MOTT MACDONALD

PennEast PIPELINE

Erosion & Sediment Control Plan – Church Road Interconnects

PennEast Pipeline Project

February 2020

353754-MM-E-E-140 RevA

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Contents

Tables

Executive Summary

The Church Road Interconnects site is located in Bethlehem Township, Northampton County, PA, and is being developed to create an interconnect station to support the proposed PennEast pipeline (see Appendix E for location map and E&SCP drawing). The proposed site will include the pipeline meter and supporting equipment on a gravel pad. Erosion and sediment control measures are proposed to meet the regulatory requirements for this type of development.

1 Introduction and Overview

This Erosion and Sediment Control Plan (E&SCP) has been developed to address control of accelerated erosion and sedimentation resulting from earth disturbances associated with the proposed Church Road Interconnects site. It was developed in accordance with the requirements of 25 PA Administrative Code Chapters 78 and 102, as well as the Clean Streams Law (35 P. S. §§ 691.1001), as amended, utilizing guidelines and Best Management Practice (BMP) information provided in the Erosion and Sediment Control BMP Manual. This plan complements the PennEast Post Construction Stormwater Management Plan (PCSM Plan) prepared for this project, and was planned and designed to be consistent with that Plan under PA Code §102.8. An up to date copy of this plan, and any subsequently granted variances to the E&SCP, shall be available at the project field site during all stages of earth disturbance activities. This plan was prepared under the supervision of a Professional Engineer licensed in the state of Pennsylvania, who is trained and experienced in erosion and sediment control methods and techniques applicable to the size and scope of the proposed project (see Appendix D for Standard E&S Worksheet #22 - Plan Preparer Record of Training and Experience in Erosion and Sediment Pollution Control Methods and Techniques).

2 Existing Site Conditions

The Existing Conditions Plan (Drawing 024B-03-03-001) in Appendix E, depicts all relevant existing site features, including the topography of the project site and the surrounding area, mapped soil boundaries, municipal and county boundaries, known property, easement, and right-of-way boundaries, roadways, streams, watercourses, existing structures, aerial imagery of existing ground cover, utilities, and other important features.

2.1 Soil Characteristics

The location of mapped soil types and the attributes of the soils map units crossed by the facility site are provided in Appendix A. These soil boundaries and associated information were obtained from the United States Department of Agriculture (USDA) SSURGO database. Additionally, the Natural Resource Conservation Service (USDA-NRCS) "Web Soil Survey" website (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) was used to generate an "NRCS Custom Soils Resources Report" for this project. The methods that will be utilized to minimize impacts on soils during construction include, but are not limited to:

- Minimizing the area and duration of soil exposure
- Protecting critical areas by reducing the velocity of and control of runoff
- Installing and maintaining the erosion and sediment control measures
- Segregating and stockpiling topsoil
- Reestablishing vegetation following final grading
- Inspecting the area of disturbance and maintaining the erosion and sediment controls as necessary until final stabilization is achieved

The soil report in Appendix A contains the types, depth, slope, and limitations of the soils within the facility construction limits. Additional information in the soil report includes data on the physical characteristics of the soils, such as texture, erosion resistance, and suitability for the intended use.

2.2 Existing Land Use and Land Cover

Land use data is based on information obtained through field surveys, review of aerial photography, and USDA National Agricultural Statistics Service (NASS) Cropland Data Layer (USDA-NASS, 2014). The land use characteristics are classified by primary vegetation cover type and/or predominant land use. The facility site's current land use type is predominantly open land (meadow), with a small portion of impervious road and residential (existing site) to the southwest.

2.3 Receiving Waters

AECOM conducted an environmental survey of the site and no wetlands or watercourses were delineated within the site. The site is located within the Nancy Run watershed, which has a Chapter 93 designated use of CWF (cold-water fish), and MF (migratory fish), and no existing use.

One of the objectives in minimizing changes in *runoff volume and rate of runoff flow is to preserve the integrity of stream channels and any receiving streams. The peak runoffs will be attenuated with an infiltration basin and an infiltration trench. The stormwater will be routed through structural and non-structural BMPs and discharged overland towards the stream which is greater than 150' away from the site*.

2.4 Existing Riparian Forest Buffers

Riparian buffers are areas of permanent vegetation situated along any surface water(s). When this vegetation is predominantly native trees, shrubs, and forbs that are maintained in a natural state or sustainably managed to protect and enhance water quality, it is considered a riparian forest buffer. The project is not located within 150 feet of a perennial or intermittent river, stream, or creek, or lake,

pond, or reservoir, and is not located in a watershed of Exceptional Value or High Quality. No existing riparian forest buffers were identified within the proposed facility site.

2.5 Naturally Occurring Geologic Formations

General Geology:

The Church Road Interconnects site lies within the Cambrian Allentown Formation, according to the Pennsylvania Department of Conservation and Natural Resources (PADCNR). The Cambrian Allentown Formation consists of "Medium- to medium-dark-gray, thick-bedded dolomite and impure limestone; dark-gray chert stringers and nodules; laminated; oolitic and stromatolitic; some orange-brown-weathering calcareous siltstone at base." Based on the United States Geological Survey (USGS) mapping, there are no known faults within the vicinity of the proposed site.

Although the proposed interconnection site falls within the approximate outlines of the Allentown Formation, it is possible that other formations or rock types could occur in the vicinity of the proposed interconnects station site, due to the approximate nature of USGS maps.

Surficial Geology:

Based on the Natural Resources Conservation Service (NRCS) Web Soil Survey, the surficial geology within the area of interest consists heavily of the Washington silt loam. The Washington silt loam is mapped as generally 22.4 percent sand, 55.1 percent silt, and 22.5 percent clay. The Washington silt loam has 0 to 8 percent slopes and is part of the group B Hydrologic Soil Group.

Acid Producing Soils:

There are no acid producing soils located within the proposed facility site.

Karst Formations and Abandoned Mines:

Mapped karst features in the vicinity of the proposed interconnects are depicted in Figure 1. Pennsylvania Department of Conservation & Natural Resources (PA DCNR) mapping indicate that there are more than 100 surface depressions and 29 sinkholes within 0.5 miles of the proposed site location. There are two documented surface depressions on site, and one documented sinkhole near the site.

Figure 1 – Karst Formations

Source: PA DCNR Interactive Online Map

Landslide Susceptibility:

"Landslide" is a general term for downslope mass movement of soil, rock, or a combination of materials on an unstable slope. Landslides can vary greatly in their rate of movement, area affected, and volume of material. The principal types of movement are falling, sliding, and flowing, but combinations of these are common. The primary cause of landslides is when colluvial (loose) soil and old landslide debris on steep slopes give way.

According to the USGS landslide susceptibility map, the facility site is located in an area of low incidence of landslides, and is not located within the vicinity of an area with high susceptibility to landsliding.

Seismic Considerations:

Liquefaction is the full or partial loss of shear strength of granular or cohesionless soil during an earthquake event. Liquefiable soils can be loose sands, silty sands, and soft silts. The general soils observed at the site consisted mainly of stiff clay with decomposed rock. Based on this assessment, liquefaction is unlikely during a seismic event.

Mott MacDonald utilized data obtained from the soil boring, B-JBSR33-1, to determine the seismic site class of the site. In accordance with the SPT average N-value method as prescribed in Chapter 20 of the ASCE Standard 7-10 design manual, site class D for "stiff soil" should be utilized across the project site.

Faults:

PA DCNR and United Stated Geological Survey (USGS) mapping indicate that one fault line exists approximately one mile south of the site vicinity. This fault is not considered to be an active fault as earthquake activity has not been mapped within the site vicinity. Mott MacDonald does not believe this presents a risk to the proposed site improvements.

3 Proposed Conditions

Earth disturbance shall be minimized to the extent practicable. Planning of the construction sequencing is required to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into environmental resource areas. Approximately 5.37 acres will be disturbed at the facility site (2.71 acres for the permanent facility and 2.66 acres of temporary workspace).

Earth disturbance shall be restricted to the Limit of Disturbance (LOD) delineated on the E&SCP drawing 024B-03-03-002 in Appendix E. This drawing contains the "Plan View", which depicts the proposed facility and site features. This includes the limits of earth disturbance, the locations of the existing road, and the location of proposed BMPs.

3.1 Proposed Land Use and Land Cover

The proposed land cover will change throughout the duration of the proposed project. During the initial construction phase, much of the area will be bare earth. Upon completion of the construction, the site will be stabilized with vegetative cover, an impervious gravel pad, an infiltration basin, an infiltration trench and two access driveways, as indicated on the Plan drawings.

3.2 Proposed Site Drainage Characteristics

An assessment of the site's natural features was completed during the initial stage of project planning. The proposed facility has been sited to protect sensitive natural resources by avoiding these areas whenever possible. The site has also been planned and designed to maintain pre-development drainage patterns to the maximum extent practicable. A conscious effort has been made to maintain existing vegetation where possible, and limit the extents of earth disturbance to the absolute minimum area necessary to construct the proposed facility.

Under existing conditions, site stormwater runoff flows overland southwest across the site to a roadside ditch running along Church Road. Under proposed conditions, the northeastern section of the site will be conveyed by an infiltration trench and by vegetated swales that discharge overland towards Church Road. The southwestern section of the site will be conveyed by vegetated swales to an infiltration basin that will discharge via an emergency spillway offsite toward Church Road. These proposed stormwater conveyance systems were designed to preserve existing drainage patterns and the integrity of the receiving watercourse. The location of the proposed drainage features is shown on the E&SCP drawing 024B-03-03-002 in Appendix E.

4 Description of Erosion & Sediment Control BMP's

The erosion and sediment control BMPs for this earth disturbance activity have been planned to minimize the extent and duration of the proposed earth disturbance, to protect existing drainage features and vegetation, minimize soil compaction, and employ measures and controls that minimize the generation of increased runoff. Specific BMPs have been selected for this site to achieve these broad goals. The location of each proposed BMP is shown on E&SCP drawing 024B-03-03-002.

