Site Restoration and Post-Construction Stormwater Management Plan

Pennsylvania Pipeline Project

Mt. Union Station Expansion

November 2016

Prepared for:

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LIST OF ACRONYMS

ACRONYM	MEANING
AASHTO	American Association of State Highway and Transportation Officials
ABACT	Antidegradation Best Available Combination of Technologies
ac	Acre
ac-ft	Acre-feet
BMP	Best Management Practice
CCE	Calcium Carbonate Equivalent
CFS	Compost Filter Sock
cfs	Cubic Feet per Second
CN	Curve Number
E&SC	Erosion and Sediment Control
ENV	Effective Neutralizing Value
HDPE	High Density Polyethylene
hr	Hour
in/hr	Inches per Hour
IT	Infiltration Test

lbs	Pounds
LOD	Limit of Disturbance
NRCS	Natural Resources Conservation Service
PADEP	Pennsylvania Department of Environmental Protection
PASDA	Pennsylvania Spatial Data Access
PCSM	Post-Construction Stormwater Management
PennDOT	Pennsylvania Department of Transportation
POI	Point of Interest
PPP	Pennsylvania Pipeline Project
SCS	Soil Conservation Service
sq ft	Square feet
sq yds	Square yards
SPLP	Sunoco Pipeline, L.P.
TSF	Trout Stock Fishes
Tt	Tetra Tech, Inc.
UNT	Unnamed tributary
USDA	United States Department of Agriculture
USGS	United States Geological Survey
yr	Year

1.0 INTRODUCTION

Tetra Tech, Inc. (Tt) has prepared this Site Restoration and Post-Construction Stormwater Management (PCSM) Plan for Sunoco Pipeline, L.P. (SPLP) – Pennsylvania Pipeline Project (PPP). The Plan addresses post-construction stormwater management BMPs following the proposed modifications at the Mt. Union Station. The Project is located in Shirley Township, Huntingdon County, Pennsylvania. A United States Geological Survey (USGS) site location map is provided in Appendix A.

SPLP is proposing to construct the Project in Shirley Township, Huntingdon County, PA. The Project will be located adjacent to State Route 522 (Croghan Pike) at latitude 40.345°, longitude -77.866°. The Project will be connected to the PPP twenty-inch diameter transmission pipeline and will include the construction of a gravel access road, clearing and grubbing, pump station installation, and site restoration. The pump station installation will include a launcher, receiver, knock out tank, and pipe supports. The proposed Project will be constructed within a limit of disturbance (LOD) of approximately 2.83 acres.

Section 2.0 discusses the existing site and its characteristics. Section 3.0 discusses the construction sequence, site restoration practices, and the inspection and maintenance procedures. Section 4.0 discusses the proposed BMPs, the design criteria, and design process.

2.0 EXISTING SITE DESCRIPTION

Past and present land use of the Project area and surrounding area is meadowland. Future land use will be a maintained gravel access road and a maintained gravel pad which the pump station will sit on. The project area drains to an unnamed tributary (UNT) to Aughwick Creek. Site soils information was taken from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey. A soil map and list of existing soil types is located in Appendix B. Relevant topographic features including streams, streets, pipelines, structures, utility lines, fences, paving and other significant items along the pump station LOD are indicated on the plans, where applicable.

2.1 TOPOGRAPHY

The work zone is located on ground gently sloping southeast toward an UNT to Aughwick Creek and State Route 522 (Croghan Pike). Site elevations vary from approximately 609 feet (western corner of pad area) to 600 feet (eastern corner of pad area) above mean sea level based on the Pennsylvania Spatial Data Access (PASDA). The site development plans show the topography of the site and the surrounding area and can be found in Appendix G.

2.2 GEOLOGY AND SOILS

The soils and geologic formations surrounding the site are shown on the figures provided in Appendix B. Appendix B also provides soil descriptions and properties of the soils found at the site. In general, the following actions will be taken to counteract soil limitations:

- Pipes installed will be protected from potential corrosive soils. The pipeline(s) being installed will be either high-density polyethylene (HDPE) or coated steel.
- Prompt stabilization practices will be implemented.
- Soils will be evaluated throughout the construction process to determine whether additional measures will need to be taken to make the soil suitable for its intended use on site.
- Soil amendments will be added to site soils to promote vegetative growth.
- A wetland delineation and stream investigation has been conducted to determine the presence and location of hydric soils. No streams or wetlands have been identified within the LOD. There are streams and wetlands located on the property. To prevent sediment from leaving the site, stabilization practices will be in place and functional prior to earth disturbances, and stabilization practices will be implemented in disturbed areas as soon as practical. Geologic formations or soil conditions that may have the potential to cause pollution after earth disturbance were not observed during pre-design field activities.

- If a high groundwater table is encountered, water will be drained away from disturbed areas to a well vegetated area or a placed compost filter sock (CFS) prior to being discharged off the site. Water encountered during construction activities will be pumped through a pumped water filter bag to a well vegetated upland area. Saturated soils will be dried prior to being used on-site.

The site consists of **Bedington (BeB)** channery silt loam, 3 to 8 percent slopes**, Berks (BoB)** Channery silt loam, 8 to 15 percent slopes**,** and **Blairton (BkC)** silt loam, 2 to 8 percent, which are described below.

BeB – Bedington-channery silt loam, 3 to 8 percent slopes.

This moderately well-draining soil is located on concave hills at elevations ranging from 300 to 1,500 feet above mean sea-level. It is formed from local silty colluvium derived from shale and siltstone over acid and silty residuum weathered from shale and siltstone; colluvium derived from shale and siltstone. The typical soil profile is: 0 to 9 inches: channery silt loam **(Hydrological Soil Group B)**; 9 to 30 inches: channery silt clay loam **(Hydrological Soil Group D)**; and 30 to 38 inches: channery silt loam **(Hydrological Soil Group B)**; 38 to 42 inches: bedrock. The depth to water table is 12 to 24 inches. The restrictive feature, lithic bedrock, is encountered 20 to 40 inches below the surface. There is no frequency of flooding or ponding.

BoB-Berks-channery silt loam, 8 to 15 percent slopes.

This moderately well-draining soil is located on concave hills at elevations ranging from 300 to 1,500 feet above mean sea-level. It is formed from local silty colluvium derived from shale and siltstone over acid and silty residuum weathered from shale and siltstone; colluvium derived from shale and siltstone. The typical soil profile is: 0 to 9 inches: channery silt loam **(Hydrological Soil Group B)**; 9 to 30 inches: channery silt clay loam **(Hydrological Soil Group D)**; and 30 to 38 inches: channery silt loam **(Hydrological Soil Group B)**; 38 to 42 inches: bedrock. The depth to water table is 12 to 24 inches. The restrictive feature, lithic bedrock, is encountered 20 to 40 inches below the surface. There is no frequency of flooding or ponding.

BkC – Blairton-silt loam, 2 to 8 percent slopes.

This moderately well-draining soil is located on concave hills at elevations ranging from 300 to 1,500 feet above mean sea-level. It is formed from local silty colluvium derived from shale and siltstone over acid and silty residuum weathered from shale and siltstone; colluvium derived from shale and siltstone. The typical soil profile is: 0 to 9 inches: channery silt loam **(Hydrological Soil Group B)**; 9 to 30 inches: channery silt clay loam **(Hydrological Soil Group D)**; and 30 to 38 inches: channery silt loam **(Hydrological Soil Group B)**; 38 to 42 inches: bedrock. The depth to water table is 12 to 24 inches. The restrictive feature, lithic bedrock, is encountered 20 to 40 inches below the surface. There is no frequency of flooding or ponding.

2.3 SURFACE WATER HYDROLOGY

The project area surface water runoff drains to the south to an UNT to Aughwick Creek, which is designated as Trout Stock Fishes (TSF) under PA Code 25 Chapter 93.

This PCSM plan contains BMPs to maintain the designated use of the receiving waters. The locations of the receiving waters relative to the project area can be seen in Appendix A, the Site Location Map.

No streams and wetlands will be affected during construction.

3.0 SITE RESTORATION PRACTICES

Minimizing the LOD for the Project was taken into consideration in order to limit ground disturbance. Grounds disturbed by any of the operations necessary to complete the work for this project are to be permanently seeded, or if specified, sodded, unless occupied by structures, paved, graveled, or designated as a permanent access road. Disturbed areas will be seeded and mulched as soon as practical once final grades are achieved. If seeding cannot be completed within a four (4) day period due to weather conditions, the disturbed area will be mulched with straw at the rate of three (3) tons per acre. This straw will be anchored using a method described in Section 3.4. An infiltration filter will be installed as a post construction stormwater BMP to mitigate the permanent stormwater impacts of construction.

3.1 CONSTRUCTION SEQUENCE

A construction sequence is provided below for installing post construction stormwater BMPs. The construction sequence is intended to provide a course of action to conform to the applicable regulatory agency requirements for restoration and post-construction stormwater management of the site. Necessary steps for proper and complete execution of work pertaining to this plan, whether specifically mentioned or not, are to be performed by the contractor. The contractor will comply with all requirements listed in this section and the Pennsylvania Stormwater Best Management Practices Manual. The contractor may be required to alter controls based on the effectiveness of controls or differing conditions encountered in the field. If the contractor plans on deviating from the methods and controls in this PCSM Plan, they must get approval from the county conservation district and PADEP before any actions commence.

A pre-construction meeting is required prior to the start of any construction activity. The Pennsylvania Department of Environmental Protection (PADEP) or applicable county conservation district, contractors, the landowner, appropriate municipal officials, and the plan preparer must be invited to this meeting at least 7 days prior to construction commencement. All construction activities shall be discussed in this meeting including, but not limited to, the PCSM features and any deviations the contractor has planned. A licensed professional shall oversee all installation and testing procedures for the berms, infiltration filters, and all associated piping and inlets, as they are critical stages of the BMP installation.

Install post construction BMPs after completion and stabilization of the Project to prevent sediment accumulation in the BMPs.

Minimize Total Disturbed Area

1. All construction shall take place within the designated limits of disturbance as shown on the plans.
2. Maintain soil stockpiles in the areas designated on the plans.
3. The existing compressor station gravel pad shall be used for equipment and material storage to minimize the limits of disturbance and soil compaction.

4. Within the limits of disturbance, contractors are to minimize land disturbance to the maximum extent. Repeated travel is restricted to travel lanes and travel through areas are limited to those necessary to complete the work.

5. Surface roughing is the practice of providing a rough soil surface with horizontal depressions for the purpose of reducing runoff velocity, increasing infiltration, aiding the establishment of vegetation, and reducing erosion. During the preparation for seeding on slopes 3H:1V or steeper, unless a stable rock face is provided, surface roughening is to be conducted by tracking the slopes by running tracked equipment (with blades up) across the surface as to leave grooves parallel to the contour. Any area where stone and/or timber mats are used for temporary stabilization, soil will be decompacted through multiple passes using tracked equipment. The tracking method can be used elsewhere to aid in the decompaction of soils as deemed necessary to facilitate successful restoration. The tracking method can be used on the subsoil before topsoil replacement and/or on the topsoil prior to seeding. In agricultural areas, severely compacted areas are to be plowed with a harrow, paraplow, paratill or other equipment before subsoil replacement. Vehicular traffic is to be restricted from areas that are ready to be seeded. The level of soil compaction will vary greatly across the project and the decompaction measures to be implemented will be considered on case-by-case basis and evaluated through testing (e.g., penetrometer) and discussions between Spread Managers and Environmental Inspectors.

Re-Vegetate Disturbed Areas

1. Apply permanent seeding as described in Section 3.2

Infiltration Filter

1. Permanent filters should not be installed until the site is stabilized. Excessive sediment generated during construction can clog the filter and prevent or reduce the anticipated post-construction water quality benefits. Stabilize all contributing areas before runoff enters filters.

2. Structures shall be installed in accordance with the manufacturers' or design engineers guidance.

3. The excavation for the infiltration filter shall be excavated from the sides without entering the trench in such a manner as to avoid compaction of the subbase.

4. A layer of non-woven-geotextile fabric shall be placed in the excavation.

5. Place gravel/stone in minimum 6 inch lifts and lightly spread with equipment bucket until stone is level and does not settle. Place underdrain pipes in gravel during placement.

6. Wrap and secure nonwoven geotextile to prevent gravel/stone from clogging with sediments.

7. Saturate filter media and allow media to drain to properly settle and distribute.

Stormwater Inlets, Piping and Outlets

1. Excessive sediment generated during construction can clog the inlets, outlets, and piping and prevent or reduce the anticipated post-construction water quality benefits. Stabilize all contributing areas before

runoff enters structures. If inlets require installation prior to site stabilization, the inlet shall be protected with sand bags or other means necessary to prevent sediment laden runoff from entering.

2. Excavate trenches for stormwater inlets, piping, and outlets. Take care to ensure slope stability during excavation in order to avoid slope failure.

3. Place underlying gravel, stone, or clean fill per the construction details provided on the PCSM plan sheets. Lightly compact the underlying media.

4. Place stormwater structure on top of the lightly compacted underlying media.

5. Cover the inlets, outlets, and piping per the construction details provided in the PCSM plan sheets.

Berm

1. Lightly scarify the soil in the area of the proposed berm before delivering soil to site.

2. Bring in fill material to make up the majority of the berm. Soil shall be added and compacted according to design specifications. The slope and shape of the berm shall be graded out as soil is added.

3. Complete final grading of berm after the top layer of soil is added. Tamp soil down lightly and smooths sides of the berm.

4. Plant berm with permanent grass seed mix.

5. Mulch planted and disturbed areas with compost mulch to prevent erosion while plants become established.

3.2 PERMANENT SEEDING

Site preparation and establishment of permanent cover will be conducted according to the following guidelines:

1. Install needed surface water control measures.

2. Hydroseed or follow Steps 3 through 6 below.

3. Perform all cultural operations at right angles to the slope.

4. Determine agricultural lime application rates by field pH testing. Perform testing at a rate of 1 test per acre (minimum). In the absence of testing, apply at 6 tons per acre.

5. Apply dry 10-20-20 formulation of fertilizer at the rate of 678 pounds (lbs) per acre or at a rate determined by field testing.

6. Work in lime and fertilizer to a depth of 4 inches using suitable equipment.

7. Seed Mixture - The seed mixture will be:

TABLE 1: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION (PENNDOT) FORMULA W							
SCIENTIFIC NAME	**COMMON NAME**	**REQUIRED VARIETIES**	**% BY WEIGHT**	**MINIMUM % PURITY**	**MINIMUM % GERMINATION**	**MAX % WEED**	**SEEDING RATE (POUNDS/1000 SQUARE FEET, LBS/1000 SQ FT)**
Festuca Arundinacea	Tall Fesuce	Festuca arundinacea var. Kentucy 31	70	98	85	0.15	7.5
Lotus Corniculatus	Birdsfoot Trefoil Mixture	A combination of varieties (Viking, Empire, Norcen, Dawn, Leo, Bull, Maitland) with no one variety exceeding 50% of the total Trefoil component.	20	98	80(1)	0.10	2.0
Agrostis Alba	Redtop	Agrostis alba	10	92	80	0.15	1.0

(1) Recommended 10% hardseed and 70% normal sprouts.

8. If not hydroseeding, apply mulch.

Notes:

1. *Spread seeds where indicated and at the rates specified in Table 1, or as otherwise indicated.*
2. *Spread seeds within April 1 to June 15 or August 16 to September 15.*
3. *Extend seeding dates where project conditions warrant. Apply full treatment or apply only 50% of the permanent seeding and soil supplements and apply the remaining 50% within the next seeding dates, as directed in writing.*
4. *Use tillage and soil supplements before permanent seeding on topsoiled areas, where temporary seeding or mulching has been applied.*
    a. *On topsoiled areas, 1:3 (3:1) and flatter, loosen the surface to a depth of at least 50 millimeters (2 inches) by disking, harrowing, or other acceptable methods until the tillage is satisfactory. On untopsoiled areas, 1:3 (3:1) and flatter, till only as directed. Also, till or scarify areas if the surface is glazed or crusted.*
    b. *Correct surface irregularities by filling depressions and leveling rough or uneven areas. Remove metal objects, stones larger than 50 millimeters (2 inches) in any dimension, and other debris or objects deemed detrimental to maintenance operations.*
5. *Inoculate leguminous seed, such as Birdsfoot Trefoil, with proper cultures, according to the manufacturer's directions.*
6. *At the rates specified in Table 1, sow seeds uniformly on the prepared areas by the helicopter, hydraulic placement, broadcasting, drilling, or hand seeding methods. Inspect seeding equipment and adjust the equipment, if required, to ensure the specified application rates. Periodically perform a check on the rate and uniformity of application, as directed. Prior to seed application of each designated seed formula, thoroughly clean-out seed tank by rinsing with clean water to prevent contamination from one seed formula to the next. Repeat rinsing cycle until tank is clean. Collect all non-applied seed derived from each clean-out event and remove as waste from the project.*

7. *After seeding, roll topsoiled areas that are to be mowed. Use a roller with a mass (weight) not more than 100 kilograms/meter (65 pounds per foot). If soil is wet or frozen, roll only when directed.*
8. *Apply herbicides as directed, to areas that are to be mowed and where weed growth is prominent. The Representative will designate existing plants or groups of plants to be saved within these areas before herbicide application. If directed, more than one application may be required to control undesirable growth. Apply material with application personnel certified by the Department of Agriculture and with equipment specified in Section 108.05(c).*
9. *Final acceptance of seeding and soil supplement materials and installation are subject to the results of official sampling and testing as specified before use and installation and the resultant establishment of the specified vegetation. Remove non-approved materials from the project.*
    a. *Reseed rejected areas with additional applications of the specified seed and soil supplement materials. Redress soil surfaces when directed. Perform reapplication of seed and soil supplements within the next applicable seeding date if necessary or as directed. When directed, reseed areas damaged by herbicide applications and mowing operations. NOTE: Reseeded areas will also require the application of appropriate mulch as specified in Section 805.*
    b. *Seeded areas may be rejected based on the lack of actual grass seedling establishment exhibited in the area for the specified seed formula.*
        i. *Table 1 formula seeded areas that exhibit less than 70% surface area coverage with the specified germinated grass seedlings after 90 days of growth may be rejected upon visual inspection. The seed germination and growth period is determined from the date of the seeding operation for the area when these operations are performed within the specified seeding dates.*
        ii. *Special seed formula planted areas (seed mixtures not indicated in Table 1) may be rejected based on the lack of the specified seed germination and growth of less than 11 seedlings/square meter (9 seedlings/square yard) after 120 days of growth determined by visual inspection. The seed germination and growth period is determined from the date of the seeding operation of the area when these operations are performed within the specified seeding dates.*
        iii. *Seeded areas exhibiting soil surface erosion rills or gullies deeper than 250 millimeters (1 inch) may be rejected upon visual inspection. Redress and reseed designated eroded areas with specified materials and application rates as directed.*

Liming Rates

Minimum 6 tons per acre at 100% effective neutralizing value (% ENV), unless the soil test determines that a lesser amount is needed. To determine the actual amount of regular lime to apply, divide the amount called for by the soil test by the % ENV for the product used. For example, if 6 tons per acre is needed and the ENV for the lime used is 88%, divide 6 by 0.88 resulting in 6.8 tons needing to be applied. For dolomitic lime, which has a significant amount of magnesium in it, divide the amount called for by the soil test by the % calcium carbonate equivalent (% CCE) listed for the product instead of the % ENV. The % CCE may be above 100% which accounts for the fact that magnesium has a greater effect per pound than the calcium in regular lime. Note: When a soil test requires more than 8,000 pounds of lime per acre, the lime must be mixed into the top 6 inches of soil.

