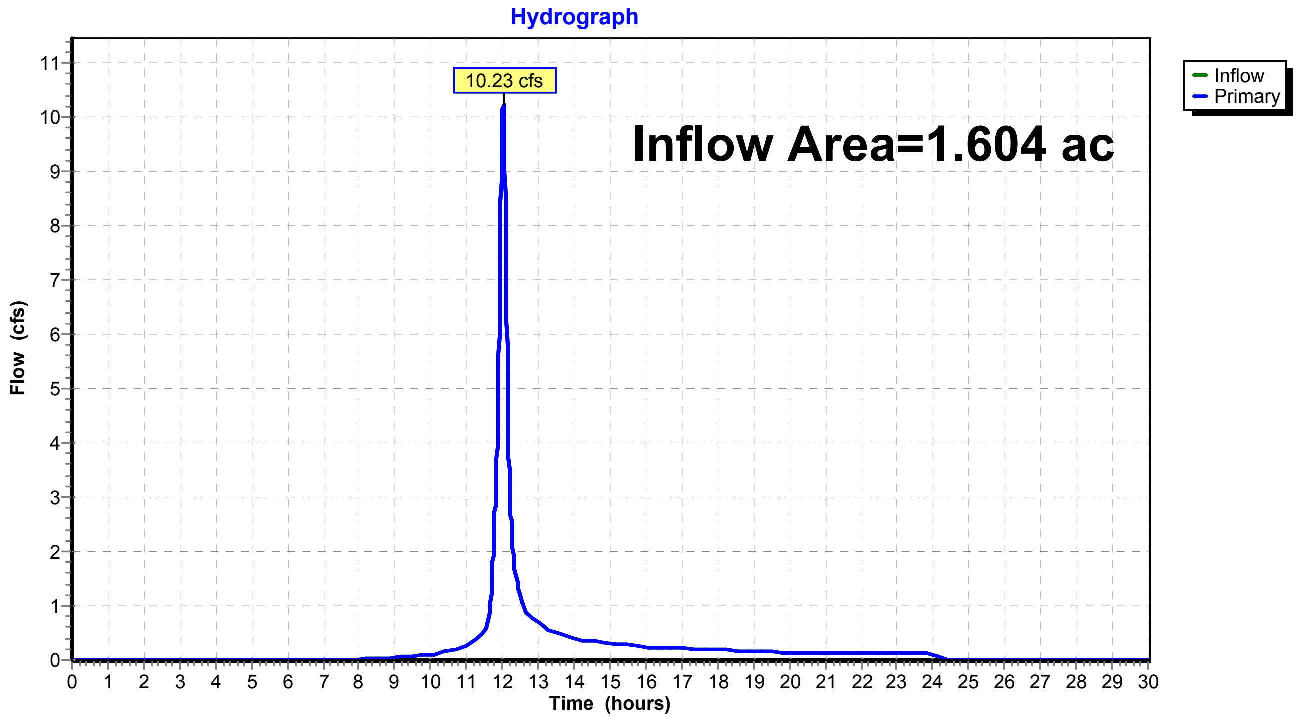


Summary for Link 20L: Existing Conditions

Inflow Area = 1.604 ac, 0.00% Impervious, Inflow Depth = 4.23" for 100-Year event
Inflow = 10.23 cfs @ 12.02 hrs, Volume= 0.566 af
Primary = 10.23 cfs @ 12.02 hrs, Volume= 0.566 af, Atten= 0%, Lag= 0.0 min

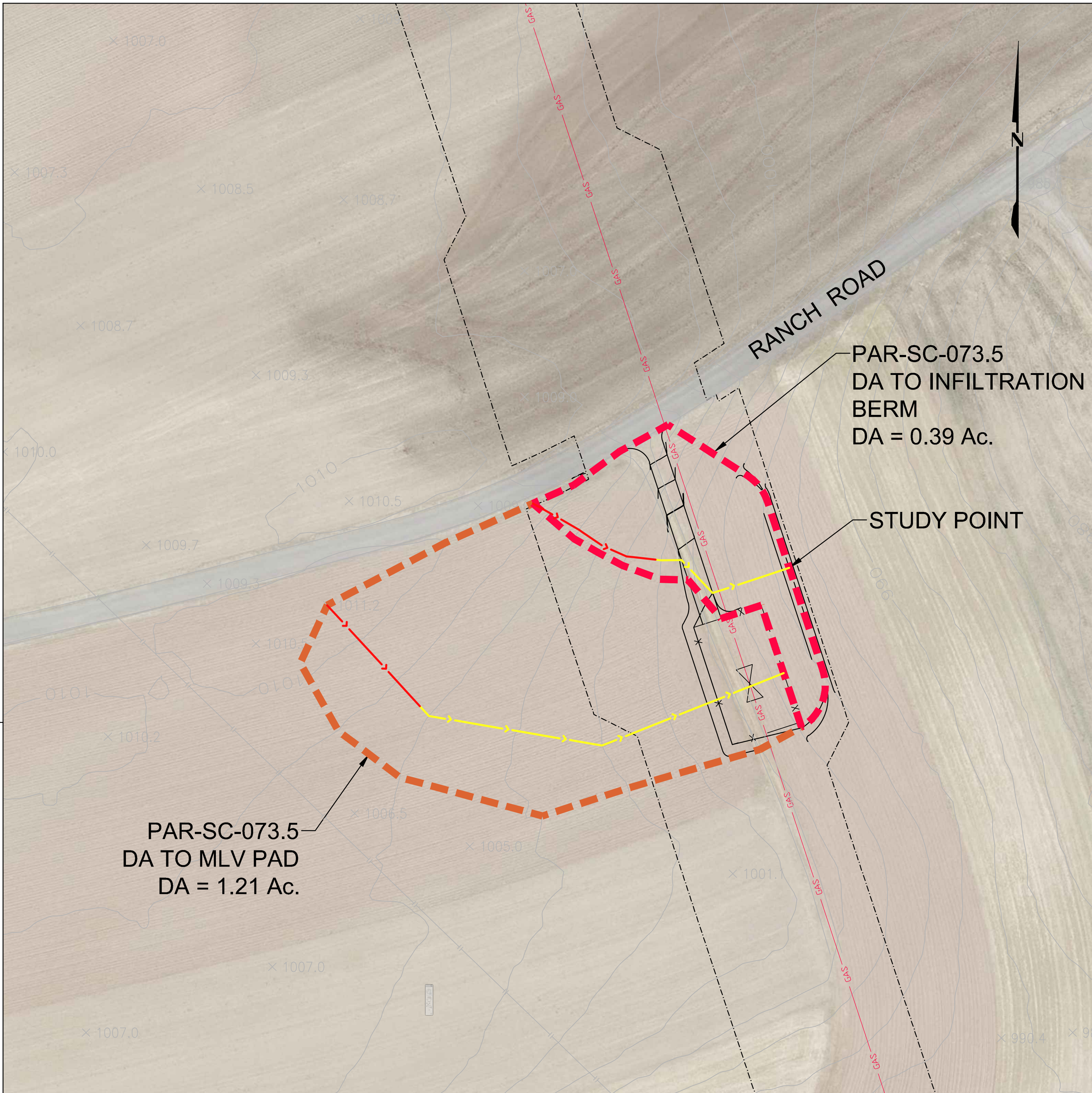
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 20L: Existing Conditions



V.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



100 50 100

SCALE IN FEET

ISSUED FOR PERMITTING

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

BL Companies

LEGEND

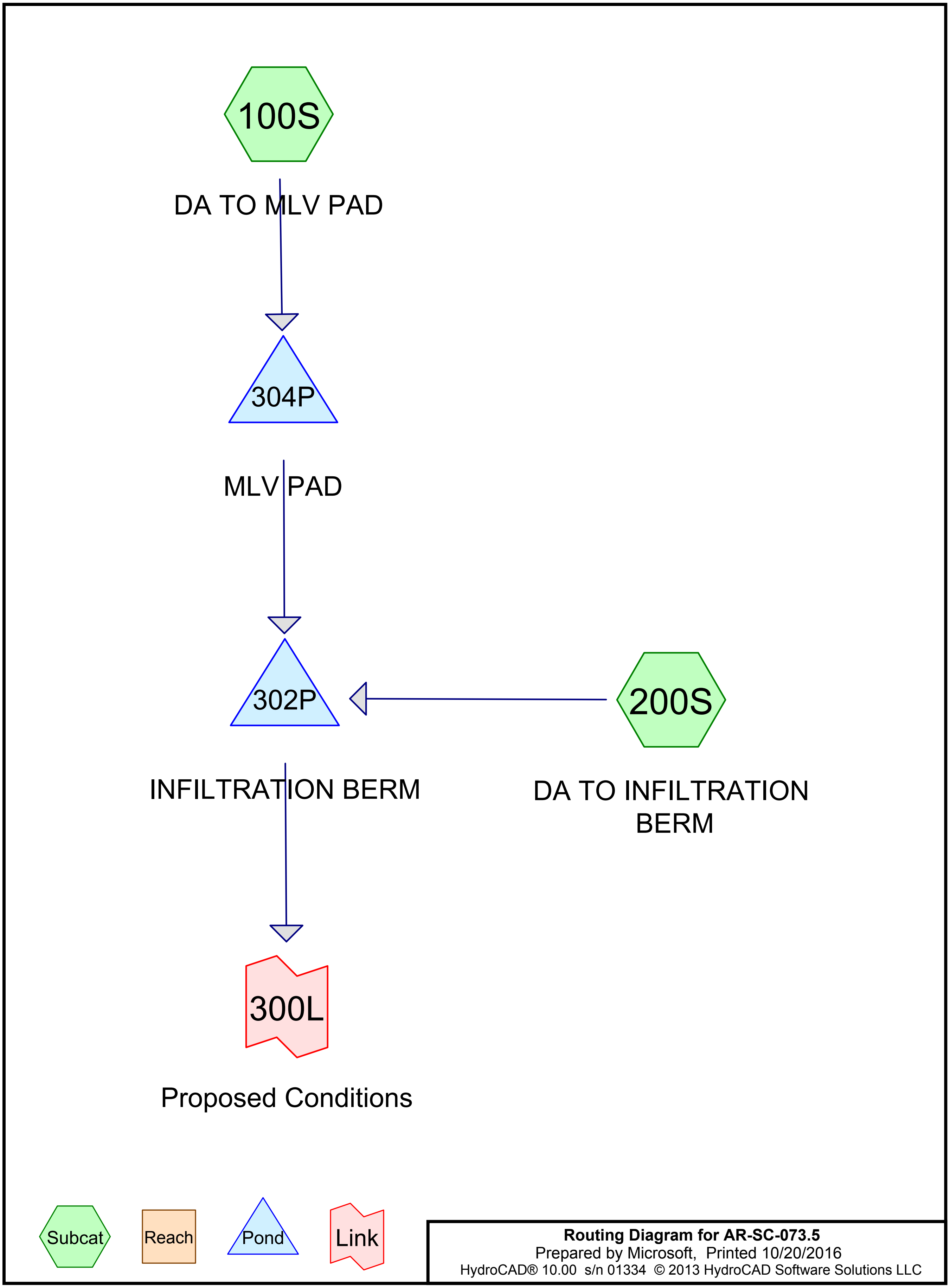
TIME OF CONCENTRATION-SHEET FLOW	red arrow line
TIME OF CONCENTRATION-SHALLOW CONCENTRATED FLOW	yellow arrow line
DRAINAGE AREA	dashed line
PROPOSED GAS PIPELINE	GAS — GAS

ATLANTIC SUNRISE PROJECT -
CENTRAL PENN LINE SOUTH

PROPOSED 42" NATURAL GAS PIPELINE
ACCESS ROAD DRAINAGE AREA MAP
AR-SC-073.5 POST
ELDRED TOWNSHIP
SCHYULKILL COUNTY, PENNSYLVANIA

Williams

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.				
							DRAWN BY: OLC	DATE: 10/26/15	ISSUED FOR BID:	SCALE: 1" = 100'
							CHECKED BY: BJP	DATE: 10/26/15	ISSUED FOR CONSTRUCTION:	
							APPROVED BY: BJP	DATE: 10/26/15	DRAWING NUMBER: AR-SC-073.5 POST	
							WO:			



Routing Diagram for AR-SC-073.5
Prepared by Microsoft, Printed 10/20/2016
HydroCAD® 10.00 s/n 01334 © 2013 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.107	98	Crushed Stone Pad, HSG C (100S)
0.048	89	Gravel roads, HSG C (100S, 200S)
1.448	71	Meadow, non-grazed, HSG C (100S, 200S)
1.604	**73**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.604	HSG C	100S, 200S
0.000	HSG D	
0.000	Other	
1.604		**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=0.60"
Flow Length=381' Tc=13.4 min CN=73 Runoff=0.90 cfs 0.061 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=0.60"
Flow Length=211' Tc=9.2 min CN=73 Runoff=0.34 cfs 0.019 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.24' Storage=3,036 cf Inflow=1.21 cfs 0.070 af
Outflow=0.00 cfs 0.000 af

Pond 304P: MLV PAD Peak Elev=994.98' Storage=450 cf Inflow=0.90 cfs 0.061 af
Outflow=0.85 cfs 0.050 af

Link 300L: Proposed Conditions Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.080 af Average Runoff Depth = 0.60"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

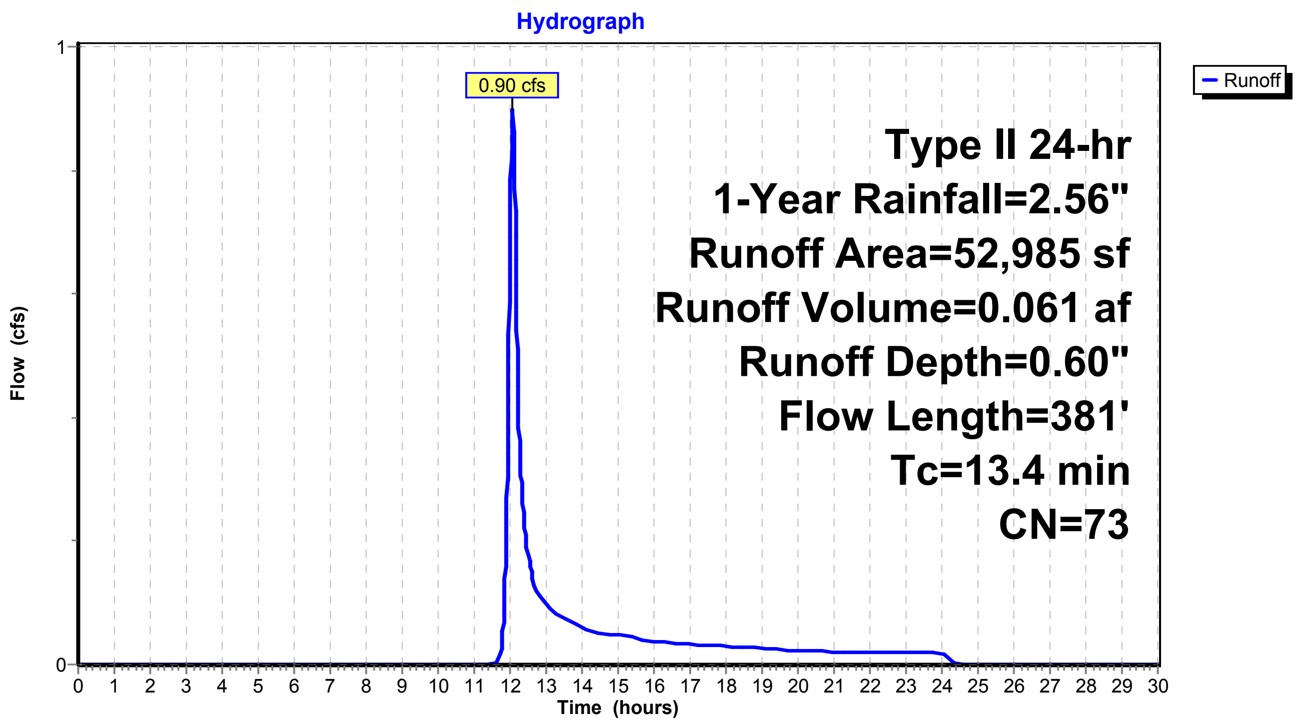
Runoff = 0.90 cfs @ 12.07 hrs, Volume= 0.061 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.56"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

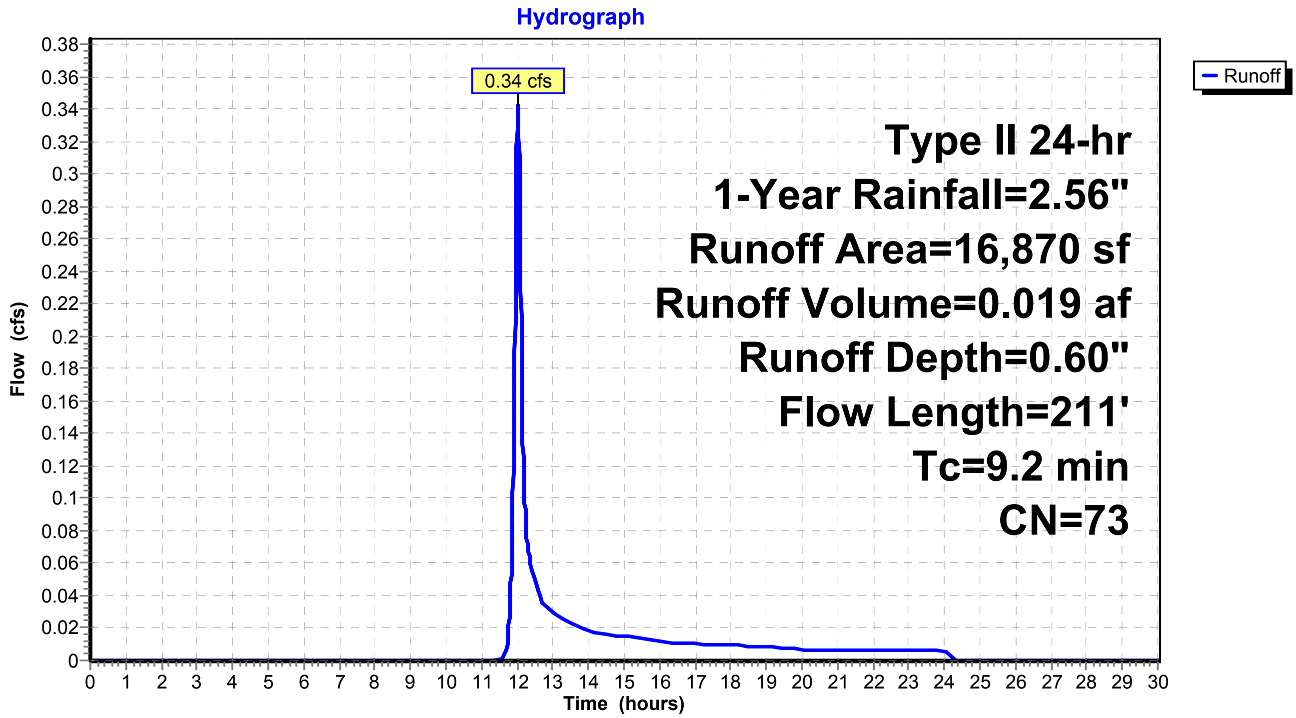
Runoff = 0.34 cfs @ 12.02 hrs, Volume= 0.019 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-Year Rainfall=2.56"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 0.52" for 1-Year event
Inflow = 1.21 cfs @ 12.08 hrs, Volume= 0.070 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.24' @ 24.77 hrs Surf.Area= 4,497 sf Storage= 3,036 cf

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

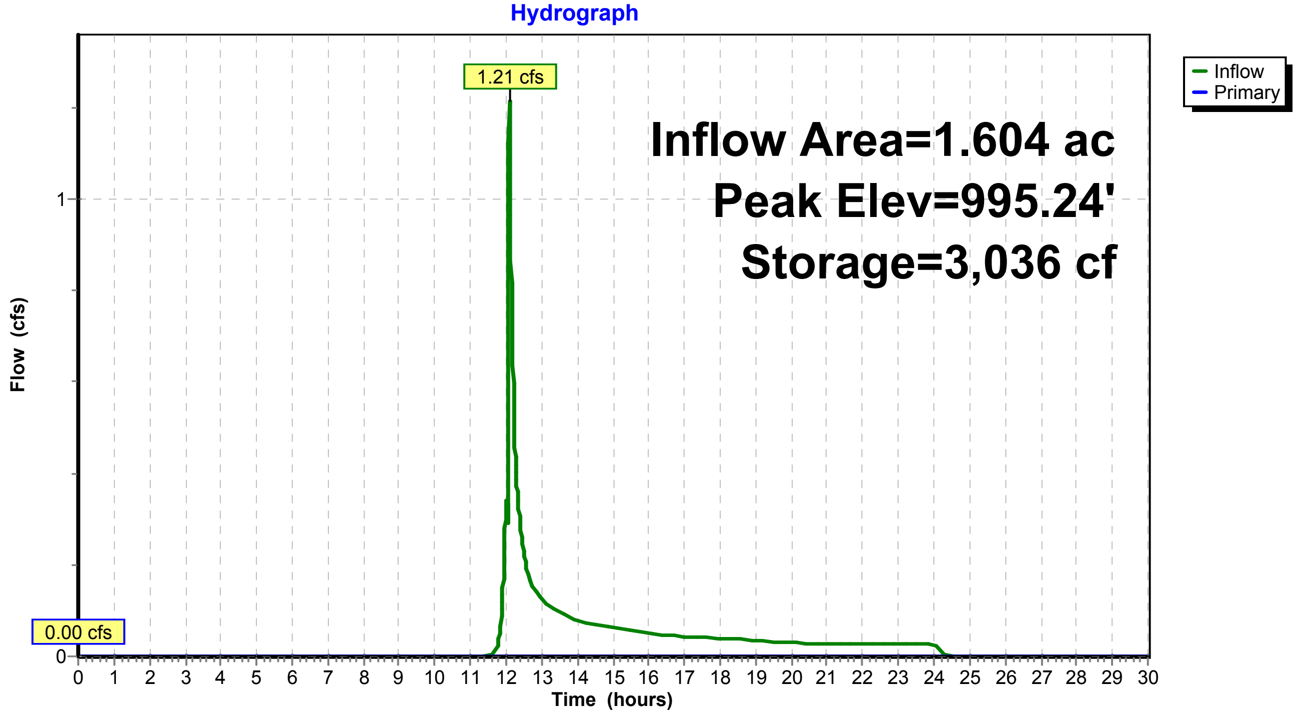
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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 @ 0.00 hrs HW=993.75' (Free Discharge)
└─**1=Broad-Crested Weir** (Controls 0.00 cfs)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 0.60" for 1-Year event
Inflow = 0.90 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.85 cfs @ 12.08 hrs, Volume= 0.050 af, Atten= 5%, Lag= 0.5 min
Primary = 0.85 cfs @ 12.08 hrs, Volume= 0.050 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 994.98' @ 12.08 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 114.6 min calculated for 0.050 af (83% of inflow)
Center-of-Mass det. time= 34.8 min (920.4 - 885.6)