- **Rock Construction Entrance:**

  Two rock construction entrances will be installed at the end of the facility site driveways to control sediment tracking from the construction site at the egress points. The rock construction entrance locations are shown on the E&SCP drawing 024B-03-03-002. The rock construction entrance detail is presented on Drawing 024B-03-04-001 (Figure 2).

- **Erosion Control Blankets:**

  In accordance with the notes listed on Drawing 024B-03-04-002 (Figures 23 and 24), erosion control blankets are to be placed on disturbed slopes 3H:1V and steeper. Areas to be blanketed are indicated on the E&SCP drawing.

- **Compost Filter Sock:**

  Compost filter sock on the E&SCP Drawing 024B-03-03-002 is presented as a perimeter control for disturbed areas. The compost filter sock detail and specifications are presented on Drawing 024B-03-04-001 (Figures 4, 4A and 4B). The sizing calculations for the proposed compost filter socks are presented in Appendix C.

- **Weighted Sediment Filter Tubes:**

  Weighted sediment filter tubes are proposed to protect against sediment pollution within the channels proposed along the edges of the proposed pad areas, as depicted on the E&SCP drawing 024B-03-03-002. The weighted sediment filter tube detail is presented on Drawing 024B-03-04-001 (Figure 12A).

- **Channels:**

  Vegetated channels are proposed along the edges of the proposed pad areas to collect runoff and convey towards the ditch running along Church Road or the proposed infiltration basin.

  The locations of the channels are depicted on the E&SCP drawing 024B-03-03-002. Runoff and sizing calculations for the channels are included in Appendix C. The vegetated channel detail is presented on Drawing 024B-03-04-002 (Figure 49).

- **Pumped Water Filter Bag**

  Filter bags may be used as needed to filter water pumped from the disturbed areas. The pumped water filter bag detail is presented on Drawing 024B-03-04-002 (Figure 36).

4.1 Minimize Earth Disturbance

The most simple and effective BMP available is to limit the extent and duration of earth disturbance to that which is absolutely necessary to construct the proposed facility. The LOD delineated on E&SCP Drawing 024B-03-03-002 has been established to restrict construction activities to the minimum area needed to effectively and efficiently construct the proposed facilities. In addition to limiting the extents of the proposed earth disturbance, construction activities have been planned to limit the duration of earth disturbance. Construction activities shall be sequenced to prevent, to the extent possible, excessive erosion or sediment flow into environmental resource areas.

4.2 General Erosion and Sediment Control Plan Requirements

The BMPs listed in this E&SCP shall be installed and maintained in accordance with FERC requirements, and the PADEP Erosion and Sediment Pollution Control Program Manual, March 2012. These BMPs shall be installed as shown prior to earth disturbance (including clearing and grubbing) within the drainage area of the BMP in question. Appropriate BMPs shall be provided for each stage of activity. Each BMP shall be kept functional until all earth disturbances within the drainage area are completed and a minimum vegetative cover (uniform 70% coverage of perennial vegetation over the entire disturbed area) has been achieved or other suitable permanent erosion protection has been installed.

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

Prior to commencement of any earth disturbance activity, including clearing and grubbing, the owner and/or operator shall clearly delineate sensitive areas, riparian forest buffer boundaries, areas proposed for infiltration practices, the limits of clearing, and trees that are to be conserved within the project site. These parties shall also install appropriate barriers where equipment may not be parked, staged, operated, or located for any purpose.

E&SCP measures and facilities shall be installed and operational as indicated in the construction schedule prior to any earth moving activities. See the “BMP Installation Sequence” in Section 5.0 of this E&SCP. Control measures must be in place and operational at the beginning and end of each workday. Wherever possible, the disturbed area shall be permanently stabilized immediately after the final earthmoving has been completed. For disturbed areas that cannot be permanently stabilized, interim stabilization in the form of temporary seeding and mulching shall be implemented. Until the site is permanently stabilized, all E&SCP measures shall be properly maintained by the Contractor.

Only after permanent stabilization is achieved, will the temporary E&SC measures be removed. Areas disturbed during removal of the controls must be stabilized immediately. For vegetated areas, permanent stabilization is defined as a uniform 70% perennial vegetative cover.

Minor modification to the approved E&SCP shall be noted on the E&SCP that is available at the site and initialed by the appropriate reviewing entity staff from PADEP and/or the County Conservation District.

Minor changes to the E&SCP may include adjustments to BMPs and locations within the permitted boundary to improve environmental performance, prevent potential pollution, changes in ownership or address, typographical errors, and on-site field adjustments such as the addition or deletion of BMPs, or alteration of earth disturbance activities to address unforeseen circumstances.

Major modifications to the approved E&SCP involving new or additional earth disturbance activity other than those described as minor modifications above, and/or the addition of a discharge will require prior approval by the reviewing entity and may require the submittal of a new E&SCP.

5 BMP Installation Sequence

The following is a general description of the planned sequence of BMP installation and removal. The entire construction sequence listing steps to be taken from initial site clearing through final stabilization is included on general notes sheet 024B-03-02-001 of the Plan drawings. Refer to the Plan drawings for additional site-specific installation information. All earth disturbance activities shall proceed in accordance with the following sequence:

1. At least seven (7) days before starting any earth disturbance activities, the owner and/or operator shall notify the PADEP and Northampton County Conservation District by either telephone or certified mail of the intent to commence earth disturbance activities. Attendance at a pre-construction conference is required upon request of the PADEP.
2. At least three (3) days before starting any earth disturbance activities, all contractors involved in these activities shall notify the Pennsylvania One Call system at 1-800-242-1776 to determine the location of existing underground utilities.
3. Install rock construction entrances.
4. Install compost filter sock downslope of any proposed disturbed/excavated area and stockpiles as shown on the ESC Plan.
5. Perform clearing and grubbing to those areas described in each stage of work. Dispose of excess topsoil off-site. The Contractor is responsible for ensuring that off-site waste areas have an E&S plan approved by the local conservation district or PADEP prior to being activated.
6. Construct diversion channels on the easterly side of the site (Swale 3 and Swale 4). Immediately provide temporary seeding and mulch to newly graded slopes. Install weighted sediment filter tubes in swales at locations shown on the E&SC plans. Construct proposed infiltration trench. Engineer shall inspect the infiltration trench upon installation.
7. Perform grading activities detailed by proposed grading, notes, and details shown on the plan drawings. As per project specifications, additional temporary placement of compost filter sock may be necessary at the contractor's discretion should accelerated erosion be observed during grading activities.
8. Construct pad and facilities according to specifications within these plan sheets including all stabilization measures.
9. Construct proposed infiltration basin and both swales (Swale 1 and Swale 2) leading to the basin. Install weighted sediment filter tubes in swales at locations shown on the E&SC plans. Engineer shall inspect the basin and swale installation.
10. Areas with minor soil compaction shall be ripped to a depth of 8”, and areas of major compaction shall be ripped to a depth of 20”. No ripping shall take place in the vicinity of the mainline piping or other underground utilities.
11. Place topsoil in all areas to be vegetated. If work is completed outside of the germinating season, then immediately provide temporary seeding and mulch to newly graded slopes.
12. Apply permanent seed mix and mulch to disturbed areas as specified and in accordance with this plan.
13. Any temporary measures (such as compost filter sock and weighted sediment filter tubes) installed by contractor during grading shall remain in place until final stabilization has a minimum uniform 70% perennial vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated surface erosion and subsurface characteristics sufficient to resist sliding and other movements. The Engineer shall inspect final stabilization prior to removal of

temporary measures.

14. Clean work area of any debris created during the construction sequence.

6 Description of Project Site Runoff

A primary component of this E&SCP was the design of erosion and sediment control BMPs to minimize and control accelerated erosion and the generation of increased runoff. All proposed E&SC facilities have been designed per design guidance provided in the Erosion and Sediment Pollution Control Program Manual (PADEP, 2012).

Proposed facilities were sized based on the maximum tributary drainage area anticipated during construction. Runoff volumes and rates for specific BMPs were calculated utilizing the methods recommended in the Manual for that type of facility. BMP sizing calculations are provided in Appendix C.

7 Erosion & Sediment Control BMP Maintenance Plan

A maintenance program that provides for routine inspection, as well as repair and replacement as necessary, is essential to effective and efficient operation of the proposed erosion and sediment control BMPs. Implementation of the following maintenance plan is a key component in achieving the intent of this Plan and minimizing accelerated erosion and sedimentation from the proposed earth disturbance. The permittee and any co-permittees shall be responsible for implementing the following maintenance program:

7.1 Inspections

To effectively mitigate project-related impacts, the E&SCP must be properly implemented in the field. Quick and appropriate decisions in the field regarding critical issues such as stream and wetland crossings, placement of erosion controls, trench dewatering, spoil containment, and other construction related items are essential. The Contractor shall inspect all erosion and sediment BMPs after each runoff event and on a weekly basis, at a minimum. This inspection shall include a general review of the performance of all erosion and sediment control facilities, as well as an examination of each individual BMP, noting when maintenance (e.g., cleanout, repair, replacement, regrading, re-stabilizing, etc.) is required, when specific deficiencies exist, and/or signs of potential future problems are present. The progress of vegetation cover shall also be included in this inspection. All inspections shall be documented in a written report summarizing each inspection and shall include a schedule for repair of all noted deficiencies. All preventive and remedial maintenance work, including clean out, repair, replacement, re-grading, re-seeding, re-mulching, and re-netting must be scheduled for immediate corrective action. If any installed BMPs are identified as failing to perform as expected, corrective modifications or replacement BMPs shall be scheduled for installation.

An erosion and sediment BMP inspection log shall be maintained on site and be made available to regulatory agency officials and project personnel at the time of inspection. The log shall contain inspection dates, observed deficiencies, and remediation dates.