Fertilization Rates

Prepare areas for seeding by uniformly applying supplements. Document bulk delivery. Blend the initial soil supplements into the soil at least 50 millimeters (2 inches), on topsoiled areas, by raking, disking, harrowing, or other acceptable methods. Blend the supplements into the soil during tillage operations. Apply slow-release nitrogen fertilizer to the surface of Formula W seeded areas before project completion. Apply soil supplements as shown in the following table, unless otherwise indicated:

Permanent Seeding Application Rate				
Soil Amendment	**Per Acre**	**Per 1,000 square feet (sq ft)**	**Per 1,000 square yards (sq yds)**	**Notes**
Agricultural Lime	3872 lbs	89 lbs	800 lbs	or as per soil test; may not be required in agricultural fields
10-20-20 Fertilizer	678 lbs	16 lbs	140 lbs	
38-0-0 Ureaform Fertilizer, OR	242 lbs	6 lbs	50 lbs	
32-0-0 to 38-0-0 Sulfur Coated Urea Fertilizer, OR	286 lbs	7 lbs	59 lbs	
31-0-0 IBDU Fertilizer	295 lbs	7 lbs	61 lbs	

3.3 TEMPORARY SEEDING

Temporary grass cover will be established in the following areas:

- Where vegetative filters must be established below filter bags, a minimum distance of 10 feet will be seeded down slope of the trap outlet. Seed mixture for temporary cover will consist of 100-percent annual ryegrass. Seed will be applied at the rate of 40 lbs per acre or as recommended by a local recognized seed supplier and approved by the owner's representative. Prior to seeding, apply 1 ton of agricultural grade limestone per acre plus 10-10-10 fertilizer at the rate of 500 lbs per acre and work into soil.
- Where soil stockpiles are to be exposed for a period greater than four (4) days, the stockpile shall be seeded.

Temporary Seeding Application Rate				
Soil Amendment	**Per Acre**	**Per 1,000 sq ft**	**Per 1,000 sq yd**	**Notes**
Agricultural Lime	1 ton	40 lbs	410 lbs	Typically not required for topsoil stockpiles
10-10-10 Fertilizer	500 lbs	12.5 lbs	100 lbs	Typically not required for topsoil stockpiles

3.4 MULCHING

The purpose of mulch is to reduce runoff and erosion, prevent surface compaction or crusting, conserve moisture, aid in establishing plant cover, and control weeds. Mulch will be applied on any area subject to erosion, or which has unfavorable conditions for plant establishment and growth. The practice will be used alone or in conjunction with other structural and vegetative conservation practices, such as waterways, ponds,

sedimentation traps or critical area planting. On sediment producing areas where the period of exposure is less than 2 months, mulch materials will be applied according to the following guidelines:

- Apply straw mulch at the rate of 3 tons per acre. Chemically treated or salted straw is not acceptable as mulch.
- Anchor straw mulch immediately after application by at least one of the following methods.

  A. "Crimp" straw mulch into the soil using tractor drawn equipment (straight bladed coulter or similar). This method is limited to slopes no steeper than 3:1. Operate machinery on the contour. Crimping of hay or straw by running it over with tracked machinery is not recommended.

  B. Uniformly apply asphalt, either emulsified or cut-back, containing no solvents or other diluting agents toxic to plant or animal life, at the rate of 31 gallons per 1,000 square feet.

  C. Use synthetic binders (chemical binders) as recommended by the manufacturer to anchor mulch provided sufficient documentation is provided to show that it is non-toxic to native plant and animal species.

  D. Staple lightweight plastic, fiber, or paper nets over the mulch according to the manufacturer's recommendations.

Mulched areas will be checked periodically and after each runoff event (e.g. rain, snowmelt, etc.) for damage until the desired purpose of the mulching is achieved. Damaged portions of the mulch or tie-down material will be repaired upon discovery.

3.5 MATERIAL RECYCLING AND DISPOSAL

The operator will remove from the site, recycle, or dispose of all building materials and wastes in accordance with PADEP's solid waste management regulations at 25 PA Code 260.1 et seq., 271.1 et seq., and 287.1 et seq. The operator will first characterize the waste materials as municipal, residual or hazardous waste. Before the waste material is hauled away, the material will be stored and labeled in accordance with the applicable management procedures, if any, under the Solid Waste Management Act regulations. The operator will then hire a licensed and insured waste hauler to transport the waste material to a properly permitted waste disposal facility. The contractor will not illegally bury, dump, or discharge building material or wastes at the site. Excess material brought into the site areas to facilitate construction access will be completely removed prior to rough grading and final surface stabilization. Expected construction wastes will consist of packaging material and sediment cleaned from BMPs. Sediment removed from BMPs will either be spread in a protected area within the LOD, to dry and then recycled as fill material or disposed of off-site. Off-site spoil and/or borrow sites greater than one acre must be operated under an E&SC Plan approved by the County Conservation District.

3.6 THERMAL IMPACTS

Potential pollution to surface waters from thermal impacts will be minimized by minimizing clearing and retaining existing vegetation where possible during construction. Following construction, permanent seeding will occur as soon as practicable to facilitate vegetative growth. All post-construction water storage will be underground, thus minimizing the opportunity for increase in water temperature. Additionally, all other proposed BMPs allow for stormwater runoff to flow consistently, thus reducing the opportunity for the temperature to rise in the stormwater.

3.7 RIPARIAN FOREST BUFFERS

Existing riparian forest buffers do not exist within the Project area.

3.8 INSPECTION AND MAINTENANCE PROCEDURES

Seeded areas will be inspected weekly and after each runoff event for bare spots, washouts, and healthy growth. Necessary repairs will be made immediately. Mulched areas will be checked periodically and after severe storms for damage until the desired purpose of the mulching is achieved. Damaged portions of the mulch or tie-down material will be repaired upon discovery.

All sedimentation control measures will remain in place until the disturbed areas are stabilized and a uniform 70-percent perennial vegetative cover is established. Any area not achieving a 70-percent vegetative cover will be reseeded and mulched within 24 hours of detection. The following inspection and maintenance practices will be used to maintain PCSM BMPs on site:

- PCSM BMPs will be in place and inspected according to the schedule below. PCSM BMPs will also be inspected after each runoff event. The Contractor will immediately repair any deficiencies.
- Maintenance and inspection of PCSM BMPs will conform to PADEP Chapter 102 and 105 rules and regulations.
- A licensed professional shall oversee all installation and testing procedures for the Infiltration Filter and Berm.

If BMPs are found to be inoperative or ineffective during an inspection, PADEP should be contacted within 24 hours, followed by submission of a written noncompliance report to PADEP within 5 days of the initial contact.

Long-Term Maintenance

The owner will maintain the stormwater management facilities for this site. Maintenance of the stormwater management facilities includes, but is not limited to, the following:

1. The proposed stormwater BMPs will be inspected and maintained by the property owner in accordance with the approved operation and maintenance program.

2. The stormwater BMPs are fixtures that can be altered or removed only after approval by PADEP.

3. Vegetation should be inspected around the site during all regular inspections. Vegetation outside of the fence and equipment pad shall be mowed sparingly to maintain a meadow condition. Bare spots shall be re-seeded and mulched to maintain full vegetated cover. Invasive plants shall be removed manually or by mowing.

4. Berm:

   - Inspections to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth)
   - Maintain turf grass and other vegetation by mowing and re-mulching
   - The crest of the berm may be used as access for heavy equipment when necessary to limit disturbance.
   - Routinely remove accumulated trash and debris.
   - Remove invasive plants as needed.
   - Inspect for signs of flow channelization; restore level gradient immediately after deficiencies are observed.

5. Infiltration Filter:

   - Inspect Infiltration Filters and associated inlets and piping at least four times per year and within 48 hours after every major storm event (> 1 inch rainfall depth). Inspection considerations include:
     - Inspect cleanouts – any water left in a surface filter after the design drain down time indicates the filter is not optimally functioning.
     - Film or discoloration of any surface filter material – this indicates organics or debris have clogged the filter surface.
   - Remove trash and debris as necessary.
   - Catch Basins and Inlets should be cleaned of sediment when accumulation is more than 6 inches.
   - Scrape gravel with rakes or vacuum to remove silt.
   - Replace gravel / filter media if scraping/removal has reduced depth of filtering media or if dewatering times are inadequate.
   - Dispose of gravel / filter media in accordance with all state and federal regulations.

Long-Term Operation and Maintenance Schedule

PCSM BMP	Inspections	Repairs	Reconstruction	BMP Life Expectancy
Infiltration Filter	1 hr Quarterly @ $70/hr	Replace 10% of filter media: $2,200	1-2 weeks Cost: $100,000	20-30 years
Berm	1 hr Quarterly @ $70/hr	Replacing 10% of vegetation Time: 1 day Cost: $800	Time: 1-2 days Cost: $2,200	20-30 years

1. *Sunoco Pipeline L.P. is the owner/operator of the Houston Injection Station and is responsible for the long term maintenance of the site PCSM BMPs. SPLP can be contacted at: 610-670-3200*

3.9 ANTIDEGRADATION REQUIREMENTS

Post-construction stormwater management BMPs associated with the Mt. Union Pump Station Expansion Activities will drain to receiving waters that are classified as Trout Stock Fishes (TSF) with a designated use of attaining. Therefore, a PCSM anti-degradation analysis and anti-degradation BMPs are not required.

4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT ANALYSIS

4.1 DESIGN BASIS

This plan has been prepared to comply with the Township of Shirley Subdivision and Land Development Ordinance, the Township of Shirley Stormwater Management Plan, and the Pennsylvania Stormwater Best Management Practices Manual. The Township of Shirley Stormwater Management Plan was created under authority of the Pennsylvania Storm Water Management Act (Act 167).

The site's pre-development and post-development drainage characteristics were modeled in accordance with local and state requirements. The hydrology calculations were performed utilizing the U.S. Soil Conservation Service (SCS) TR-55 Urban Hydrology for Small Watersheds. The 1, 2, 10, 25, 50, and 100-year, 24-hour storm events have been analyzed for pre- and post-developed conditions. The rainfall depths for each storm event are 2.4, 2.8, 4.1, 5.0, 5.7, and 6.5 inches, respectively, and follow the SCS 24-hour Type II rainfall distribution. Rainfall depths were taken from the Township of Shirley Stormwater Management Plan. Bentley PondPack V8i was used to perform the hydrology analysis. The pre-development watershed maps are located in Appendix C. The post-development watershed maps are located in Appendix D. The PondPack report and Flowmaster calculations are located in Appendix E.

The stormwater BMPs have been designed for the Project to comply with the stormwater quality and quantity management requirements. The watershed calculations were performed using Bentley PondPack V8i. The BMP has also been designed meet state stormwater quality and quantity management requirements where possible. Calculation worksheets from Chapter 8 of the Pennsylvania Stormwater Best Management Practices Manual were used to ensure compliance with state requirements. The completed worksheets are located in Appendix F.

4.2 HYDROLOGY

Pre-development and post-development runoff results were calculated using the previously described design basis. The pre-development and post-development watersheds have a single point of interest (POI) that encompass the developed pad area. The full post-development area is directed to the BMP. Table 4.1 provides a summary of the pre-development and post-development hydrology and associated peak flow discharge rates without BMP controls. Table 4.2 provides a summary of the pre-development and post-development hydrograph volumes without BMP controls.

Table 4.1: Pre-Development and Post-Development Hydrology

				Peak Flow (cubic feet per second, cfs)					
	Drainage Area (acre, ac)	Tc (hour, hr)	Curve Number (CN)	1-year, yr	2-yr	10-yr	25-yr	50-yr	100-yr
Pre-Development	0.632	0.083	60.07	0.05	0.18	0.70	1.16	1.60	2.13
Post-Development	0.632	0.083	98.00	1.87	2.26	3.34	4.00	4.60	5.26

Table 4.2: Pre-Development and Post-Development Hydrograph Volumes

	Hydrograph Volume (acre feet, ac-ft)					
	1-yr	2-yr	10-yr	25-yr	50-yr	100-yr
Pre-Development	0.007	0.015	0.043	0.067	0.090	0..119
Post-Development	0.112	0.137	0.203	0.248	0.286	0.329

Maps for the pre-development and post-development watersheds are located in Appendix C and Appendix D, respectively.

4.3 BMP DESIGN

The infiltration filter consists of a 3.5-foot deep flat gravel bed surrounded by filter fabric. A 1 foot high berm is constructed downslope of the gravel pad area to retain surface runoff. The berm directs runoff into two drop inlets that connect to four, 280-foot long lengths of perforated High Density Polyethylene (HDPE) pipe that run the length of the infiltration filter. The drop inlets are also connected to a manhole with an interior weir that controls discharge from the infiltration filter during larger storm events. The BMP design details are shown in Appendix G.

The PondPack report of the storm routing for the BMP is provided in Appendix E. The cumulative storage volume for the BMP is shown in Table 4.3. The routing summary for the BMP is summarized in Table 4.4.

Table 4.3: BMP Cumulative Storage Volume

Elevation of Water in System[1]	Cumulative Pipe Storage[2]	Cumulative Pipe and Gravel Storage[3]	Total System Cumulative Storage[4]	Total System Cumulative Storage
(Feet)	(Cubic Feet)	(Cubic Feet)	(Cubic Feet)	(Acre Feet)
0.0	0.00	0.00	0.00	0.000
0.5	0.00	1.00	1120.00	0.026
1.0	0.61	2.37	2652.74	0.061
1.5	1.57	3.94	4415.58	0.101
2.0	2.53	5.52	6178.41	0.142
2.5	3.14	6.88	7711.16	0.177
3.0	3.14	7.88	8831.16	0.203
3.5	3.14	8.88	9951.16	0.228

1. BMP bottom elevation 0.0 corresponds to elevation 601.00 AMSL on the plan.
2. Storage per foot of length of a 24" pipe set at invert elevation 0.5.
3. Storage per foot of length of a 24" pipe set at invert elevation 0.5 plus surrounding gravel set in a 5 foot wide trench with 40% pore space [pipe storage + 40% * ((5ft * depth) – pipe storage)]
4. Total System Cumulative Storage = Cumulative Pipe and Gravel Storage * 450 feet of pipe length.

Table 4.4: BMP Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
1	1.87	0.00	0.112	602.64
2	2.26	0.00	0.137	602.94
10	3.31	0.12	0.151	603.13
25	4.00	0.33	0.166	603.35
50	4.60	0.57	0.184	603.64
100	5.26	0.85	0.206	604.06

4.4 INFILTRATION AREA

The BMP is designed to provide infiltration for volume control. PondPack allows for infiltration information to be included in the BMP design and it can be used to calculate the volumes removed by the BMPs through infiltration. Infiltration testing was performed according to the Pennsylvania Stormwater Best Management Practices Manual to determine the infiltration rates to use in the calculations. Infiltration test results are located in Appendix B. Infiltration rates were determined as follows:

The BMP is located at infiltration test (IT) points IT-A and IT-B. The previous infiltration test results at IT-1 and IT-2 were invalid due to incorrect location and depth. The infiltration rate at IT-A was measured to be 3.34 inches per hour (in/hr). The infiltration rate at IT-B was measured to be 1.66 in/hr. The geometric mean of IT-A and IT-B is 2.4 in/hr. With a safety factor of 3 applied, the infiltration rate used is 0.8 in/hr (0.0667 ft/hr). The method for entering the infiltration rate into PondPack is as a volumetric rate. Therefore the volumetric rate was determined as follows:

Surface area of BMP = 5,600 ft^2

2,250 ft^2 * 0.97 in/hr * 0.0166 hr/minute * 0.0166 minute/sec = 0.06 ft^3/sec

The dewatering time (t) in hours is:

t = d / k

d = depth of water below dewatering orifice (ft) = 2

k = infiltration rate (ft/hr) = 0.0667

t = 2 ft / 0.0667 ft/hr = 30 hours

Groundwater was not encountered in the test pits that were dug during infiltration testing. If groundwater is encountered during construction of the BMP, the certifying engineer should be consulted to determine what measures, if any, need to be taken to ensure that groundwater will not interfere with proper functioning of the BMP.

4.5 STORMWATER MANAGEMENT

Stormwater quality management for the project will comply with Township ordinances and state regulations through the implementation of erosion and sediment controls during construction and implementation and maintenance of post construction stormwater management (PCSM) controls after construction. Stormwater quality is achieved with the proposed BMP design, which is in accordance with the Pennsylvania Stormwater Best Management Practices Manual.

Table 4.5 shows how the design criterion for peak discharge rate and volume reduction is achieved for this project. The post development flow is less than the pre-development peak flow for each design storm event.

For the 1- and 2-year storm events, the post development hydrograph volume is less than the pre-development hydrograph volume.

Table 4.5: POI-1 Peak Discharge Rate Reduction Summary

Storm Event (years)	Total Pre-Development Peak Flow (cfs)	Total Post-Development Peak Flow (cfs)	Total Peak Flow Rate Difference (cfs)	Total Pre-Development Hydrograph Volume (ac-ft)	Total Post-Development Hydrograph Volume (ac-ft)	Total Hydrograph Volume Difference (ac-ft)
1	0.05	0.00	-0.05	0.007	0.000	-0.007
2	0.18	0.00	-0.18	**0.015**	**0.000**	**-0.015**
10	0.70	0.12	-0.58	0.043	0.059	0.016
25	1.16	0.33	-0.83	0.067	0.103	0.036
50	1.60	0.57	-1.03	0.009	0.141	0.132
100	2.13	0.85	-1.28	0.119	0.183	0.064

1. The total post development peak flow is the routed flow of all post-development watersheds to POI-1

5.0 REFERENCES

Erosion and Sediment Pollution Control Program Manual, Commonwealth of Pennsylvania, Department of Environmental Protection, Office of Water Management, March 2012.

Pennsylvania Stormwater Best Management Practices Manual Draft, Document Number 363-0300-002, Pennsylvania Department of Environmental Protection, Bureau of Watershed Management, December 2006.