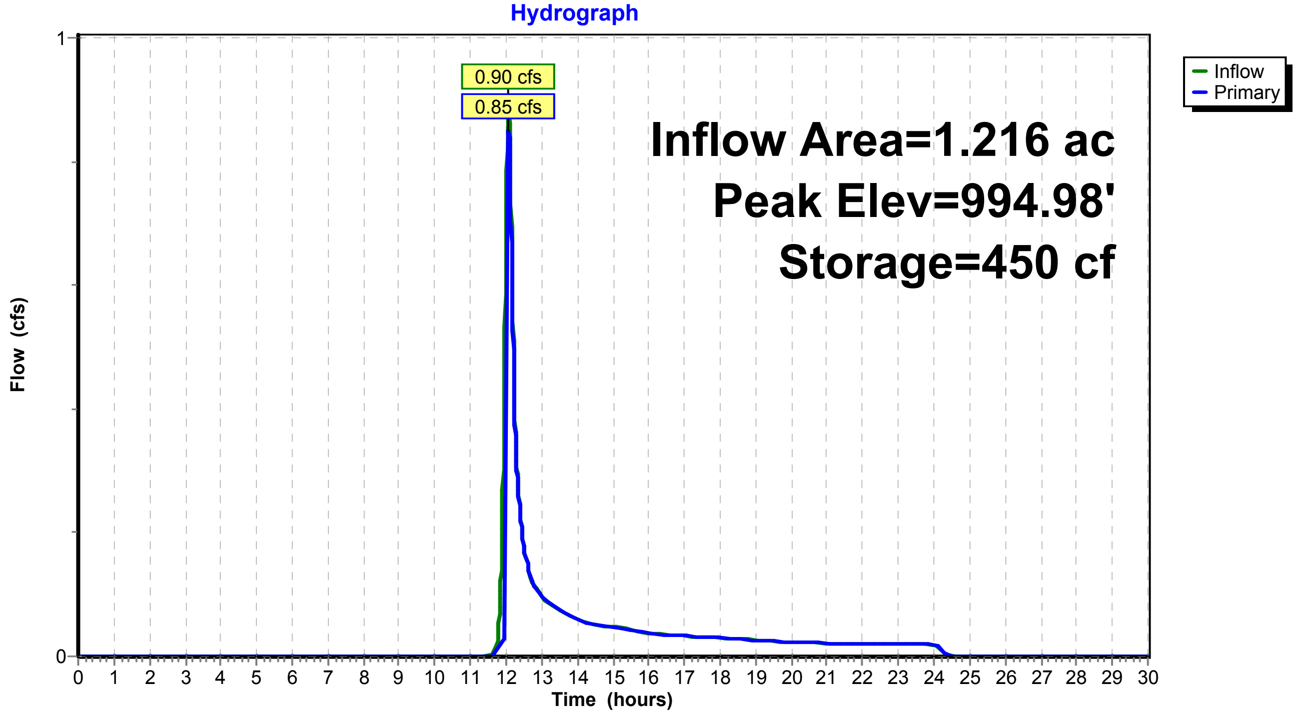
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=0.84 cfs @ 12.08 hrs HW=994.98' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 0.84 cfs @ 0.38 fps)

Pond 304P: MLV PAD

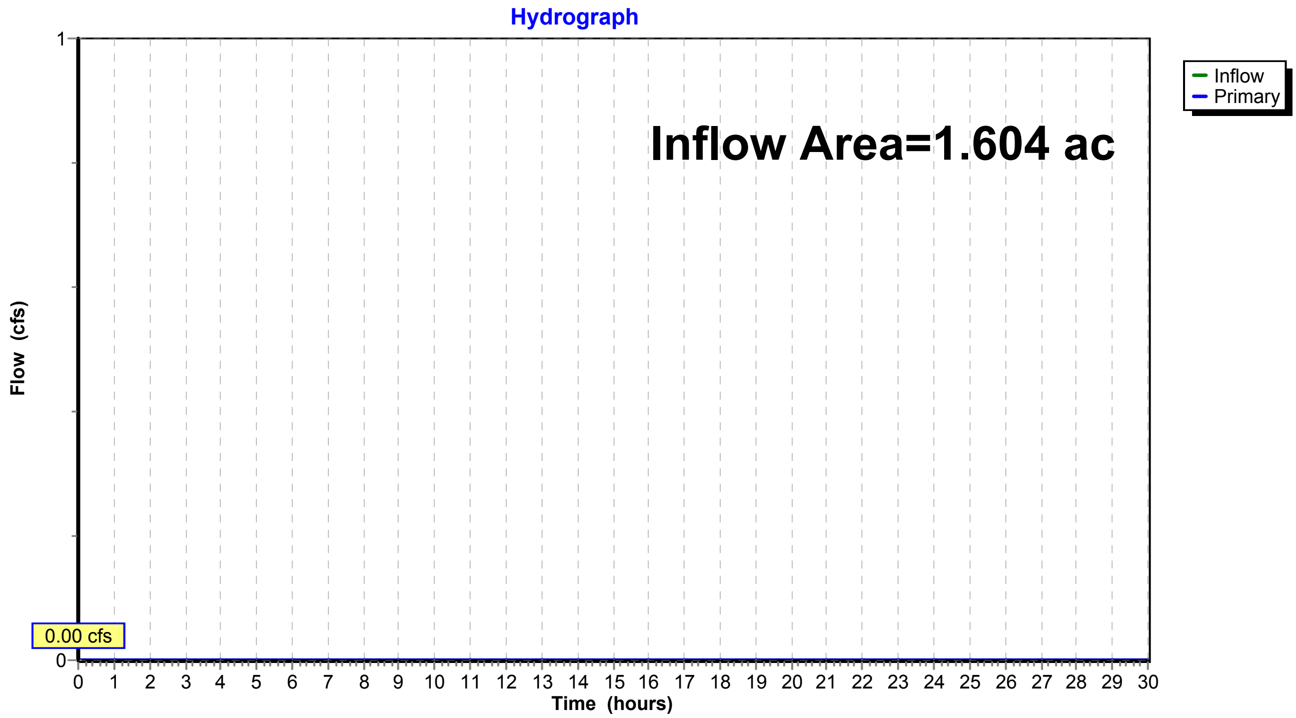


Summary for Link 300L: Proposed Conditions

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 0.00" for 1-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=0.90"
Flow Length=381' Tc=13.4 min CN=73 Runoff=1.42 cfs 0.091 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=0.90"
Flow Length=211' Tc=9.2 min CN=73 Runoff=0.54 cfs 0.029 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.31' Storage=3,336 cf Inflow=1.74 cfs 0.108 af
Outflow=0.07 cfs 0.032 af

Pond 304P: MLV PAD Peak Elev=994.99' Storage=450 cf Inflow=1.42 cfs 0.091 af
Outflow=1.27 cfs 0.079 af

Link 300L: Proposed Conditions Inflow=0.07 cfs 0.032 af
Primary=0.07 cfs 0.032 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.120 af Average Runoff Depth = 0.90"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

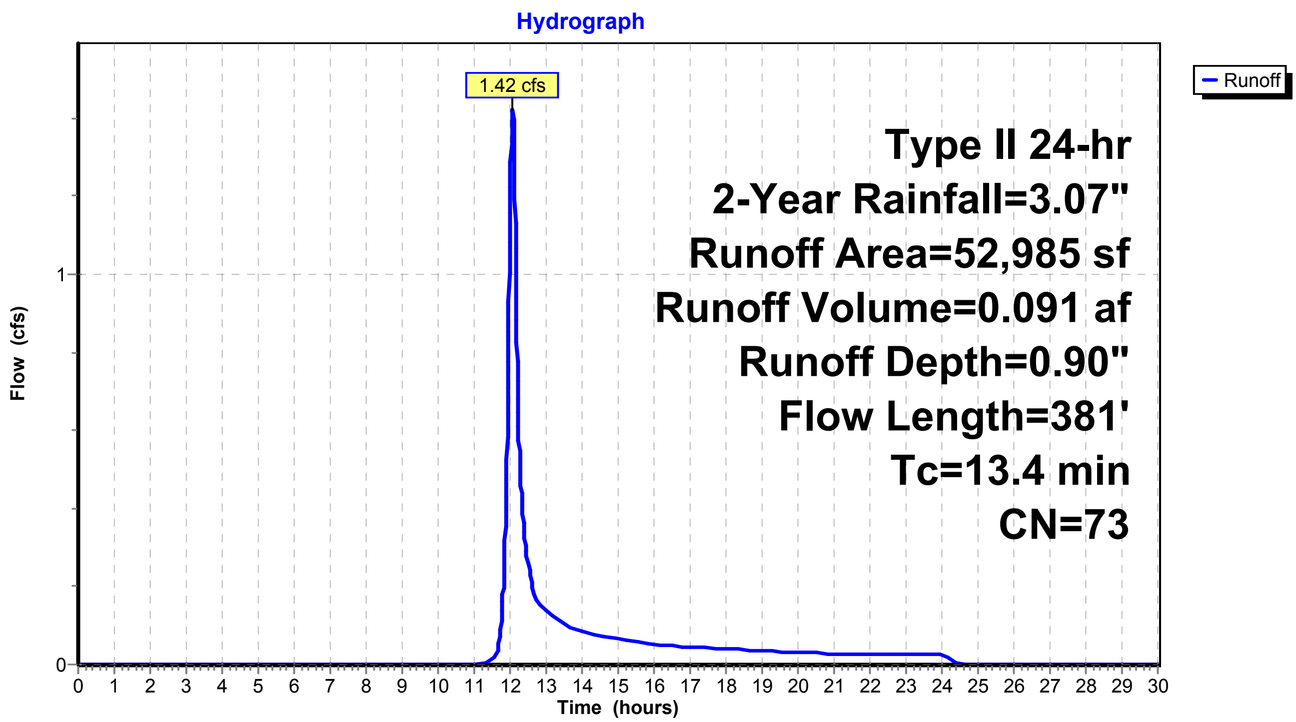
Runoff = 1.42 cfs @ 12.07 hrs, Volume= 0.091 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.07"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

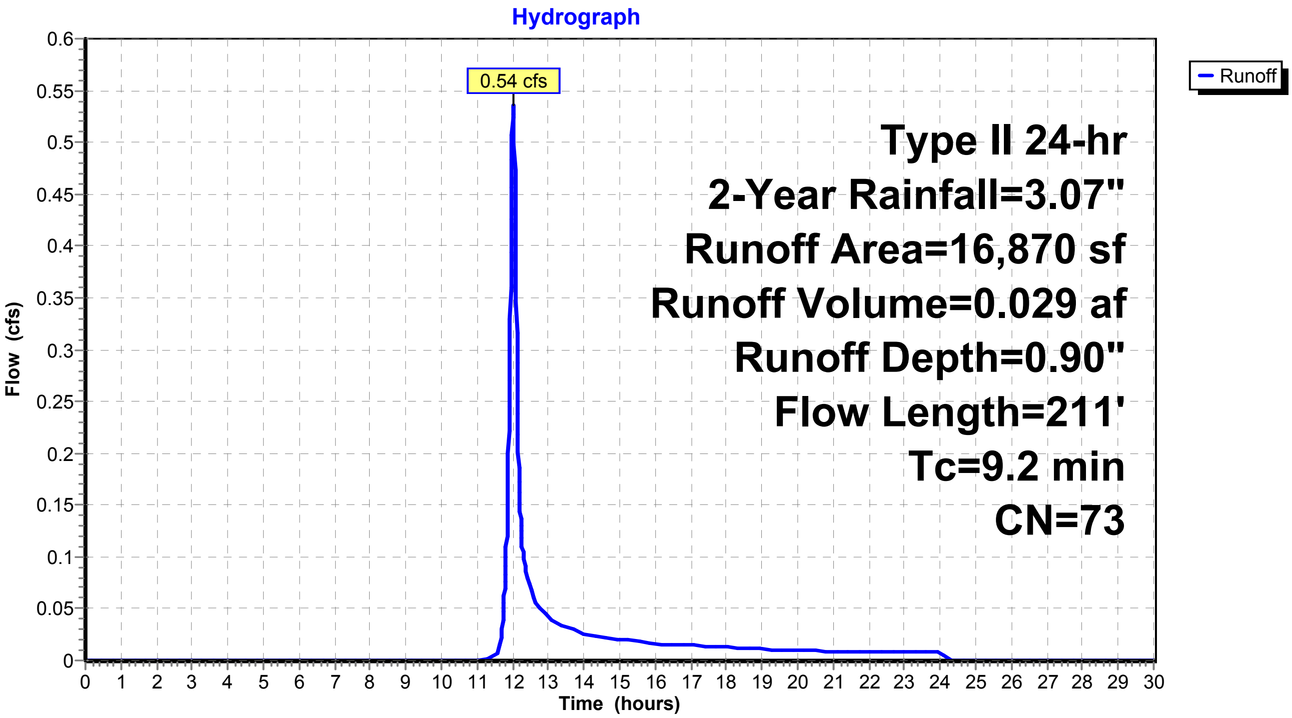
Runoff = 0.54 cfs @ 12.02 hrs, Volume= 0.029 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Year Rainfall=3.07"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 0.81" for 2-Year event
Inflow = 1.74 cfs @ 12.05 hrs, Volume= 0.108 af
Outflow = 0.07 cfs @ 16.28 hrs, Volume= 0.032 af, Atten= 96%, Lag= 253.7 min
Primary = 0.07 cfs @ 16.28 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.31' @ 16.28 hrs Surf.Area= 4,697 sf Storage= 3,336 cf

Plug-Flow detention time= 450.7 min calculated for 0.032 af (29% of inflow)
Center-of-Mass det. time= 285.6 min (1,174.7 - 889.1)

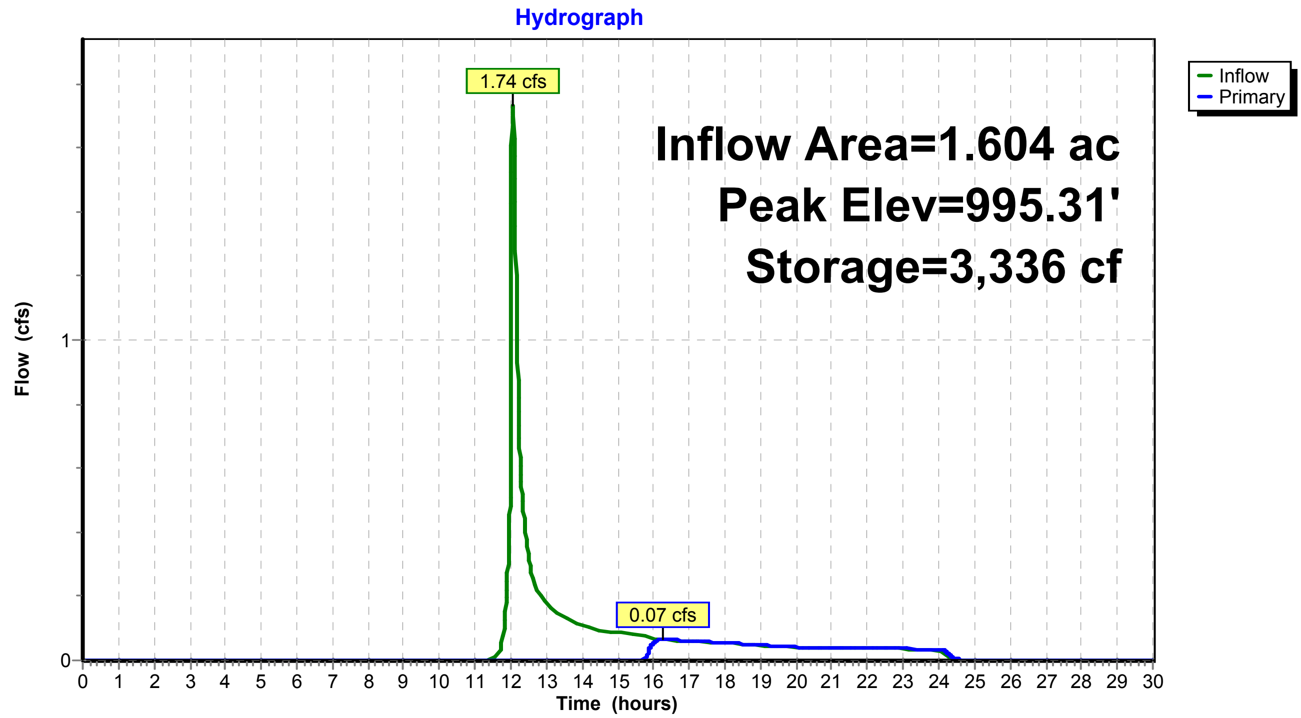
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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 @ 16.28 hrs HW=995.31' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 0.06 cfs @ 0.19 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 0.90" for 2-Year event
Inflow = 1.42 cfs @ 12.07 hrs, Volume= 0.091 af
Outflow = 1.27 cfs @ 12.07 hrs, Volume= 0.079 af, Atten= 11%, Lag= 0.4 min
Primary = 1.27 cfs @ 12.07 hrs, Volume= 0.079 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 994.99' @ 12.07 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 92.2 min calculated for 0.079 af (86% of inflow)
Center-of-Mass det. time= 25.2 min (897.0 - 871.7)

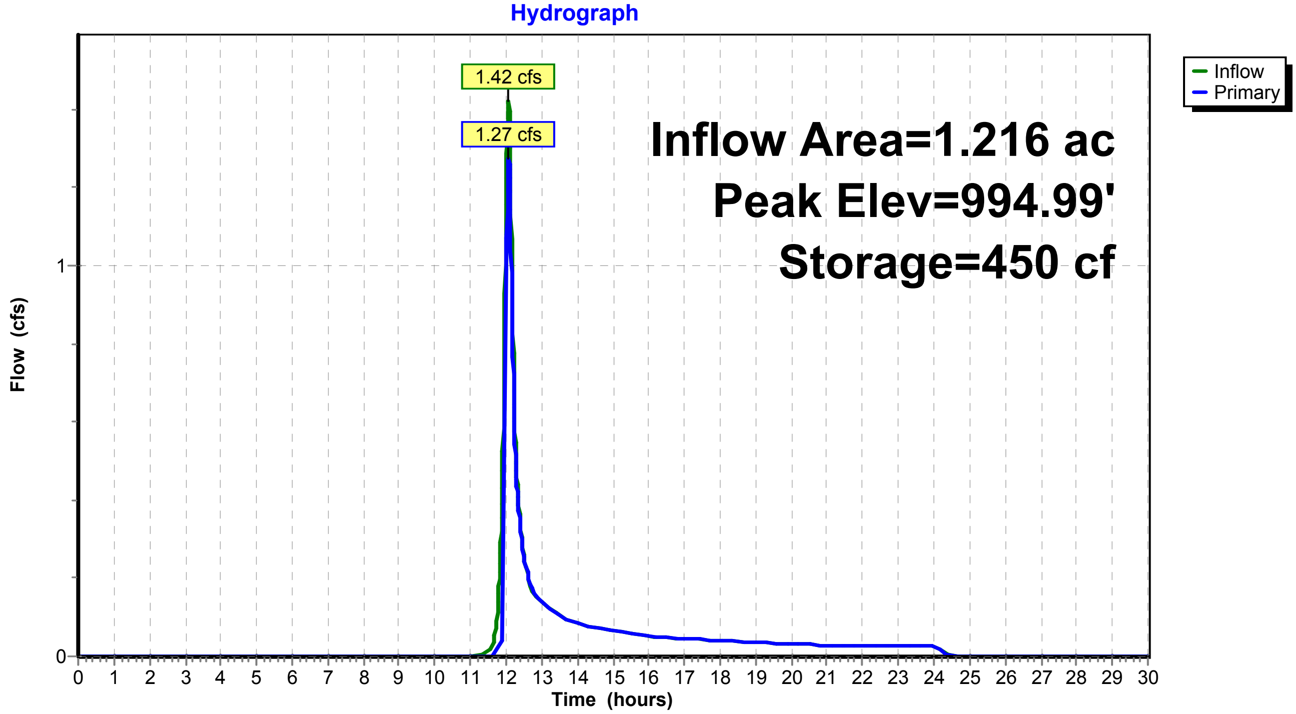
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=1.26 cfs @ 12.07 hrs HW=994.99' (Free Discharge)
1=Broad-Crested Weir (Weir Controls 1.26 cfs @ 0.44 fps)