7.2 General Maintenance

The Contractor shall be responsible for the continuous maintenance of all measures and devices for the duration of the project, until such time the area is stabilized with a minimum uniform perennial 70% vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion and received a written approval of Notice of Termination.

Vegetation voided areas shall promptly be reseeded and mulched to establish protection. Any device found to be clogged, damaged, half-full of silt, or not fully operational shall be cleaned of all debris. BMPs shall be repaired or replaced (as necessary) to ensure effective and efficient operation. Solid waste disposal is the responsibility of the Contractor. All necessary repairs shall be made immediately after any deficiencies are observed.

7.3 Specific Maintenance

The Contractor shall be responsible for the specific maintenance activities throughout the duration of the project as follows:

7.3.1 Rock Construction Entrance

Rock Construction Entrance thickness shall be constantly maintained to the specified dimensions by adding the required aggregate. A stockpile of aggregate shall be maintained on site for this purpose. Aggregate shall also be added to the rock construction entrance to maintain the capacity to remove sediment from tires. In the event the entrance becomes too clogged with sediment and debris to remain effective, the rock construction entrance shall be removed and replaced.

At the end of each construction day, all sediment deposited on paved roadways shall be removed and returned immediately to the construction site upslope of appropriate BMPs. Washing the roadway or sweeping the deposits into roadway ditches, sewer, culverts, or other drainage courses is not acceptable.

If excessive amounts of sediment are being deposited on roadways, the length of the rock construction entrance shall be extended by 50 foot increments until the condition is alleviated. Alternatively, a wash rack shall be installed.

7.3.2 Erosion Control Blankets

Inspect erosion control matting for good continuous contact with underlying soil throughout the entire length. Erosion control matting shall be checked for loose stapled areas and repaired as necessary.

Inspect for erosion and undermining beneath all erosion control matting. Immediately re-grade and repair any undermined or washed out areas.

Check vegetation growth during inspections. Reseed areas as necessary to ensure uniform vegetative cover.

Inspect erosion control matting for displaced, torn, or otherwise damaged matting, and restore or replace within four (4) calendar days.

7.3.3 Compost Filter Sock

Check compost filter sock for areas of concentrated discharge. When identified, concentrated discharge locations shall be remediated by adjusting sock alignment to restore level grade and encourage even distribution of discharge.

Check compost filter sock for torn or otherwise damaged sections allowing water to flow under or around the barrier. Damaged socks shall be repaired according to the manufacturer's specification or replaced within 24 hours of identification.

Any section of the barrier which has been undermined or topped shall be immediately repaired with a rock filter outlet, or other acceptable repair as detailed on the Plan drawings.

Sediment shall be removed when accumulations reach ½ the above ground height of the barrier. Removed sediment shall be disposed of in the manner described in this Plan.

Maintain the additional blown/placed mulch on the upslope side of the compost filter sock. Replace biodegradable compost filter socks 6 months after installation and replace photodegradable compost filter socks 12 months after installation.

7.3.4 Weighted Sediment Filter Tubes

Inspect weighted sediment filter tubes weekly and after each runoff event. If repairs are needed, initiate them immediately after the inspection.

Accumulated sediment shall be removed when it reaches half the height of the tube and disposed as directed elsewhere in the E&SC Plan.

Immediately upon stabilization of each channel, the installer shall remove accumulated sediment, remove the filter tube, and stabilize disturbed areas.

7.3.5 Channels

Channels shall be inspected to ensure that the specified design dimensions and protective linings are maintained at all times.

Inspect channels for channelized flow lines within the channel, unstable side slopes, wash outs, bulges, or slumps in the ditch line. Repair as necessary to correct the issue.

Damaged lining shall be repaired or replaced within 48 hours of discovery.

Channels shall be cleaned whenever total channel depth is reduced by 25% at any location and shall be maintained free of any sediment/debris blocking the normal flow of water. Sediment deposits shall be removed within 24 hours of discovery or as soon as soil conditions permit access to the channel without causing further damage. Removed sediment shall be disposed of in the manner described in this Plan.

7.4 E&S Control BMP Removal

Upon completion of earth disturbance described in this plan, the rock construction entrances shall be removed and the areas stabilized in a manner similar to the remainder of the access road. All other Erosion and Sediment Control BMPs shall remain functional until implementation of the PCSM Plan. At no time shall any BMPs be removed prior to all areas tributary to them achieving permanent stabilization, except when replaced by another state-approved BMP.

After final stabilization has been achieved, temporary erosion and sediment BMPs may be removed if they are not necessary for implementation of the PCSM Plan. Areas disturbed during removal or conversion of the BMPs to PCSM BMPs must be stabilized immediately. To ensure rapid revegetation of disturbed areas, such removal\conversions are to be done only during the germinating season.

8 Recycling and Disposal of Materials

Building materials and other construction site waste must be properly managed and disposed of to reduce the potential for pollution to surface and ground waters, as per 25 PA Code § 102.4(b)(5)(xi). All building materials and waste shall be removed from the site and recycled or disposed of in accordance with PADEP Solid Waste Management Regulations per 25 PA Code 260.1 et seq., 271.1 and 287.1 et. seq. No off-site disposal area has been identified as part of this E&SCP. Construction waste shall be disposed of properly by the Contractor only at a state-approved disposal or recycling facility.

No building materials or waste shall be burned, buried, dumped, or discharged at the site.

The Contractor shall develop and implement procedures which shall detail the proper measures for disposal and recycling of materials associated with or from the project site in accordance with PADEP regulations. Construction waste include, but are not limited to, excess soil materials, building materials, concrete wash water, and sanitary waste that could adversely impact water quality. The Contractor shall inspect the project area weekly and properly dispose of all construction waste. Measures shall be planned and implemented for housekeeping, materials management, and litter control. Wherever possible, re-useable waste shall be segregated from other waste and stored separately for recycling.

The Contractor shall be responsible for submitting an E&SCP for any borrow or waste areas required for completing the work. Disposal locations for excess soil/rock waste shall have appropriate BMPs implemented at the waste site. The disposal locations must be verified with the applicable state agency to show compliance with wetland and floodplain regulations. If an off-site location is used for borrow or disposal, the contractor shall be responsible for developing and implementing an adequate E&SCP for each location, and submitting it to the applicable state agency for review and approval. The Contractor shall immediately stabilize the waste site upon completion of any stage or phase of earth disturbance activity at the waste site.

9 Thermal Impact Analysis

The proposed project was analyzed for potential thermal impacts associated with the planned activities and how potential impacts could be avoided, minimized, or mitigated. Thermal impacts resulting from activities similar to the proposed project are primarily due to the negative impacts of increased impervious area. The following opportunities for negative thermal impacts exist for projects similar to the proposed one:

- Heat transfer from impervious cover to surface runoff
- Solar heat gain in ponded surface water.
- Increased surface temperatures caused by removal of vegetation
- Reduced thermal buffering of stormwater due to reduction in site's infiltration capacity
- Increased stream temperatures due to reduced base flow caused by reduction in site's infiltration capacity

Siting of oil and gas facilities is constrained by the location of the geologic formation planned for extraction and transmission, surface restrictions such as regulatory setbacks from building and waterways, and existing property boundaries. From this perspective, the potential to limit thermal impacts by altering the location of the project is limited. Table 1 below shows the site selection criteria used for the proposed project and how they help prevent or minimize thermal impacts to receiving waters:

Table 1: Thermal Impact Benefits of Oil and Gas Facility Selection Criteria

Siting Restrictions	Thermal Impact Benefits
Locate proposed construction activities at least 100' from all blue-line surface water features	Maintain riparian buffers and canopy cover over surface waters to the maximum extent practicable
Avoid impacts to all surface waters and wetlands to the maximum extent possible	Maintain existing hydrology and encourage natural thermal buffering
Locate proposed facilities as close as possible to existing roads	Minimize proposed impervious cover
Choose sites with minimal existing tree cover	Reduce removal of existing tree canopy

In addition to the above site selection criteria, several BMPs will be used to help mitigate negative thermal impacts from the proposed project. Minimizing the LOD to the absolute minimum area necessary to construct the necessary facilities will maintain existing vegetative cover and the infiltration capacity of undisturbed areas to the maximum extent practicable. Also, disturbed areas will be immediately re-vegetated to help cool runoff prior to discharge.

10 Anti-degradation Analysis

The site drains to Nancy Run, which in turn drains to the Lehigh River. The site is part of the Nancy Run watershed. Chapter 93.9d from the PADEP Code indicates that the length of Nancy Run between the source and SR 3007 Bridge is classified as “CWF, MF” and there are no exceptions to specific criteria. CWF indicates the maintenance or propagation, or both, of fish species and additional flora and fauna which are indigenous to a cold-water habitat. MF indicates the passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.

The site does not drain to an EV/HQ watercourse, therefore the anti-degradation measures are not proposed.