Soil Survey of Huntingdon County, Pennsylvania, United States Department of Agriculture, Soil Conservation Service.

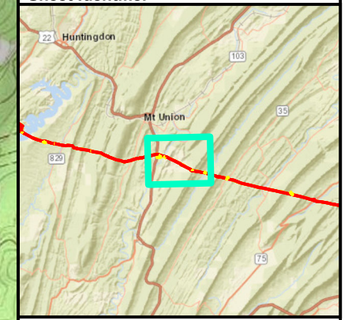
APPENDIX A – SITE LOCATION MAP

Mt. Union Pump Station

Legend

- Access Road
- Alignment Centerline
- Limit of Disturbance
- Pump Station

Sheet Identifier



N

0 1,000 2,000 Feet

0 300 600 Meters

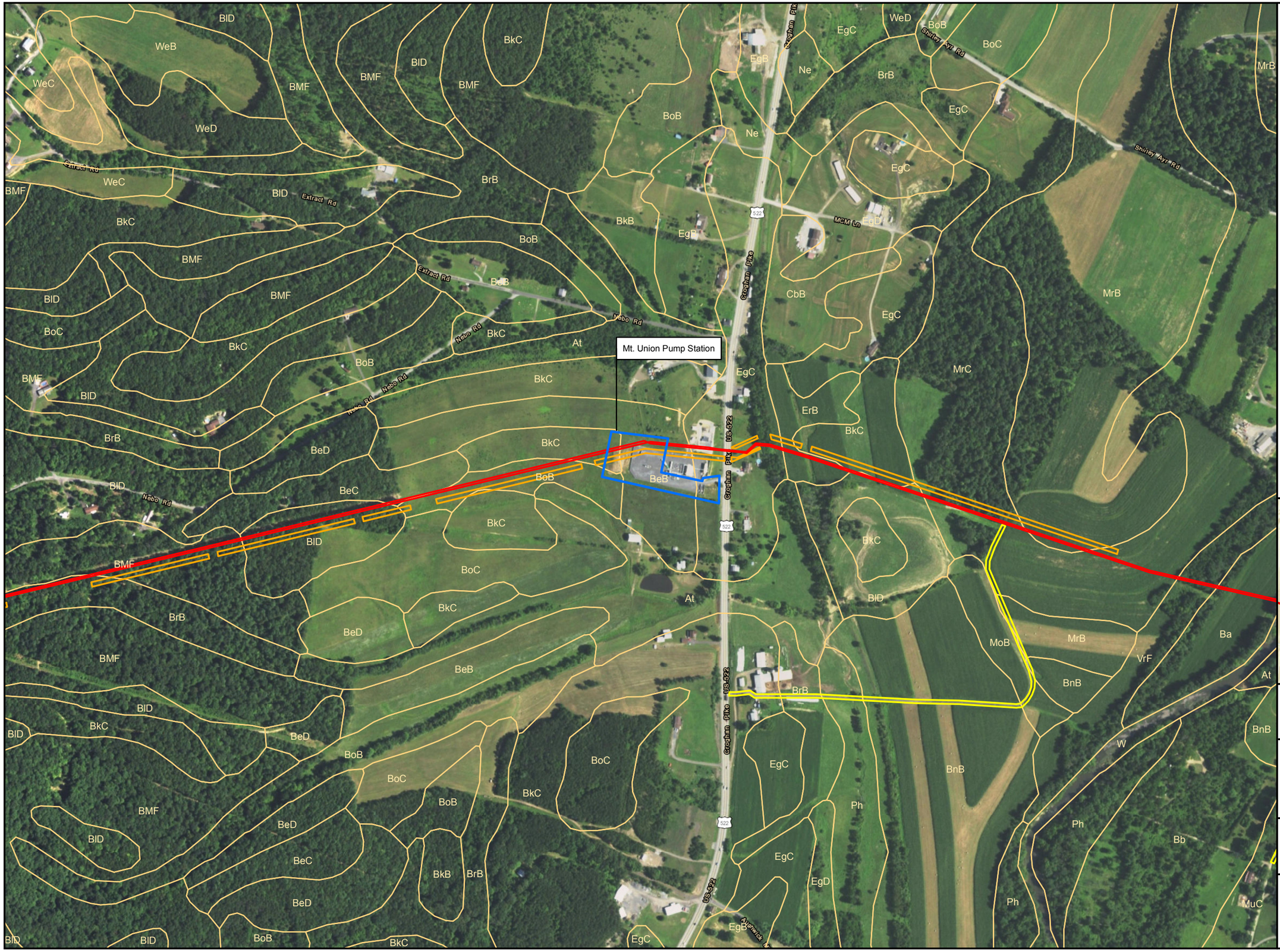
PROJECT LOCATION MAP
ATTACHMENT 1
PENNSYLVANIA PIPELINE PROJECT
OCTOBER 3, 2016 ALIGNMENT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
1) Topographic map provided by ESRI's ArcGIS Online USA Topo Maps map service (© 2013 National Geographic Society, i-cubed).
2) Quadrangles being displayed are Aughwick, Butler Knob

P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP ESCGP\PUMP STATIONS\PENNPIPELINE_PUMPSTATIONS_USGS_ESCGP.MXD 10/14/16 SP

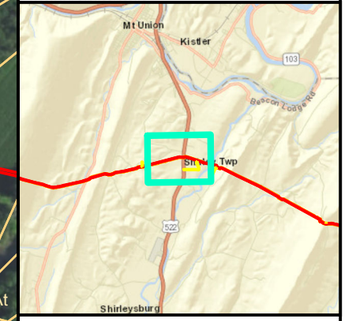
APPENDIX B – SOILS LOCATION MAP AND INFILTRATION TEST RESULTS



Legend

- Access Road
- Alignment Centerline
- Limit of Disturbance
- NRCS Soils and Codes
- Pump Station

Sheet Identifier



N

0 250 500 Feet

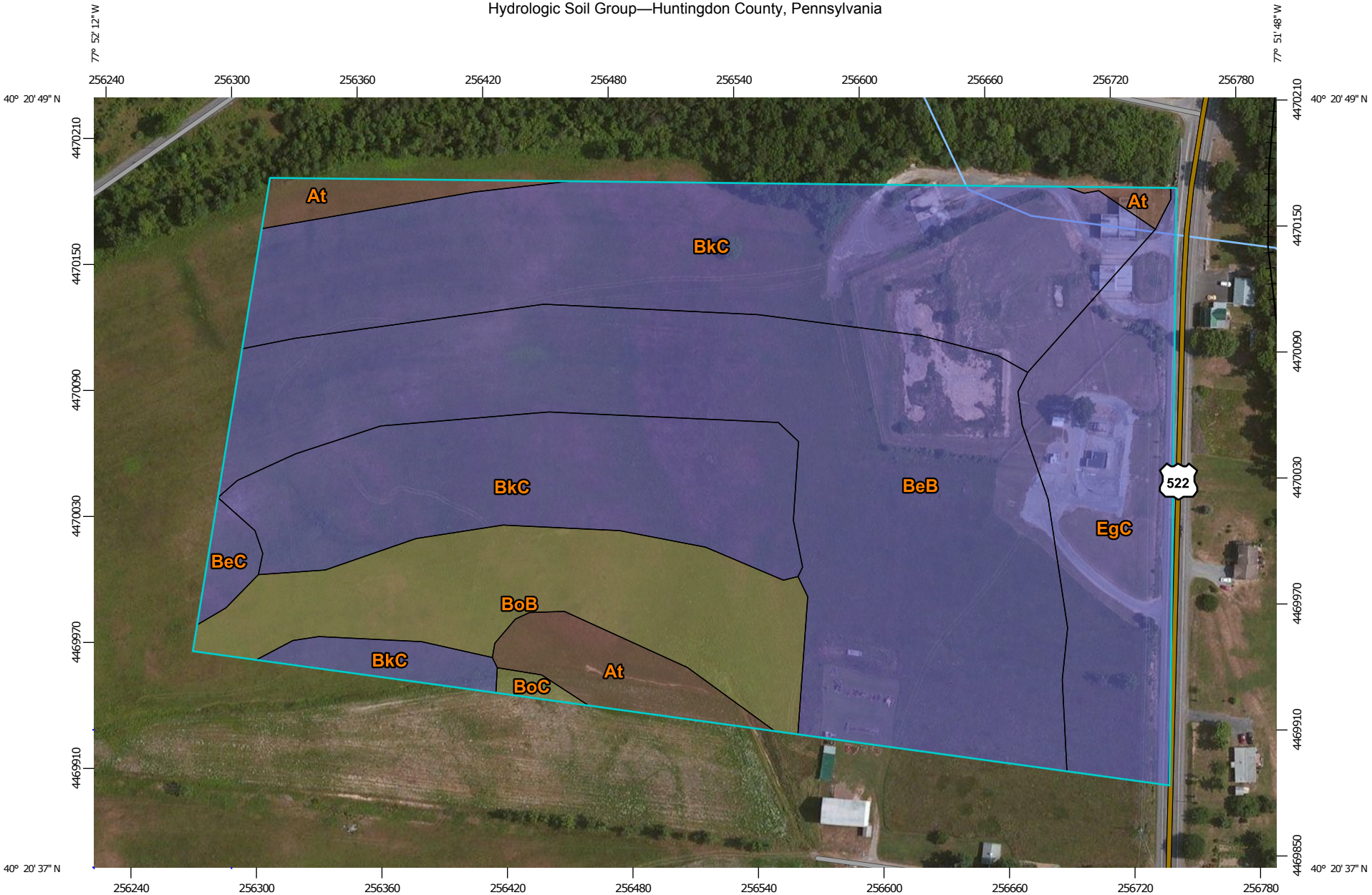
0 76.2 152.4 Meters

NRCS SOILS MAP
ATTACHMENT 2
PENNSYLVANIA PIPELINE PROJECT
OCTOBER 3, 2016 ALIGNMENT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PA

TETRA TECH

Notes:
Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers)

P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP ESC\PP\PUMP STATIONS\PENNPIPELINE_PUMPSTATIONS_SOILS_ESCGP1.MXD 10/14/16 SP


77° 52' 12" W
77° 51' 48" W
40° 20' 49" N
40° 20' 37" N
256240
256300
256360
256420
256480
256540
256600
256660
256720
256780
4470210
4470150
4470090
4470030
4469970
4469910
4469850
At
BkC
BeB
EgC
BeC
BoB
BoC
522
Map Scale: 1:2,580 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 35 70 140 210
Feet
0 100 200 400 600
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Huntingdon County, Pennsylvania
Survey Area Data: Version 6, Sep 19, 2014

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

Date(s) aerial images were photographed: Jun 18, 2010—Sep 25, 2010

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Huntingdon County, Pennsylvania (PA061)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
At	Atkins silt loam	B/D	1.3	4.7%
BeB	Bedington channery silt loam, 3 to 8 percent slopes	B	9.3	32.5%
BeC	Bedington channery silt loam, 8 to 15 percent slopes	B	0.3	0.9%
BkC	Berks channery silt loam, 8 to 15 percent slopes	B	10.7	37.5%
BoB	Blairton silt loam, 2 to 8 percent slopes	C/D	3.4	12.0%
BoC	Blairton silt loam, 8 to 15 percent slopes	C/D	0.1	0.3%
EgC	Edom-Weikert complex, 8 to 15 percent slopes	B	3.5	12.1%
Totals for Area of Interest			**28.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TRIP REPORT

Date: October 25, 2016

To: Tim Dunaway, P.E.

From: Scott Anderson, Hydrogeologist

Subject: Summary of Soil Infiltration Tests
Mt. Union Station
Sunoco PPP
Shirley Township, Huntingdon County, Pennsylvania

This trip report provides results of soil infiltration tests that were completed at the Mt. Union Station located in Shirley Township, Huntingdon County, Pennsylvania as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Logistics L.P.

1.0 PURPOSE

This report presents the field data and results of double-ring soil infiltration tests conducted to support stormwater management system design. Two deep tests (IT-A and IT-B) were performed at the property. Test locations are listed by coordinates in World Geodetic System 84 (WGS 84) latitude and longitude format in Table 1, and locations are also illustrated on a figure attached to this report.

2.0 FIELD ACTIVITIES

The infiltration tests were conducted by Kevin Schwab and Mark Mengel of Tetra Tech, Inc., on October 3, 2016. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit. Table 1 provides the coordinates of the test locations. IT-A and IT-B were located in a flat hay field.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. Double-ring tests were performed. The double-ring test locations were prepared for test locations with the assistance of a mini-excavator, with care taken to minimize disturbance of the soil surface to be tested. The double-ring infiltrometers that were used for testing consisted of 10-inch and 6-inch diameter sections of steel casing. After digging to the target depth, the test surface was leveled, and any loose soil or fallen vegetation was removed. The rings were driven a minimum of 2 inches into the soil. Infiltration test depths are provided on Table 1.

Test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 30-minute intervals, based on the observed water level drops during the second half of the presoak period. Presoak and test information was recorded on infiltration test sheets; copies of the test sheets are attached to this report.

During the testing, the weather was overcast and mild, and no precipitation was observed during the tests. No rain for a period of 24 hours prior to testing was noted.

In addition, test pits were machine-excavated for each testing location to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of a seasonal high water table. The test pits were identified with the corresponding infiltration test name. The test pits were completed to approximately two feet below the target infiltration test depth. Descriptions of the soil from the test pits were recorded by a Tetra Tech geologist on field logs, which were based on the example form in the BMP manual. Copies of the field soil logs are attached to this report.

3.0 RESULTS

3.1 SOILS DESCRIPTION

Soils encountered consisted of thin (approximately a foot thick) brown to dark yellowish brown topsoil/surface loam overlying reddish-yellow, brown, and dark gray silt and clay, with weathered parent material (siltstone, sandstone, and shale fragments) noted in the bottom horizons (silt and clay horizons) of the test pits. Munsell color classifications for each horizon are provided on attached soil logs. Thin grass roots were encountered in the topsoil/surface soils. Soils were noted to be moist during the excavation activities. Soil mottling was observed below 30 inches depth in both test pits. Seasonal high groundwater was not observed in either test pit. Additionally, bedrock was not encountered. Table 1 summarizes the depths of the infiltration tests (test pits completed approximately 2 feet deeper than infiltration test depths).

The soils were not noted to be wet during the excavation activities and generally exhibited an increasing degree of degradation of parent material with depth. Mottling was noted below 30 inches in both test pits in variable brown silts and clays. Since seasonally high groundwater was not encountered, the mottling observed is not likely due to the unconfined water table. Rather, the mottling observed is likely a consequence of a seasonal perched zone or slow infiltration of increased precipitation events through the finer grained soils.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey[1] data, the soil types for the test locations are mapped as Beddington channery silt loam (BeB), 3 to 8 percent slopes

[1] http://websoilsurvey.nrcs.usda.gov/. Accessed October 25, 2016.

3.2 INFILTRATION TEST RESULTS

Table 1 summarizes the infiltration rates (inches per hour) calculated from the test data. Infiltration rates presented in Table 1 were calculated from the averaged water level drop of the last four (stabilized) readings measured in the inner ring. The tests exhibited light to moderate infiltration rates, utilizing a 30-minute test cycle.

In consideration of the infiltration rates for design purposes, a safety factor of 3 is assumed based on the significant presence of silts and clays at the test depths. The geometric mean of IT-A and IT-B is 2.4 inches per hour. With application of the safety factor of 3, the resultant recommended rate is 0.8 inches per hour.

TABLE 1
Summary of Infiltration Test Results and Work Locations
Mt. Union Station

Location (IT-#)	Location Data[1]		Test Depth (inches)	Infiltration Test Result (inches per hour)
	LATITUDE WGS 84	LONGITUDE WGS 84		
A	40.344647	-77.864839	72	3.34
B	40.344694	-77.865111	72	1.66

Note

[1] Field coordinates

ATTACHMENTS

SITE FIGURE

Figure 1

Infiltration Testing Locations
Mount Union Station
Soil Type: Beddington Channery Silt Loam (BeB)
Huntington County

INFILTRATION TEST DATA SHEETS

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: MOUNT UNION
PROJECT NUMBER: 112IC05958
TEST AREA ID: IT-A closest to road
PERSONNEL: MM

TEST METHOD: (Double Ring Infiltrometer) Percolation ~~Single Ring Infiltrometer~~

Location Coordinates or Description:

INNER RING INSIDE DIAMETER/HEIGHT: 6/10
OUTER RING INSIDE DIAMETER/HEIGHT: 10/10

PERCOLATION HOLE DIAMETER: NA (If performing an open hole perc test)

DATE(s): 10/3/16

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): 7"

MEASURING POINT: (Ring Rim) Indicator Mark

DEPTH OF TEST: 6'

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
1530	0	-------	4.2 L	1540 down 4" added 2.1 L
1600	30	3 10/16	2.0 L	
1630	60	2 7/16	1.3 L	Rings installed on top of
				Rock - NOT seating completely.
1630	0	-------	4.2	
1700	30	1 9/16	1.0L	
1730	60	1 11/16	1.1 L	
1800	90	1 11/16	1.0 L	
1830	120	1 11/16	-	END OF TEST

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Mount Union
PROJECT NUMBER: 112IC05958
TEST AREA ID: IT-B Furthest from road
PERSONNEL: KAS

TEST METHOD: (Double Ring Infiltrometer) Percolation
Single Ring Infiltrometer

Location Coordinates or Description:

INNER RING INSIDE DIAMETER/HEIGHT: 6/10
OUTER RING INSIDE DIAMETER/HEIGHT: 10/10

PERCOLATION HOLE DIAMETER: _____ (If performing an open hole perc test)

DATE(s): 10/3/16

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): 8"

MEASURING POINT: (Ring Rim) Indicator Mark

DEPTH OF TEST: 6'

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
1610	0	———	4.2 L	
1640	30	14/16	.5L	
1710	60	1 0/16	.55L	
TEST DATA				
1710	0	———		
1740	30	14/16	.5 L	
1810	60	14/16	.5L	
1840	90	13/16	.5L	
1910	120	12/16	.45 L	

Sunoco - Mount Union Station		Test Loc. IT-A (6')	10/3/2016	
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)	
1630	0	0.00	0	
1700	30	1.63	1	
1730	60	1.69	1.1	
1800	90	1.69	1	
1830	120	1.69	NA	Infiltration Rate
				Average Stabilized Rate (in/hr)
				3.34

Sunoco - Mount Union Station		Test Loc. IT-B (6')	10/3/2016	
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)	
1710	0	0.00	0	
1740	30	0.875	0.5	
1810	60	0.875	0.5	
1840	90	0.813	0.5	
1910	120	0.750	0.45	Infiltration Rate
				Average Stabilized Rate (in/hr)
				1.66