Pond 304P: MLV PAD

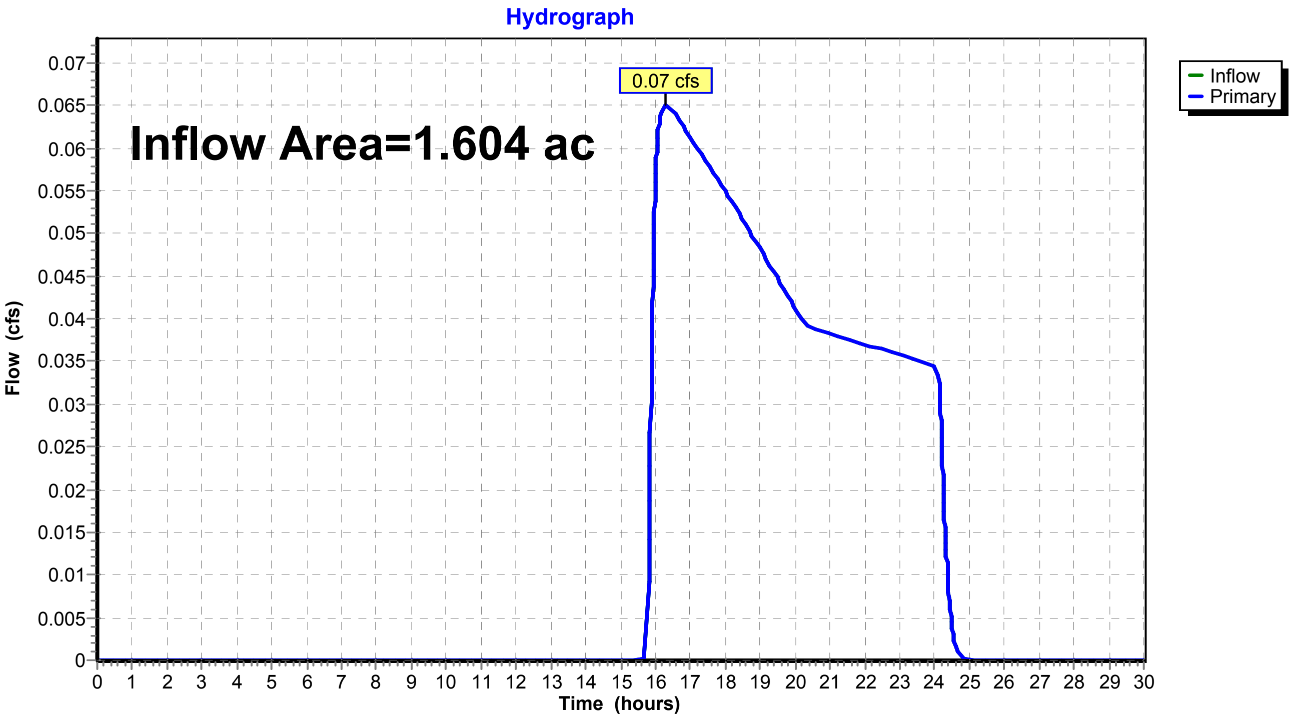


Summary for Link 300L: Proposed Conditions

Inflow Area =	1.604 ac,	6.70% Impervious, Inflow Depth = 0.24"	for 2-Year event
Inflow =	0.07 cfs @	16.28 hrs, Volume=	0.032 af
Primary =	0.07 cfs @	16.28 hrs, Volume=	0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=1.39"
Flow Length=381' Tc=13.4 min CN=73 Runoff=2.27 cfs 0.141 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=1.39"
Flow Length=211' Tc=9.2 min CN=73 Runoff=0.85 cfs 0.045 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.32' Storage=3,389 cf Inflow=2.77 cfs 0.167 af
Outflow=0.31 cfs 0.091 af

Pond 304P: MLV PAD Peak Elev=995.00' Storage=450 cf Inflow=2.27 cfs 0.141 af
Outflow=2.00 cfs 0.122 af

Link 300L: Proposed Conditions Inflow=0.31 cfs 0.091 af
Primary=0.31 cfs 0.091 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.186 af Average Runoff Depth = 1.39"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

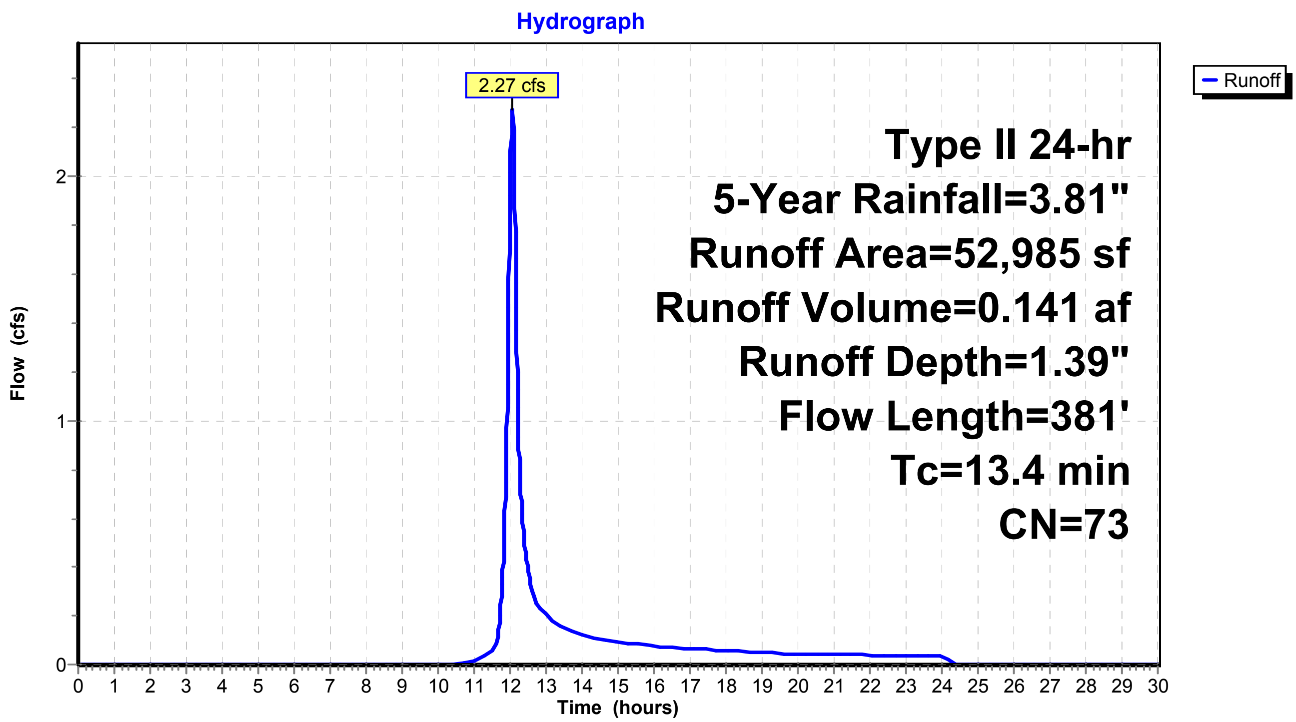
Runoff = 2.27 cfs @ 12.06 hrs, Volume= 0.141 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.81"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

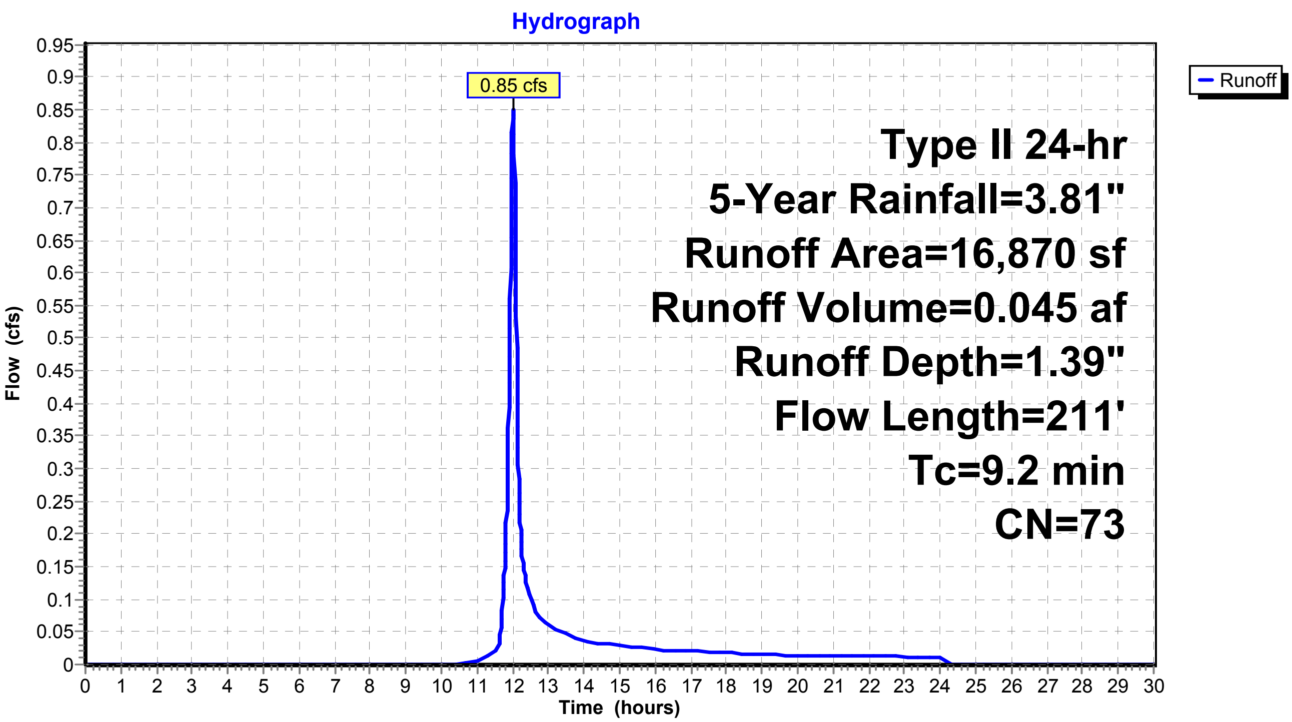
Runoff = 0.85 cfs @ 12.01 hrs, Volume= 0.045 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Year Rainfall=3.81"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 1.25" for 5-Year event
Inflow = 2.77 cfs @ 12.05 hrs, Volume= 0.167 af
Outflow = 0.31 cfs @ 12.77 hrs, Volume= 0.091 af, Atten= 89%, Lag= 43.8 min
Primary = 0.31 cfs @ 12.77 hrs, Volume= 0.091 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.32' @ 12.77 hrs Surf.Area= 4,735 sf Storage= 3,389 cf

Plug-Flow detention time= 268.1 min calculated for 0.091 af (54% of inflow)
Center-of-Mass det. time= 128.9 min (1,002.9 - 873.9)

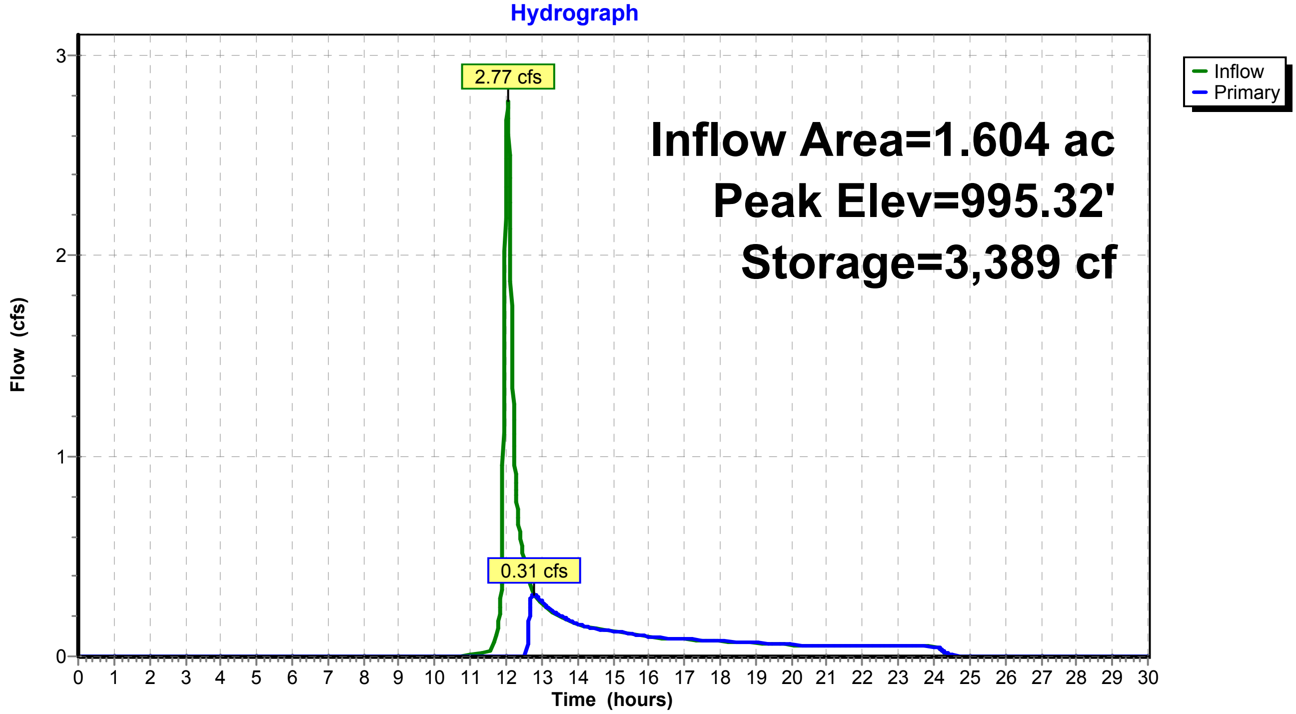
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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=0.28 cfs @ 12.77 hrs HW=995.32' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 0.28 cfs @ 0.32 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 1.39" for 5-Year event
Inflow = 2.27 cfs @ 12.06 hrs, Volume= 0.141 af
Outflow = 2.00 cfs @ 12.06 hrs, Volume= 0.122 af, Atten= 12%, Lag= 0.0 min
Primary = 2.00 cfs @ 12.06 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.00' @ 12.06 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 88.8 min calculated for 0.122 af (86% of inflow)
Center-of-Mass det. time= 23.1 min (881.2 - 858.1)

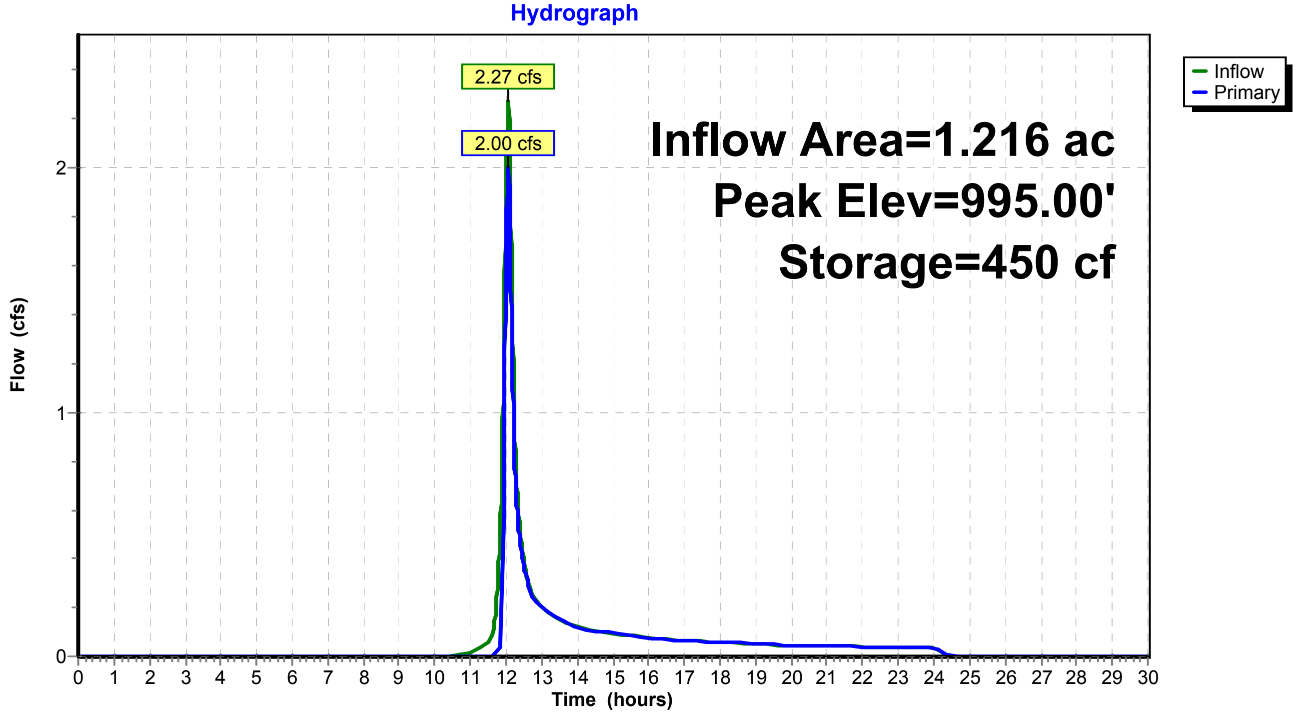
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=1.99 cfs @ 12.06 hrs HW=995.00' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 1.99 cfs @ 0.51 fps)

Pond 304P: MLV PAD

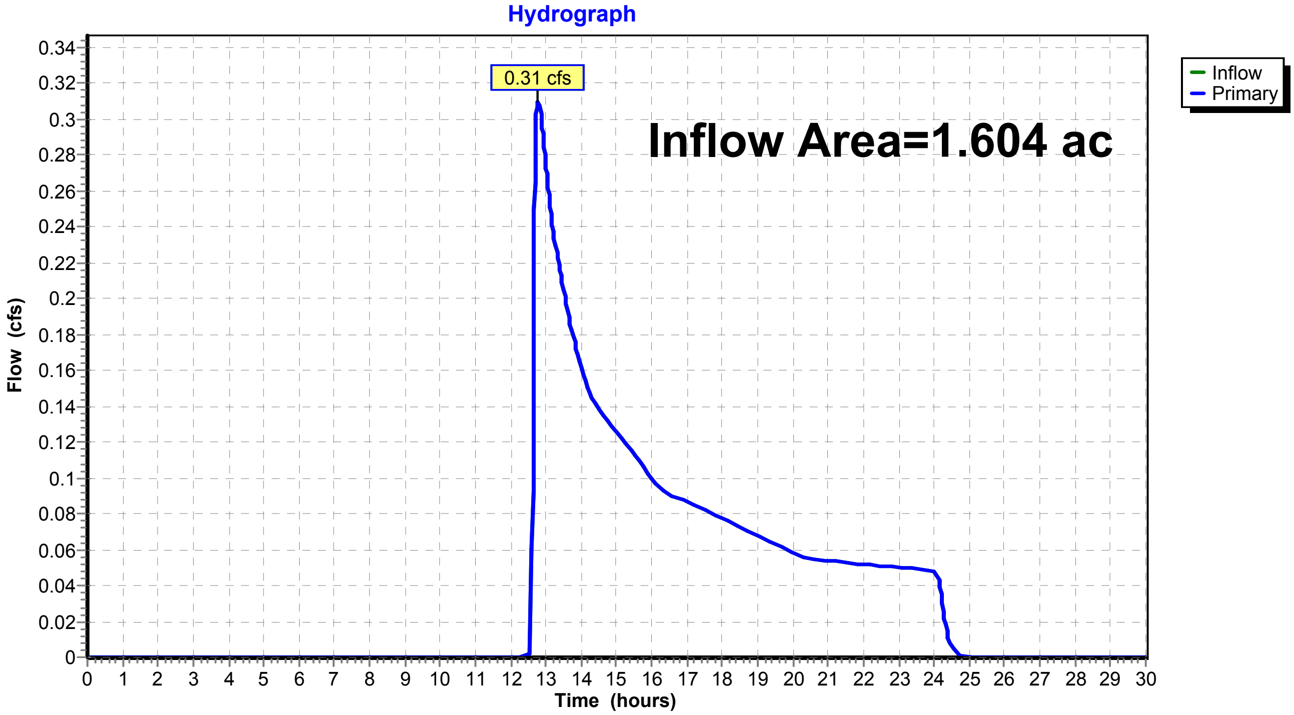


Summary for Link 300L: Proposed Conditions

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 0.68" for 5-Year event
Inflow = 0.31 cfs @ 12.77 hrs, Volume= 0.091 af
Primary = 0.31 cfs @ 12.77 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=1.86"
Flow Length=381' Tc=13.4 min CN=73 Runoff=3.07 cfs 0.188 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=1.86"
Flow Length=211' Tc=9.2 min CN=73 Runoff=1.14 cfs 0.060 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.36' Storage=3,580 cf Inflow=3.98 cfs 0.231 af
Outflow=1.68 cfs 0.155 af