10.1 Non-discharge Alternatives

Not Applicable

10.2 Alternative Siting

Not Applicable

10.3 Limited Disturbed Area

Not Applicable

10.4 Limiting Extent and Duration of Disturbance

Not Applicable

Appendices

A. Soils Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Northampton County, Pennsylvania

December 4, 2019

Preface

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,790 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Northampton County, Pennsylvania
Survey Area Data: Version 12, Sep 17, 2019

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

Date(s) aerial images were photographed: Sep 20, 2010—Aug 28, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UudB	Urban land-Udorthents, limestone complex, 0 to 8 percent slopes	0.4	4.8%
WaA	Washington silt loam, 0 to 3 percent slopes	5.7	63.6%
WaB	Washington silt loam, 3 to 8 percent slopes	2.8	31.5%
Totals for Area of Interest		**8.9**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Northampton County, Pennsylvania

UudB—Urban land-Udorthents, limestone complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 227x6
Elevation: 300 to 1,000 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Udorthents, limestone, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills, valleys
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Interfluve, side slope, nose slope, head slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Udorthents, Limestone

Setting

Landform: Valleys, hills
Landform position (two-dimensional): Shoulder, footslope, backslope, summit
Landform position (three-dimensional): Interfluve, side slope, nose slope, head slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Graded areas of argillaceous limestone

Typical profile

H1 - 0 to 6 inches: clay loam

H2 - 6 to 60 inches: clay

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Duffield

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

WaA—Washington silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7dt
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Washington

Setting

Landform: Valleys

Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from limestone and/or old glacial drift

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 42 inches: clay loam
H3 - 42 to 61 inches: gravelly loam
H4 - 61 to 71 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Clarksburg

Percent of map unit: 5 percent
Landform: Valley flats
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Ryder

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Thorndale

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave

Hydric soil rating: Yes

Penlaw

Percent of map unit: 1 percent
Landform: Swales
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

WaB—Washington silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7dv
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Washington and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Washington

Setting

Landform: Valleys
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from limestone and/or old glacial drift

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 42 inches: clay loam
H3 - 42 to 61 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Clarksburg

Percent of map unit: 2 percent
Landform: Valley flats
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Loudonville

Percent of map unit: 1 percent
Landform: Till plains
Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ryder

Percent of map unit: 1 percent
Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Thorndale

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

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B. Drainage Area Maps

Legend

- Tc Path
- Drainage Area
- MEAD
- GRV
- Contours

0 125 250

SCALE: 1" = 125'

N
W E
S

CHURCH ROAD INTERCONNECT - EXISTING CONDITIONS DRAINAGE AREA MAP

Legend

- Tc Path
- Drainage Area
- MEAD
- GRV
- GRV-IMP
- Existing Contours
- Proposed Contours

0 125 250

SCALE: 1" = 125'

N
W E
S

CHURCH ROAD INTERCONNECT - PROPOSED CONDITIONS DRAINAGE AREA MAP

Legend

- Tc Path
- Drainage Area
- MEAD
- GRV
- GRV-IMP
- Existing Contours
- Proposed Contours
- Proposed Compost Filter Sock Locations
- Flow Path to Filter Sock (TYP)

0 125 250

SCALE: 1" = 125'

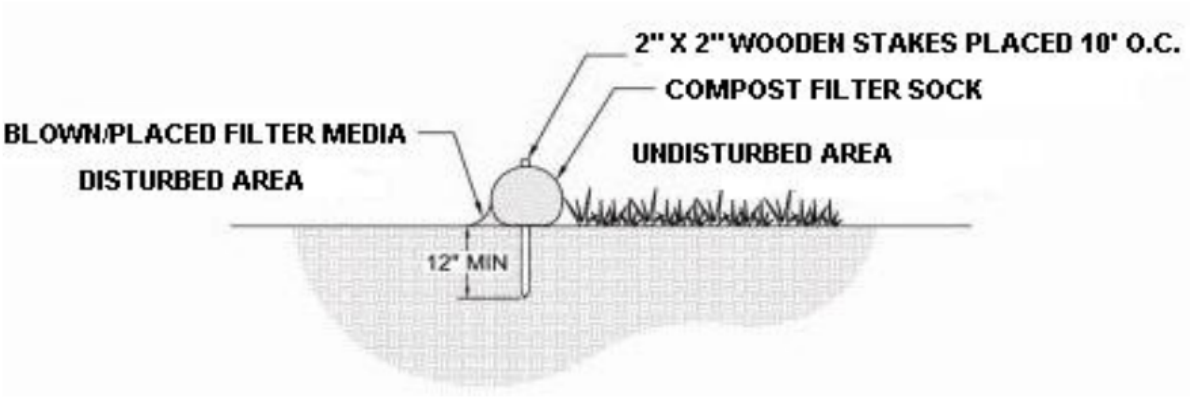
N W E S

CHURCH ROAD INTERCONNECT - SESC BMP DRAINAGE AREA MAP

C. E&SCP Design Calculations

STANDARD E&S WORKSHEET #1
Compost Filter Socks

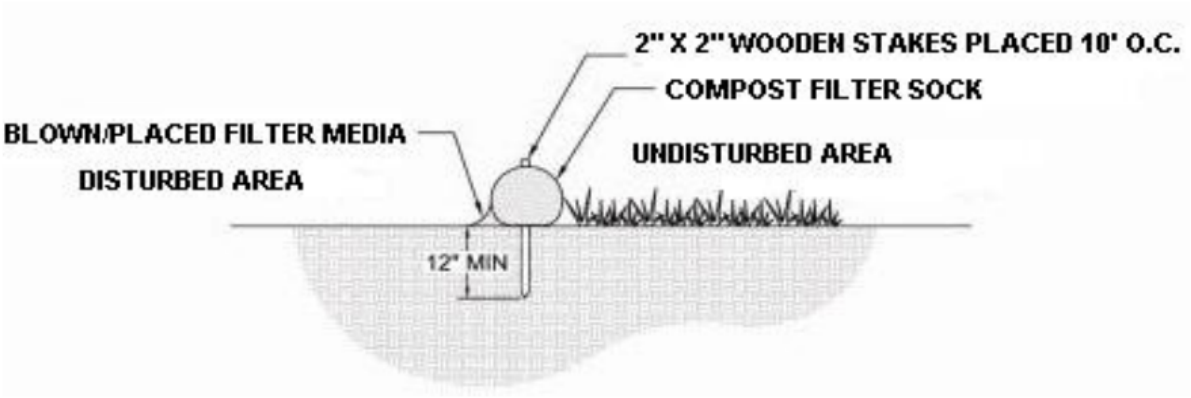
PROJECT NAME: PENNEAST PIPELINE PROJECT - CHURCH ROAD INTERCONNECTS
LOCATION: NORTHAMPTON COUNTY
PREPARED BY: KEK DATE: 02/2020
CHECKED BY: MDN DATE: 02/2020



Sock No.	Dia. (in)	Location	Slope Percent	Slope Length Above Barrier (ft)
1	12	Westerly side of site, west corner of site	4	51
2	12	Westerly side of site, northwest edge of site	3	34
3	12	Westerly side of site, northwest edge of site	3	39
4	12	Westerly side of site, northwest edge of site	3	150
5	12	Westerly side of site, northwest edge of site	3	101
6	12	Westerly side of site, northwest edge of site	1	105
7	12	Westerly side of site, northeast edge of site	1	148
8	12	Westerly side of site, northeast edge of site	3	38
9	12	Westerly side of site, northeast edge of site	2	29
10	12	Westerly side of site, south edge of site	1	94
11	12	Westerly side of site, south edge of site	33	7
12	12	Westerly side of site, south edge of pad	1	82
13	12	Westerly side of site, south edge of pad	1	166
14	12	Westerly side of site, south edge of pad	1	232
15	12	Westerly side of site, southwest edge of pad	1	235
16	12	Westerly side of site, northwest edge of pad	2	12
17	12	Westerly side of site, northwest edge of pad	2	12
18	12	Westerly side of site, northwest edge of pad	2	12
19	12	Westerly side of site, northwest edge of pad	2	12
20	12	Easterly side of site, northwest corner of site	2	86
21	12	Easterly side of site, north corner of site	2	76
22	12	Easterly side of site, north corner of site	1	38
23	12	Easterly side of site, north corner of site	2	32
24	12	Easterly side of site, downslope of stockpile	4	140
25	12	Easterly side of site, downslope of stockpile	2	130

STANDARD E&S WORKSHEET #1
Compost Filter Socks

PROJECT NAME:	PENNEAST PIPELINE PROJECT - CHURCH ROAD INTERCONNECTS		
LOCATION:	NORTHAMPTON COUNTY		
PREPARED BY:	KEK	DATE:	02/2020
CHECKED BY:	MDN	DATE:	02/2020



Sock No.	Dia. (in)	Location	Slope Percent	Slope Length Above Barrier (ft)
26	18	Easterly side of site, southwest edge of site	3	290
27	12	Easterly side of site, southwest edge of site	4	76
28	12	Easterly side of site, southwest edge of site	4	55
29	12	Easterly side of site, southwest edge of site	3	39
30	12	Easterly side of site, southwest edge of site	2	162
31	12	Easterly side of site, southwest edge of site	3	40
32	12	Easterly side of site, southwest edge of site	4	69
33	12	Easterly side of site, southwest edge of site	4	88
34	12	Easterly side of site, southwest edge of site	4	138
35	12	Easterly side of site, southwest edge of site	3	198
36	12	Easterly side of site, northwest corner of site	2	182
37	12	Easterly side of site, northwest corner of site	3	111