SOIL LOGS

TETRA TECH

Soil Log

Tested By: KAS **Project:** Mt. Union **Project No.:** 112IC05958

Test Pit: IT - A **Date:** 10/3/16 **Elevation:** **Equipment Used:** mini-ex

Geology: flat ag field **Soil Type:** silt and clay **Land Use:** Hay field **Weather:** partly cloudy

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
A	0	30 cm	loam	fine granular	10YR 4/3	even				
B	30	~~78~~ cm	silt clay	med angular blocky	7.5YR 5/6	even				hard
B2	78	125 cm	clay	SAA	7.5YR 4/6 & 5/6	60% mottled <10%	10% siltstones channers			hard
B3	125	160 cm	silt clay	platty	7.5YR 4/3 & 5/2	50% mottled 50%	15% siltstones channers	semi degraded		med
BC	160	140 cm	clay	fine-med subangular	7.5YR 4/4 & 5/3	70% mottled 30%	10% siltstones 10% shales	degrading		soft
CB	140	235 cm	clay trace silt	med subangular blocky	7.5YR 3/2 & 4/3 & 5/6	33% mottled 33%	25% siltstones & shale degrading			soft

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification Classification as Follows: Abrupt	
A	Dark colored, mixed mineral organic matter			
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

3/2
4/3
5/6

TETRA TECH

Soil Log

Tested By: LAS **Project:** Mt. Union **Project No.:** 112IC05958

Test Pit: IT-B **Date:** 10/3/16 **Elevation:** **Equipment Used:** mini-ex

Geology: flat ag field **Soil Type:** silt and clay **Land Use:** Hay field **Weather:** partly cloudy

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
A	0	28	silt loam	fine granular	10YR 4/4	even	few small roots			
B	28	80	silt clay	fine - med sub angular	7.5YR 6/6	even				
B2	80	110	clay	fine - med sub angular - angular	7.5YR 5/4 7.5YR 5/2	80% mottled 20%				
B3	110	155	silt clay	fine - med sub angular blocky	7.5YR 4/3 7.5YR 5/6	70% mottles 30%	5% degrading siltstones & shales			
BC	155	200	clay trace silt	SAA	7.5YR 3/1 7.5YR 5/4	60% mottles 40%	30% degrading silt/sandstones & shales			
CB	200	245	silt clay	SAA	7.5YR 4/3 7.5YR 5/2	50% mottles 50%	45% siltstones and shales of various stages of degredation			still has some rock structure

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

APPENDIX C – PRE-DEVELOPED RUNOFF MAP

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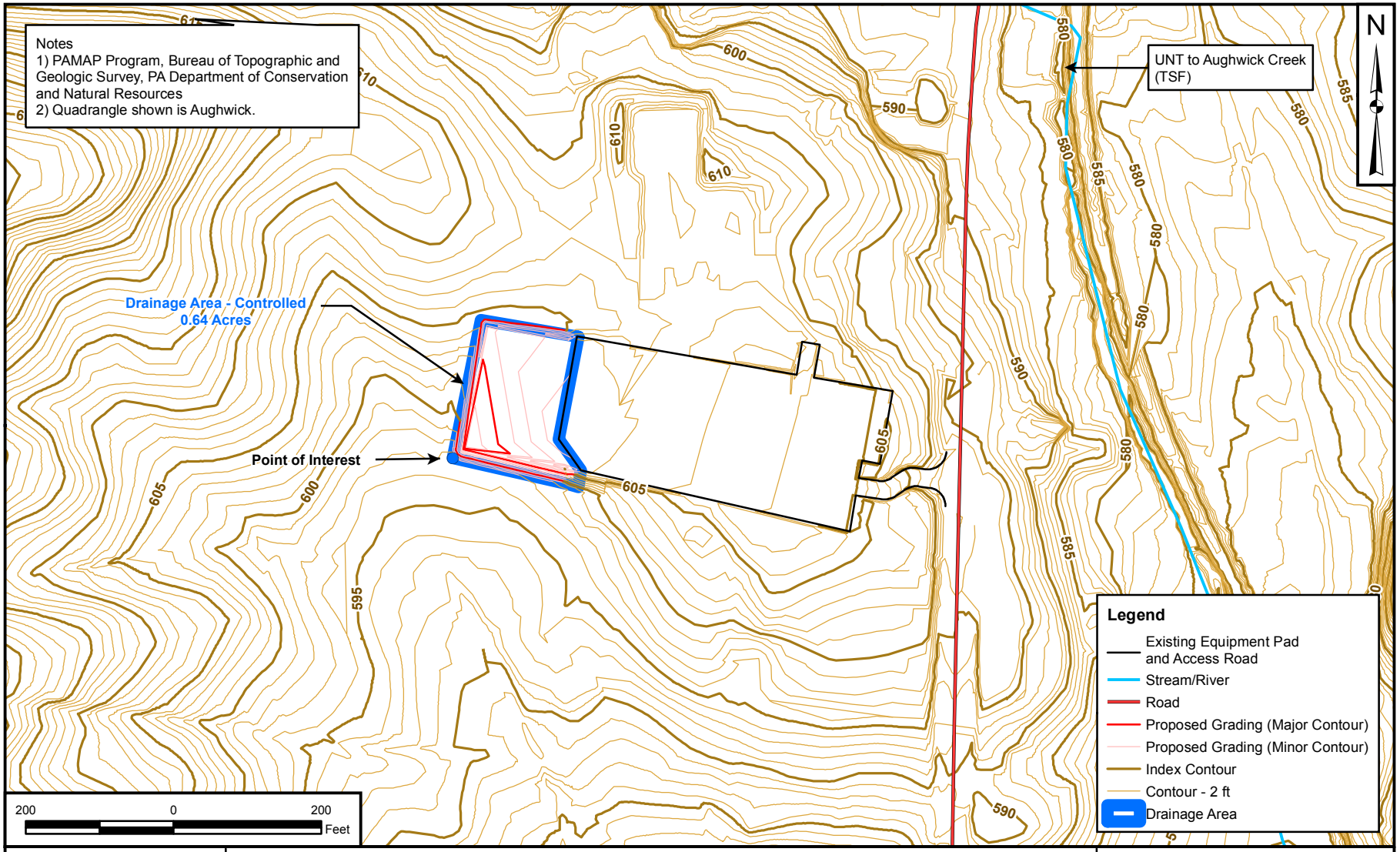


TETRA TECH

DRAINAGE AREA MAP
MT. UNION PUMP STATION
MARINER EAST
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PENNSYLVANIA

DRAWN BY: J. HERNING 09/29/15
CHECKED BY: T. DUNAWAY 11/15/16
APPROVED BY:

CONTRACT NUMBER: 212IC-PB-00136

FIGURE NUMBER	REV
1	0

PGH P:\GIS\SUNOCO\MAPDOCS\ME1_MT-UNION_STATION_PRE-CONSTRUCTION_11182015.MXD 11/15/16 SP

TETRA TECH

PRE-CONSTRUCTION DRAINAGE AREA MAP

MT. UNION PUMP STATION

MARINER EAST

SUNOCO LOGISTICS, L.P.

HUNTINGDON COUNTY, PENNSYLVANIA

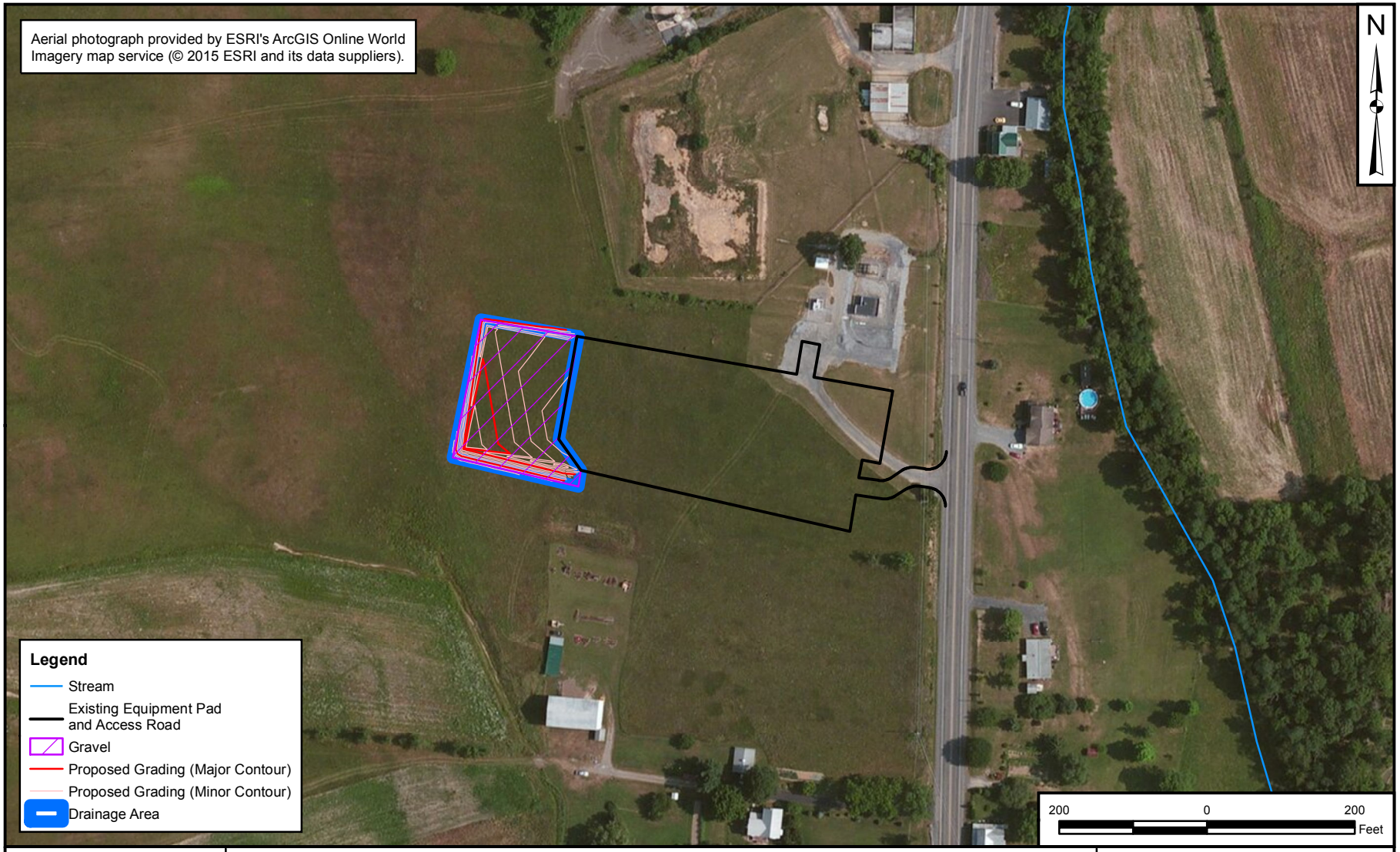
DRAWN BY: K. MOORE 12/16/13
CHECKED BY: T. DUNAWAY 11/15/16
APPROVED BY:

CONTRACT NUMBER: 212IC-PB-00136

FIGURE NUMBER	REV
1	0

APPENDIX D – POST-DEVELOPED RUNOFF MAP

PGH P:\GIS\SUNOCO\MAPDOCS\ME1_MT-UNION_STATION_POST-CONSTRUCTION_11182015.MXD 11/15/16 SP



TETRA TECH

POST-CONSTRUCTION DRAINAGE AREA MAP

MT. UNION PUMP STATION

MARINER EAST

SUNOCO LOGISTICS, L.P.

HUNTINGDON COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 12/16/13
CHECKED BY: T. DUNAWAY 11/15/16
APPROVED BY:

CONTRACT NUMBER: 212IC-PB-00136

FIGURE NUMBER	REV
1	0

APPENDIX E – PONDPACK AND FLOWMASTER CALCULATIONS

Project Summary	
Title	
Engineer	
Company	
Date	1/28/2014

Notes

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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Post-Controlled	1-year	1	0.112	11.900	1.87
Post-Controlled	2-year	2	0.137	11.900	2.26
Post-Controlled	10-year	10	0.203	11.900	3.31
Post-Controlled	25-year	25	0.248	11.900	4.00
Post-Controlled	50-year	50	0.286	11.900	4.60
Post-Controlled	100-year	100	0.329	11.900	5.26
Pre-Developed	1-year	1	0.007	12.050	0.05
Pre-Developed	2-year	2	0.015	12.000	0.18
Pre-Developed	10-year	10	0.043	12.000	0.70
Pre-Developed	25-year	25	0.067	11.950	1.16
Pre-Developed	50-year	50	0.090	11.950	1.60
Pre-Developed	100-year	100	0.119	11.950	2.13

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Post Out	1-year	1	0.000	0.000	0.00
Post Out	2-year	2	0.000	0.000	0.00
Post Out	10-year	10	0.059	13.550	0.12
Post Out	25-year	25	0.103	12.500	0.33
Post Out	50-year	50	0.141	12.250	0.57
Post Out	100-year	100	0.183	12.150	0.85
Pre-Out	1-year	1	0.007	12.050	0.05
Pre-Out	2-year	2	0.015	12.000	0.18
Pre-Out	10-year	10	0.043	12.000	0.70
Pre-Out	25-year	25	0.067	11.950	1.16
Pre-Out	50-year	50	0.090	11.950	1.60
Pre-Out	100-year	100	0.119	11.950	2.13

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	1-year	1	0.112	11.900	1.87	(N/A)	(N/A)
PO-1 (OUT)	1-year	1	0.000	0.000	0.00	602.64	0.112
PO-1 (IN)	2-year	2	0.137	11.900	2.26	(N/A)	(N/A)
PO-1 (OUT)	2-year	2	0.000	0.000	0.00	602.94	0.137
PO-1 (IN)	10-year	10	0.203	11.900	3.31	(N/A)	(N/A)
PO-1 (OUT)	10-year	10	0.059	13.550	0.12	603.13	0.151
PO-1 (IN)	25-year	25	0.248	11.900	4.00	(N/A)	(N/A)
PO-1 (OUT)	25-year	25	0.103	12.500	0.33	603.35	0.166

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	50-year	50	0.286	11.900	4.60	(N/A)	(N/A)
PO-1 (OUT)	50-year	50	0.141	12.250	0.57	603.64	0.184
PO-1 (IN)	100-year	100	0.329	11.900	5.26	(N/A)	(N/A)
PO-1 (OUT)	100-year	100	0.183	12.150	0.85	604.06	0.206

Time-Depth Curve: 100-year	
Label	100-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.1	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.2	0.2	0.2	0.2
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.2	0.2	0.3
3.500	0.3	0.3	0.3	0.3	0.3
4.000	0.3	0.3	0.3	0.3	0.3
4.500	0.4	0.4	0.4	0.4	0.4
5.000	0.4	0.4	0.4	0.4	0.5
5.500	0.5	0.5	0.5	0.5	0.5
6.000	0.5	0.5	0.5	0.6	0.6
6.500	0.6	0.6	0.6	0.6	0.6
7.000	0.6	0.7	0.7	0.7	0.7
7.500	0.7	0.7	0.7	0.8	0.8
8.000	0.8	0.8	0.8	0.8	0.8
8.500	0.9	0.9	0.9	0.9	0.9
9.000	1.0	1.0	1.0	1.0	1.0
9.500	1.1	1.1	1.1	1.1	1.1
10.000	1.2	1.2	1.2	1.3	1.3
10.500	1.3	1.4	1.4	1.4	1.5
11.000	1.5	1.6	1.6	1.7	1.8
11.500	1.8	2.0	2.3	2.8	3.7
12.000	4.3	4.4	4.5	4.6	4.7
12.500	4.8	4.8	4.9	4.9	5.0
13.000	5.0	5.0	5.1	5.1	5.2
13.500	5.2	5.2	5.2	5.3	5.3
14.000	5.3	5.3	5.4	5.4	5.4
14.500	5.4	5.5	5.5	5.5	5.5
15.000	5.5	5.6	5.6	5.6	5.6
15.500	5.6	5.6	5.7	5.7	5.7
16.000	5.7	5.7	5.7	5.8	5.8
16.500	5.8	5.8	5.8	5.8	5.8
17.000	5.9	5.9	5.9	5.9	5.9
17.500	5.9	5.9	5.9	6.0	6.0

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 100 years
Storm Event: 100-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	6.0	6.0	6.0	6.0	6.0
18.500	6.0	6.0	6.1	6.1	6.1
19.000	6.1	6.1	6.1	6.1	6.1
19.500	6.1	6.1	6.2	6.2	6.2
20.000	6.2	6.2	6.2	6.2	6.2
20.500	6.2	6.2	6.2	6.2	6.3
21.000	6.3	6.3	6.3	6.3	6.3
21.500	6.3	6.3	6.3	6.3	6.3
22.000	6.3	6.3	6.4	6.4	6.4
22.500	6.4	6.4	6.4	6.4	6.4
23.000	6.4	6.4	6.4	6.4	6.4
23.500	6.5	6.5	6.5	6.5	6.5
24.000	6.5	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 10-year	
Label	10-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.2	0.2	0.2	0.2	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.3
6.000	0.3	0.3	0.3	0.4	0.4
6.500	0.4	0.4	0.4	0.4	0.4
7.000	0.4	0.4	0.4	0.4	0.4
7.500	0.4	0.5	0.5	0.5	0.5
8.000	0.5	0.5	0.5	0.5	0.5
8.500	0.5	0.6	0.6	0.6	0.6
9.000	0.6	0.6	0.6	0.6	0.7
9.500	0.7	0.7	0.7	0.7	0.7
10.000	0.7	0.8	0.8	0.8	0.8
10.500	0.8	0.9	0.9	0.9	0.9
11.000	1.0	1.0	1.0	1.1	1.1
11.500	1.2	1.3	1.5	1.8	2.3
12.000	2.7	2.8	2.9	2.9	3.0
12.500	3.0	3.0	3.1	3.1	3.1
13.000	3.2	3.2	3.2	3.2	3.3
13.500	3.3	3.3	3.3	3.3	3.3
14.000	3.4	3.4	3.4	3.4	3.4
14.500	3.4	3.4	3.5	3.5	3.5
15.000	3.5	3.5	3.5	3.5	3.5
15.500	3.6	3.6	3.6	3.6	3.6
16.000	3.6	3.6	3.6	3.6	3.6
16.500	3.7	3.7	3.7	3.7	3.7
17.000	3.7	3.7	3.7	3.7	3.7
17.500	3.7	3.7	3.8	3.8	3.8