Pond 304P: MLV PAD Peak Elev=995.02' Storage=450 cf Inflow=3.07 cfs 0.188 af
Outflow=2.94 cfs 0.171 af

Link 300L: Proposed Conditions Inflow=1.68 cfs 0.155 af
Primary=1.68 cfs 0.155 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.248 af Average Runoff Depth = 1.86"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

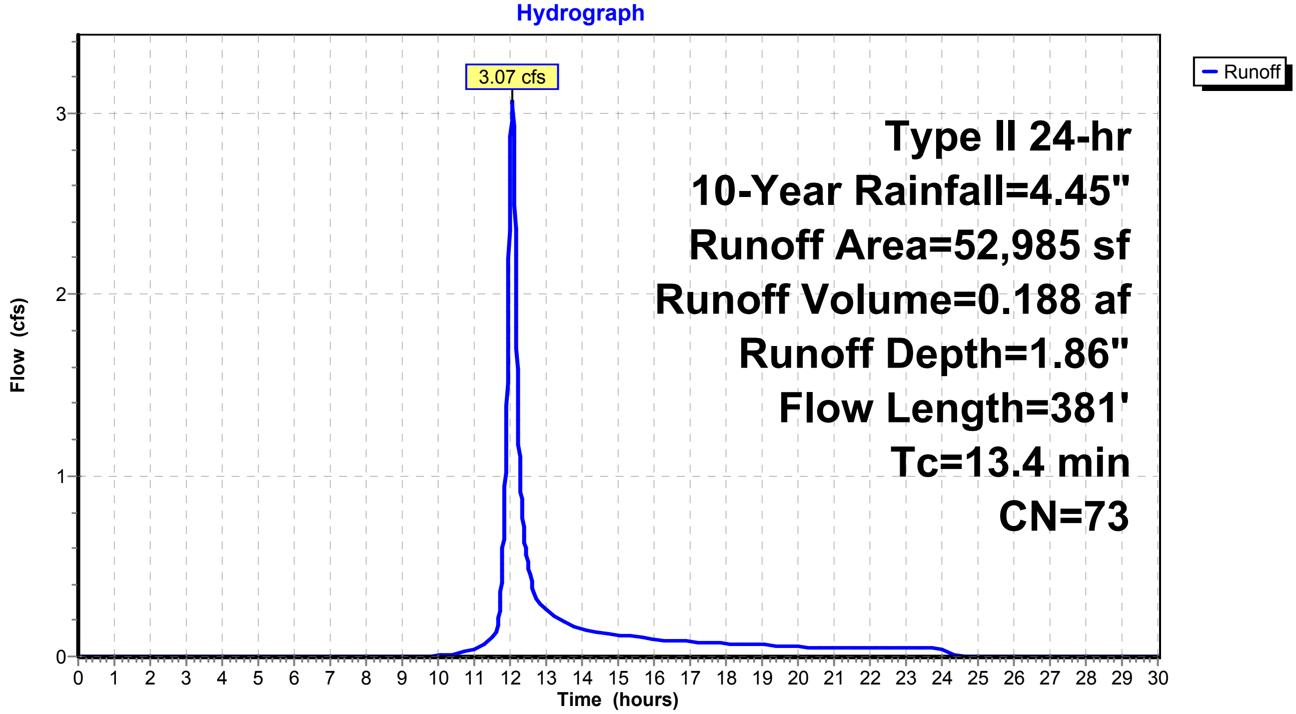
Runoff = 3.07 cfs @ 12.06 hrs, Volume= 0.188 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.45"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

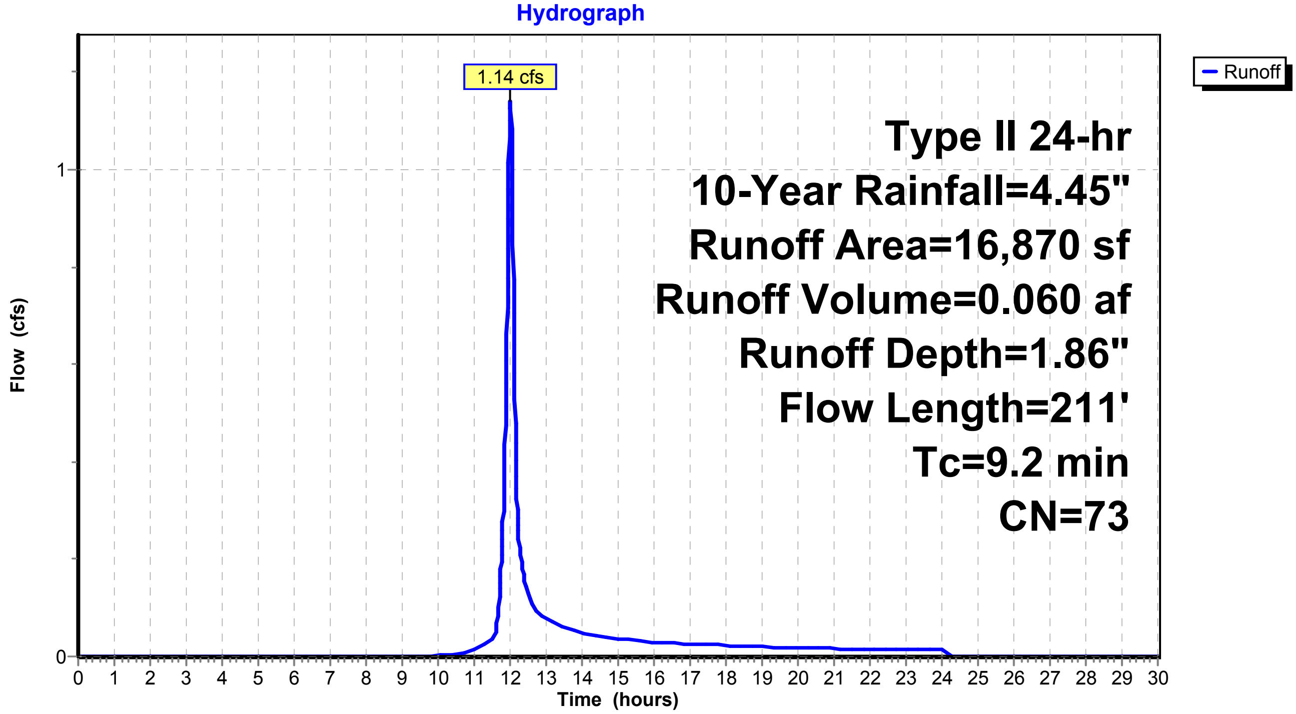
Runoff = 1.14 cfs @ 12.01 hrs, Volume= 0.060 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Year Rainfall=4.45"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 1.73" for 10-Year event
Inflow = 3.98 cfs @ 12.04 hrs, Volume= 0.231 af
Outflow = 1.68 cfs @ 12.21 hrs, Volume= 0.155 af, Atten= 58%, Lag= 10.0 min
Primary = 1.68 cfs @ 12.21 hrs, Volume= 0.155 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.36' @ 12.21 hrs Surf.Area= 4,871 sf Storage= 3,580 cf

Plug-Flow detention time= 189.9 min calculated for 0.155 af (67% of inflow)
Center-of-Mass det. time= 74.0 min (933.6 - 859.5)

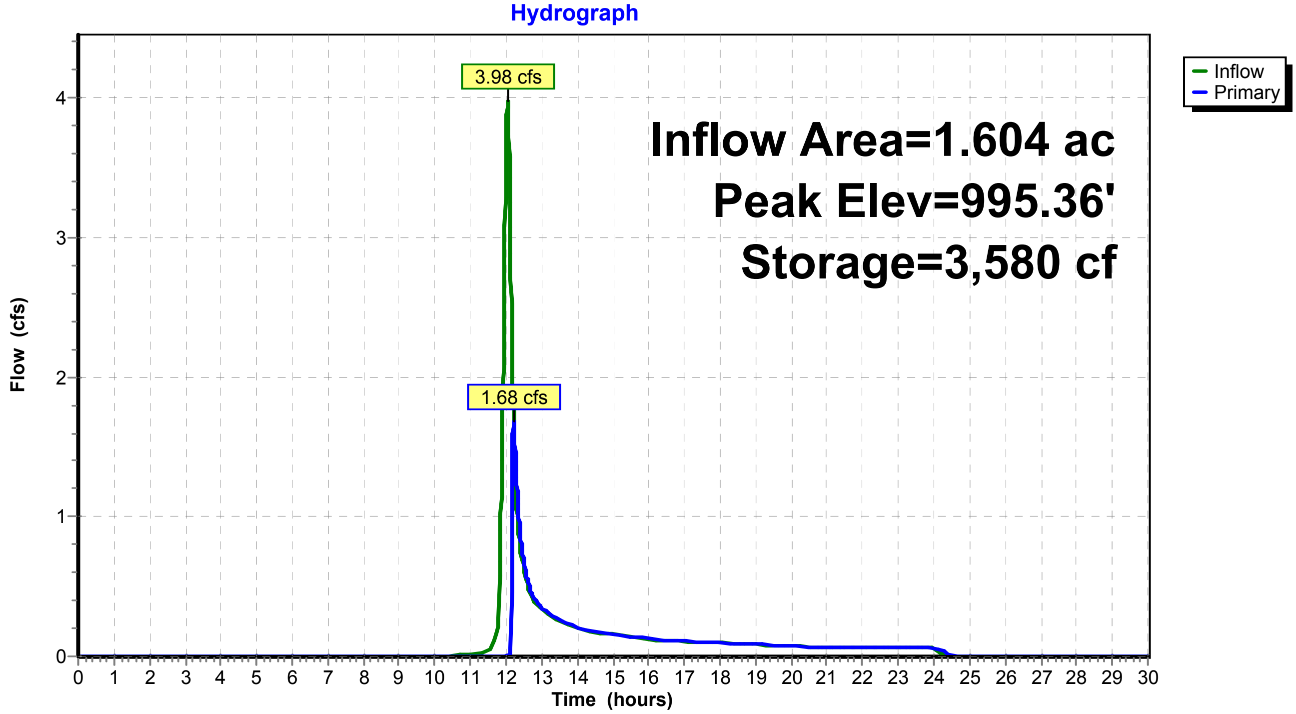
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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=1.67 cfs @ 12.21 hrs HW=995.36' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 1.67 cfs @ 0.58 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 1.86" for 10-Year event
Inflow = 3.07 cfs @ 12.06 hrs, Volume= 0.188 af
Outflow = 2.94 cfs @ 12.06 hrs, Volume= 0.171 af, Atten= 4%, Lag= 0.0 min
Primary = 2.94 cfs @ 12.06 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.02' @ 12.06 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 61.7 min calculated for 0.171 af (91% of inflow)
Center-of-Mass det. time= 14.8 min (864.4 - 849.5)

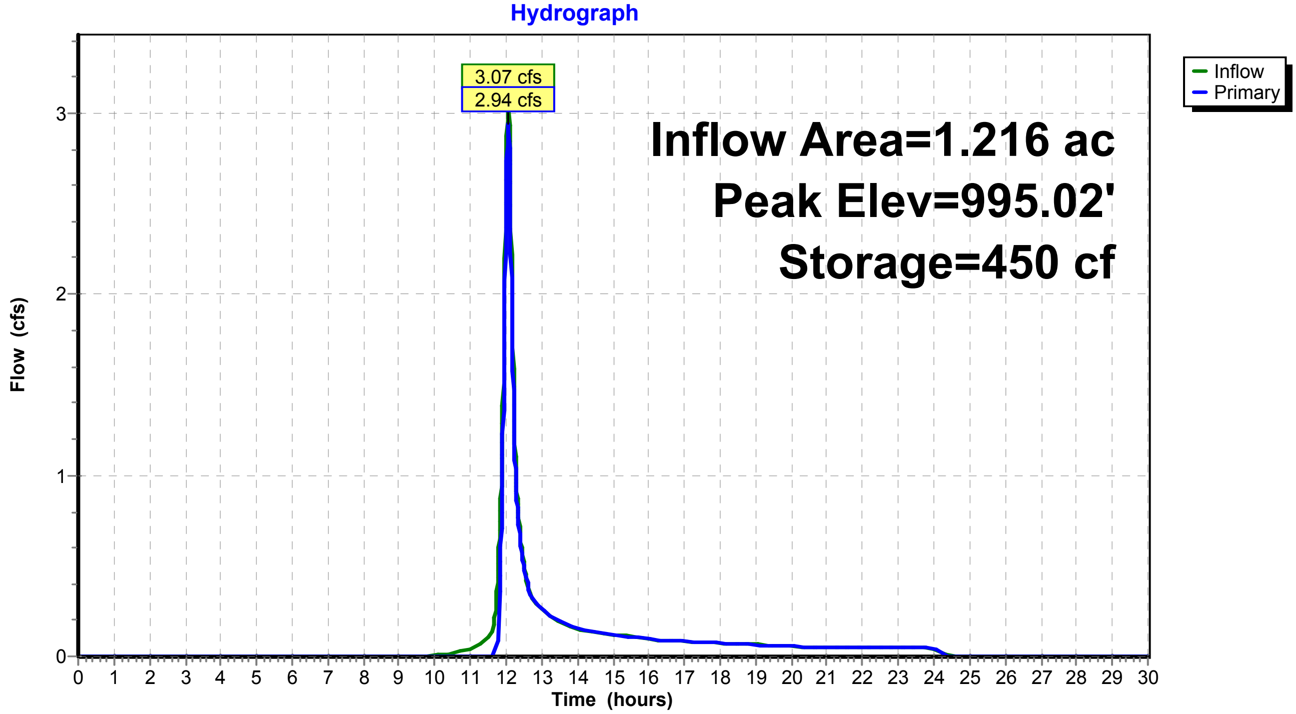
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=2.93 cfs @ 12.06 hrs HW=995.02' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 2.93 cfs @ 0.58 fps)

Pond 304P: MLV PAD

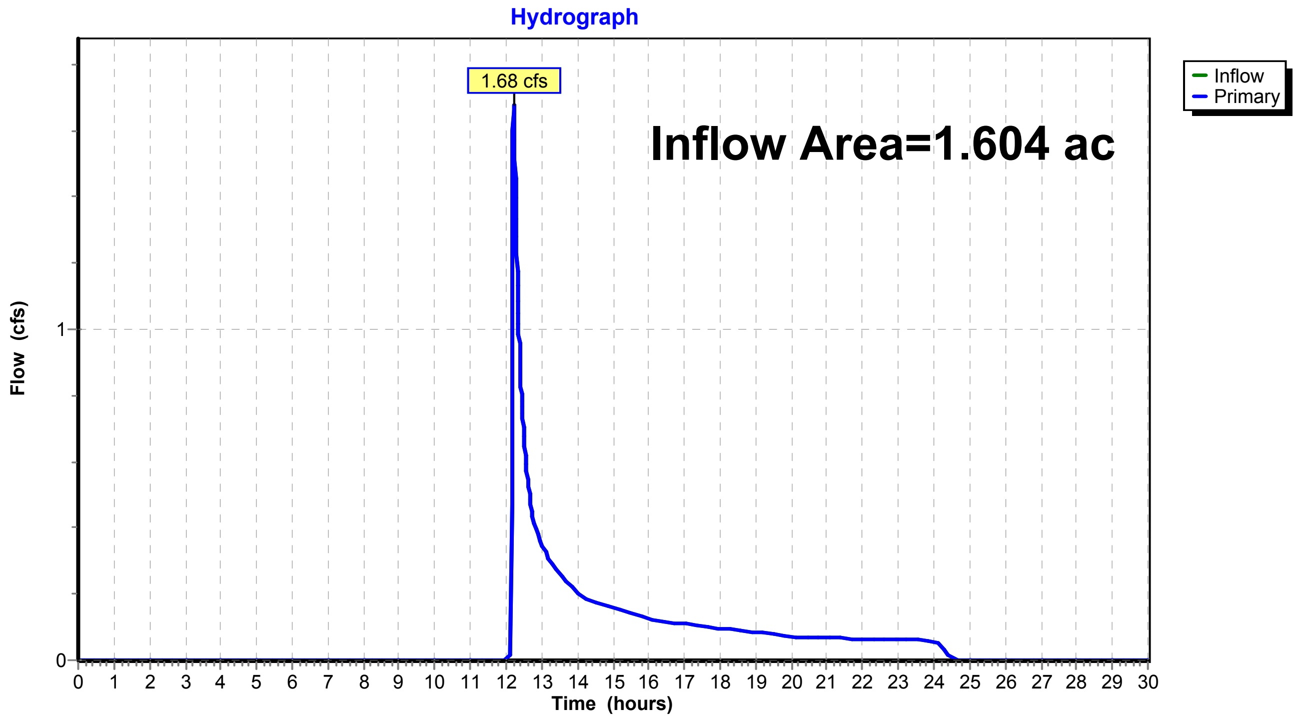


Summary for Link 300L: Proposed Conditions

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 1.16" for 10-Year event
Inflow = 1.68 cfs @ 12.21 hrs, Volume= 0.155 af
Primary = 1.68 cfs @ 12.21 hrs, Volume= 0.155 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=2.64"
Flow Length=381' Tc=13.4 min CN=73 Runoff=4.39 cfs 0.267 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=2.64"
Flow Length=211' Tc=9.2 min CN=73 Runoff=1.62 cfs 0.085 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.42' Storage=3,906 cf Inflow=5.87 cfs 0.342 af
Outflow=5.25 cfs 0.266 af

Pond 304P: MLV PAD Peak Elev=995.03' Storage=450 cf Inflow=4.39 cfs 0.267 af
Outflow=4.39 cfs 0.257 af

Link 300L: Proposed Conditions Inflow=5.25 cfs 0.266 af
Primary=5.25 cfs 0.266 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.353 af Average Runoff Depth = 2.64"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

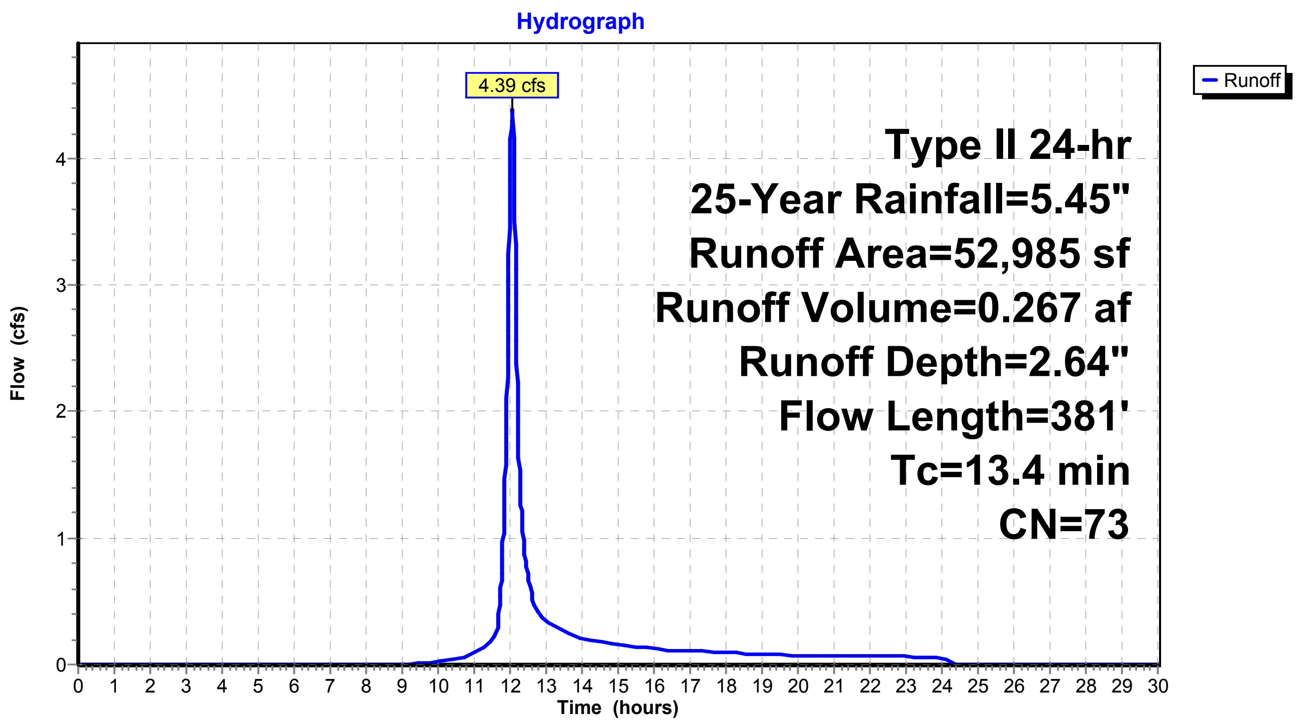
Runoff = 4.39 cfs @ 12.06 hrs, Volume= 0.267 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.45"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