Post Construction Stormwater Management Facility Calculations

NOAA Atlas 14, Volume 2, Version 3
Location name: Easton, Pennsylvania, USA*
Latitude: 40.6757°, Longitude: -75.2945°
Elevation: 401.51 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.319** (0.286-0.355)	**0.380** (0.341-0.424)	**0.449** (0.402-0.499)	**0.501** (0.448-0.557)	**0.568** (0.504-0.629)	**0.618** (0.545-0.685)	**0.671** (0.588-0.744)	**0.724** (0.629-0.805)	**0.796** (0.683-0.889)	**0.855** (0.725-0.960)
10-min	**0.509** (0.456-0.567)	**0.607** (0.545-0.677)	**0.718** (0.643-0.798)	**0.800** (0.716-0.889)	**0.903** (0.802-1.00)	**0.983** (0.867-1.09)	**1.06** (0.933-1.18)	**1.15** (0.995-1.27)	**1.26** (1.08-1.40)	**1.35** (1.14-1.51)
15-min	**0.636** (0.570-0.708)	**0.762** (0.685-0.850)	**0.908** (0.813-1.01)	**1.01** (0.905-1.12)	**1.14** (1.02-1.27)	**1.24** (1.10-1.38)	**1.34** (1.18-1.49)	**1.44** (1.25-1.61)	**1.58** (1.36-1.77)	**1.69** (1.43-1.89)
30-min	**0.870** (0.780-0.969)	**1.05** (0.944-1.17)	**1.29** (1.15-1.43)	**1.46** (1.31-1.63)	**1.69** (1.50-1.88)	**1.87** (1.65-2.07)	**2.06** (1.80-2.28)	**2.24** (1.95-2.50)	**2.51** (2.15-2.80)	**2.73** (2.31-3.06)
60-min	**1.09** (0.972-1.21)	**1.32** (1.19-1.47)	**1.65** (1.48-1.84)	**1.91** (1.71-2.12)	**2.25** (2.00-2.50)	**2.53** (2.23-2.81)	**2.83** (2.48-3.14)	**3.15** (2.73-3.50)	**3.60** (3.09-4.02)	**3.98** (3.37-4.46)
2-hr	**1.31** (1.17-1.46)	**1.58** (1.42-1.76)	**1.99** (1.78-2.21)	**2.30** (2.06-2.56)	**2.76** (2.46-3.07)	**3.15** (2.79-3.49)	**3.57** (3.13-3.96)	**4.03** (3.50-4.48)	**4.72** (4.04-5.27)	**5.30** (4.48-5.95)
3-hr	**1.44** (1.30-1.61)	**1.74** (1.57-1.94)	**2.17** (1.95-2.42)	**2.52** (2.26-2.80)	**3.01** (2.68-3.34)	**3.42** (3.03-3.79)	**3.87** (3.40-4.29)	**4.37** (3.79-4.85)	**5.09** (4.36-5.68)	**5.72** (4.83-6.41)
6-hr	**1.83** (1.66-2.04)	**2.20** (1.99-2.45)	**2.72** (2.46-3.02)	**3.16** (2.85-3.50)	**3.80** (3.39-4.20)	**4.34** (3.85-4.80)	**4.95** (4.34-5.47)	**5.63** (4.88-6.22)	**6.65** (5.66-7.37)	**7.54** (6.33-8.37)
12-hr	**2.25** (2.04-2.51)	**2.71** (2.46-3.02)	**3.37** (3.05-3.75)	**3.94** (3.54-4.37)	**4.78** (4.26-5.29)	**5.52** (4.87-6.09)	**6.35** (5.54-7.01)	**7.29** (6.29-8.05)	**8.72** (7.37-9.65)	**9.98** (8.29-11.1)
24-hr	**2.63** (2.44-2.85)	**3.16** (2.94-3.43)	**3.96** (3.67-4.27)	**4.62** (4.27-4.98)	**5.59** (5.14-6.02)	**6.42** (5.87-6.90)	**7.33** (6.65-7.86)	**8.32** (7.49-8.91)	**9.78** (8.70-10.5)	**11.0** (9.70-11.8)
2-day	**3.08** (2.86-3.35)	**3.72** (3.44-4.04)	**4.65** (4.30-5.05)	**5.42** (5.00-5.87)	**6.52** (5.98-7.05)	**7.44** (6.80-8.03)	**8.44** (7.67-9.10)	**9.52** (8.59-10.3)	**11.1** (9.90-12.0)	**12.4** (11.0-13.4)
3-day	**3.25** (3.01-3.52)	**3.91** (3.63-4.24)	**4.88** (4.52-5.28)	**5.67** (5.24-6.14)	**6.82** (6.27-7.36)	**7.78** (7.11-8.38)	**8.81** (8.02-9.48)	**9.93** (8.97-10.7)	**11.6** (10.3-12.4)	**12.9** (11.5-13.9)
4-day	**3.41** (3.17-3.69)	**4.11** (3.81-4.44)	**5.11** (4.74-5.52)	**5.93** (5.49-6.41)	**7.12** (6.56-7.67)	**8.12** (7.43-8.74)	**9.18** (8.37-9.87)	**10.3** (9.36-11.1)	**12.0** (10.8-12.9)	**13.4** (11.9-14.4)
7-day	**4.02** (3.74-4.36)	**4.82** (4.47-5.22)	**5.93** (5.51-6.43)	**6.86** (6.35-7.42)	**8.19** (7.56-8.86)	**9.32** (8.56-10.1)	**10.5** (9.61-11.4)	**11.8** (10.7-12.8)	**13.7** (12.3-14.8)	**15.3** (13.7-16.5)
10-day	**4.63** (4.32-4.99)	**5.53** (5.16-5.95)	**6.72** (6.27-7.23)	**7.69** (7.16-8.26)	**9.06** (8.40-9.72)	**10.2** (9.41-10.9)	**11.4** (10.5-12.2)	**12.6** (11.5-13.5)	**14.4** (13.0-15.4)	**15.8** (14.3-17.0)
20-day	**6.23** (5.85-6.63)	**7.38** (6.94-7.85)	**8.78** (8.24-9.33)	**9.89** (9.27-10.5)	**11.4** (10.7-12.1)	**12.6** (11.8-13.4)	**13.9** (12.9-14.7)	**15.1** (14.0-16.1)	**16.9** (15.5-18.0)	**18.3** (16.7-19.5)
30-day	**7.79** (7.36-8.23)	**9.18** (8.67-9.69)	**10.7** (10.1-11.3)	**11.8** (11.2-12.5)	**13.4** (12.6-14.2)	**14.6** (13.7-15.4)	**15.8** (14.8-16.7)	**17.1** (15.9-18.0)	**18.7** (17.4-19.8)	**19.9** (18.4-21.1)
45-day	**9.88** (9.38-10.4)	**11.6** (11.0-12.2)	**13.3** (12.6-14.0)	**14.6** (13.8-15.4)	**16.2** (15.4-17.1)	**17.5** (16.6-18.5)	**18.7** (17.7-19.7)	**19.9** (18.8-21.0)	**21.4** (20.1-22.6)	**22.6** (21.1-23.9)
60-day	**11.8** (11.3-12.5)	**13.9** (13.2-14.6)	**15.8** (15.0-16.6)	**17.2** (16.4-18.2)	**19.1** (18.1-20.1)	**20.5** (19.4-21.5)	**21.8** (20.6-22.9)	**23.0** (21.8-24.3)	**24.6** (23.2-26.0)	**25.8** (24.3-27.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PENNEAST-CHURCH ROAD INTERCONNECT

EXISTING CONDITIONS CURVE NUMBER CALCULATIONS

ID	DA	Cover	Soils	HSG	Area	Area (Acres)	CN	CN*A	Weighted CN
	EX-SITE-SWALE-1								
	EX-SITE-SWALE-1	MEAD	WaA	B	40,765	0.936	58	54.28	58.0
	EX-SITE-SWALE-1	80% IMPERVIOUS	WaA	B	4,256	0.098	98	9.58	98.0
	EX-SITE-SWALE-1	20% MEADOW	WaA	B	1,064	0.024	58	1.42	58.0
		EX-SITE-SWALE-1 TOTAL			**46,085**	**1.058**		**65.27**	**61.7**
	EX-SITE-SWALE-2								
	EX-SITE-SWALE-2	MEAD	WaA	B	5,000	0.115	58	6.66	58.0
	EX-SITE-SWALE-2	80% IMPERVIOUS	WaA	B	360	0.008	98	0.81	98.0
	EX-SITE-SWALE-2	20% MEADOW	WaA	B	90	0.002	58	0.12	99.0
		EX-SITE-SWALE-2 TOTAL			**5,450**	**0.125**		**7.59**	**60.6**
	EX-SITE-SWALE-3								
	EX-SITE-SWALE-3	MEAD	WaA	B	3,135	0.072	58	4.17	58.0
	EX-SITE-SWALE-3	MEAD	WaB	B	1,585	0.036	58	2.11	58.0
		EX-SITE-SWALE-3 TOTAL			**4,720**	**0.108**		**6.28**	**58.0**
	EX-SITE-SWALE-4								
	EX-SITE-SWALE-4	MEAD	WaA	B	3,820	0.088	58	5.09	58.0
	EX-SITE-SWALE-4	MEAD	WaB	B	5,445	0.125	58	7.25	58.0
		EX-SITE-SWALE-4 TOTAL			**9,265**	**0.213**		**12.34**	**58.0**
	EX-SITE-BASIN								
	EX-SITE-BASIN	MEAD	WaA	B	12,275	0.282	58	16.34	58.0
		EX-SITE-BASIN TOTAL			**12,275**	**0.282**		**16.34**	**58.0**
	EX-SITE-TRENCH								
	EX-SITE-TRENCH	MEAD	WaA	B	9,150	0.210	58	12.18	58.0
		EX-SITE-TRENCH TOTAL			**9,150**	**0.210**		**12.18**	**58.0**
	EX-SITE-BYPASS								
	EX-SITE-BYPASS	MEAD	WaA	B	20,385	0.468	58	27.14	58.0
	EX-SITE-BYPASS	80% IMPERVIOUS	WaA	B	188	0.004	98	0.42	98.0
	EX-SITE-BYPASS	20% MEADOW	WaA	B	47	0.001	58	0.06	58.0
		EX-SITE-BYPASS-2 TOTAL			**20,620**	**0.473**		**27.57**	**58.2**
	EX-OFFSITE-BYPASS SWALE-1								
	EX-OFFSITE-BYPASS-SWALE-1	MEAD	WaB	B	26,790	0.615	58	35.67	58.0
		EX-OFFSITE-BYPASS SWALE-1 TOTAL			**26,790**	**0.615**		**35.67**	**58.0**
	EX-OFFSITE-BYPASS SWALE-2								
	EX-OFFSITE-BYPASS-SWALE-2	MEAD	WaA	B	1,820	0.042	58	2.42	58.0
	EX-OFFSITE-BYPASS-SWALE-2	MEAD	WaB	B	15,585	0.358	58	20.75	58.0
		EX-OFFSITE-BYPASS SWALE-2 TOTAL			**17,405**	**0.400**		**23.17**	**58.0**
	Grand Total				**151,760**	**3.484**		**206.417**	**59.2**