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 10 years
Storm Event: 10-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	3.8	3.8	3.8	3.8	3.8
18.500	3.8	3.8	3.8	3.8	3.8
19.000	3.8	3.9	3.9	3.9	3.9
19.500	3.9	3.9	3.9	3.9	3.9
20.000	3.9	3.9	3.9	3.9	3.9
20.500	3.9	3.9	3.9	3.9	4.0
21.000	4.0	4.0	4.0	4.0	4.0
21.500	4.0	4.0	4.0	4.0	4.0
22.000	4.0	4.0	4.0	4.0	4.0
22.500	4.0	4.0	4.0	4.0	4.0
23.000	4.1	4.1	4.1	4.1	4.1
23.500	4.1	4.1	4.1	4.1	4.1
24.000	4.1	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 1-year	
Label	1-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	1 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0
1.500	0.0	0.0	0.0	0.0	0.0
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.1
3.500	0.1	0.1	0.1	0.1	0.1
4.000	0.1	0.1	0.1	0.1	0.1
4.500	0.1	0.1	0.1	0.1	0.1
5.000	0.1	0.2	0.2	0.2	0.2
5.500	0.2	0.2	0.2	0.2	0.2
6.000	0.2	0.2	0.2	0.2	0.2
6.500	0.2	0.2	0.2	0.2	0.2
7.000	0.2	0.2	0.2	0.2	0.3
7.500	0.3	0.3	0.3	0.3	0.3
8.000	0.3	0.3	0.3	0.3	0.3
8.500	0.3	0.3	0.3	0.3	0.3
9.000	0.3	0.4	0.4	0.4	0.4
9.500	0.4	0.4	0.4	0.4	0.4
10.000	0.4	0.4	0.4	0.5	0.5
10.500	0.5	0.5	0.5	0.5	0.5
11.000	0.6	0.6	0.6	0.6	0.6
11.500	0.7	0.7	0.8	1.0	1.3
12.000	1.6	1.6	1.6	1.7	1.7
12.500	1.7	1.8	1.8	1.8	1.8
13.000	1.8	1.8	1.8	1.9	1.9
13.500	1.9	1.9	1.9	1.9	1.9
14.000	1.9	1.9	2.0	2.0	2.0
14.500	2.0	2.0	2.0	2.0	2.0
15.000	2.0	2.0	2.0	2.0	2.0
15.500	2.0	2.1	2.1	2.1	2.1
16.000	2.1	2.1	2.1	2.1	2.1
16.500	2.1	2.1	2.1	2.1	2.1
17.000	2.1	2.1	2.1	2.1	2.1
17.500	2.2	2.2	2.2	2.2	2.2

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 1 years
Storm Event: 1-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	2.2	2.2	2.2	2.2	2.2
18.500	2.2	2.2	2.2	2.2	2.2
19.000	2.2	2.2	2.2	2.2	2.2
19.500	2.2	2.2	2.2	2.2	2.2
20.000	2.2	2.2	2.3	2.3	2.3
20.500	2.3	2.3	2.3	2.3	2.3
21.000	2.3	2.3	2.3	2.3	2.3
21.500	2.3	2.3	2.3	2.3	2.3
22.000	2.3	2.3	2.3	2.3	2.3
22.500	2.3	2.3	2.3	2.3	2.3
23.000	2.3	2.3	2.3	2.3	2.3
23.500	2.3	2.3	2.4	2.4	2.4
24.000	2.4	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 25-year	
Label	25-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	25 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.2	0.2	0.2
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.3	0.3	0.3
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.4	0.4	0.4	0.4	0.4
6.000	0.4	0.4	0.4	0.4	0.4
6.500	0.4	0.5	0.5	0.5	0.5
7.000	0.5	0.5	0.5	0.5	0.5
7.500	0.5	0.6	0.6	0.6	0.6
8.000	0.6	0.6	0.6	0.6	0.6
8.500	0.7	0.7	0.7	0.7	0.7
9.000	0.7	0.7	0.8	0.8	0.8
9.500	0.8	0.8	0.8	0.9	0.9
10.000	0.9	0.9	0.9	1.0	1.0
10.500	1.0	1.0	1.1	1.1	1.1
11.000	1.2	1.2	1.2	1.3	1.3
11.500	1.4	1.5	1.8	2.1	2.8
12.000	3.3	3.4	3.5	3.5	3.6
12.500	3.6	3.7	3.7	3.8	3.8
13.000	3.8	3.9	3.9	3.9	3.9
13.500	4.0	4.0	4.0	4.0	4.0
14.000	4.1	4.1	4.1	4.1	4.1
14.500	4.1	4.2	4.2	4.2	4.2
15.000	4.2	4.2	4.3	4.3	4.3
15.500	4.3	4.3	4.3	4.3	4.3
16.000	4.4	4.4	4.4	4.4	4.4
16.500	4.4	4.4	4.4	4.4	4.5
17.000	4.5	4.5	4.5	4.5	4.5
17.500	4.5	4.5	4.5	4.5	4.5

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 25 years
Storm Event: 25-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	4.6	4.6	4.6	4.6	4.6
18.500	4.6	4.6	4.6	4.6	4.6
19.000	4.6	4.6	4.7	4.7	4.7
19.500	4.7	4.7	4.7	4.7	4.7
20.000	4.7	4.7	4.7	4.7	4.7
20.500	4.7	4.8	4.8	4.8	4.8
21.000	4.8	4.8	4.8	4.8	4.8
21.500	4.8	4.8	4.8	4.8	4.8
22.000	4.8	4.8	4.8	4.9	4.9
22.500	4.9	4.9	4.9	4.9	4.9
23.000	4.9	4.9	4.9	4.9	4.9
23.500	4.9	4.9	4.9	4.9	4.9
24.000	5.0	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 2-year	
Label	2-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	2 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0
1.500	0.0	0.0	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.1
3.500	0.1	0.1	0.1	0.1	0.1
4.000	0.1	0.1	0.1	0.1	0.2
4.500	0.2	0.2	0.2	0.2	0.2
5.000	0.2	0.2	0.2	0.2	0.2
5.500	0.2	0.2	0.2	0.2	0.2
6.000	0.2	0.2	0.2	0.2	0.2
6.500	0.3	0.3	0.3	0.3	0.3
7.000	0.3	0.3	0.3	0.3	0.3
7.500	0.3	0.3	0.3	0.3	0.3
8.000	0.3	0.3	0.4	0.4	0.4
8.500	0.4	0.4	0.4	0.4	0.4
9.000	0.4	0.4	0.4	0.4	0.5
9.500	0.5	0.5	0.5	0.5	0.5
10.000	0.5	0.5	0.5	0.5	0.6
10.500	0.6	0.6	0.6	0.6	0.6
11.000	0.7	0.7	0.7	0.7	0.8
11.500	0.8	0.9	1.0	1.2	1.6
12.000	1.9	1.9	2.0	2.0	2.1
12.500	2.1	2.1	2.1	2.1	2.2
13.000	2.2	2.2	2.2	2.2	2.2
13.500	2.3	2.3	2.3	2.3	2.3
14.000	2.3	2.3	2.3	2.4	2.4
14.500	2.4	2.4	2.4	2.4	2.4
15.000	2.4	2.4	2.4	2.4	2.4
15.500	2.5	2.5	2.5	2.5	2.5
16.000	2.5	2.5	2.5	2.5	2.5
16.500	2.5	2.5	2.5	2.5	2.5
17.000	2.6	2.6	2.6	2.6	2.6
17.500	2.6	2.6	2.6	2.6	2.6

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 2 years
Storm Event: 2-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	2.6	2.6	2.6	2.6	2.6
18.500	2.6	2.6	2.6	2.6	2.6
19.000	2.7	2.7	2.7	2.7	2.7
19.500	2.7	2.7	2.7	2.7	2.7
20.000	2.7	2.7	2.7	2.7	2.7
20.500	2.7	2.7	2.7	2.7	2.7
21.000	2.7	2.7	2.7	2.7	2.7
21.500	2.7	2.8	2.8	2.8	2.8
22.000	2.8	2.8	2.8	2.8	2.8
22.500	2.8	2.8	2.8	2.8	2.8
23.000	2.8	2.8	2.8	2.8	2.8
23.500	2.8	2.8	2.8	2.8	2.8
24.000	2.8	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 50-year	
Label	50-year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	50 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.2
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.3	0.3
4.000	0.3	0.3	0.3	0.3	0.3
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.4	0.4	0.4	0.4	0.4
5.500	0.4	0.4	0.4	0.4	0.4
6.000	0.5	0.5	0.5	0.5	0.5
6.500	0.5	0.5	0.5	0.5	0.6
7.000	0.6	0.6	0.6	0.6	0.6
7.500	0.6	0.6	0.6	0.7	0.7
8.000	0.7	0.7	0.7	0.7	0.7
8.500	0.8	0.8	0.8	0.8	0.8
9.000	0.8	0.9	0.9	0.9	0.9
9.500	0.9	0.9	1.0	1.0	1.0
10.000	1.0	1.1	1.1	1.1	1.1
10.500	1.2	1.2	1.2	1.3	1.3
11.000	1.3	1.4	1.4	1.5	1.5
11.500	1.6	1.7	2.0	2.4	3.2
12.000	3.8	3.9	4.0	4.1	4.1
12.500	4.2	4.2	4.3	4.3	4.3
13.000	4.4	4.4	4.5	4.5	4.5
13.500	4.5	4.6	4.6	4.6	4.6
14.000	4.7	4.7	4.7	4.7	4.7
14.500	4.8	4.8	4.8	4.8	4.8
15.000	4.8	4.9	4.9	4.9	4.9
15.500	4.9	4.9	5.0	5.0	5.0
16.000	5.0	5.0	5.0	5.0	5.0
16.500	5.1	5.1	5.1	5.1	5.1
17.000	5.1	5.1	5.1	5.2	5.2
17.500	5.2	5.2	5.2	5.2	5.2

Subsection: Time-Depth Curve
Label: Time-Depth - 1

Return Event: 50 years
Storm Event: 50-year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
18.000	5.2	5.2	5.3	5.3	5.3
18.500	5.3	5.3	5.3	5.3	5.3
19.000	5.3	5.3	5.3	5.4	5.4
19.500	5.4	5.4	5.4	5.4	5.4
20.000	5.4	5.4	5.4	5.4	5.4
20.500	5.4	5.5	5.5	5.5	5.5
21.000	5.5	5.5	5.5	5.5	5.5
21.500	5.5	5.5	5.5	5.5	5.5
22.000	5.5	5.6	5.6	5.6	5.6
22.500	5.6	5.6	5.6	5.6	5.6
23.000	5.6	5.6	5.6	5.6	5.6
23.500	5.6	5.7	5.7	5.7	5.7
24.000	5.7	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Unit Hydrograph Equations

Unit Hydrograph Method (Computational Notes)
Definition of Terms

At	Total area (acres): At = Ai+Ap
Ai	Impervious area (acres)
Ap	Pervious area (acres)
CNi	Runoff curve number for impervious area
CNp	Runoff curve number for pervious area
fLoss	f loss constant infiltration (depth/time)
gKs	Saturated Hydraulic Conductivity (depth/time)
Md	Volumetric Moisture Deficit
Psi	Capillary Suction (length)
hK	Horton Infiltration Decay Rate (time^-1)
fo	Initial Infiltration Rate (depth/time)
fc	Ultimate(capacity)Infiltration Rate (depth/time)
Ia	Initial Abstraction (length)
dt	Computational increment (duration of unit excess rainfall) Default dt is smallest value of 0.1333Tc, rtm, and th (Smallest dt is then adjusted to match up with Tp)
UDdt	User specified override computational main time increment (only used if UDdt is => .1333Tc)
D(t)	Point on distribution curve (fraction of P) for time step t
K	2 / (1 + (Tr/Tp)): default K = 0.75: (for Tr/Tp = 1.67)
Ks	Hydrograph shape factor = Unit Conversions * K: = ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K Default Ks = 645.333 * 0.75 = 484
Lag	Lag time from center of excess runoff (dt) to Tp: Lag = 0.6Tc
P	Total precipitation depth, inches
Pa(t)	Accumulated rainfall at time step t
Pi(t)	Incremental rainfall at time step t
qp	Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi. = (Ks * A * Q) / Tp (where Q = 1in. runoff, A=sq.mi.)
Qu(t)	Unit hydrograph ordinate (cfs) at time step t
Q(t)	Final hydrograph ordinate (cfs) at time step t
Rai(t)	Accumulated runoff (inches) at time step t for impervious area
Rap(t)	Accumulated runoff (inches) at time step t for pervious area
Rii(t)	Incremental runoff (inches) at time step t for impervious area
Rip(t)	Incremental runoff (inches) at time step t for pervious area
R(t)	Incremental weighted total runoff (inches)
Rtm	Time increment for rainfall table
Si	S for impervious area: Si = (1000/CNi) - 10
Sp	S for pervious area: Sp = (1000/CNp) - 10
t	Time step (row) number
Tc	Time of concentration
Tb	Time (hrs) of entire unit hydrograph: Tb = Tp + Tr
Tp	Time (hrs) to peak of a unit hydrograph: Tp = (dt/2) + Lag
Tr	Time (hrs) of receding limb of unit hydrograph: Tr = ratio of Tp

Subsection: Unit Hydrograph Equations

Unit Hydrograph Method
Computational Notes
Precipitation

Column (1)	Time for time step t
Column (2)	D(t) = Point on distribution curve for time step t
Column (3)	Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4)	Pa(t) = D(t) x P: Col.(2) x P

Pervious Area Runoff (using SCS Runoff CN Method)

Column (5)	Rap(t) = Accumulated pervious runoff for time step t
	If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
	If (Pa(t) is > 0.2Sp) then use:
	
	Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6)	Rip(t) = Incremental pervious runoff for time step t Rip(t) = Rap(t) - Rap(t-1) Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

Impervious Area Runoff

Column (7 & 8)...	Did not specify to use impervious areas.

Incremental Weighted Runoff

Column (9)	R(t) = (Ap/At) x Rip(t) + (Ai/At) x Rii(t) R(t) = (Ap/At) x Col.(6) + (Ai/At) x Col.(8)

SCS Unit Hydrograph Method

Column (10)	Q(t) is computed with the SCS unit hydrograph method using R(t) and Qu(t).

Storm Event	1-year
Return Event	1 years
Duration	24.000 hours
Depth	2.4 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	1.91 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	1.87 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.1 in
Runoff Volume (Pervious)	0.112 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.112 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	2-year
Return Event	2 years
Duration	24.000 hours
Depth	2.8 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	2.30 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	2.26 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.6 in
Runoff Volume (Pervious)	0.137 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.137 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	10-year
Return Event	10 years
Duration	24.000 hours
Depth	4.1 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	3.36 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	3.31 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.9 in
Runoff Volume (Pervious)	0.204 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.203 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	25-year
Return Event	25 years
Duration	24.000 hours
Depth	5.0 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	4.07 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	4.00 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	4.7 in
Runoff Volume (Pervious)	0.248 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.248 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	50-year
Return Event	50 years
Duration	24.000 hours
Depth	5.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	4.67 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	4.60 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	5.4 in
Runoff Volume (Pervious)	0.287 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.286 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	100-year
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.922 hours
Flow (Peak, Computed)	5.34 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	5.26 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	6.3 in
Runoff Volume (Pervious)	0.329 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.329 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1-year
Return Event	1 years
Duration	24.000 hours
Depth	2.4 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.033 hours
Flow (Peak, Computed)	0.05 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.050 hours
Flow (Peak Interpolated Output)	0.05 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.1 in
Runoff Volume (Pervious)	0.007 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.007 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	2-year
Return Event	2 years
Duration	24.000 hours
Depth	2.8 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.022 hours
Flow (Peak, Computed)	0.19 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	0.18 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.3 in
Runoff Volume (Pervious)	0.015 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.015 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	10-year
Return Event	10 years
Duration	24.000 hours
Depth	4.1 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.011 hours
Flow (Peak, Computed)	0.70 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	0.70 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.8 in
Runoff Volume (Pervious)	0.043 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.043 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	25-year
Return Event	25 years
Duration	24.000 hours
Depth	5.0 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.933 hours
Flow (Peak, Computed)	1.17 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	1.16 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.3 in
Runoff Volume (Pervious)	0.067 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.067 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	50-year
Return Event	50 years
Duration	24.000 hours
Depth	5.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.933 hours
Flow (Peak, Computed)	1.63 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	1.60 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.7 in
Runoff Volume (Pervious)	0.091 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.090 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	100-year
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	0.632 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.933 hours
Flow (Peak, Computed)	2.19 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	2.13 ft³/s

Drainage Area	
SCS CN (Composite)	60.071
Area (User Defined)	0.632 acres
Maximum Retention (Pervious)	6.6 in
Maximum Retention (Pervious, 20 percent)	1.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.3 in
Runoff Volume (Pervious)	0.119 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.119 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	8.59 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.000	0.000	0.00
Flow (In)	Post Out	0.000	0.000	0.00

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.000	0.000	0.00
Flow (In)	Post Out	0.000	0.000	0.00

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.059	13.550	0.12
Flow (In)	Post Out	0.059	13.550	0.12

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.103	12.500	0.33
Flow (In)	Post Out	0.103	12.500	0.33

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.141	12.250	0.57
Flow (In)	Post Out	0.141	12.250	0.57

Summary for Hydrograph Addition at 'Post Out'

Upstream Link	Upstream Node
Outlet-1	PO-1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.183	12.150	0.85
Flow (In)	Post Out	0.183	12.150	0.85

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.007	12.050	0.05
Flow (In)	Pre-Out	0.007	12.050	0.05

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.015	12.000	0.18
Flow (In)	Pre-Out	0.015	12.000	0.18

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.043	12.000	0.70
Flow (In)	Pre-Out	0.043	12.000	0.70

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.067	11.950	1.16
Flow (In)	Pre-Out	0.067	11.950	1.16

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.090	11.950	1.60
Flow (In)	Pre-Out	0.090	11.950	1.60

Summary for Hydrograph Addition at 'Pre-Out'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Pre-Developed

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Pre-Developed	0.119	11.950	2.13
Flow (In)	Pre-Out	0.119	11.950	2.13