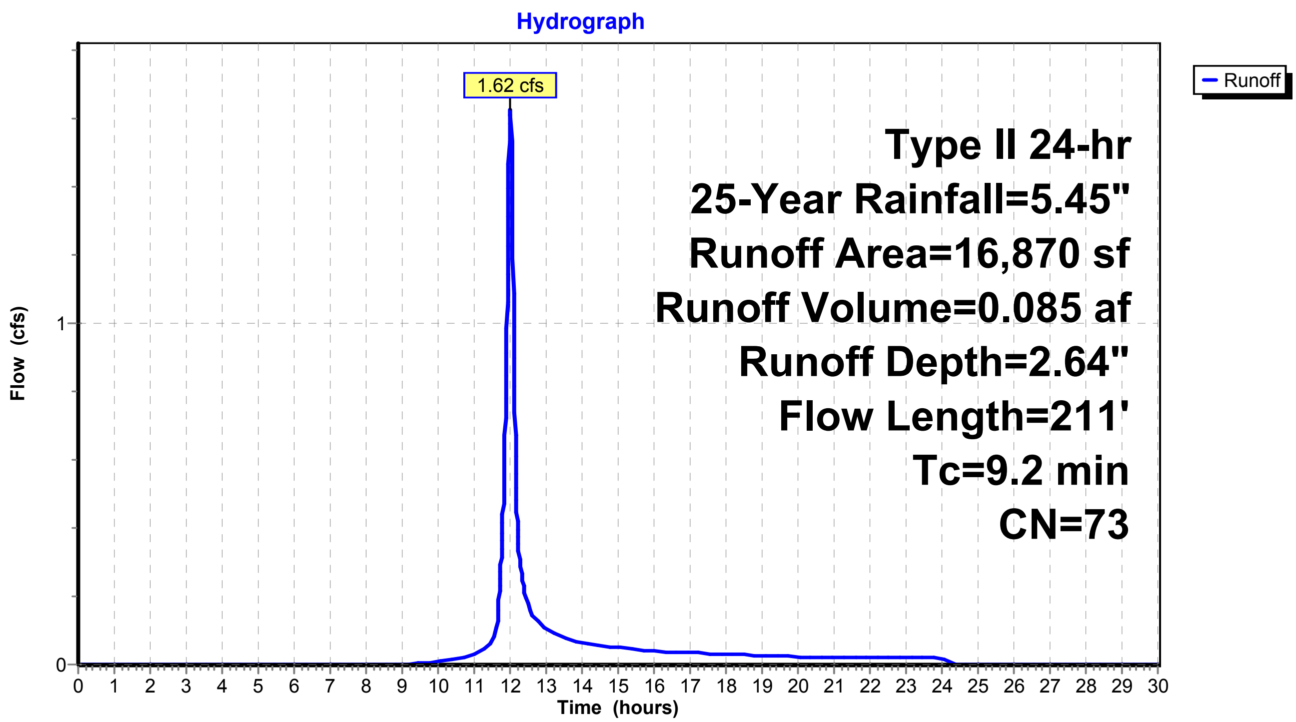
Runoff = 1.62 cfs @ 12.01 hrs, Volume= 0.085 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-Year Rainfall=5.45"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 2.56" for 25-Year event
Inflow = 5.87 cfs @ 12.04 hrs, Volume= 0.342 af
Outflow = 5.25 cfs @ 12.09 hrs, Volume= 0.266 af, Atten= 11%, Lag= 3.0 min
Primary = 5.25 cfs @ 12.09 hrs, Volume= 0.266 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.42' @ 12.09 hrs Surf.Area= 5,100 sf Storage= 3,906 cf

Plug-Flow detention time= 132.7 min calculated for 0.266 af (78% of inflow)
Center-of-Mass det. time= 42.5 min (886.8 - 844.4)

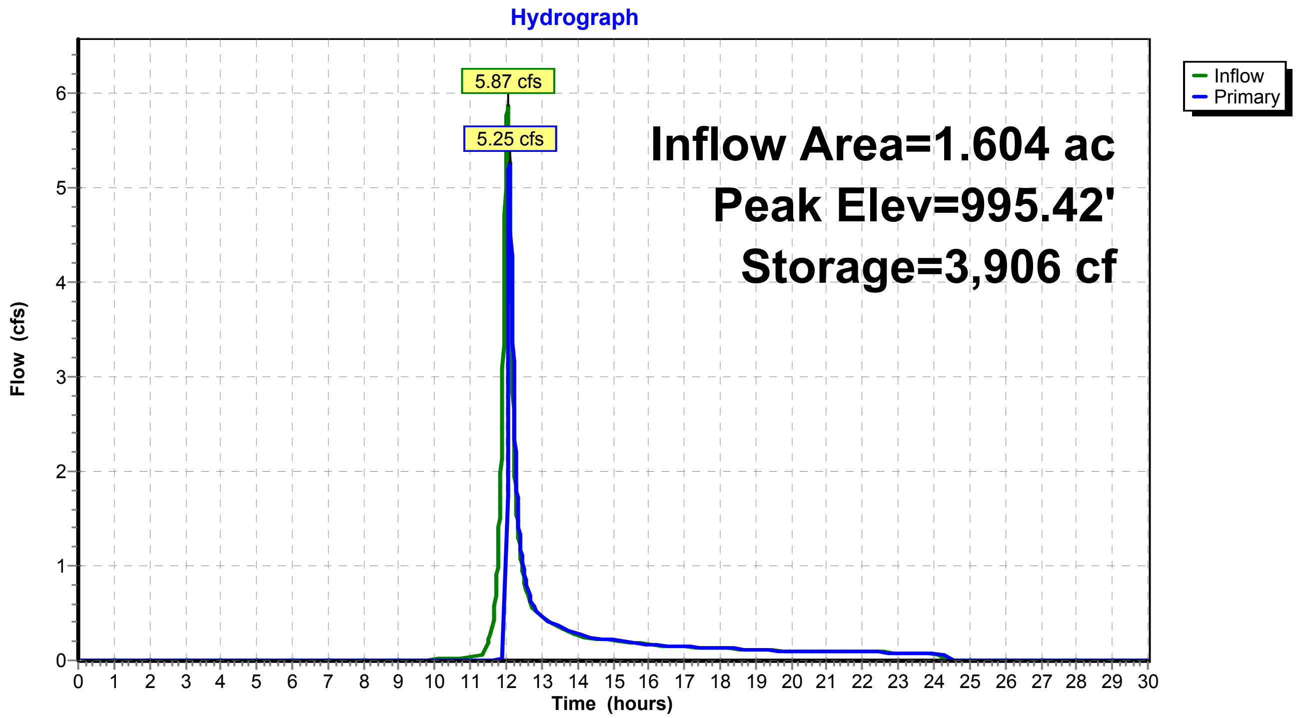
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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=5.24 cfs @ 12.09 hrs HW=995.42' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 5.24 cfs @ 0.85 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area =	1.216 ac,	8.83% Impervious, Inflow Depth = 2.64"	for 25-Year event	
Inflow =	4.39 cfs @	12.06 hrs, Volume=	0.267 af	
Outflow =	4.39 cfs @	12.06 hrs, Volume=	0.257 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.39 cfs @	12.06 hrs, Volume=	0.257 af	

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.03' @ 12.06 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 31.0 min calculated for 0.257 af (96% of inflow)
Center-of-Mass det. time= 7.9 min (847.3 - 839.4)

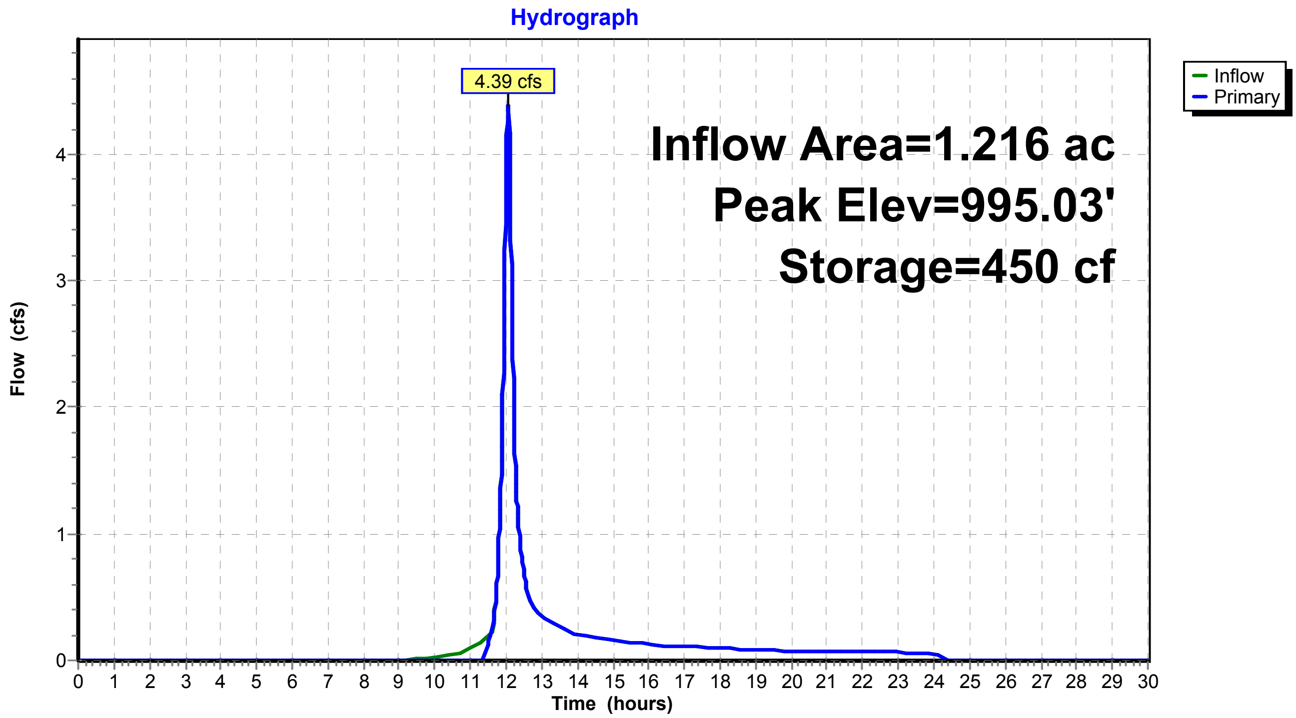
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=4.38 cfs @ 12.06 hrs HW=995.03' (Free Discharge)
↑**1=Broad-Crested Weir** (Weir Controls 4.38 cfs @ 0.66 fps)

Pond 304P: MLV PAD

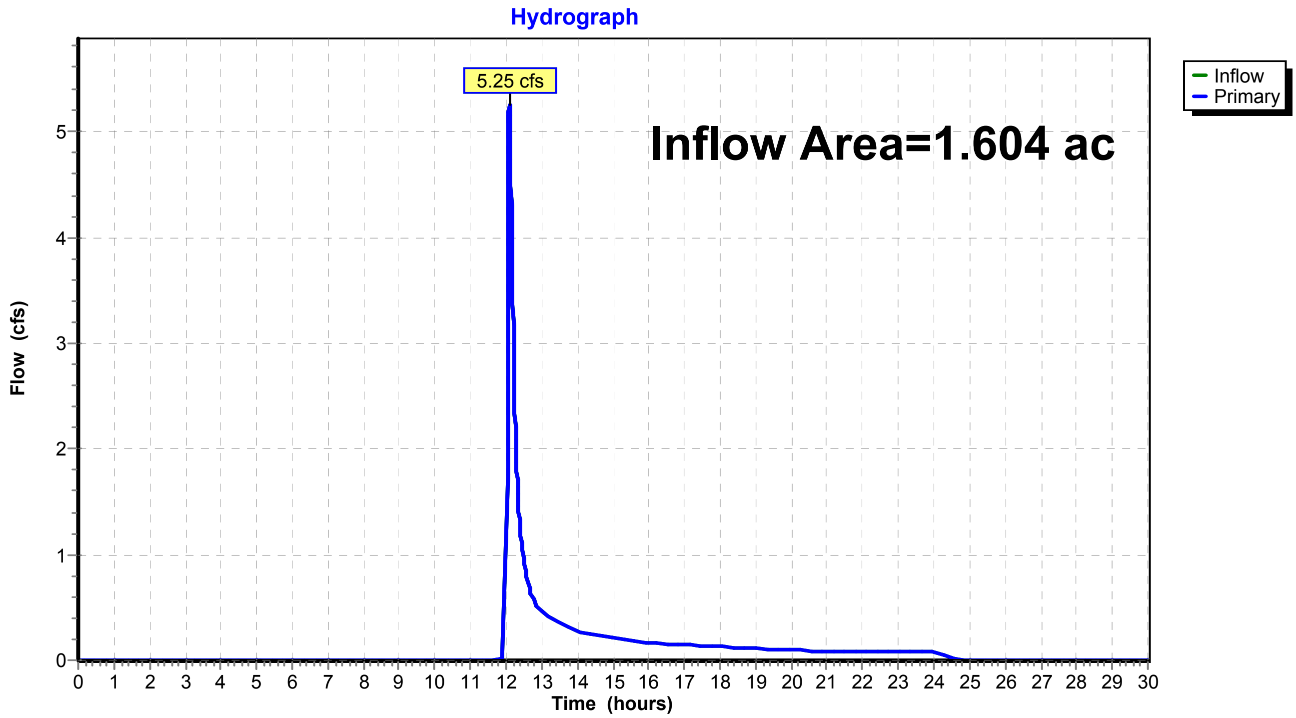


Summary for Link 300L: Proposed Conditions

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 1.99" for 25-Year event
Inflow = 5.25 cfs @ 12.09 hrs, Volume= 0.266 af
Primary = 5.25 cfs @ 12.09 hrs, Volume= 0.266 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=3.41"
Flow Length=381' Tc=13.4 min CN=73 Runoff=5.67 cfs 0.345 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=3.41"
Flow Length=211' Tc=9.2 min CN=73 Runoff=2.09 cfs 0.110 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.45' Storage=4,069 cf Inflow=7.58 cfs 0.445 af
Outflow=7.40 cfs 0.369 af

Pond 304P: MLV PAD Peak Elev=995.05' Storage=450 cf Inflow=5.67 cfs 0.345 af
Outflow=5.67 cfs 0.335 af

Link 300L: Proposed Conditions Inflow=7.40 cfs 0.369 af
Primary=7.40 cfs 0.369 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.455 af Average Runoff Depth = 3.41"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

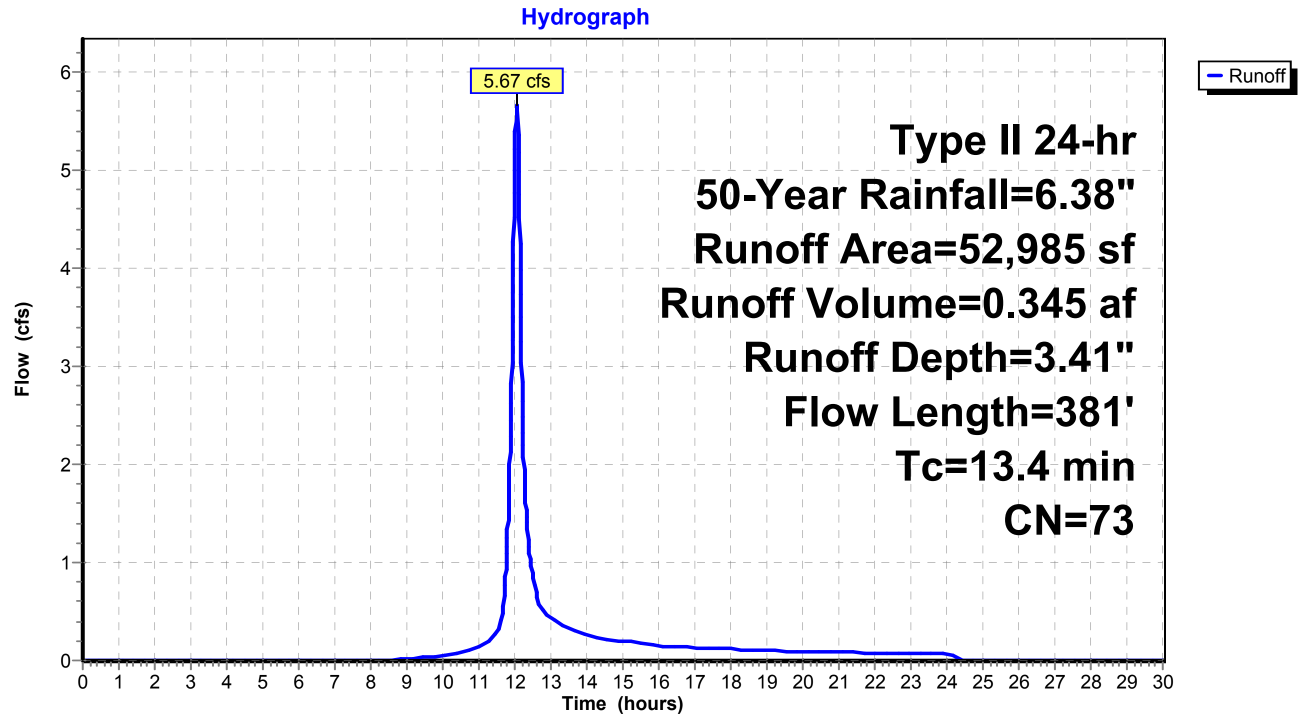
Runoff = 5.67 cfs @ 12.05 hrs, Volume= 0.345 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.38"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

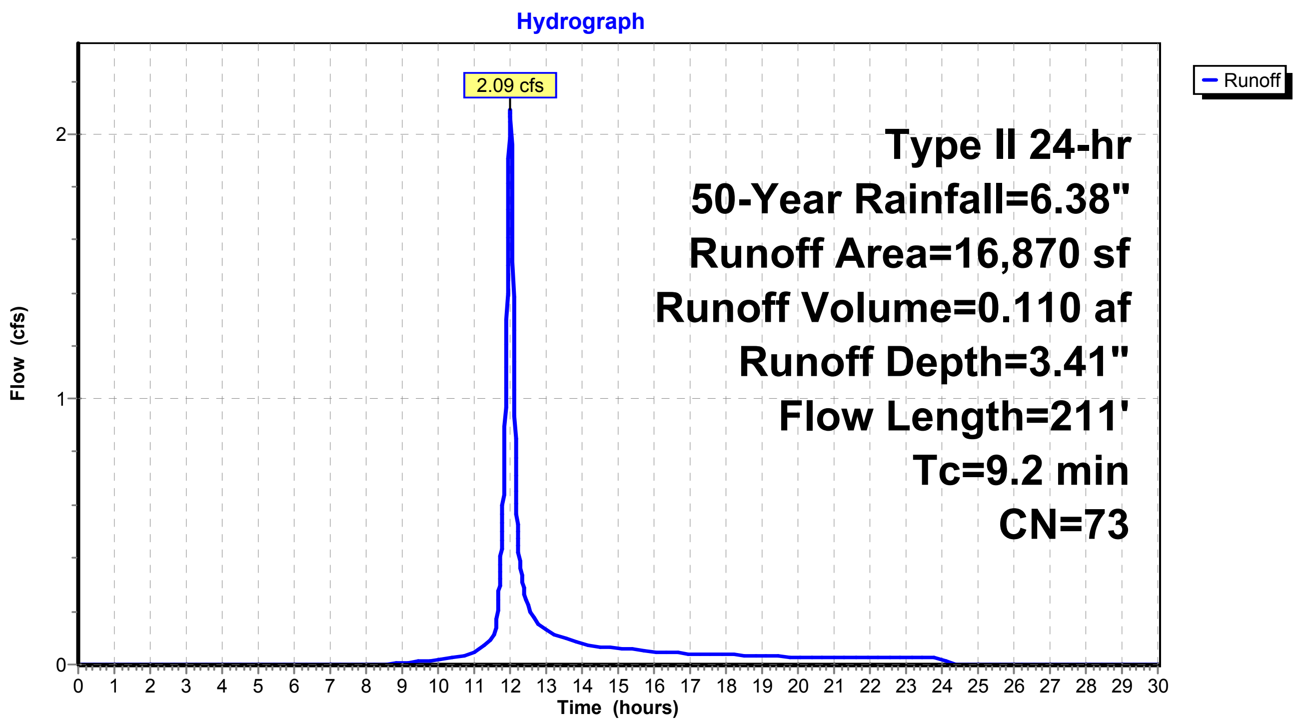
Runoff = 2.09 cfs @ 12.01 hrs, Volume= 0.110 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Year Rainfall=6.38"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 3.33" for 50-Year event
Inflow = 7.58 cfs @ 12.04 hrs, Volume= 0.445 af
Outflow = 7.40 cfs @ 12.06 hrs, Volume= 0.369 af, Atten= 2%, Lag= 1.4 min
Primary = 7.40 cfs @ 12.06 hrs, Volume= 0.369 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.45' @ 12.06 hrs Surf.Area= 5,212 sf Storage= 4,069 cf

Plug-Flow detention time= 107.1 min calculated for 0.369 af (83% of inflow)
Center-of-Mass det. time= 31.7 min (867.9 - 836.2)