PENNEAST-CHURCH ROAD INTERCONNECT

PROPOSED CONDITIONS CURVE NUMBER CALCULATIONS

ID	DA	Cover	Soils	HSG	Area	Area (Acres)	CN	CN*A	Weighted CN
	PR-SITE-SWALE-1								
	PR-SITE-SWALE-1	GRAVEL	WaA	B	41,890	0.962	98	94.24	98.0
	PR-SITE-SWALE-1	MEAD	WaA	B	4,195	0.096	58	5.59	58.0
		PR-SITE-SWALE-1 TOTAL			**46,085**	**1.058**		**99.83**	**94.4**
	PR-SITE-SWALE-2								
	PR-SITE-SWALE-2	GRAVEL	WaA	B	805	0.018	98	1.81	98.0
	PR-SITE-SWALE-2	MEAD	WaA	B	4,645	0.107	58	6.18	58.0
		PR-SITE-SWALE-2 TOTAL			**5,450**	**0.125**		**8.00**	**63.9**
	PR-SITE-SWALE-3								
	PR-SITE-SWALE-3	MEAD	WaA	B	3,135	0.072	58	4.17	58.0
	PR-SITE-SWALE-3	MEAD	WaB	B	1,585	0.036	58	2.11	58.0
		PR-SITE-SWALE-3 TOTAL			**4,720**	**0.108**		**6.28**	**58.0**
	PR-SITE-SWALE-4								
	PR-SITE-SWALE-4	MEAD	WaA	B	3,820	0.088	58	5.09	58.0
	PR-SITE-SWALE-4	MEAD	WaB	B	5,445	0.125	58	7.25	58.0
		PR-SITE-SWALE-4 TOTAL			**9,265**	**0.213**		**12.34**	**58.0**
	PR-SITE-BASIN								
	PR-SITE-BASIN	MEAD	WaA	B	12,275	0.282	58	16.34	58.0
		PR-SITE-BASIN TOTAL			**12,275**	**0.282**		**16.34**	**58.0**
	PR-SITE-TRENCH								
	PR-SITE-TRENCH	GRAVEL PAD	WaA	B	6,560	0.151	98	14.76	98.0
	PR-SITE-TRENCH	GRAVEL ROAD	WaA	B	2,590	0.059	98	5.83	98.0
		PR-SITE-TRENCH TOTAL			**9,150**	**0.210**		**14.76**	**70.3**
	PR-SITE-BYPASS								
	PR-SITE-BYPASS	GRAVEL	WaA	B	1,610	0.037	98	3.62	98.0
	PR-SITE-BYPASS	MEAD	WaA	B	19,010	0.436	58	25.31	58.0
		PR-SITE-BYPASS-2 TOTAL			**20,620**	**0.473**		**28.93**	**61.1**
	PR-OFFSITE-BYPASS SWALE-1								
	PR-OFFSITE-BYPASS SWALE-1	MEAD	WaB	B	26,790	0.615	58	35.67	58.0
		PR-OFFSITE-BYPASS SWALE-1 TOTAL			**26,790**	**0.615**		**35.67**	**58.0**
	PR-OFFSITE-BYPASS SWALE-2								
	PR-OFFSITE-BYPASS SWALE-2	MEAD	WaA	B	1,820	0.042	58	2.42	58.0
	PR-OFFSITE-BYPASS SWALE-2	MEAD	WaB	B	15,585	0.358	58	20.75	58.0
		PR-OFFSITE-BYPASS SWALE-2 TOTAL			**17,405**	**0.400**		**23.17**	**58.0**
	Grand Total				**151,760**	**3.484**		**245.327**	**70.4**

EXISTING CONDITIONS
SITE EXISTING BASIN -Tc CALCULATIONS

SHEET FLOW		
Manning's n		0.24
Flow length, ft		69
2-Yr 24-Hr rainfall, in		3.16
Land slope, %		0.14
Sheet flow time, min		**30.5**
Manning's n		0.011
Flow length, ft		18
2-Yr 24-Hr rainfall, in		3.16
Land slope, %		0.56
Sheet flow time, min		**0.5**
Manning's n		0.24
Flow length, ft		63
2-Yr 24-Hr rainfall, in		3.16
Land slope, %		0.32
Sheet flow time, min		**20.7**
SHALLOW CONC. FLOW		
Flow length, ft	0	176
Watercourse slope, %	0	1.14
Surface Description	0	unpaved
Velocity, ft/s	0	1.72
Sh. Conc. Flow time, min	**0**	**1.7**
TIME OF CONC., mins	0	**53.4**

EXISTING CONDITIONS
SITE EXISTING TRENCH -Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.24
Flow length, ft	93
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	1.34
Sheet flow time, min	**15.9**
TIME OF CONC., mins	**15.9**

EXISTING CONDITIONS
SITE EXISTING BYPASS -Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.24
Flow length, ft	94
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	2.93
Sheet flow time, min	**11.7**
TIME OF CONC., mins	**11.7**

EXISTING CONDITIONS
OFFSITE EXISTING BYPASS -Tc

SHEET FLOW	
Manning's n	0.24
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	2.00
Sheet flow time, min	**19.9**
	0
SHALLOW CONC. FLOW	
Flow length, ft	147
Watercourse slope, %	2.21
Surface Description	unpaved
Velocity, ft/s	2.40
Sh. Conc. Flow time, min	**1.0**
TIME OF CONC., mins	**20.9**

PROPOSED CONDITIONS
SITE PROPOSED BASIN -Tc

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	1.17
Sheet flow time, min	**2.1**
	0
SHALLOW CONC. FLOW - GRAVEL	
Flow length, ft	80
Watercourse slope, %	1.88
Surface Description	paved
Velocity, ft/s	2.78
Sh. Conc. Flow time, min	**0.5**
0	
TIME OF CONC., mins	**2.6**

PROPOSED CONDITIONS
SITE PROPOSED TRENCH -Tc

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	0.17
Sheet flow time, min	**4.6**
0 0	0
SHALLOW CONC. FLOW - GRAVEL	
Flow length, ft	30
Watercourse slope, %	0.83
Surface Description	paved
Velocity, ft/s	1.86
Sh. Conc. Flow time, min	**0.3**
TIME OF CONC., mins	**4.8**

PROPOSED CONDITIONS
SITE PROPOSED BYPASS -Tc

SHEET FLOW		
Manning's n		0.24
Flow length, ft		118
2-Yr 24-Hr rainfall, in		3.16
Land slope, %		2.75
Sheet flow time, min		**14.4**
SHALLOW CONC. FLOW		
Flow lengtl	0	123
Watercour:	0	0.61
Surface De	0	unpaved
Velocity, ft	0	1.26
Sh. Conc.	**0**	**1.6**
TIME OF CONC., mins		**16.1**

PROPOSED CONDITIONS
OFFSITE PROPOSED BYPASS -Tc

SHEET FLOW	
Manning's n	0.24
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	2.00
Sheet flow time, min	**19.9**
	0
SHALLOW CONC. FLOW	
Flow length, ft	147
Watercourse slope, %	2.21
Surface Description	unpaved
Velocity, ft/s	2.40
Sh. Conc. Flow time, min	**1.0**
TIME OF CONC., mins	**20.9**

PENNEAST-CHURCH ROAD INTERCONNECTS

PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PROPOSED SWALES

***Note: Rational C Coefficients adopted from PA Erosion and Sediment Pollution Control Program Manual, Mar 2012, Table 5.2**

DA	Land Use	Soils	HSG	Area	Area (Acres)	C	C*A	RC
SWALE 1	GRAVEL	WaA	B	41,890	0.962	0.22	0.212	0.22
SWALE 1	MEAD	WaA	B	4,195	0.096	0.22	0.021	0.22
SWALE 1 TOTAL					**1.058**		**0.233**	**0.22**
SWALE 2	GRAVEL	WaA	B	805	0.018	0.22	0.004	0.22
SWALE 2	MEAD	WaA	B	4,645	0.107	0.22	0.023	0.22
SWALE 2 TOTAL					**0.125**		**0.028**	**0.22**
SWALE 3	MEAD	WaA	B	3,135	0.072	0.22	0.016	0.22
SWALE 3	MEAD	WaB	B	1,585	0.036	0.22	0.008	0.22
SWALE 3	MEAD	WaB	B	1,820	0.042	0.22	0.009	0.22
SWALE 3	MEAD	WaB	B	15,585	0.358	0.22	0.079	0.22
SWALE 3 TOTAL					**0.508**		**0.112**	**0.22**
SWALE 4	MEAD	WaA	B	3,820	0.088	0.22	0.019	0.22
SWALE 4	MEAD	WaB	B	8,558	0.196	0.22	0.043	0.22
SWALE 4	MEAD	WaA	B	26,790	0.615	0.22	0.135	0.22
SWALE 3 TOTAL					**0.899**		**0.198**	**0.22**
Grand Total					**2.590**		**0.570**	**0.22**

The "RC" value is an area averaged runoff coefficient value (arithmatic mean) calculated as:

$$RC = \frac{\sum_{i=1}^{n} C_i \, x \, Area_i}{\sum_{i=1}^{n} Area_i}$$

PENNEAST-TCO&UGI-LEH INTERCONNECTS
RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PROPOSED SWALES

Return Period (Yrs) 10
Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
SWALE 1	1.058	0.22	5.0	6.5	1.5
SWALE 2	0.125	0.22	5.0	6.5	0.2
SWALE 3	0.508	0.22	16.1	5.1	0.6
SWALE 4	0.899	0.22	16.1	5.1	1.0