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.00
1.250	601.00	601.00	601.00	601.00	601.00
1.500	601.00	601.00	601.00	601.00	601.00
1.750	601.00	601.00	601.00	601.00	601.00
2.000	601.00	601.00	601.00	601.00	601.00
2.250	601.00	601.00	601.00	601.00	601.00
2.500	601.00	601.00	601.00	601.00	601.00
2.750	601.00	601.00	601.00	601.01	601.01
3.000	601.01	601.01	601.01	601.01	601.01
3.250	601.01	601.01	601.01	601.01	601.01
3.500	601.01	601.01	601.01	601.01	601.01
3.750	601.01	601.02	601.02	601.02	601.02
4.000	601.02	601.02	601.02	601.02	601.02
4.250	601.02	601.02	601.02	601.02	601.03
4.500	601.03	601.03	601.03	601.03	601.03
4.750	601.03	601.03	601.03	601.03	601.04
5.000	601.04	601.04	601.04	601.04	601.04
5.250	601.04	601.04	601.04	601.05	601.05
5.500	601.05	601.05	601.05	601.05	601.05
5.750	601.05	601.06	601.06	601.06	601.06
6.000	601.06	601.06	601.06	601.07	601.07
6.250	601.07	601.07	601.07	601.07	601.07
6.500	601.08	601.08	601.08	601.08	601.08
6.750	601.08	601.09	601.09	601.09	601.09
7.000	601.09	601.09	601.10	601.10	601.10
7.250	601.10	601.10	601.11	601.11	601.11
7.500	601.11	601.11	601.11	601.12	601.12
7.750	601.12	601.12	601.12	601.13	601.13
8.000	601.13	601.13	601.13	601.14	601.14
8.250	601.14	601.14	601.15	601.15	601.15
8.500	601.15	601.16	601.16	601.16	601.16
8.750	601.17	601.17	601.17	601.18	601.18
9.000	601.18	601.18	601.19	601.19	601.19
9.250	601.20	601.20	601.20	601.21	601.21
9.500	601.21	601.22	601.22	601.22	601.23
9.750	601.23	601.24	601.24	601.24	601.25
10.000	601.25	601.25	601.26	601.26	601.27
10.250	601.27	601.28	601.28	601.29	601.29
10.500	601.30	601.30	601.31	601.31	601.32

Subsection: Time vs. Elevation
Label: PO-1 (OUT)

Return Event: 1 years
Storm Event: 1-year

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	601.33	601.33	601.34	601.35	601.35
11.000	601.36	601.37	601.38	601.39	601.40
11.250	601.41	601.42	601.43	601.44	601.45
11.500	601.46	601.48	601.50	601.52	601.55
11.750	601.60	601.65	601.73	601.82	601.93
12.000	602.02	602.09	602.13	602.14	602.16
12.250	602.17	602.18	602.20	602.21	602.21
12.500	602.22	602.23	602.24	602.24	602.25
12.750	602.26	602.26	602.27	602.27	602.28
13.000	602.28	602.29	602.29	602.30	602.30
13.250	602.31	602.31	602.31	602.32	602.32
13.500	602.33	602.33	602.33	602.34	602.34
13.750	602.34	602.35	602.35	602.35	602.36
14.000	602.36	602.36	602.37	602.37	602.37
14.250	602.37	602.38	602.38	602.38	602.38
14.500	602.39	602.39	602.39	602.39	602.40
14.750	602.40	602.40	602.40	602.41	602.41
15.000	602.41	602.41	602.42	602.42	602.42
15.250	602.42	602.43	602.43	602.43	602.43
15.500	602.43	602.44	602.44	602.44	602.44
15.750	602.44	602.45	602.45	602.45	602.45
16.000	602.45	602.46	602.46	602.46	602.46
16.250	602.46	602.46	602.47	602.47	602.47
16.500	602.47	602.47	602.47	602.48	602.48
16.750	602.48	602.48	602.48	602.48	602.49
17.000	602.49	602.49	602.49	602.49	602.49
17.250	602.49	602.50	602.50	602.50	602.50
17.500	602.50	602.50	602.51	602.51	602.51
17.750	602.51	602.51	602.51	602.51	602.52
18.000	602.52	602.52	602.52	602.52	602.52
18.250	602.52	602.52	602.53	602.53	602.53
18.500	602.53	602.53	602.53	602.53	602.53
18.750	602.54	602.54	602.54	602.54	602.54
19.000	602.54	602.54	602.54	602.55	602.55
19.250	602.55	602.55	602.55	602.55	602.55
19.500	602.55	602.55	602.56	602.56	602.56
19.750	602.56	602.56	602.56	602.56	602.56
20.000	602.56	602.56	602.57	602.57	602.57
20.250	602.57	602.57	602.57	602.57	602.57
20.500	602.57	602.57	602.58	602.58	602.58
20.750	602.58	602.58	602.58	602.58	602.58
21.000	602.58	602.58	602.58	602.59	602.59
21.250	602.59	602.59	602.59	602.59	602.59

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	602.59	602.59	602.59	602.60	602.60
21.750	602.60	602.60	602.60	602.60	602.60
22.000	602.60	602.60	602.60	602.60	602.61
22.250	602.61	602.61	602.61	602.61	602.61
22.500	602.61	602.61	602.61	602.61	602.61
22.750	602.61	602.62	602.62	602.62	602.62
23.000	602.62	602.62	602.62	602.62	602.62
23.250	602.62	602.62	602.63	602.63	602.63
23.500	602.63	602.63	602.63	602.63	602.63
23.750	602.63	602.63	602.63	602.63	602.64
24.000	602.64	(N/A)	(N/A)	(N/A)	(N/A)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.00
1.250	601.00	601.00	601.00	601.00	601.00
1.500	601.00	601.00	601.00	601.00	601.00
1.750	601.00	601.00	601.00	601.00	601.00
2.000	601.00	601.00	601.00	601.00	601.00
2.250	601.00	601.00	601.00	601.00	601.01
2.500	601.01	601.01	601.01	601.01	601.01
2.750	601.01	601.01	601.01	601.01	601.01
3.000	601.01	601.01	601.01	601.01	601.01
3.250	601.02	601.02	601.02	601.02	601.02
3.500	601.02	601.02	601.02	601.02	601.02
3.750	601.02	601.03	601.03	601.03	601.03
4.000	601.03	601.03	601.03	601.03	601.03
4.250	601.03	601.04	601.04	601.04	601.04
4.500	601.04	601.04	601.04	601.04	601.05
4.750	601.05	601.05	601.05	601.05	601.05
5.000	601.05	601.06	601.06	601.06	601.06
5.250	601.06	601.06	601.06	601.07	601.07
5.500	601.07	601.07	601.07	601.07	601.08
5.750	601.08	601.08	601.08	601.08	601.09
6.000	601.09	601.09	601.09	601.09	601.09
6.250	601.10	601.10	601.10	601.10	601.10
6.500	601.11	601.11	601.11	601.11	601.11
6.750	601.12	601.12	601.12	601.12	601.13
7.000	601.13	601.13	601.13	601.13	601.14
7.250	601.14	601.14	601.14	601.15	601.15
7.500	601.15	601.15	601.16	601.16	601.16
7.750	601.16	601.17	601.17	601.17	601.17
8.000	601.18	601.18	601.18	601.18	601.19
8.250	601.19	601.19	601.20	601.20	601.20
8.500	601.21	601.21	601.21	601.22	601.22
8.750	601.22	601.23	601.23	601.23	601.24
9.000	601.24	601.24	601.25	601.25	601.26
9.250	601.26	601.27	601.27	601.27	601.28
9.500	601.28	601.29	601.29	601.29	601.30
9.750	601.30	601.31	601.31	601.32	601.32
10.000	601.33	601.33	601.34	601.34	601.35
10.250	601.35	601.36	601.37	601.37	601.38
10.500	601.38	601.39	601.40	601.41	601.41

Subsection: Time vs. Elevation
Label: PO-1 (OUT)

Return Event: 2 years
Storm Event: 2-year

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	601.42	601.43	601.44	601.45	601.45
11.000	601.46	601.47	601.48	601.49	601.50
11.250	601.51	601.52	601.53	601.54	601.55
11.500	601.56	601.58	601.60	601.63	601.66
11.750	601.72	601.78	601.87	601.99	602.10
12.000	602.21	602.28	602.33	602.35	602.37
12.250	602.39	602.40	602.41	602.42	602.44
12.500	602.45	602.45	602.46	602.47	602.48
12.750	602.49	602.49	602.50	602.51	602.51
13.000	602.52	602.52	602.53	602.53	602.54
13.250	602.54	602.55	602.55	602.56	602.56
13.500	602.57	602.57	602.58	602.58	602.59
13.750	602.59	602.59	602.60	602.60	602.60
14.000	602.61	602.61	602.61	602.62	602.62
14.250	602.62	602.63	602.63	602.63	602.64
14.500	602.64	602.64	602.65	602.65	602.65
14.750	602.65	602.66	602.66	602.66	602.67
15.000	602.67	602.67	602.67	602.68	602.68
15.250	602.68	602.69	602.69	602.69	602.69
15.500	602.70	602.70	602.70	602.70	602.70
15.750	602.71	602.71	602.71	602.71	602.72
16.000	602.72	602.72	602.72	602.72	602.73
16.250	602.73	602.73	602.73	602.73	602.74
16.500	602.74	602.74	602.74	602.74	602.75
16.750	602.75	602.75	602.75	602.75	602.76
17.000	602.76	602.76	602.76	602.76	602.76
17.250	602.77	602.77	602.77	602.77	602.77
17.500	602.78	602.78	602.78	602.78	602.78
17.750	602.78	602.79	602.79	602.79	602.79
18.000	602.79	602.79	602.80	602.80	602.80
18.250	602.80	602.80	602.80	602.81	602.81
18.500	602.81	602.81	602.81	602.81	602.81
18.750	602.82	602.82	602.82	602.82	602.82
19.000	602.82	602.82	602.83	602.83	602.83
19.250	602.83	602.83	602.83	602.83	602.84
19.500	602.84	602.84	602.84	602.84	602.84
19.750	602.84	602.84	602.85	602.85	602.85
20.000	602.85	602.85	602.85	602.85	602.85
20.250	602.86	602.86	602.86	602.86	602.86
20.500	602.86	602.86	602.86	602.86	602.87
20.750	602.87	602.87	602.87	602.87	602.87
21.000	602.87	602.87	602.87	602.88	602.88
21.250	602.88	602.88	602.88	602.88	602.88

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	602.88	602.88	602.89	602.89	602.89
21.750	602.89	602.89	602.89	602.89	602.89
22.000	602.89	602.90	602.90	602.90	602.90
22.250	602.90	602.90	602.90	602.90	602.90
22.500	602.91	602.91	602.91	602.91	602.91
22.750	602.91	602.91	602.91	602.91	602.91
23.000	602.92	602.92	602.92	602.92	602.92
23.250	602.92	602.92	602.92	602.92	602.93
23.500	602.93	602.93	602.93	602.93	602.93
23.750	602.93	602.93	602.93	602.93	602.94
24.000	602.94	(N/A)	(N/A)	(N/A)	(N/A)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.00
1.250	601.00	601.00	601.00	601.00	601.00
1.500	601.00	601.00	601.00	601.00	601.00
1.750	601.00	601.01	601.01	601.01	601.01
2.000	601.01	601.01	601.01	601.01	601.01
2.250	601.01	601.01	601.02	601.02	601.02
2.500	601.02	601.02	601.02	601.02	601.02
2.750	601.02	601.03	601.03	601.03	601.03
3.000	601.03	601.03	601.03	601.04	601.04
3.250	601.04	601.04	601.04	601.04	601.05
3.500	601.05	601.05	601.05	601.05	601.05
3.750	601.06	601.06	601.06	601.06	601.06
4.000	601.07	601.07	601.07	601.07	601.07
4.250	601.08	601.08	601.08	601.08	601.08
4.500	601.09	601.09	601.09	601.09	601.10
4.750	601.10	601.10	601.10	601.11	601.11
5.000	601.11	601.11	601.12	601.12	601.12
5.250	601.12	601.13	601.13	601.13	601.13
5.500	601.14	601.14	601.14	601.15	601.15
5.750	601.15	601.15	601.16	601.16	601.16
6.000	601.17	601.17	601.17	601.18	601.18
6.250	601.18	601.18	601.19	601.19	601.19
6.500	601.20	601.20	601.20	601.21	601.21
6.750	601.21	601.22	601.22	601.23	601.23
7.000	601.23	601.24	601.24	601.24	601.25
7.250	601.25	601.25	601.26	601.26	601.27
7.500	601.27	601.27	601.28	601.28	601.29
7.750	601.29	601.29	601.30	601.30	601.31
8.000	601.31	601.31	601.32	601.32	601.33
8.250	601.33	601.34	601.34	601.34	601.35
8.500	601.35	601.36	601.36	601.37	601.38
8.750	601.38	601.39	601.39	601.40	601.40
9.000	601.41	601.42	601.42	601.43	601.43
9.250	601.44	601.45	601.45	601.46	601.47
9.500	601.47	601.48	601.48	601.49	601.50
9.750	601.50	601.51	601.51	601.52	601.52
10.000	601.53	601.54	601.54	601.55	601.55
10.250	601.56	601.57	601.57	601.58	601.59
10.500	601.60	601.60	601.61	601.62	601.63

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	601.64	601.64	601.65	601.66	601.67
11.000	601.68	601.69	601.70	601.72	601.73
11.250	601.74	601.76	601.77	601.79	601.80
11.500	601.82	601.84	601.87	601.91	601.97
11.750	602.04	602.12	602.24	602.39	602.55
12.000	602.70	602.81	602.87	602.90	602.93
12.250	602.95	602.97	602.99	603.01	603.03
12.500	603.04	603.05	603.06	603.07	603.08
12.750	603.09	603.10	603.10	603.11	603.11
13.000	603.11	603.12	603.12	603.12	603.12
13.250	603.13	603.13	603.13	603.13	603.13
13.500	603.13	603.13	603.13	603.13	603.13
13.750	603.13	603.13	603.13	603.13	603.13
14.000	603.13	603.12	603.12	603.12	603.12
14.250	603.12	603.12	603.12	603.12	603.11
14.500	603.11	603.11	603.11	603.11	603.11
14.750	603.11	603.11	603.11	603.10	603.10
15.000	603.10	603.10	603.10	603.10	603.10
15.250	603.10	603.10	603.10	603.09	603.09
15.500	603.09	603.09	603.09	603.09	603.09
15.750	603.09	603.09	603.09	603.08	603.08
16.000	603.08	603.08	603.08	603.08	603.08
16.250	603.08	603.08	603.08	603.08	603.07
16.500	603.07	603.07	603.07	603.07	603.07
16.750	603.07	603.07	603.07	603.07	603.07
17.000	603.07	603.07	603.07	603.07	603.07
17.250	603.06	603.06	603.06	603.06	603.06
17.500	603.06	603.06	603.06	603.06	603.06
17.750	603.06	603.06	603.06	603.06	603.06
18.000	603.06	603.06	603.06	603.06	603.06
18.250	603.06	603.06	603.05	603.05	603.05
18.500	603.05	603.05	603.05	603.05	603.05
18.750	603.05	603.05	603.05	603.05	603.05
19.000	603.05	603.05	603.05	603.05	603.05
19.250	603.05	603.05	603.05	603.05	603.05
19.500	603.05	603.05	603.05	603.05	603.04
19.750	603.04	603.04	603.04	603.04	603.04
20.000	603.04	603.04	603.04	603.04	603.04
20.250	603.04	603.04	603.04	603.04	603.04
20.500	603.04	603.04	603.04	603.04	603.04
20.750	603.04	603.04	603.04	603.04	603.04
21.000	603.04	603.04	603.04	603.04	603.04
21.250	603.04	603.04	603.04	603.04	603.04

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	603.04	603.04	603.04	603.04	603.04
21.750	603.04	603.04	603.04	603.04	603.04
22.000	603.04	603.03	603.03	603.03	603.03
22.250	603.03	603.03	603.03	603.03	603.03
22.500	603.03	603.03	603.03	603.03	603.03
22.750	603.03	603.03	603.03	603.03	603.03
23.000	603.03	603.03	603.03	603.03	603.03
23.250	603.03	603.03	603.03	603.03	603.03
23.500	603.03	603.03	603.03	603.03	603.03
23.750	603.03	603.03	603.03	603.03	603.03
24.000	603.03	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time vs. Elevation
Label: PO-1 (OUT)

Return Event: 25 years
Storm Event: 25-year

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.00
1.250	601.00	601.00	601.00	601.00	601.00
1.500	601.01	601.01	601.01	601.01	601.01
1.750	601.01	601.01	601.01	601.01	601.01
2.000	601.02	601.02	601.02	601.02	601.02
2.250	601.02	601.02	601.03	601.03	601.03
2.500	601.03	601.03	601.03	601.04	601.04
2.750	601.04	601.04	601.04	601.04	601.05
3.000	601.05	601.05	601.05	601.05	601.06
3.250	601.06	601.06	601.06	601.07	601.07
3.500	601.07	601.07	601.07	601.08	601.08
3.750	601.08	601.08	601.09	601.09	601.09
4.000	601.09	601.10	601.10	601.10	601.10
4.250	601.11	601.11	601.11	601.12	601.12
4.500	601.12	601.12	601.13	601.13	601.13
4.750	601.14	601.14	601.14	601.15	601.15
5.000	601.15	601.16	601.16	601.16	601.17
5.250	601.17	601.17	601.18	601.18	601.18
5.500	601.19	601.19	601.19	601.20	601.20
5.750	601.20	601.21	601.21	601.22	601.22
6.000	601.22	601.23	601.23	601.24	601.24
6.250	601.24	601.25	601.25	601.26	601.26
6.500	601.26	601.27	601.27	601.28	601.28
6.750	601.28	601.29	601.29	601.30	601.30
7.000	601.31	601.31	601.32	601.32	601.33
7.250	601.33	601.33	601.34	601.34	601.35
7.500	601.35	601.36	601.36	601.37	601.37
7.750	601.38	601.38	601.39	601.39	601.40
8.000	601.40	601.41	601.41	601.42	601.42
8.250	601.43	601.43	601.44	601.45	601.45
8.500	601.46	601.46	601.47	601.48	601.48
8.750	601.49	601.50	601.50	601.51	601.51
9.000	601.52	601.53	601.53	601.54	601.54
9.250	601.55	601.55	601.56	601.56	601.57
9.500	601.58	601.58	601.59	601.59	601.60
9.750	601.61	601.61	601.62	601.63	601.63
10.000	601.64	601.65	601.65	601.66	601.67
10.250	601.68	601.68	601.69	601.70	601.71
10.500	601.72	601.73	601.74	601.75	601.76