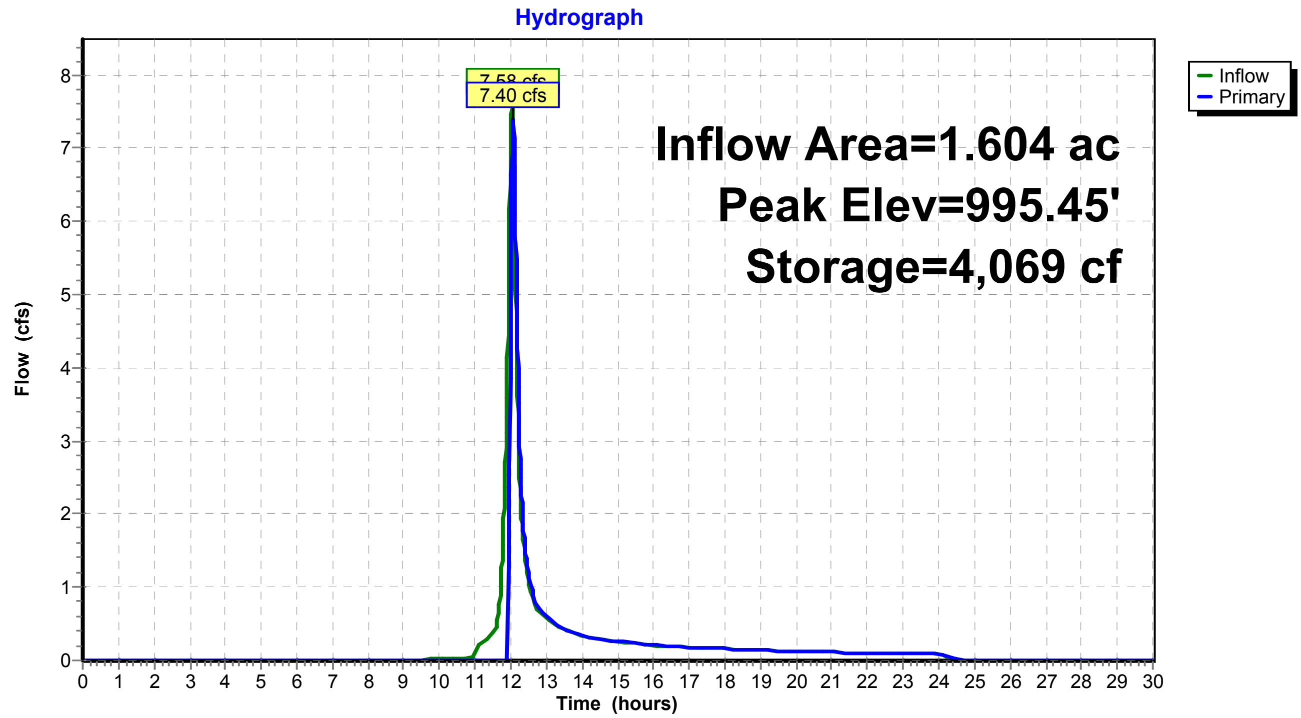
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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=7.39 cfs @ 12.06 hrs HW=995.45' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 7.39 cfs @ 0.96 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 3.41" for 50-Year event
Inflow = 5.67 cfs @ 12.05 hrs, Volume= 0.345 af
Outflow = 5.67 cfs @ 12.05 hrs, Volume= 0.335 af, Atten= 0%, Lag= 0.0 min
Primary = 5.67 cfs @ 12.05 hrs, Volume= 0.335 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.05' @ 12.05 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 24.4 min calculated for 0.335 af (97% of inflow)
Center-of-Mass det. time= 6.8 min (838.9 - 832.1)

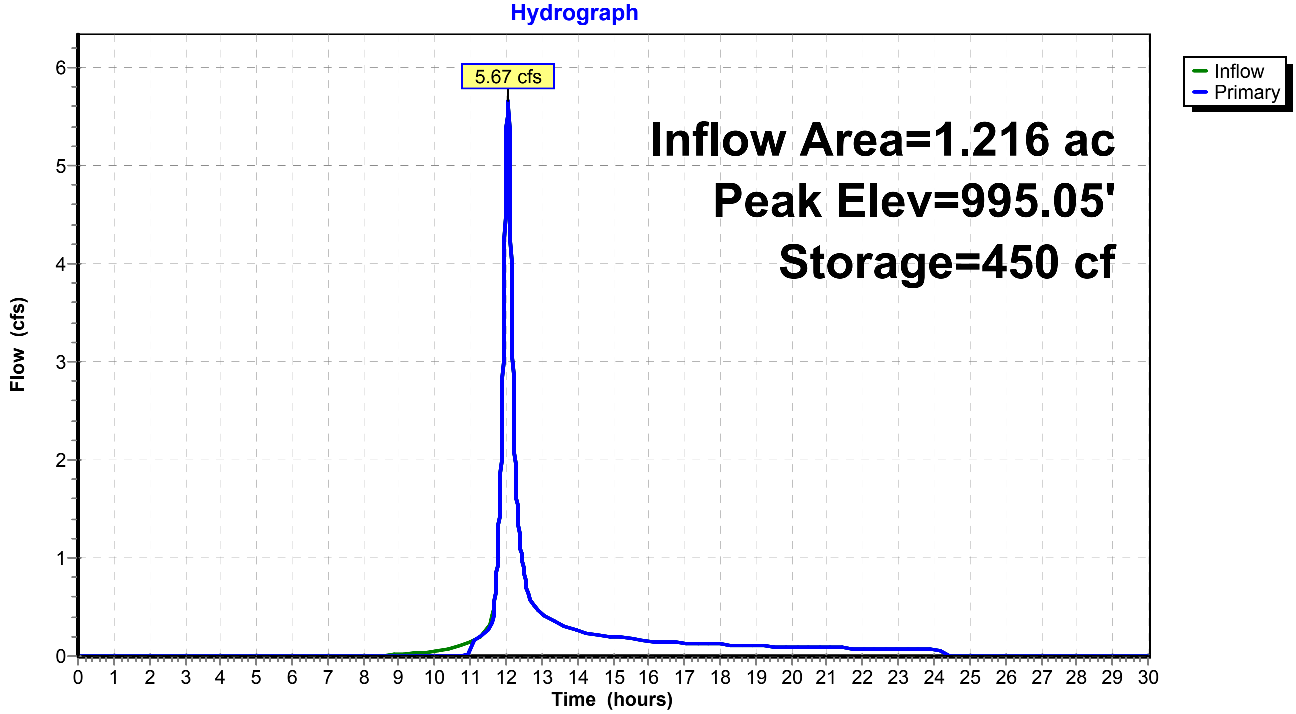
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=5.65 cfs @ 12.05 hrs HW=995.05' (Free Discharge)
1=Broad-Crested Weir (Weir Controls 5.65 cfs @ 0.72 fps)

Pond 304P: MLV PAD

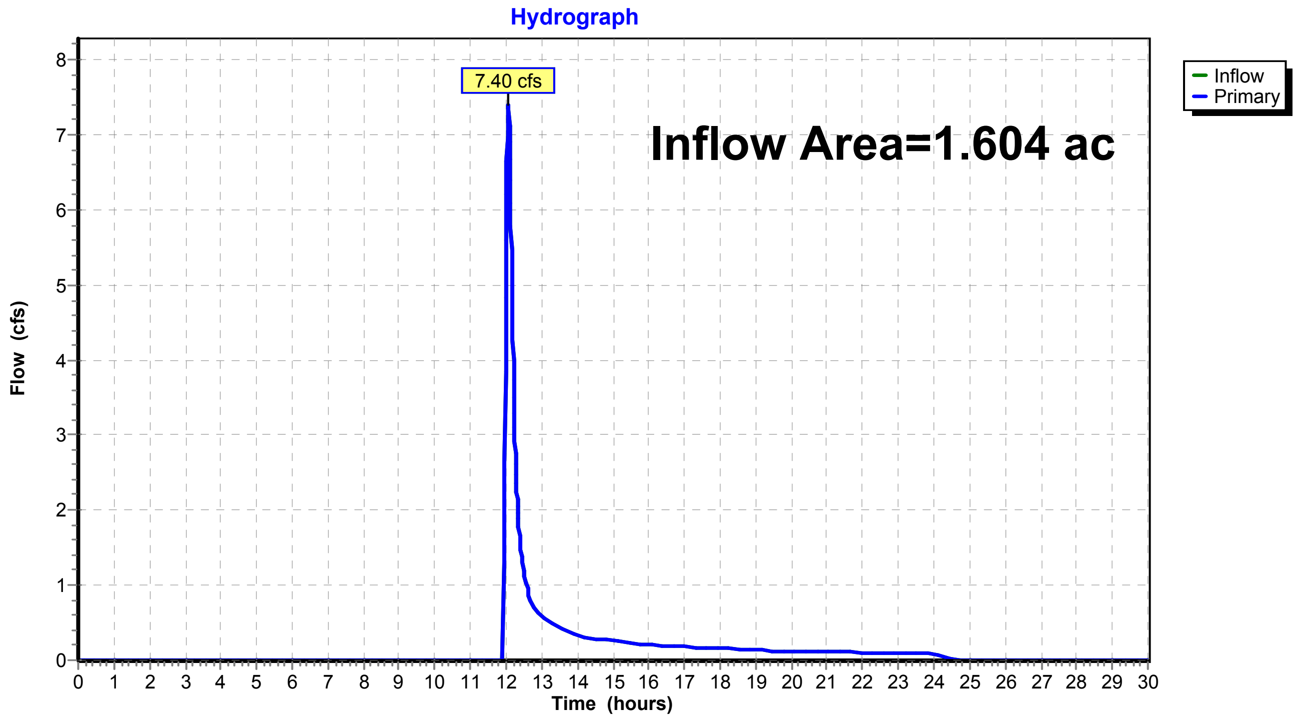


Summary for Link 300L: Proposed Conditions

Inflow Area =	1.604 ac,	6.70% Impervious, Inflow Depth = 2.76"	for 50-Year event	
Inflow =	7.40 cfs @	12.06 hrs, Volume=	0.369 af	
Primary =	7.40 cfs @	12.06 hrs, Volume=	0.369 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Link 300L: Proposed Conditions



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100S: DA TO MLV PAD Runoff Area=52,985 sf 8.83% Impervious Runoff Depth=4.34"
Flow Length=381' Tc=13.4 min CN=73 Runoff=7.20 cfs 0.440 af

Subcatchment200S: DA TO INFILTRATION Runoff Area=16,870 sf 0.00% Impervious Runoff Depth=4.34"
Flow Length=211' Tc=9.2 min CN=73 Runoff=2.65 cfs 0.140 af

Pond 302P: INFILTRATIONBERM Peak Elev=995.48' Storage=4,216 cf Inflow=9.64 cfs 0.570 af
Outflow=9.48 cfs 0.494 af

Pond 304P: MLV PAD Peak Elev=995.06' Storage=450 cf Inflow=7.20 cfs 0.440 af
Outflow=7.20 cfs 0.430 af

Link 300L: Proposed Conditions Inflow=9.48 cfs 0.494 af
Primary=9.48 cfs 0.494 af

Total Runoff Area = 1.604 ac Runoff Volume = 0.580 af Average Runoff Depth = 4.34"
93.30% Pervious = 1.496 ac 6.70% Impervious = 0.107 ac

Summary for Subcatchment 100S: DA TO MLV PAD

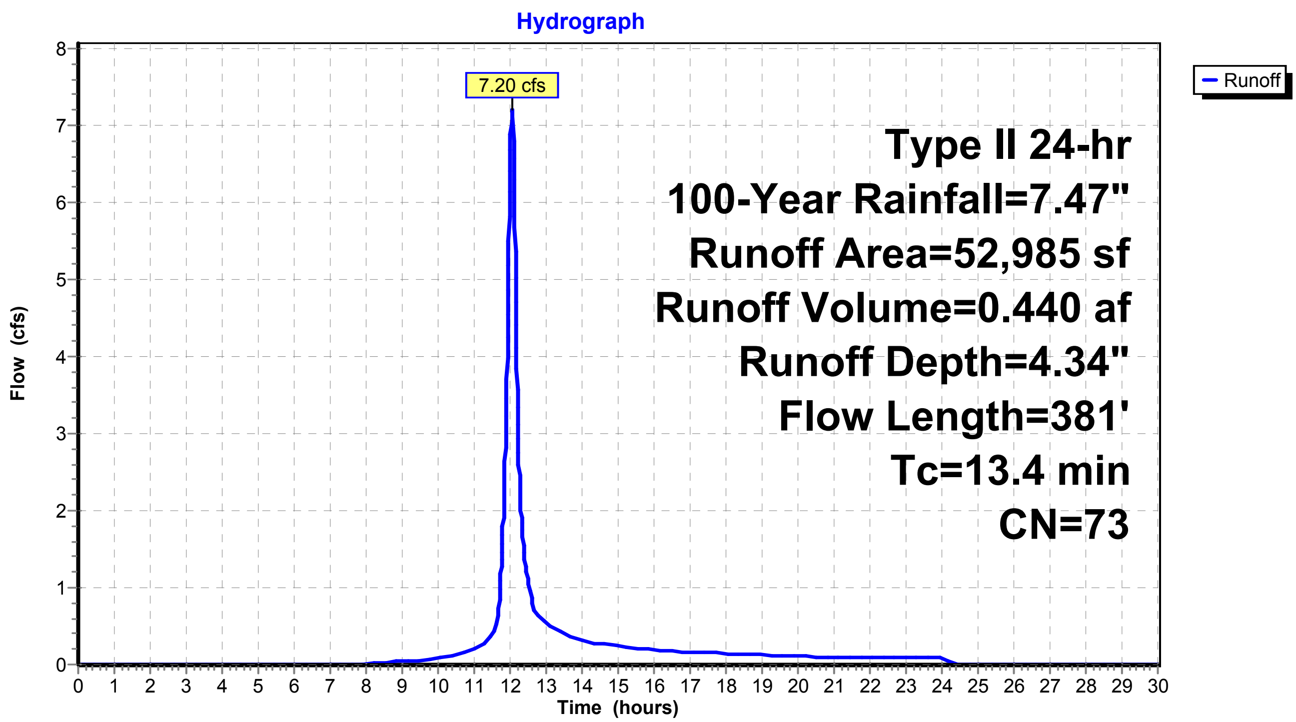
Runoff = 7.20 cfs @ 12.05 hrs, Volume= 0.440 af, Depth= 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=7.47"

	Area (sf)	CN	Description
*	4,680	98	Crushed Stone Pad, HSG C
	240	89	Gravel roads, HSG C
	48,065	71	Meadow, non-grazed, HSG C
	52,985	73	Weighted Average
	48,305		91.17% Pervious Area
	4,680		8.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
2.9	229	0.0350	1.31		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.4	52	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
13.4	381	Total			

Subcatchment 100S: DA TO MLV PAD



Summary for Subcatchment 200S: DA TO INFILTRATION BERM

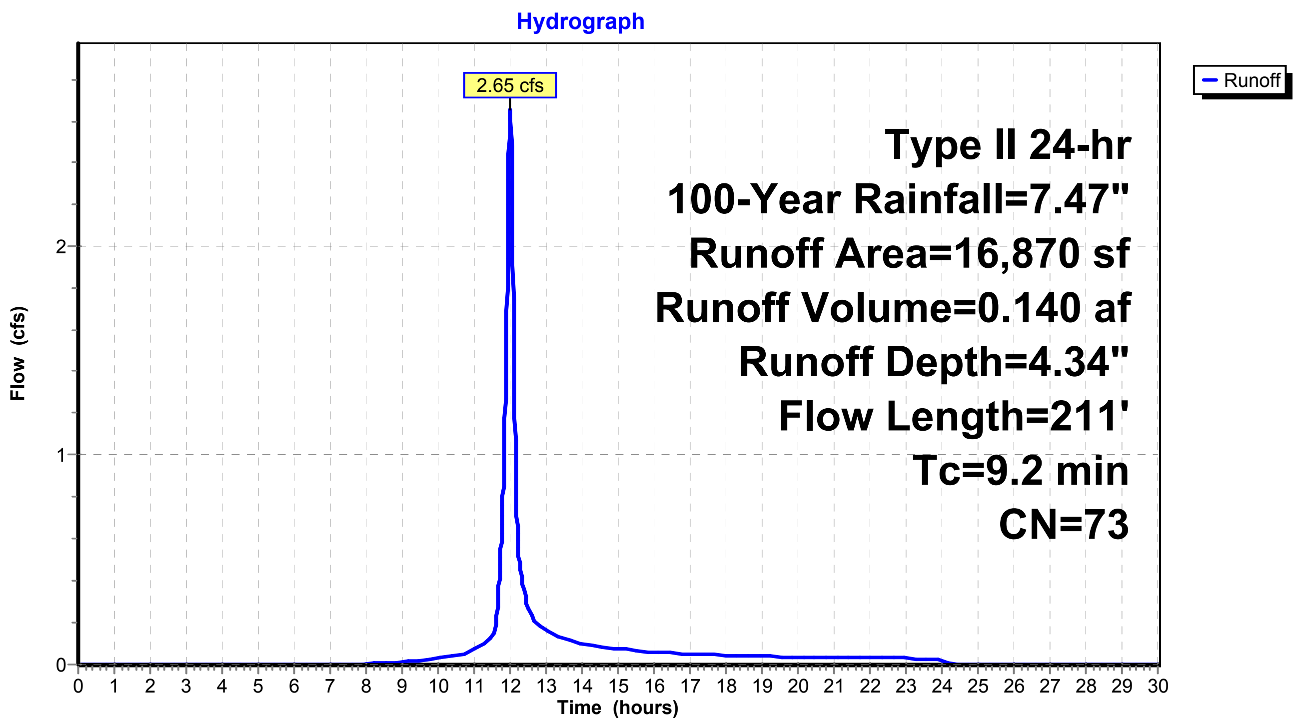
Runoff = 2.65 cfs @ 12.01 hrs, Volume= 0.140 af, Depth= 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Year Rainfall=7.47"

	Area (sf)	CN	Description
	1,860	89	Gravel roads, HSG C
*	15,010	71	Meadow, non-grazed, HSG C
	16,870	73	Weighted Average
	16,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0850	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.07"
0.2	19	0.0850	2.04		**Shallow Concentrated Flow, SC1** Short Grass Pasture Kv= 7.0 fps
0.2	33	0.0200	2.28		**Shallow Concentrated Flow, SC2** Unpaved Kv= 16.1 fps
0.6	59	0.0650	1.78		**Shallow Concentrated Flow, SC3** Short Grass Pasture Kv= 7.0 fps
9.2	211	Total			

Subcatchment 200S: DA TO INFILTRATION BERM



Summary for Pond 302P: INFILTRATION BERM

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 4.27" for 100-Year event
Inflow = 9.64 cfs @ 12.04 hrs, Volume= 0.570 af
Outflow = 9.48 cfs @ 12.06 hrs, Volume= 0.494 af, Atten= 2%, Lag= 1.1 min
Primary = 9.48 cfs @ 12.06 hrs, Volume= 0.494 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.48' @ 12.06 hrs Surf.Area= 5,311 sf Storage= 4,216 cf

Plug-Flow detention time= 88.5 min calculated for 0.494 af (87% of inflow)
Center-of-Mass det. time= 25.5 min (854.2 - 828.8)

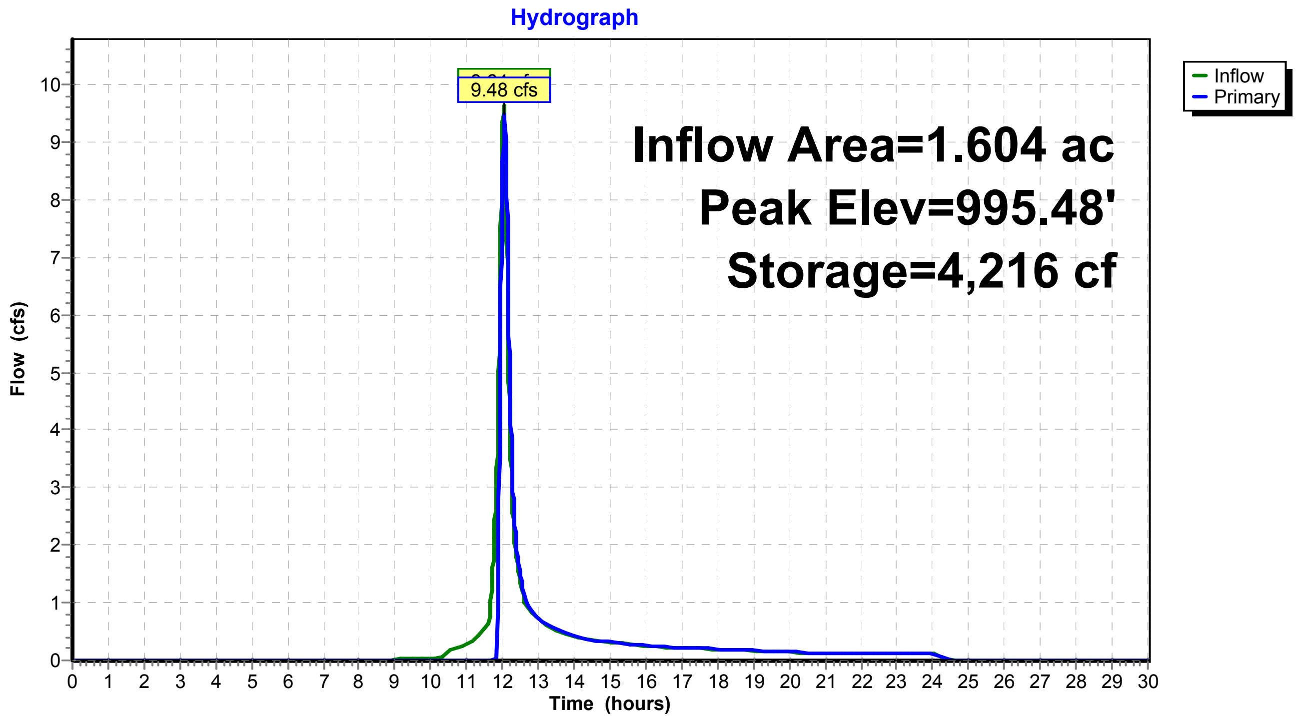
Volume	Invert	Avail.Storage	Storage Description
#1	993.75'	4,311 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
993.75	0	0.0	0	0	0
994.00	455	225.5	38	38	4,047
994.50	2,009	324.3	570	608	8,371
995.00	3,803	364.6	1,429	2,037	10,587
995.30	4,676	385.8	1,270	3,307	11,858
995.50	5,376	394.8	1,004	4,311	12,423