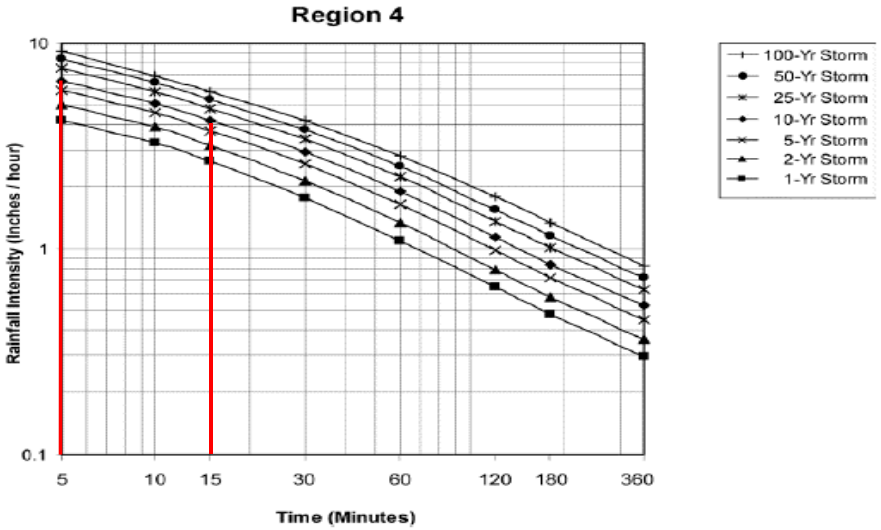


Figure - Rainfall Amount for 1- through 100-year Storms for Region 4 (U.S. Customary).
Source: PennDOT Drainage Manual, March 2015 Edition

PENNEAST-TCO&UGI-LEH INTERCONNECTS
RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PROPOSED SWALES

Return Period (Yrs) 10
Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
SWALE 1	1.058	0.22	5.0	9.1	2.1
SWALE 2	0.125	0.22	5.0	9.1	0.3
SWALE 3	0.508	0.22	16.1	6.0	0.7
SWALE 4	0.899	0.22	16.1	6.0	1.2

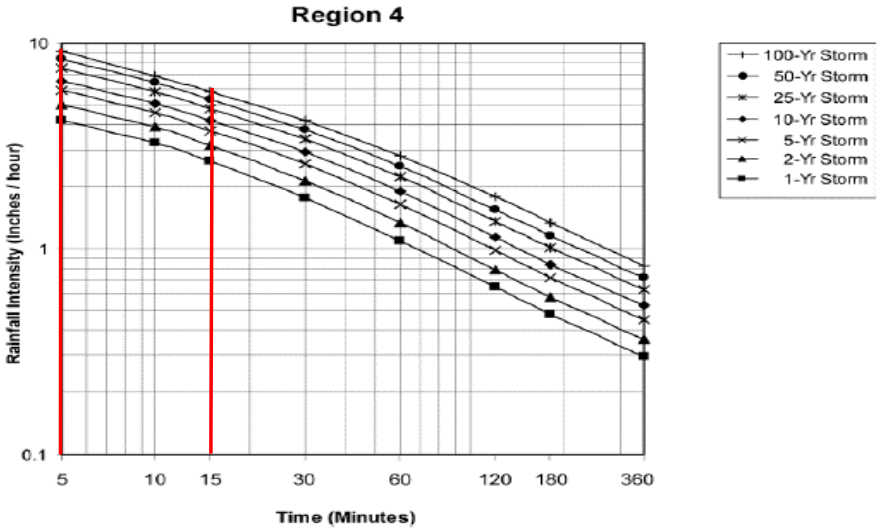


Figure - Rainfall Amount for 1- through 100-year Storms for Region 4 (U.S. Customary).
Source: PennDOT Drainage Manual, March 2015 Edition

PENNEAST SPRINGVILLE INTERCONNECT					
PROPOSED VEGETATED SWALE SCHEDULE					
SWALE No.	**BOTTOM WIDTH (FT)**	**LEFT SIDE SLOPE (H:V)**	**RIGHT SIDE SLOPE (H:V)**	**DEPTH (FT)**	**LINING MATERIAL**
SWALE1	3.0	3.0	3.0	1.0	Landlok TRM-435 or equal.
SWALE2	5.0	3.0	3.0	1.0	Landlok TRM-435 or equal.
SWALE3	5.0	3.0	3.0	1.0	Landlok TRM-435 or equal.
SWALE4	5.0	3.0	3.0	1.0	Landlok TRM-435 or equal.

***Note: Refer to Site Plans for location of proposed swales**

PROJECT NAME:	**SWALE-1**	
LOCATION:	**CHURCH ROAD INTERCONNECTION**	
PREPARED BY:	**DATE:**	**2/19/2020**
CHECKED BY:	**DATE:**	**2/19/2020**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	1.50	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	3	
Channel Depth provided, ft	1	
Channel bed slope, %	1	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.01	
Calculated channel flow depth, ft	0.41	
top width at flow depth, ft	5.48	
Bottom Width:Flow Depth Ratio	7.26	
wetted area, sq. ft	1.75	
wetted peri, ft	5.61	
hyd. Radius, ft	0.31	
velocity, ft/s	0.86	
Discharge, cfs	1.50	
Theta, rad	0.010	
Froudes Number	0.23	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.26	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.09	
Calculated Critical Slope,Sc ft/ft	0.18	
0.7 Sc, ft/ft	0.13	
1.3 Sc, ft/ft	0.23	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.59	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE-2**	
LOCATION:	**CHURCH ROAD INTERCONNECTION**	
PREPARED BY:	**DATE:**	**2/19/2020**
CHECKED BY:	**DATE:**	**2/19/2020**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	0.20	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	5	
Channel Depth provided, ft	1	
Channel bed slope, %	0.25	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0025	
Calculated channel flow depth, ft	0.15	
top width at flow depth, ft	5.89	
Bottom Width:Flow Depth Ratio	33.56	
wetted area, sq. ft	0.81	
wetted peri, ft	5.94	
hyd. Radius, ft	0.14	
velocity, ft/s	0.25	
Discharge, cfs	0.20	
Theta, rad	0.002	
Froudes Number	0.11	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.02	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.22	
Calculated Critical Slope,Sc ft/ft	1.37	
0.7 Sc, ft/ft	0.96	
1.3 Sc, ft/ft	1.78	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.85	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE-3**	
LOCATION:	**CHURCH ROAD INTERCONNECTION**	
PREPARED BY:	**DATE:**	**2/19/2020**
CHECKED BY:	**DATE:**	**2/19/2020**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	0.60	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	5	
Channel Depth provided, ft	1	
Channel bed slope, %	1.33	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0133	
Calculated channel flow depth, ft	0.17	
top width at flow depth, ft	6.04	
Bottom Width:Flow Depth Ratio	28.79	
wetted area, sq. ft	0.96	
wetted peri, ft	6.10	
hyd. Radius, ft	0.16	
velocity, ft/s	0.63	
Discharge, cfs	0.60	
Theta, rad	0.013	
Froudes Number	0.26	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.14	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.11	
Calculated Critical Slope,Sc ft/ft	0.31	
0.7 Sc, ft/ft	0.21	
1.3 Sc, ft/ft	0.40	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.83	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE-4**	
LOCATION:	**CHURCH ROAD INTERCONNECTION**	
PREPARED BY:	**DATE:**	**2/19/2020**
CHECKED BY:	**DATE:**	**2/19/2020**

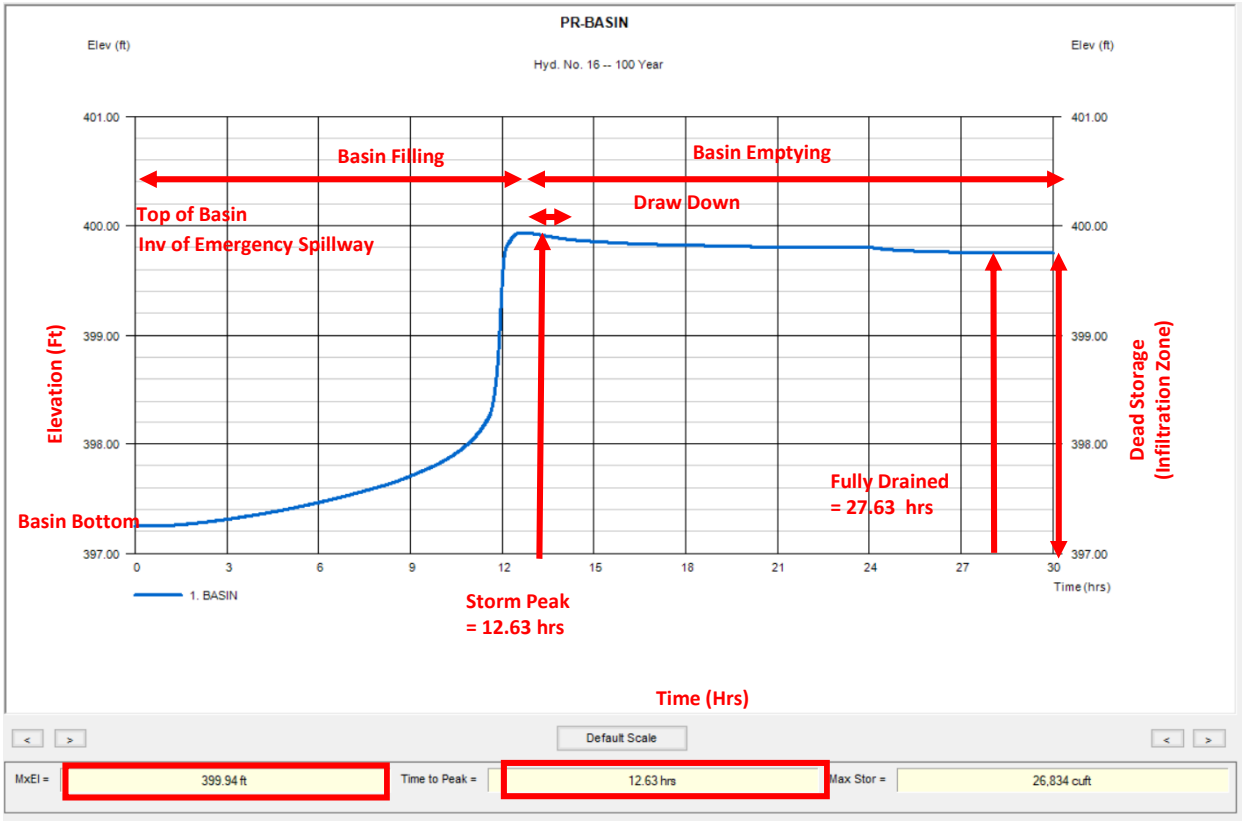
CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	1.00	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	5	
Channel Depth provided, ft	1	
Channel bed slope, %	1	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.01	
Calculated channel flow depth, ft	0.25	
top width at flow depth, ft	6.53	
Bottom Width:Flow Depth Ratio	19.66	**Check Design**
wetted area, sq. ft	1.47	
wetted peri, ft	6.61	
hyd. Radius, ft	0.22	
velocity, ft/s	0.68	
Discharge, cfs	1.00	
Theta, rad	0.010	
Froudes Number	0.24	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.16	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.10	
Calculated Critical Slope,Sc ft/ft	0.26	
0.7 Sc, ft/ft	0.18	
1.3 Sc, ft/ft	0.34	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.75	**Freeboard Ok, Calculated<Provided**