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	601.77	601.78	601.79	601.80	601.81
11.000	601.83	601.84	601.85	601.87	601.88
11.250	601.90	601.91	601.93	601.95	601.97
11.500	601.99	602.01	602.04	602.09	602.15
11.750	602.23	602.34	602.47	602.65	602.85
12.000	603.02	603.17	603.25	603.29	603.31
12.250	603.32	603.33	603.34	603.34	603.35
12.500	603.35	603.35	603.34	603.34	603.34
12.750	603.33	603.33	603.32	603.32	603.31
13.000	603.31	603.30	603.30	603.29	603.29
13.250	603.28	603.28	603.27	603.27	603.26
13.500	603.26	603.25	603.25	603.24	603.24
13.750	603.23	603.23	603.22	603.22	603.21
14.000	603.21	603.20	603.20	603.19	603.19
14.250	603.19	603.18	603.18	603.18	603.17
14.500	603.17	603.17	603.16	603.16	603.16
14.750	603.15	603.15	603.15	603.15	603.14
15.000	603.14	603.14	603.14	603.14	603.13
15.250	603.13	603.13	603.13	603.13	603.12
15.500	603.12	603.12	603.12	603.12	603.12
15.750	603.11	603.11	603.11	603.11	603.11
16.000	603.11	603.10	603.10	603.10	603.10
16.250	603.10	603.10	603.10	603.09	603.09
16.500	603.09	603.09	603.09	603.09	603.09
16.750	603.09	603.09	603.09	603.08	603.08
17.000	603.08	603.08	603.08	603.08	603.08
17.250	603.08	603.08	603.08	603.08	603.08
17.500	603.08	603.08	603.07	603.07	603.07
17.750	603.07	603.07	603.07	603.07	603.07
18.000	603.07	603.07	603.07	603.07	603.07
18.250	603.07	603.07	603.07	603.07	603.07
18.500	603.07	603.06	603.06	603.06	603.06
18.750	603.06	603.06	603.06	603.06	603.06
19.000	603.06	603.06	603.06	603.06	603.06
19.250	603.06	603.06	603.06	603.06	603.06
19.500	603.06	603.06	603.06	603.05	603.05
19.750	603.05	603.05	603.05	603.05	603.05
20.000	603.05	603.05	603.05	603.05	603.05
20.250	603.05	603.05	603.05	603.05	603.05
20.500	603.05	603.05	603.05	603.05	603.05
20.750	603.05	603.05	603.05	603.05	603.05
21.000	603.05	603.05	603.05	603.04	603.04
21.250	603.04	603.04	603.04	603.04	603.04

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	603.04	603.04	603.04	603.04	603.04
21.750	603.04	603.04	603.04	603.04	603.04
22.000	603.04	603.04	603.04	603.04	603.04
22.250	603.04	603.04	603.04	603.04	603.04
22.500	603.04	603.04	603.04	603.04	603.04
22.750	603.04	603.04	603.04	603.04	603.04
23.000	603.04	603.04	603.04	603.04	603.04
23.250	603.04	603.04	603.04	603.04	603.04
23.500	603.04	603.04	603.04	603.04	603.04
23.750	603.04	603.04	603.04	603.04	603.04
24.000	603.04	(N/A)	(N/A)	(N/A)	(N/A)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.00
1.250	601.00	601.00	601.01	601.01	601.01
1.500	601.01	601.01	601.01	601.01	601.01
1.750	601.02	601.02	601.02	601.02	601.02
2.000	601.02	601.02	601.03	601.03	601.03
2.250	601.03	601.03	601.04	601.04	601.04
2.500	601.04	601.04	601.05	601.05	601.05
2.750	601.05	601.05	601.06	601.06	601.06
3.000	601.06	601.07	601.07	601.07	601.07
3.250	601.08	601.08	601.08	601.09	601.09
3.500	601.09	601.09	601.10	601.10	601.10
3.750	601.11	601.11	601.11	601.11	601.12
4.000	601.12	601.12	601.13	601.13	601.13
4.250	601.14	601.14	601.14	601.15	601.15
4.500	601.15	601.16	601.16	601.16	601.17
4.750	601.17	601.18	601.18	601.18	601.19
5.000	601.19	601.19	601.20	601.20	601.21
5.250	601.21	601.21	601.22	601.22	601.23
5.500	601.23	601.23	601.24	601.24	601.25
5.750	601.25	601.26	601.26	601.27	601.27
6.000	601.27	601.28	601.28	601.29	601.29
6.250	601.30	601.30	601.31	601.31	601.32
6.500	601.32	601.33	601.33	601.34	601.34
6.750	601.35	601.35	601.36	601.36	601.37
7.000	601.37	601.38	601.38	601.39	601.39
7.250	601.40	601.40	601.41	601.42	601.42
7.500	601.43	601.43	601.44	601.44	601.45
7.750	601.46	601.46	601.47	601.47	601.48
8.000	601.48	601.49	601.50	601.50	601.51
8.250	601.51	601.52	601.52	601.53	601.53
8.500	601.54	601.54	601.55	601.55	601.56
8.750	601.56	601.57	601.58	601.58	601.59
9.000	601.60	601.60	601.61	601.61	601.62
9.250	601.63	601.63	601.64	601.65	601.65
9.500	601.66	601.67	601.67	601.68	601.69
9.750	601.70	601.70	601.71	601.72	601.73
10.000	601.73	601.74	601.75	601.76	601.77
10.250	601.78	601.79	601.80	601.81	601.82
10.500	601.83	601.84	601.85	601.86	601.87

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	601.88	601.90	601.91	601.92	601.94
11.000	601.95	601.97	601.98	602.00	602.01
11.250	602.03	602.05	602.06	602.08	602.10
11.500	602.12	602.15	602.18	602.23	602.30
11.750	602.40	602.52	602.67	602.88	603.11
12.000	603.34	603.49	603.59	603.62	603.63
12.250	603.64	603.63	603.63	603.62	603.61
12.500	603.60	603.59	603.57	603.55	603.54
12.750	603.52	603.50	603.49	603.48	603.47
13.000	603.46	603.44	603.43	603.42	603.41
13.250	603.40	603.39	603.38	603.37	603.36
13.500	603.35	603.34	603.33	603.32	603.32
13.750	603.31	603.30	603.29	603.29	603.28
14.000	603.27	603.26	603.26	603.25	603.25
14.250	603.24	603.23	603.23	603.22	603.22
14.500	603.21	603.21	603.20	603.20	603.20
14.750	603.19	603.19	603.18	603.18	603.18
15.000	603.17	603.17	603.17	603.17	603.16
15.250	603.16	603.16	603.15	603.15	603.15
15.500	603.15	603.14	603.14	603.14	603.14
15.750	603.14	603.13	603.13	603.13	603.13
16.000	603.12	603.12	603.12	603.12	603.12
16.250	603.12	603.11	603.11	603.11	603.11
16.500	603.11	603.11	603.11	603.10	603.10
16.750	603.10	603.10	603.10	603.10	603.10
17.000	603.10	603.10	603.09	603.09	603.09
17.250	603.09	603.09	603.09	603.09	603.09
17.500	603.09	603.09	603.09	603.09	603.09
17.750	603.08	603.08	603.08	603.08	603.08
18.000	603.08	603.08	603.08	603.08	603.08
18.250	603.08	603.08	603.08	603.08	603.08
18.500	603.07	603.07	603.07	603.07	603.07
18.750	603.07	603.07	603.07	603.07	603.07
19.000	603.07	603.07	603.07	603.07	603.07
19.250	603.07	603.07	603.07	603.07	603.06
19.500	603.06	603.06	603.06	603.06	603.06
19.750	603.06	603.06	603.06	603.06	603.06
20.000	603.06	603.06	603.06	603.06	603.06
20.250	603.06	603.06	603.06	603.06	603.06
20.500	603.06	603.05	603.05	603.05	603.05
20.750	603.05	603.05	603.05	603.05	603.05
21.000	603.05	603.05	603.05	603.05	603.05
21.250	603.05	603.05	603.05	603.05	603.05

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	603.05	603.05	603.05	603.05	603.05
21.750	603.05	603.05	603.05	603.05	603.05
22.000	603.05	603.05	603.05	603.05	603.05
22.250	603.05	603.05	603.05	603.05	603.05
22.500	603.05	603.05	603.05	603.05	603.05
22.750	603.05	603.05	603.05	603.05	603.05
23.000	603.05	603.05	603.05	603.05	603.05
23.250	603.05	603.05	603.05	603.05	603.05
23.500	603.05	603.04	603.04	603.04	603.04
23.750	603.04	603.04	603.04	603.04	603.04
24.000	603.04	(N/A)	(N/A)	(N/A)	(N/A)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	601.00	601.00	601.00	601.00	601.00
0.250	601.00	601.00	601.00	601.00	601.00
0.500	601.00	601.00	601.00	601.00	601.00
0.750	601.00	601.00	601.00	601.00	601.00
1.000	601.00	601.00	601.00	601.00	601.01
1.250	601.01	601.01	601.01	601.01	601.01
1.500	601.01	601.01	601.02	601.02	601.02
1.750	601.02	601.02	601.03	601.03	601.03
2.000	601.03	601.03	601.04	601.04	601.04
2.250	601.04	601.05	601.05	601.05	601.05
2.500	601.06	601.06	601.06	601.06	601.07
2.750	601.07	601.07	601.07	601.08	601.08
3.000	601.08	601.09	601.09	601.09	601.10
3.250	601.10	601.10	601.11	601.11	601.11
3.500	601.12	601.12	601.12	601.13	601.13
3.750	601.13	601.14	601.14	601.14	601.15
4.000	601.15	601.16	601.16	601.16	601.17
4.250	601.17	601.17	601.18	601.18	601.19
4.500	601.19	601.19	601.20	601.20	601.21
4.750	601.21	601.22	601.22	601.22	601.23
5.000	601.23	601.24	601.24	601.25	601.25
5.250	601.26	601.26	601.27	601.27	601.28
5.500	601.28	601.29	601.29	601.30	601.30
5.750	601.31	601.31	601.32	601.32	601.33
6.000	601.33	601.34	601.34	601.35	601.35
6.250	601.36	601.37	601.37	601.38	601.38
6.500	601.39	601.39	601.40	601.41	601.41
6.750	601.42	601.42	601.43	601.43	601.44
7.000	601.45	601.45	601.46	601.47	601.47
7.250	601.48	601.48	601.49	601.50	601.50
7.500	601.51	601.51	601.52	601.52	601.53
7.750	601.53	601.54	601.54	601.55	601.55
8.000	601.56	601.56	601.57	601.57	601.58
8.250	601.58	601.59	601.59	601.60	601.61
8.500	601.61	601.62	601.63	601.63	601.64
8.750	601.64	601.65	601.66	601.67	601.67
9.000	601.68	601.69	601.70	601.70	601.71
9.250	601.72	601.73	601.73	601.74	601.75
9.500	601.76	601.76	601.77	601.78	601.79
9.750	601.80	601.80	601.81	601.82	601.83
10.000	601.84	601.85	601.86	601.87	601.88
10.250	601.89	601.90	601.91	601.92	601.93
10.500	601.95	601.96	601.97	601.98	602.00

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
10.750	602.01	602.02	602.04	602.05	602.06
11.000	602.08	602.09	602.11	602.12	602.14
11.250	602.16	602.18	602.20	602.22	602.24
11.500	602.27	602.30	602.34	602.39	602.47
11.750	602.58	602.71	602.89	603.14	603.43
12.000	603.72	603.94	604.04	604.06	604.06
12.250	604.04	604.03	604.01	603.98	603.96
12.500	603.93	603.90	603.88	603.85	603.82
12.750	603.79	603.76	603.73	603.71	603.68
13.000	603.66	603.63	603.61	603.58	603.56
13.250	603.54	603.52	603.50	603.48	603.47
13.500	603.46	603.44	603.43	603.42	603.41
13.750	603.39	603.38	603.37	603.36	603.35
14.000	603.34	603.33	603.32	603.31	603.31
14.250	603.30	603.29	603.28	603.28	603.27
14.500	603.26	603.26	603.25	603.24	603.24
14.750	603.23	603.23	603.22	603.22	603.21
15.000	603.21	603.21	603.20	603.20	603.19
15.250	603.19	603.19	603.18	603.18	603.18
15.500	603.17	603.17	603.17	603.16	603.16
15.750	603.16	603.16	603.15	603.15	603.15
16.000	603.15	603.14	603.14	603.14	603.14
16.250	603.13	603.13	603.13	603.13	603.13
16.500	603.13	603.12	603.12	603.12	603.12
16.750	603.12	603.12	603.12	603.11	603.11
17.000	603.11	603.11	603.11	603.11	603.11
17.250	603.11	603.11	603.10	603.10	603.10
17.500	603.10	603.10	603.10	603.10	603.10
17.750	603.10	603.10	603.10	603.09	603.09
18.000	603.09	603.09	603.09	603.09	603.09
18.250	603.09	603.09	603.09	603.09	603.09
18.500	603.09	603.09	603.08	603.08	603.08
18.750	603.08	603.08	603.08	603.08	603.08
19.000	603.08	603.08	603.08	603.08	603.08
19.250	603.08	603.08	603.08	603.07	603.07
19.500	603.07	603.07	603.07	603.07	603.07
19.750	603.07	603.07	603.07	603.07	603.07
20.000	603.07	603.07	603.07	603.07	603.07
20.250	603.07	603.06	603.06	603.06	603.06
20.500	603.06	603.06	603.06	603.06	603.06
20.750	603.06	603.06	603.06	603.06	603.06
21.000	603.06	603.06	603.06	603.06	603.06
21.250	603.06	603.06	603.06	603.06	603.06

Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
21.500	603.06	603.06	603.06	603.06	603.06
21.750	603.06	603.06	603.06	603.06	603.06
22.000	603.06	603.06	603.06	603.06	603.05
22.250	603.05	603.05	603.05	603.05	603.05
22.500	603.05	603.05	603.05	603.05	603.05
22.750	603.05	603.05	603.05	603.05	603.05
23.000	603.05	603.05	603.05	603.05	603.05
23.250	603.05	603.05	603.05	603.05	603.05
23.500	603.05	603.05	603.05	603.05	603.05
23.750	603.05	603.05	603.05	603.05	603.05
24.000	603.05	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Elevation vs. Volume Curve
Label: PO-1

Return Event: 1 years
Storm Event: 1-year

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
601.00	0.000
601.50	0.026
602.00	0.061
602.50	0.101
603.00	0.142
603.50	0.177
604.00	0.203
604.50	0.228

Requested Pond Water Surface Elevations	
Minimum (Headwater)	601.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	604.50 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	Culvert - 1	604.50	604.50
Orifice-Circular	Orifice - 2	Forward	Culvert - 1	603.00	604.50
Culvert-Circular	Culvert - 1	Forward	TW	601.00	604.50
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	12.0 in
Length	90.00 ft
Length (Computed Barrel)	90.01 ft
Slope (Computed)	0.011 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.000
Kb	0.031
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 2
K	0.5190
M	0.6400
C	0.0210
Y	0.9000
T1 ratio (HW/D)	1.157
T2 ratio (HW/D)	1.230
Slope Correction Factor	-0.500

Use unsubmerged inlet control 1 equation below T1 elevation.
Use submerged inlet control 1 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	602.16 ft	T1 Flow	2.75 ft³/s
T2 Elevation	602.23 ft	T2 Flow	3.14 ft³/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	604.50 ft
Diameter	30.0 in
Orifice Area	4.9 ft²
Orifice Coefficient	0.600
Weir Length	7.85 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Orifice - 2 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	603.00 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Elevation-Volume-Flow Table (Pond)
Label: PO-1

Return Event: 1 years
Storm Event: 1-year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
601.00	0.00	0.000	0.000	0.00	0.00	0.00
601.50	0.00	0.026	0.000	0.00	0.00	12.58
602.00	0.00	0.061	0.000	0.00	0.00	29.52
602.50	0.00	0.101	0.000	0.00	0.00	48.88
603.00	0.00	0.142	0.000	0.00	0.00	68.73
603.50	0.47	0.177	0.000	0.00	0.47	86.14
604.00	0.82	0.203	0.000	0.00	0.82	99.07
604.50	1.06	0.228	0.000	0.00	1.06	111.41

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	1.87 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	602.64 ft
Volume (Peak)	0.112 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.112 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.112 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	2.26 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	602.94 ft
Volume (Peak)	0.137 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.137 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.000 ac-ft
Volume (Retained)	0.137 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	3.31 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.12 ft³/s	Time to Peak (Flow, Outlet)	13.550 hours

Elevation (Water Surface, Peak)	603.13 ft
Volume (Peak)	0.151 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.203 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.059 ac-ft
Volume (Retained)	0.144 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	4.00 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.33 ft³/s	Time to Peak (Flow, Outlet)	12.500 hours

Elevation (Water Surface, Peak)	603.35 ft
Volume (Peak)	0.166 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.248 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.103 ac-ft
Volume (Retained)	0.145 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 50 years
Storm Event: 50-year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	4.60 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.57 ft³/s	Time to Peak (Flow, Outlet)	12.250 hours

Elevation (Water Surface, Peak)	603.64 ft
Volume (Peak)	0.184 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.286 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.141 ac-ft
Volume (Retained)	0.145 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	601.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	5.26 ft³/s	Time to Peak (Flow, In)	11.900 hours
Flow (Peak Outlet)	0.85 ft³/s	Time to Peak (Flow, Outlet)	12.150 hours

Elevation (Water Surface, Peak)	604.06 ft
Volume (Peak)	0.206 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.329 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.183 ac-ft
Volume (Retained)	0.145 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.1 %

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Peak Discharge	0.12 ft³/s
Time to Peak	13.550 hours
Hydrograph Volume	0.059 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.350	0.00	0.01	0.02	0.04	0.05
12.600	0.06	0.07	0.08	0.08	0.09
12.850	0.10	0.10	0.10	0.11	0.11
13.100	0.11	0.12	0.12	0.12	0.12
13.350	0.12	0.12	0.12	0.12	0.12
13.600	0.12	0.12	0.12	0.12	0.12
13.850	0.12	0.12	0.12	0.12	0.12
14.100	0.12	0.12	0.11	0.11	0.11
14.350	0.11	0.11	0.11	0.11	0.11
14.600	0.11	0.10	0.10	0.10	0.10
14.850	0.10	0.10	0.10	0.10	0.10
15.100	0.10	0.09	0.09	0.09	0.09
15.350	0.09	0.09	0.09	0.09	0.09
15.600	0.09	0.08	0.08	0.08	0.08
15.850	0.08	0.08	0.08	0.08	0.08
16.100	0.08	0.08	0.07	0.07	0.07
16.350	0.07	0.07	0.07	0.07	0.07
16.600	0.07	0.07	0.07	0.07	0.07
16.850	0.07	0.06	0.06	0.06	0.06
17.100	0.06	0.06	0.06	0.06	0.06
17.350	0.06	0.06	0.06	0.06	0.06
17.600	0.06	0.06	0.06	0.06	0.06
17.850	0.06	0.06	0.05	0.05	0.05
18.100	0.05	0.05	0.05	0.05	0.05
18.350	0.05	0.05	0.05	0.05	0.05
18.600	0.05	0.05	0.05	0.05	0.05
18.850	0.05	0.05	0.05	0.05	0.05
19.100	0.05	0.05	0.05	0.05	0.05
19.350	0.04	0.04	0.04	0.04	0.04
19.600	0.04	0.04	0.04	0.04	0.04
19.850	0.04	0.04	0.04	0.04	0.04
20.100	0.04	0.04	0.04	0.04	0.04
20.350	0.04	0.04	0.04	0.04	0.04
20.600	0.04	0.04	0.04	0.04	0.04
20.850	0.04	0.04	0.04	0.04	0.04
21.100	0.04	0.04	0.03	0.03	0.03
21.350	0.03	0.03	0.03	0.03	0.03
21.600	0.03	0.03	0.03	0.03	0.03
21.850	0.03	0.03	0.03	0.03	0.03