Device	Routing	Invert	Outlet Devices
#1	Primary	995.30'	**50.0' long x 3.0' breadth Broad-Crested 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=9.47 cfs @ 12.06 hrs HW=995.48' (Free Discharge)
└─**1=Broad-Crested Weir** (Weir Controls 9.47 cfs @ 1.04 fps)

Pond 302P: INFILTRATION BERM



Summary for Pond 304P: MLV PAD

Inflow Area = 1.216 ac, 8.83% Impervious, Inflow Depth = 4.34" for 100-Year event
Inflow = 7.20 cfs @ 12.05 hrs, Volume= 0.440 af
Outflow = 7.20 cfs @ 12.05 hrs, Volume= 0.430 af, Atten= 0%, Lag= 0.0 min
Primary = 7.20 cfs @ 12.05 hrs, Volume= 0.430 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 995.06' @ 12.05 hrs Surf.Area= 0 sf Storage= 450 cf

Plug-Flow detention time= 19.9 min calculated for 0.430 af (98% of inflow)
Center-of-Mass det. time= 6.1 min (831.2 - 825.1)

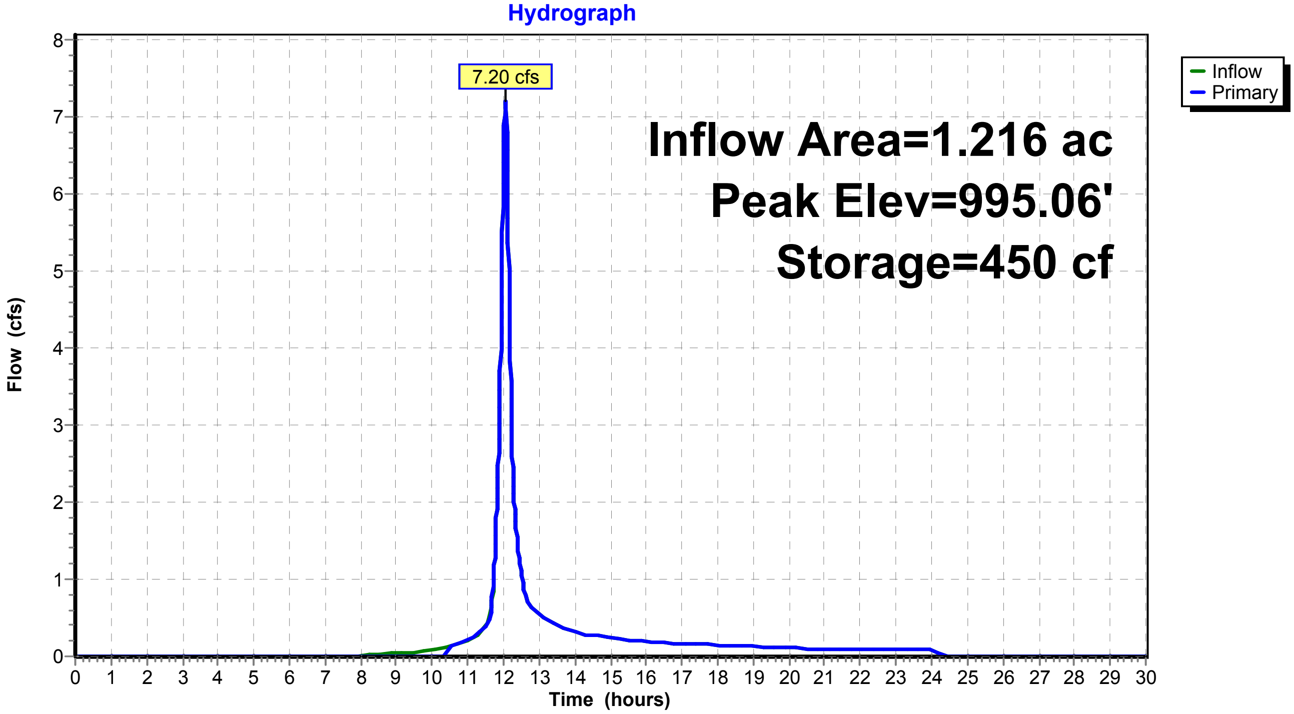
Volume	Invert	Avail.Storage	Storage Description
#1	993.96'	450 cf	**MLV Pad Storage** Listed below 1,126 cf Overall x 40.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
993.96	0
994.46	563
994.96	1,125
995.00	1,126

Device	Routing	Invert	Outlet Devices
#1	Primary	994.96'	**90.0' long x 3.0' breadth Broad-Crested 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=7.20 cfs @ 12.05 hrs HW=995.06' (Free Discharge)
1=Broad-Crested Weir (Weir Controls 7.20 cfs @ 0.78 fps)

Pond 304P: MLV PAD

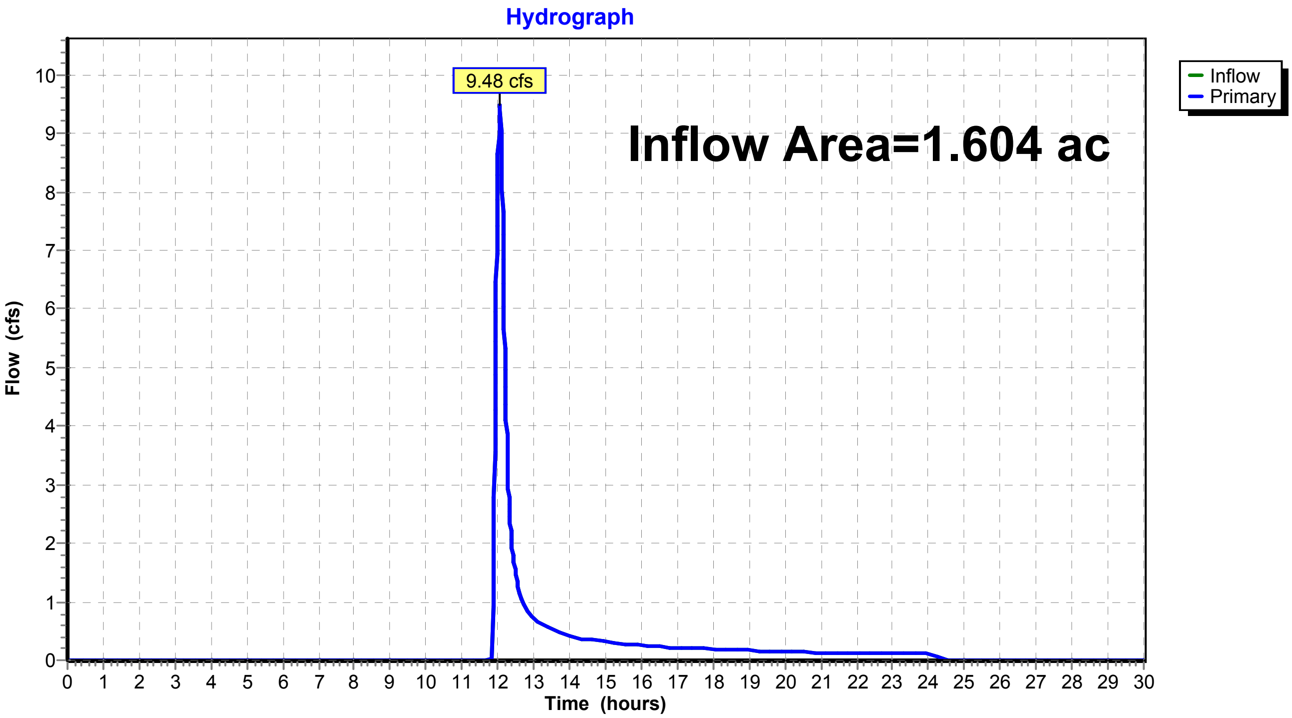


Summary for Link 300L: Proposed Conditions

Inflow Area = 1.604 ac, 6.70% Impervious, Inflow Depth = 3.70" for 100-Year event
Inflow = 9.48 cfs @ 12.06 hrs, Volume= 0.494 af
Primary = 9.48 cfs @ 12.06 hrs, Volume= 0.494 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

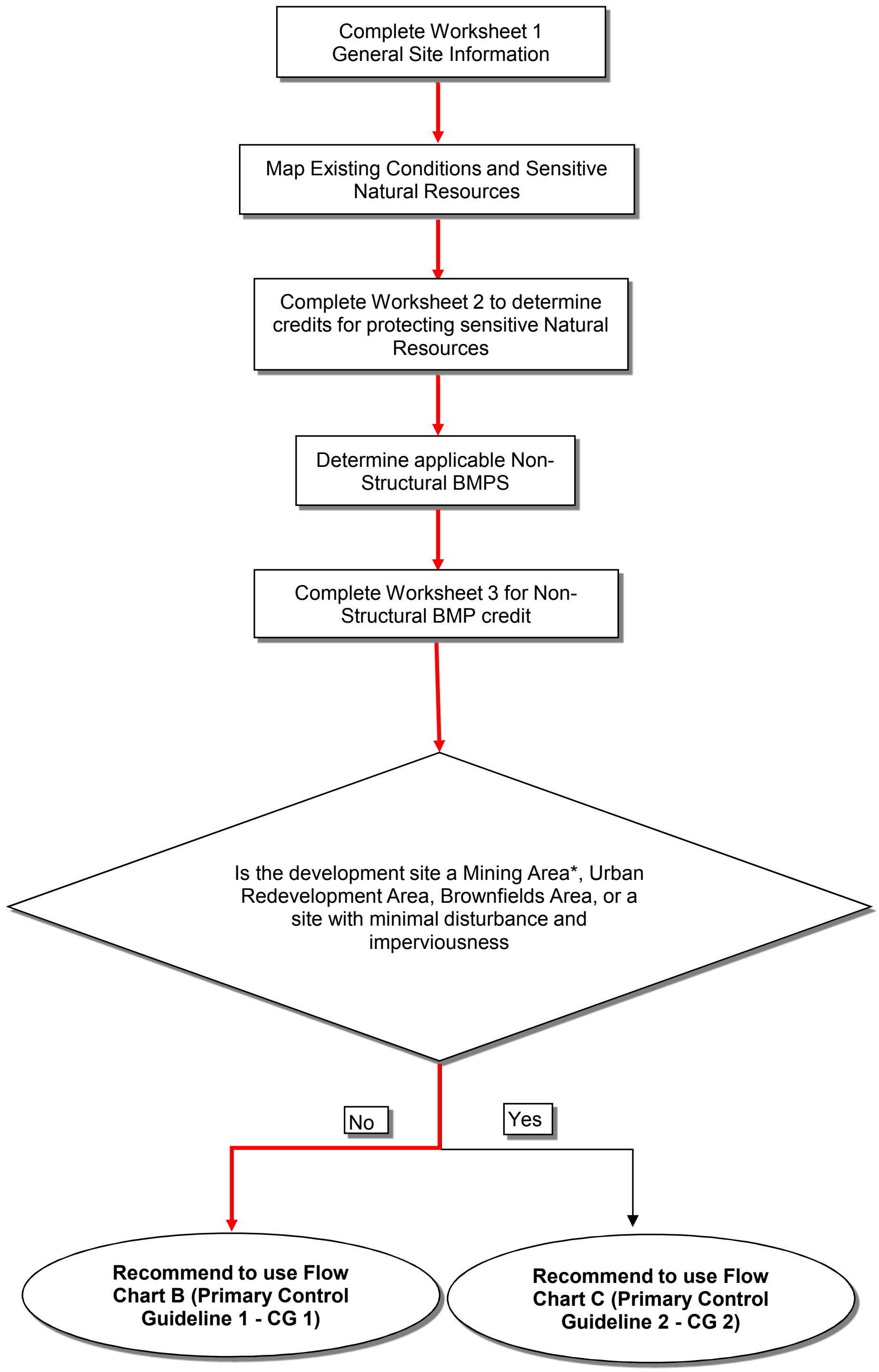
Link 300L: Proposed Conditions



V.5 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

FLOW CHART A
Stormwater Calculation Process



Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date:	20-Oct-16
Project Name:	Atlantic Sunrise Pipeline AR-SC-073.5
Municipality:	Eldred Township
County:	Schuylkill
Total Area (acres):	1.01
Major River Basin:	Susquehanna

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

Watershed:	Mahantango - Wiconisco Creeks
Sub-Basin:	Lower Central Susquehanna
Nearest Surface Water(s) to Receive Runoff:	UNT to Little Mahantango Creek
Chapter 93 - Designated Water Use:	CWF, MF

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

Impaired according to Chapter 303(d) List? Yes [X] No [ ]

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

List Causes of Impairment: Agriculture (Siltation); Source Unknown (Pathogens)

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes [ ] No [X]

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

Existing or planned drinking water supply? Yes [ ] No [X]

If yes, distance from proposed discharge (miles): ____________

Approved Act 167 Plan? Yes [ ] No [X]

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

Existing River Conservation Plan? Yes [X] No [ ]

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

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.

*Note: Sensitive areas are shown on the Soil Erosion Control Plans.

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		
Floodplains	N/A		
Riparian Areas	N/A		
Wetlands	N/A		
Woodlands	N/A		
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
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	**-**	**Ac.**
TOTAL	**-**	**Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
1.01	-	0	=	1.01

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		ft^2	x 1"	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 1/3"	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**

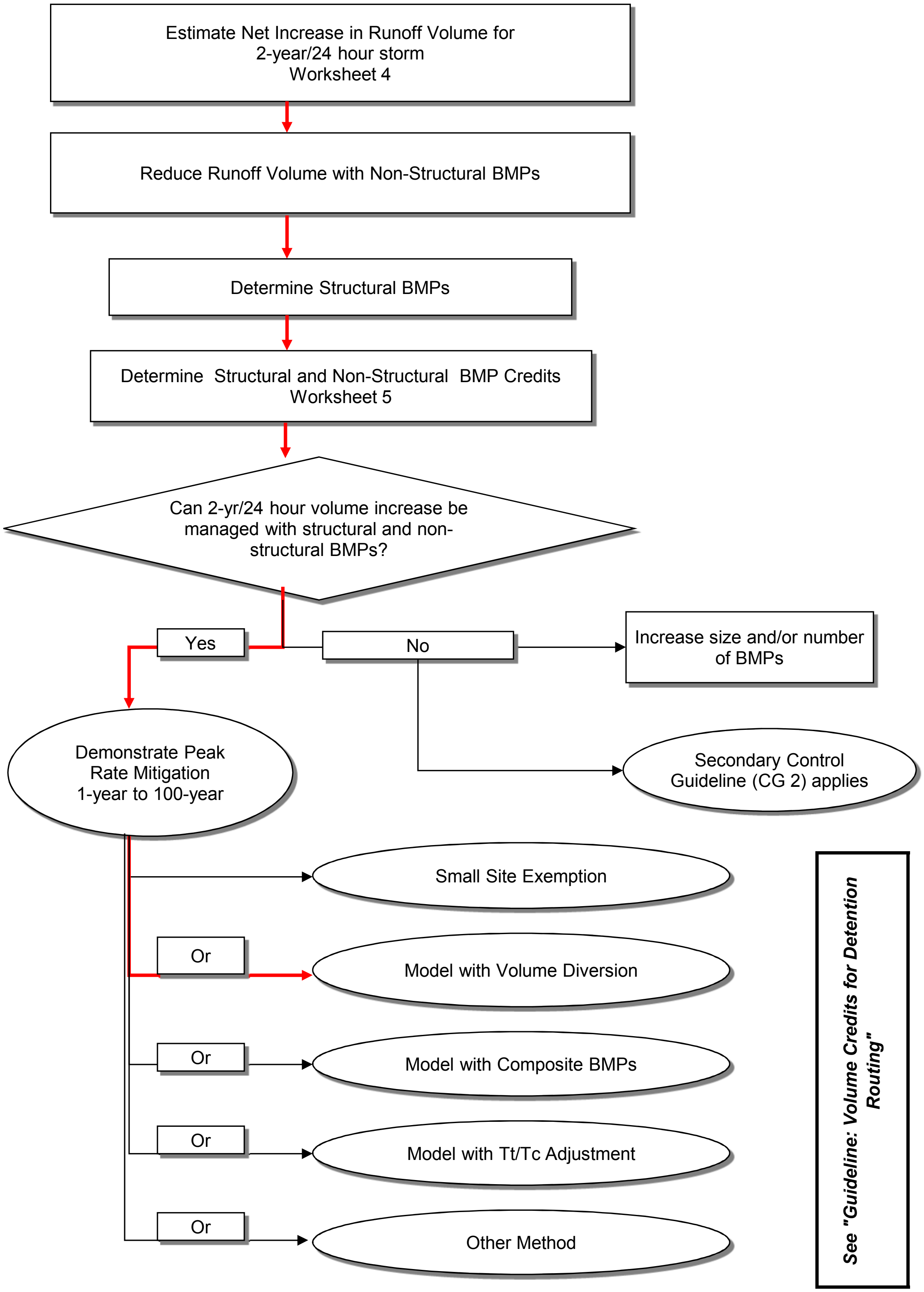
For all other disconnected non-roof areas

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-SC-073.5**

2-Year Rainfall: 3.07 **in**

Total Site Area: 1.01 **acres**
Protected Site Area: 0 **acres**
Managed Area 1.01 **acres**

Existing Conditions:

Cover Type	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Impervious[3]	C	0	0.000	98	0.20	0.04	2.84	-
"Meadow"[3]	C	0	0.000	71	4.08	0.82	0.80	-
Gravel Rd	C	0	0.000	89	1.24	0.25	1.96	-
Meadow	C	66,722	1.532	71	4.08	0.82	0.80	4,454
Woods	C	0	0.000	70	4.29	0.86	0.75	-
TOTAL:		66,722	1.532					4,454

Developed Conditions:

Cover Type	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Gravel Rd	C	3,190	0.073	89	1.24	0.25	1.96	522
Stone Pad	C	4,680	0.107	98	0.20	0.04	2.84	1,107
Impervious	C	0	0.000	98	0.20	0.04	2.84	-
Woods	C	0	0.000	70	4.29	0.86	0.75	-
Meadow	C	58,852	1.351	71	4.08	0.82	0.80	3,928
TOTAL:		66,722	1.532					5,557

2-Year Volume Increase (ft^3)	**1,103**

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.

3. Twenty (20) percent of existing impervious area, when present, shall be considered meadow (good condition) in the model for existing conditions for redevelopment per Volume Control Guideline 1.
(For Existing Condition: Impervious Area + "Meadow" = Total Impervious Area)

WORKSHEET 5. STRUCTURAL BMP VOLUME CREDITS

PROJECT: Atlantic Sunrise Pipeline AR-SC-073.5
SUB-BASIN: Lower Central Susquehanna

Required Control Volume (ft^3) - *from Worksheet 4*:		1,103
Non-structural Volume Credit (ft^3) - *from Worksheet 3*:	**-**	0
Structural Volume Reqmt (ft^3)		1,103
(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		4,311
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other	Storage in 12" stone MLV Pad		450

Total Structural Volume (ft^3):	4,761
Structural Volume Requirement (ft^3):	1,103
DIFFERENCE	3,658

MLV Pad Infiltration Calculations Summary		
Average Measured Infiltration Rate for MLV Pad	***3.94***	***in/hr***
Factor of Safety	***2.00***	
Design Infiltration Rate	***1.97***	***in/hr***
Dewatering Time for top 6 inches of MLV Pad	***3.05***	***hours***
Depth of AASHTO #57 Section of MLV Pad	***6***	***inches***
Dewatering Time for AASHTO #57 Section of MLV Pad	***3.05***	***hours***
Total Dewatering Time for MLV Pad	***6.09***	***hours***

A factor of safety of 2 is the minimal safety factor for design purposes per pager 19 of 21 of "Protocol 1, Site Evaluation and Soil Infiltration Testing, included as Appendix C of the Pennsylvania Stormwater BMP Manual.

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

<u>PRIMARY BMPs FOR NITRATE:</u>

	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

<u>SECONDARY BMPs FOR NITRATE:</u>

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention		
Structural BMP 6.4.8 - Vegetated Swale		
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration		

V.6 Infiltration Information

a. Field Observation Report

Field Observation Report

Project Number: 14C4909 - A

Project Name: Atlantic Sunrise Project – **AR-SC-073.5**

Date of Field Visit: October 20, 2015

Weather Conditions: Sunny Temperature: Approx. 40-55°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

Five 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 Meckesville loam, 3-8% slopes, and Leck kill channery silt loam, 3-8% slopes.

Test Pit #1, located at N40° 42' 25.69", W76° 29' 54.34", was observed to have two horizons, with bedrock observed at 11 inches.

Test Pit #2, located at N40° 42' 24.94", W76° 29' 54.03", was observed to have four horizons, with a restrictive soil horizon due to bedrock components observed at 24 inches, and bedrock at 35 inches.

Test Pit #3, located at N40° 42' 24.76", W76° 29' 53.58", was observed to have three horizons, with a restrictive soil horizon due to bedrock components observed at 17 inches.