Subsection: Pond Routed Hydrograph (total out) Return Event: 10 years
Label: PO-1 (OUT) Storm Event: 10-year

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.100	0.03	0.03	0.03	0.03	0.03
22.350	0.03	0.03	0.03	0.03	0.03
22.600	0.03	0.03	0.03	0.03	0.03
22.850	0.03	0.03	0.03	0.03	0.03
23.100	0.03	0.03	0.03	0.03	0.03
23.350	0.03	0.03	0.03	0.03	0.03
23.600	0.03	0.03	0.03	0.03	0.03
23.850	0.03	0.03	0.03	0.03	(N/A)

Peak Discharge	0.33 ft³/s
Time to Peak	12.500 hours
Hydrograph Volume	0.103 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.950	0.00	0.02	0.17	0.24	0.27
12.200	0.29	0.30	0.31	0.32	0.32
12.450	0.33	0.33	0.33	0.32	0.32
12.700	0.32	0.31	0.31	0.31	0.30
12.950	0.30	0.29	0.29	0.28	0.28
13.200	0.27	0.27	0.26	0.26	0.25
13.450	0.25	0.24	0.24	0.23	0.23
13.700	0.22	0.22	0.21	0.21	0.20
13.950	0.20	0.20	0.19	0.19	0.18
14.200	0.18	0.18	0.17	0.17	0.17
14.450	0.16	0.16	0.16	0.15	0.15
14.700	0.15	0.15	0.14	0.14	0.14
14.950	0.14	0.13	0.13	0.13	0.13
15.200	0.13	0.12	0.12	0.12	0.12
15.450	0.12	0.12	0.11	0.11	0.11
15.700	0.11	0.11	0.11	0.10	0.10
15.950	0.10	0.10	0.10	0.10	0.10
16.200	0.09	0.09	0.09	0.09	0.09
16.450	0.09	0.09	0.09	0.09	0.08
16.700	0.08	0.08	0.08	0.08	0.08
16.950	0.08	0.08	0.08	0.08	0.08
17.200	0.08	0.08	0.07	0.07	0.07
17.450	0.07	0.07	0.07	0.07	0.07
17.700	0.07	0.07	0.07	0.07	0.07
17.950	0.07	0.07	0.07	0.07	0.06
18.200	0.06	0.06	0.06	0.06	0.06
18.450	0.06	0.06	0.06	0.06	0.06
18.700	0.06	0.06	0.06	0.06	0.06
18.950	0.06	0.06	0.06	0.06	0.06
19.200	0.06	0.05	0.05	0.05	0.05
19.450	0.05	0.05	0.05	0.05	0.05
19.700	0.05	0.05	0.05	0.05	0.05
19.950	0.05	0.05	0.05	0.05	0.05
20.200	0.05	0.05	0.05	0.05	0.05
20.450	0.05	0.05	0.05	0.04	0.04
20.700	0.04	0.04	0.04	0.04	0.04
20.950	0.04	0.04	0.04	0.04	0.04
21.200	0.04	0.04	0.04	0.04	0.04
21.450	0.04	0.04	0.04	0.04	0.04

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
21.700	0.04	0.04	0.04	0.04	0.04
21.950	0.04	0.04	0.04	0.04	0.04
22.200	0.04	0.04	0.04	0.04	0.04
22.450	0.04	0.04	0.04	0.04	0.04
22.700	0.04	0.04	0.04	0.04	0.04
22.950	0.04	0.04	0.04	0.04	0.04
23.200	0.04	0.04	0.04	0.04	0.04
23.450	0.04	0.04	0.04	0.04	0.04
23.700	0.04	0.04	0.04	0.04	0.04
23.950	0.04	0.04	(N/A)	(N/A)	(N/A)

Peak Discharge	0.57 ft³/s
Time to Peak	12.250 hours
Hydrograph Volume	0.141 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.900	0.00	0.11	0.32	0.47	0.54
12.150	0.56	0.56	0.57	0.57	0.56
12.400	0.56	0.55	0.54	0.53	0.52
12.650	0.51	0.50	0.49	0.48	0.46
12.900	0.45	0.44	0.43	0.42	0.41
13.150	0.40	0.39	0.38	0.37	0.36
13.400	0.35	0.34	0.33	0.32	0.32
13.650	0.31	0.30	0.29	0.28	0.28
13.900	0.27	0.26	0.26	0.25	0.24
14.150	0.24	0.23	0.23	0.22	0.22
14.400	0.21	0.21	0.20	0.20	0.19
14.650	0.19	0.19	0.18	0.18	0.17
14.900	0.17	0.17	0.17	0.16	0.16
15.150	0.16	0.15	0.15	0.15	0.15
15.400	0.14	0.14	0.14	0.14	0.13
15.650	0.13	0.13	0.13	0.13	0.12
15.900	0.12	0.12	0.12	0.12	0.11
16.150	0.11	0.11	0.11	0.11	0.11
16.400	0.11	0.10	0.10	0.10	0.10
16.650	0.10	0.10	0.10	0.10	0.09
16.900	0.09	0.09	0.09	0.09	0.09
17.150	0.09	0.09	0.09	0.09	0.09
17.400	0.08	0.08	0.08	0.08	0.08
17.650	0.08	0.08	0.08	0.08	0.08
17.900	0.08	0.08	0.08	0.08	0.08
18.150	0.07	0.07	0.07	0.07	0.07
18.400	0.07	0.07	0.07	0.07	0.07
18.650	0.07	0.07	0.07	0.07	0.07
18.900	0.07	0.07	0.07	0.07	0.06
19.150	0.06	0.06	0.06	0.06	0.06
19.400	0.06	0.06	0.06	0.06	0.06
19.650	0.06	0.06	0.06	0.06	0.06
19.900	0.06	0.06	0.06	0.06	0.06
20.150	0.05	0.05	0.05	0.05	0.05
20.400	0.05	0.05	0.05	0.05	0.05
20.650	0.05	0.05	0.05	0.05	0.05
20.900	0.05	0.05	0.05	0.05	0.05
21.150	0.05	0.05	0.05	0.05	0.05
21.400	0.05	0.05	0.05	0.05	0.05

Subsection: Pond Routed Hydrograph (total out) Return Event: 50 years
Label: PO-1 (OUT) Storm Event: 50-year

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
21.650	0.05	0.05	0.05	0.05	0.05
21.900	0.05	0.05	0.05	0.05	0.05
22.150	0.05	0.05	0.05	0.05	0.05
22.400	0.04	0.04	0.04	0.04	0.04
22.650	0.04	0.04	0.04	0.04	0.04
22.900	0.04	0.04	0.04	0.04	0.04
23.150	0.04	0.04	0.04	0.04	0.04
23.400	0.04	0.04	0.04	0.04	0.04
23.650	0.04	0.04	0.04	0.04	0.04
23.900	0.04	0.04	0.04	(N/A)	(N/A)

Peak Discharge	0.85 ft³/s
Time to Peak	12.150 hours
Hydrograph Volume	0.183 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.850	0.00	0.13	0.40	0.63	0.78
12.100	0.84	0.85	0.84	0.84	0.83
12.350	0.82	0.81	0.79	0.77	0.75
12.600	0.73	0.71	0.69	0.67	0.65
12.850	0.63	0.62	0.60	0.58	0.56
13.100	0.55	0.53	0.52	0.50	0.49
13.350	0.47	0.46	0.44	0.43	0.42
13.600	0.41	0.39	0.38	0.37	0.36
13.850	0.35	0.34	0.33	0.32	0.31
14.100	0.30	0.30	0.29	0.28	0.27
14.350	0.27	0.26	0.25	0.25	0.24
14.600	0.24	0.23	0.23	0.22	0.22
14.850	0.21	0.21	0.20	0.20	0.19
15.100	0.19	0.19	0.18	0.18	0.18
15.350	0.17	0.17	0.17	0.16	0.16
15.600	0.16	0.16	0.15	0.15	0.15
15.850	0.15	0.14	0.14	0.14	0.14
16.100	0.13	0.13	0.13	0.13	0.13
16.350	0.12	0.12	0.12	0.12	0.12
16.600	0.12	0.11	0.11	0.11	0.11
16.850	0.11	0.11	0.11	0.11	0.10
17.100	0.10	0.10	0.10	0.10	0.10
17.350	0.10	0.10	0.10	0.10	0.09
17.600	0.09	0.09	0.09	0.09	0.09
17.850	0.09	0.09	0.09	0.09	0.09
18.100	0.09	0.09	0.09	0.08	0.08
18.350	0.08	0.08	0.08	0.08	0.08
18.600	0.08	0.08	0.08	0.08	0.08
18.850	0.08	0.08	0.08	0.08	0.07
19.100	0.07	0.07	0.07	0.07	0.07
19.350	0.07	0.07	0.07	0.07	0.07
19.600	0.07	0.07	0.07	0.07	0.07
19.850	0.07	0.07	0.06	0.06	0.06
20.100	0.06	0.06	0.06	0.06	0.06
20.350	0.06	0.06	0.06	0.06	0.06
20.600	0.06	0.06	0.06	0.06	0.06
20.850	0.06	0.06	0.06	0.06	0.06
21.100	0.06	0.06	0.06	0.06	0.05
21.350	0.05	0.05	0.05	0.05	0.05

Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years
Label: PO-1 (OUT) Storm Event: 100-year

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
21.600	0.05	0.05	0.05	0.05	0.05
21.850	0.05	0.05	0.05	0.05	0.05
22.100	0.05	0.05	0.05	0.05	0.05
22.350	0.05	0.05	0.05	0.05	0.05
22.600	0.05	0.05	0.05	0.05	0.05
22.850	0.05	0.05	0.05	0.05	0.05
23.100	0.05	0.05	0.05	0.05	0.05
23.350	0.05	0.05	0.05	0.05	0.05
23.600	0.05	0.05	0.05	0.05	0.05
23.850	0.05	0.05	0.05	0.05	(N/A)

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CN Area Collection - Pre-Developed (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	0.555	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C/D	75.000	0.077	0.0	0.0

CN Area Collection - Post-Controlled (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Impervious Areas - Gravel (w/ right-of-way) - Soil B	98.000	0.555	0.0	0.0
Impervious Areas - Gravel (w/ right-of-way) - Soil C/D	98.000	0.077	0.0	0.0

Worksheet for DI-1 to BMP Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00234	ft/ft
Diameter	1.50	ft
Discharge	5.26	ft³/s

Results

Normal Depth	1.17	ft
Flow Area	1.48	ft²
Wetted Perimeter	3.25	ft
Hydraulic Radius	0.46	ft
Top Width	1.24	ft
Critical Depth	0.88	ft
Percent Full	78.2	%
Critical Slope	0.00501	ft/ft
Velocity	3.55	ft/s
Velocity Head	0.20	ft
Specific Energy	1.37	ft
Froude Number	0.57	
Maximum Discharge	5.92	ft³/s
Discharge Full	5.51	ft³/s
Slope Full	0.00214	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.19	%
Downstream Velocity	Infinity	ft/s

Worksheet for DI-1 to BMP Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.17	ft
Critical Depth	0.88	ft
Channel Slope	0.00234	ft/ft
Critical Slope	0.00501	ft/ft

APPENDIX F – CALCULATION WORKSHEETS

WORKSHEET 1. GENERAL SITE INFORMATION

Date:	October 25, 2016		
Project Name:	Sunoco - Mt. Union Valves		
Municipality:	Shirley Township		
County:	Huntingdon		
Total Area (acres):	2.83		
Major River Basin:			
Watershed:	Aughwick Creek		
Sub Basin:	Aughwick Creek		
Nearest Surface Water to Receive Runoff:	UNT Aughwick Creek		
Chapter 93 - Designated Water Use:	TSF		
Impaired according to Chapter 303(d) list?		YES	
List Causes of Impairment:		NO	X
Is Project Subject to, or Part of:			
Municipal Separate Storm Sewer System (MS4) Requirements		YES	
		NO	X
Existing or Planned drinking water supply?		YES	
		NO	X
If yes, distance from proposed discharge (miles):			
Approved Act 167 Plan?		YES	
		NO	X
Existing River Conservation Plan?		YES	
		NO	X

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

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

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

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

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

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	yes	0.276	0
Woodlands	n/a	0	0
Natural Drainage Ways	n/a	0	0
Steep Slopes, 15% - 25%	no	0	0
Steep Slopes, over 25%	no	0	0
Other:	n/a	0	0
Other:	n/a	0	0
TOTAL EXISTING:		0	0

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0 **Ac.**

1.2 Area of Riparian Forest Buffer Protection 0 **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading 0 **Ac.**

TOTAL 0 **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
2.83	-	0	=	2.83

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn _____ ft^2 x 1/4" x 1/12 = 0 ft^3

Meadow _____ ft^2 x 1/3" x 1/12 = 0 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 = 0 ft^3

_____ 0

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 = 0 ft^3

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = 0 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 = 0 ft^3

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = 0 ft^3

0

** For use on Worksheet 5*

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

Project: Sunoco - Mt. Union Valves
Drainage Area: 0.63 acres
2-Year Rainfall: 2.8 inches

Total Site Area (ac.): 2.83 acres
Protected Site Area: 0.00 acres
Managed Site Area: 2.83 acres

Existing Conditions								
Cover Type/Condition	**Soil Type**	**Area (sf)**	**Area (ac)**	**CN**	**S**	**Ia**	**Q**	**Runoff Volume (cf)**
Meadow	B	24,176	0.555	58	7.24	1.45	0.21	428.38
Meadow	C/D	3,354	0.077	75	3.33	0.67	0.83	232.70
TOTAL:								**661.07**
Developed Conditions								
Cover Type/Condition	**Soil Type**	**Area (sf)**		**CN**	**S**	**Ia**	**Q**	**Runoff Volume (cf)**
Gravel	B	24,176	0.555	98	0.20	0.04	2.57	5175.95
Gravel	C/D	3,354	0.077	98	0.20	0.04	2.57	718.11
TOTAL:								**5894.06**

2-Year Volume Increase (ft3):	**5232.983**

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

1. Runoff (in) = Q = (P - 0.2S)2 / (P+ 0.8S) where
   P = 2-Year Rainfall (in)
   S = (1000/CN)-10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft.)

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

WORKSHEET 5 . STRUCTURAL BMP VOLUME CREDITS

PROJECT: Sunoco - Mt. Union Valves
SUB-BASIN: Aughwick Creek

Required Control Volume (ft^3) - *from Worksheet 4*: 5,233
Non-structural Volume Credit (ft^3) - *from Worksheet 3*: - 0

Structural Volume Reqmt (ft^3) 5,233
(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	5,600	6,186
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft^3): 6,186
Structural Volume Requirement (ft^3): 5,233

DIFFERENCE -953

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

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

PRIMARY BMPs FOR NITRATE:

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

SECONDARY BMPs FOR NITRATE:

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

Stormwater BMP Information Chart 5.B revised March 15, 2016

	Infiltration Information					Drainage Information						BMP Information					
Proposed Infiltration BMP(s) (site specific)	Measured Infiltration Rate[9]	Factor of Safety	Design Infiltration Rate	Dewatering Time[1]	Elevation of Limiting Zone - Water Table, Bedrock, etc.[2]	Total Drainage Area to BMP	Total Impervious Drainage Area to BMP	Infiltration BMP Surface Area	Total Drainage Area Loading Ratio[6]	Impervious Area Loading Ratio[7]	Volume of Runoff Tributary to BMP During the 2yr/24hr Design Storm[5]	Calculated Infiltration Volume (from storms up to and including 2yr/24hr)	Calculated Managed Volume (from storms up to and including 2yr/24hr)[8]	Maximum water surface elevation in BMP from 2yr storm[3]	Infiltration Elevation Bottom of Bed/ Basin[3]	Elevation of Infiltration Test[4]	Elevation of E&S Sediment Basin Bottom (if applies)
	in./hr.	*Min. of 2*	*in./hr.*	*hrs.*		*sq. ft*	*sq. ft.*	*sq. ft.*			*cf*	*cf*	*cf*				
BMP 6.4.1 **Pervious Pvmnt w. Infilt. Bed**																	
BMP 6.4.2 **Infiltration Basin**																	
BMP 6.4.3 **Subsurface Infiltration Bed**																	
BMP 6.4.4 **Infiltration Trench**																	
BMP 6.4.5 **Rain Garden/Bioretention**																	
BMP 6.4.6 **Dry Well / Seepage Pit**																	
Other																	
BMP 6.4.7 **Constructed Filter** BMP 6.4.8 **Vegetated Swale** BMP 6.4.9 **Vegetated Filter Strip** BMP 6.4.10 **Infilt. Berm & Ret. Grading**	2.40	3	0.8	30	N/A	27,530	27,530	5,600	5	5	5,233	6,186	0	602.9	601.0	601.0	N/A

All information to be based on the 2-year/24-hour storm
Provide page numbers from the stormwater narrative identifying the location of the above information.

[1] Can include active infiltration time - dewatering time should not exceed 72 hours after the 2-year/24-hour storm
[2] Depth to limiting zone is recommended to be at least 2 ft below infiltration testing elevation/proposed infiltration elevation.
[3] A maximum of 2 feet of Hydraulic head is recommended.
[4] Provide supporting field notes/documenation from soil evaluation.
[5] This value should be greater than or equal to the Volume to be Infiltrated or Managed by the BMP.
[6] A maximum of 8:1 is recommended.
[7] A maximum of 5:1 is recommended; however, in carbonate geology areas, a maximum of 3:1 is recommended.
[8] Calculated runoff volume that is managed in ways other than infiltration to address 25 PA Code Ch 102.8(g)(2)
[9] The infiltration testing information should be located on the plan view of the PCSM Plan and should include infiltration test elevation and rate.

Any deviations from the recommendations above should be adequately justified by a qualified professional and included with the application.

NOTE: This chart is for summary purposes only and should be consistent with all design calculations and worksheets.

* Notes:
1. The dewatering time was calculated using the following formula: (MAXIMUM WATER SURFACE ELEVATION IN BMP FROM 2YR STORM) – (INFILTRATION ELEVATION BOTTOM OF BED) * (12 IN/FT) / (DESIGN INFILTRATION RATE)

APPENDIX G – STORMWATER MANAGEMENT PLANS

SEE FULL SIZE DRAWINGS