Test Pit #4, located at N40° 42' 24.29", W76° 29' 53.58", was observed to have three horizons, with a restrictive soil horizon due to bedrock components observed at 14 inches.

Field Observation Report

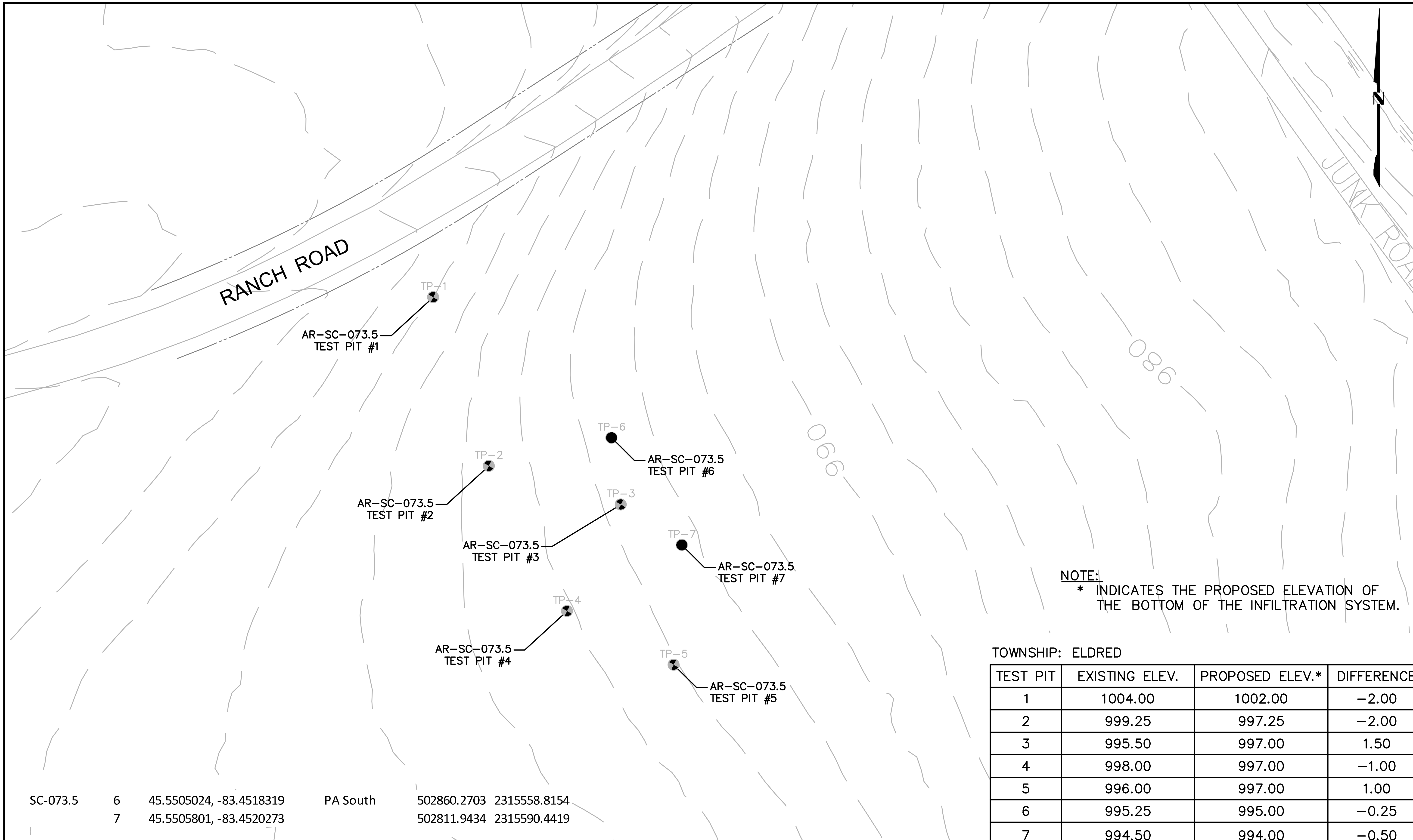
Test Pit #5 located at N40° 42’ 24.04”, W76° 29’ 52.96”, was observed to have four horizons, with a restrictive soil horizon due to bedrock components observed at 15 inches and bedrock observed at 37 inches.

Additionally, infiltration tests using the double ring infiltrometer method were conducted at each pit location, at the 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.

The infiltration rate at Test Pit #1 was observed to be 5.907 inches per hour.
The infiltration rate at Test Pit #2 was observed to be 7.221 inches per hour.
The infiltration rate at Test Pit #3 was observed to be 2.251 inches per hour.
The infiltration rate at Test Pit #4 was observed to be 1.500 inches per hour.
The infiltration rate at Test Pit #5 was observed to be 8.064 inches per hour.

The soil profile descriptions, infiltration worksheet, photographs, infiltration testing location map, and USDA-NRCS Soil Survey information are attached.



NOTE:
* INDICATES THE PROPOSED ELEVATION OF THE BOTTOM OF THE INFILTRATION SYSTEM.

TOWNSHIP: ELDRED

TEST PIT	EXISTING ELEV.	PROPOSED ELEV.*	DIFFERENCE
1	1004.00	1002.00	−2.00
2	999.25	997.25	−2.00
3	995.50	997.00	1.50
4	998.00	997.00	−1.00
5	996.00	997.00	1.00
6	995.25	995.00	−0.25
7	994.50	994.00	−0.50

SC-073.5	6	45.5505024, -83.4518319	PA South	502860.2703	2315558.8154
	7	45.5505801, -83.4520273		502811.9434	2315590.4419

LANDOWNER: ZIMMERMAN

AR-SC-073.5 INFILTRATION TESTING LOCATIONS

GRAPHIC SCALE
40 20 0 40
SCALE IN FEET

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-SC-073.5
Test Pit # 1
Name Joe Kempf and Krystal Bealing, APSS
Date October 20, 2015
Weather 40-55°F; Sunny
Equipment Mini Excavator

Elevation 1004.00 AMSL
Soil Type Leck kill channery silt loam, 3-8% slopes
Geology Sherman Creek Member of Catskill formation
Landscape Position/Slope Sideslope, 3-8%
Land Use Agricultural
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	11	SiL	35-60% Channery	5YR 3/4	-	Roots present, Moderate, Subangular blocky	11	-	Friable
R	11	54+	-	-	-	-	-	-	33	Seeps observed within the bedrock

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

Soil Profile Log

Project 14C4909-A Atlantic Sunrise Project - AR-SC-073.5
Test Pit # 2
Name Joe Kempf and Krystal Bealing, APSS
Date October 20, 2015
Weather 40-55°F; Sunny
Equipment Mini Excavator

Elevation 999.25 AMSL
Soil Type Mecksville loam, 3-8% slopes
Geology Sherman Creek Member of Catskill formation
Landscape Position/Slope Sideslope, 3-8%
Land Use Agricultural
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	8	SiL	15-35% Channery	5YR 3/4	-	Roots present, Moderate, Subangular Blocky	-	-	Friable
Bw	8	24	SiL	35-60% Channery	2.5YR 3/4	-	Moderate, Subangular Blocky	-	-	Friable
Cr	24	35	SiL	60-90% Channery	2.5YR 4/4	-	Moderate, Subangular Blocky	35	-	Firm, Limiting Layer - Restrictive soil horizon due to bedrock components
R	35	54+	-	-	-	-	-	-	-	-

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-SC-073.5
Test Pit # 3
Name Joe Kempf and Krystal Bealing, APSS
Date October 20, 2015
Weather 40-55°F; Sunny
Equipment Mini Excavator

Elevation 995.50 AMSL
Soil Type Mecksville loam, 3-8% slopes
Geology Sherman Creek Member of Catskill formation
Landscape Position/Slope Sideslope, 3-8%
Land Use Agricultural
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	7	SiL	15-35% Channery	5YR 3/4	-	Roots present, Moderate, Grandular	-	-	Very Friable
Bw	7	17	SiL	35-60% Channery	2.5YR 3/4	-	Moderate, Subangular Blocky	-	-	Friable
Cr	17	44+	L	60-90% Channery	2.5YR 4/4	-	Moderate, Subangular Blocky	-	-	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-SC-073.5
Test Pit # 4
Name Joe Kempf and Krystal Bealing, APSS
Date October 20, 2015
Weather 40-55°F; Sunny
Equipment Mini Excavator

Elevation 998.00 AMSL
Soil Type Mecksville loam, 3-8% slopes
Geology Sherman Creek Member of Catskill formation
Landscape Position/Slope Sideslope, 3-8%
Land Use Agricultural
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	9	SiL	15-35% Channery	5YR 3/4	-	Roots present, Weak, Granular	-	-	Very Friable
Bw	9	14	SiL	35-60% Channery	2.5YR 3/4	-	Moderate, Subangular Blocky	-	-	Friable
Cr	14	54+	L	60-90% Channery	2.5YR 3/4	-	Massive	-	-	Firm, 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-SC-073.5
Test Pit # 5
Name Joe Kempf and Krystal Bealing, APSS
Date October 20, 2015
Weather 40-55°F; Sunny
Equipment Mini Excavator

Elevation 996.00 AMSL
Soil Type Mecksville loam, 3-8% slopes
Geology Sherman Creek Member of Catskill formation
Landscape Position/Slope Sideslope, 3-8%
Land Use Agricultural
Additional Comments

Horizon	Upper Boundary (inches)	Lower Boundary (inches)	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Matrix Color	Color Patterns	Pores, Roots, Structure	Depth to Bedrock	Depth to Water	Comments
Ap	0	7	SiL	-	5YR 3/4	-	Roots present, Weak, Granular	-	-	Very Friable
Bw	7	15	SiL	35-60% Channery	2.5YR 3/4	-	Weak, Granular	-	-	Firm
Cr	15	37	L	60-90% Channery	2.5YR 4/4	-	Moderate, Subangular Blocky	37	-	Friable, Limiting Layer - Restrictive soil horizon due to bedrock components
R	37	38+	-	-	-	-		-	-	Observed excavator limit

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-SC-073.5

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	1.938	1.000	0.875	1.063	1.000				0.985	5.907	40-55°F, sunny. Test done at the surface.
2	Yes	10	1.188	1.188	1.313	1.125					1.204	7.221	40-55°F, sunny. Test done at the surface.
3	Yes	10	0.313	0.500	0.375	0.313					0.375	2.251	40-55°F, sunny. Test done at the surface.
4	Yes	10	0.375	0.188	0.250	0.188					0.250	1.500	40-55°F, sunny. Test done at the surface.
5	Yes	10	0.625	1.250	1.438	1.438	1.250				1.344	8.064	40-55°F, sunny. Test done at the surface.

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

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


View of Pit #4.

View of Pit #5.

Schuylkill County, Pennsylvania

MeB—Meckesville loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l3n4
Elevation: 500 to 2,800 feet
Mean annual precipitation: 34 to 48 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 130 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Meckesville and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Meckesville

Setting

Landform: Mountain valleys
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandstone, siltstone and shale colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 31 inches: gravelly loam
H3 - 31 to 70 inches: gravelly loam
H4 - 70 to 96 inches: gravelly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 25 to 48 inches to fragipan; 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 25 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

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

Minor Components

Leck kill

Percent of map unit: 5 percent

Kedron

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Schuylkill County, Pennsylvania
Survey Area Data: Version 7, Sep 22, 2014

Schuylkill County, Pennsylvania

LeB—Leck kill channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l3mw
Elevation: 300 to 2,800 feet
Mean annual precipitation: 34 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 130 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Leck Kill

Setting

Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Reddish residuum derived from sedimentary rock

Typical profile

H1 - 0 to 10 inches: channery silt loam
H2 - 10 to 43 inches: channery silt loam
H3 - 43 to 58 inches: very channery silt loam
R - 58 to 62 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 80 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

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

Minor Components

Meckesville

Percent of map unit: 10 percent

Landform: Mountain valleys
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Concave
Across-slope shape: Linear

Klinesville

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Schuylkill County, Pennsylvania
Survey Area Data: Version 7, Sep 22, 2014

V.7 Off-Site Discharge Analysis

a. Adequacy of Off-Site Discharge

ACCESS ROAD: AR-SC-073.5- Adequacy of Off-Site Discharge

AR-SC-073.5 is a proposed permanent access road (PAR) located in Eldred Township, Schuylkill County Pennsylvania. The intent of this PAR is to provide maintenance and operations access to Main Line Valve - 09 (MLV-09) located on the proposed 42" Central Penn Line South Pipeline. The road begins at Ranch Road and terminates at MLV-09 at approximate mile post 80.8. The proposed road is approximately 135 feet long over relatively hilly terrain located on an existing pasture. Existing Agricultural (Pasture) land surrounds the road and MLV site on all sides (As seen in the picture below). The proposed improvements have been designed to have no anticipated impacts or changes to downhill properties as a result of construction the MLV site.

(Ranch Road looking south toward MLV site location)

The proposed permanent access road and the MLV site has been designed to reduce overall disturbance to the maximum extent practicable. The PAR and MLV site has been constructed with stone rather than pavement to further help with keeping with the existing conditions. The proposed road maintains a new minimal width of only 14 feet wide. The MLV site has also been design to minimum the footprint to the maximum extent practical for the operation and maintenance requirements.

As for any development, the road and MLV site has been designed to match or reduce peak stormwater runoff from the design areas to an off-site discharge point where stormwater runoff is conveyed. (See the enclosed Pre and Post drainage area maps and calculations in Appendix V.3 and V.4 for details) In the case of this design, we were able to achieve a reduced peek runoff for all storm events, as shown in the Pre-vs. Post- Construction Peak Rate of Flow Summary for The Study Point chart below. The reduction was achieved by utilizing an Infiltration berm, and utilizing the MLV pad itself as a retention areas. These Stormwater BMP measures are used to slow down the stormwater runoff, infiltrate and release at a slower and reduced rate to existing land.

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	1.22	-	(1.22)
2) 2-Year/24-Hour	1.97	0.07	(1.90)
3) 5-Year/24-Hour	3.18	0.31	(2.87)
4) 10-Year/24-Hour	4.31	1.68	(2.63)
5) 25-Year/24-Hour	6.20	5.25	(0.95)
6) 50-Year/24-Hour	8.03	7.40	(0.63)
7) 100-Year/24-Hour	10.23	9.48	(0.75)

The Infiltration berm is located on the east side of the MLV site and access road. The Infiltration berm area is approximately 1.3-feet high and collects runoff from the MLV site, and access drive. The infiltrated berm is designed to create a retention area promoting infiltration after the flows travel through the MVL site and from the PAR and will reduces peak stormwater runoff rates leaving the site.

The other measure used to ensure reduced peak stormwater runoff is the MLV pad itself. The pad is a flat area constructed of a top layer of 6" of AASHTO #8 aggregate, on a non-woven geotextile fabric, and a bottom layer of 18" AASHTO #57 stone. This 18-inch-deep area will detain and infiltrate the foot print of the MLV pad, plus pasture land area around the pad to the south and west.

After being conveyed through one of these stormwater PCSM BMP's above, the runoff from the area will follow pre-construction conditions and travel through the pasture approximately 380 feet east until reaching a gravel road. From the gravel road, the runoff will travel south until it reaches a small pond that ultimately outlets into an unnamed tributary to Mahantango Creek, approximately 890 feet southeast of the MLV Site.

The flow path from the MLV site crosses the following soil types:

- LeB – Leck kill channery silt loam, 3 to 8 percent slopes.
- LeC – Leck kill channery silt loam, 8 to 15 percent slopes.
- MeB – Meckesville loam, 3 to 8 percent slopes.
- MeC – Meckesville loam, 8 to 15 percent slopes.
- WKF – Weikert and Klinesville shaly silt loams, steep.

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:

- LeB – 0.20
- LeC – 0.20
- MeB – 0.28
- MeC – 0.28

- WKF – 0.17

All soils crossed by the flow path are considered erosion resistant soils.

In addition to the stormwater flow reduction and soil data above, the VCI and MLV pad has reduced the proposed stormwater velocity as it leaves the design points. The velocities at both points are such that they are slower than 2 fps, as see in the Stormwater Velocity Rate Chart. Based on Table G.1 in the Pennsylvania DEP erosion and Sediment Pollution Control Program Manual "Allowable Velocities for Downslope covers for Channeled Flows" (shown below), The maximum allowable velocity for mulch is 2 fps. The velocity of the runoff from the proposed improvements is less than the maximum allowable velocity listed in the table, and is an allowable velocity for the area that we are discharging too.

Stormwater Velocity Rate Chart for the design frequency storm (fps)	Infiltration Berm Velocities (fps)
1) 1-Year/24-Hour	0.00
2) 2-Year/24-Hour	0.19
3) 5-Year/24-Hour	0.32
4) 10-Year/24-Hour	0.58
5) 25-Year/24-Hour	0.85
6) 50-Year/24-Hour	0.96
7) 100-Year/24-Hour	1.04

Table G.1. Allowable Velocities for Downslope Covers for Channeled Flows

Ground Cover	Allowable Velocity
Grass*	4 fps
Gravel	5 fps
Mulch	1-2 fps

* See E&S Manual for more information on permissible velocities for grass and other cover types. Allowable velocities for grass can vary from 2.5 fps to as much as 8 fps. 4 fps has been selected as a conservative figure for design purposes.

(Table from the 2012 PDEP E&S PCPM)

In conclusion, based on the designed measures discussed above, and the soil and velocity data provided for this MLV site and access road, there are no anticipated impacts or changes to downhill properties as a result of construction the MLV site.

Down Slope Property Owners:

- F. Leon Zimmerman (PA-SC-111.000)

V.8 Storage Volume Analysis

a. Storage Volume Analysis

ACCESS ROAD: SC-073.5 – Storage Volume Analysis

Stormwater detention is provided behind infiltration berm and in the void space between the AASHTO #57 stone layer at the MLV pad. The void space between the 6" AASHTO #8 stone at the surface of the pad is excluded from the detention, or 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.

The void space between the AASHTO #57 stone provides the storage volume for the MLV pad. The void space between the 6" AASHTO #8 stone at the surface of the pad is excluded from the volume calculations.

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 simply be 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 was designed to minimize these impacts by mimicking the existing grade. An actual storage volume was calculated based on the elevation of the low point of the pad (minus the 6" AASHTO #8 cover), since that is the highest runoff could be stored without overtopping the AASHTO #57 stone. Two scenarios apply to all of the main line valve pads on the project: low side pads and low corner pads. Since many of the volumes can only be obtained using calculus to determine the total storage the water surface elevation and base of the pad, AutoCAD Civil 3D was used to determine the storage volumes. To determine volumes in Civil 3D, surfaces representing the bottom of the pad and water surface elevation were built and combined into a volumetric surface; an earthwork analysis was run on the volumetric surface to determine the total volume between the two. The volume of low side pads can be checked using simple volumetric formulas for triangular (steeper grades, shallower pads) or trapezoidal (more gradual grades, deeper pads) prisms, with the cross sectional wetted area multiplied by the length of the low side of the pad. AR-SC-073.5 is a low-corner pad. Finally, the calculated storage volume was reduced by 60% to determine the available storage volume with 40% voids.

The detained stormwater will infiltrate the ground. The dewatering time for the stormwater detained in the void space of the MLV pad rock is provided at the bottom of Worksheet #5 included in Appendix V.5.

V.9 Sediment Barrier Table

a. E&S Worksheet 1

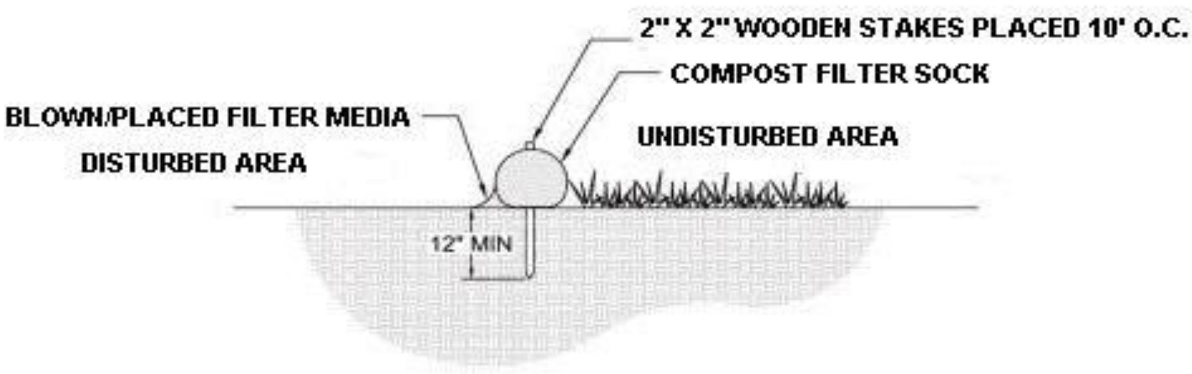
E&S WORKSHEET #1
Compost Filter Sock

PROJECT NAME: Atlantic Sunrise

LOCATION: AR-SC-073.5

PREPARED BY: EAW DATE: 10/21/16

CHECKED BY: BJP DATE: 10/21/16



SOCK NO.	Dia. In.	LOCATION	SLOPE PERCENT	SLOPE LENGTH ABOVE BARRIER (FT)	SOCK LENGTH
STOCKPILE					
SP 1	12	LOCATED IN THE PIPELINE ROW	N/A	N/A	225

SOURCE: Pennsylvania Erosion and Sediment Pollution Control Manual, Page 372