BASIN DEWATERING TIME CALCULATIONS

BASIN NAME	BASIN
Design Rate, TP-1, IN/HR	6
Design Rate, TP-2, IN/HR	2.5
AVERAGE, IN/HR	4.25
FOS	**2.00**
DESIGN RATE, IN/HR	**2.13**
INFILTRATION OF STORAGE VOLUME BELOW EMERGENCY SPILLWAY	
Bed Bottom Area	8432.00
Storage Volume	24596.00
DRAIN TIME (1)	**16.47** *DRAIN TIME FOR DEAD STORAGE BELOW EMERGENCY SPILLWAY*
INFILTRATION OF STORAGE VOLUME ABOVE EMERGENCY SPILLWAY	

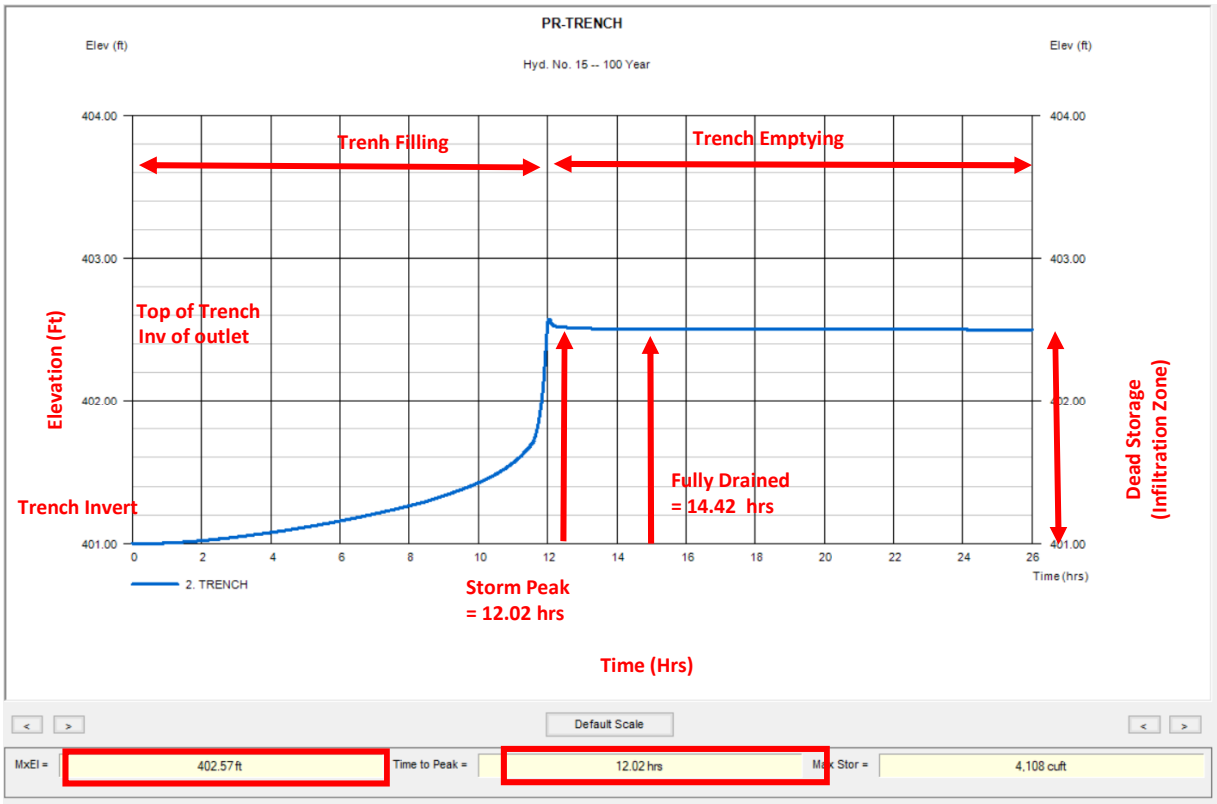


Time (hrs)	Elev (ft)
27.45	399.76
27.47	399.76
27.48	399.76
27.50	399.76
27.52	399.76
27.53	399.76
27.55	399.76
27.57	399.76
27.58	399.76
27.60	399.76
27.62	399.76
27.63	399.75
27.65	399.75
27.67	399.75
27.68	399.75
27.70	399.75
27.72	399.75
27.73	399.75
27.75	399.75
27.77	399.75
27.78	399.75
27.80	399.75
27.82	399.75
27.83	399.75
27.85	399.75
27.87	399.75
27.88	399.75
27.90	399.75

DRAIN TIME (2)	**15.00**	*DRAIN TIME FROM 100-YEAR STORM PEAK TO DEAD STORAGE ELEVATION*
TOTAL DRAIN TIME (1+2)	**31.47**	**OK**

TRENCH DEWATERING TIME CALCULATIONS

BASIN NAME	BASIN
Design Rate, TP-1, IN/HR	0.24
Design Rate, TP-2, IN/HR	0.24
AVERAGE, IN/HR	0.24
FOS	**2.00**
DESIGN RATE, IN/HR	**0.12**
INFILTRATION OF STORAGE VOLUME BELOW EMERGENCY SPILLWAY	
Bed Bottom Area	6536.00
Storage Volume	4183.00
DRAIN TIME (1)	**64.00** *DRAIN TIME FOR DEAD STORAGE BELOW EMERGENCY SPILLWAY*
INFILTRATION OF STORAGE VOLUME ABOVE EMERGENCY SPILLWAY	



Time (hrs)	Elev (ft)
14.02	402.51
14.03	402.51
14.05	402.51
14.07	402.51
14.08	402.51
14.10	402.51
14.12	402.51
14.13	402.51
14.15	402.51
14.17	402.51
14.18	402.51
14.20	402.51
14.22	402.51
14.23	402.51
14.25	402.51
14.27	402.51
14.28	402.51
14.30	402.51
14.32	402.51
14.33	402.51
14.35	402.51
14.37	402.51
14.38	402.51
14.40	402.51
14.42	402.50
14.43	402.50
14.45	402.50
14.47	402.50

DRAIN TIME (2)	**2.40**	*DRAIN TIME FROM 100-YEAR STORM PEAK TO DEAD STORAGE ELEVATION*
TOTAL DRAIN TIME (1+2)	**66.40**	**OK**

PENNEAST CHURCH ROAD INTERCONNECT
BASIN DISCHARGE

OUTLET ID	BASIN	
Discharge Type	Surface	
10-YR Peak Discharge, cfs	0.00	10-Year Trench Discharge from Model Hydrograph 16
DS Ground Cover	Grass	
Crest Elev.	399.75	
Design Criteria cfs/lf	13.0	
Calculated Crest Length, ft	0.0	
Design Crest Length, ft	**5**	
Weir Coefficient	3.33	Use sharp crested value to calculate higher velocity
Weir Head (H)	0.00	to be conservative.
Flow Area	0.00	
Velocity	0.00	
Velocity Non-Erosive	YES	

PENNEAST CHURCH ROAD INTERCONNECT
TRENCH DISCHARGE

OUTLET ID	TRENCH	
Discharge Type	Surface	
10-YR Peak Discharge, cfs	0.014	10-Year Trench Discharge from Model Hydrograph 16
DS Ground Cover	Grass	
Crest Elev.	404	
Design Criteria cfs/lf	13.0	
Calculated Crest Length, ft	0.2	
Design Crest Length, ft	**38**	
Weir Coefficient	3.33	Use sharp crested value to calculate higher velocity
Weir Head (H)	0.00	to be conservative.
Flow Area	0.09	
Velocity	0.00	
Velocity Non-Erosive	YES	

Pond Report

CALCULATION FOR VOLUME STORAGE
FOR INFILTRATION BASIN

Pond No. 1 - BASIN

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 397.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	397.25	8,432	0	0
1.00	398.25	9,370	8,896	8,896
2.00	399.25	10,769	10,060	18,956
2.50	399.75	11,800	5,640	24,596
2.75	400.00	12,275	3,009	27,605

EMERGENCY SPILLWAY ELEVATION

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 399.75	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	397.25	---	---	---	---	0.00	---	---	---	---	---	0.000
1.00	8,896	398.25	---	---	---	---	0.00	---	---	---	---	---	0.000
2.00	18,956	399.25	---	---	---	---	0.00	---	---	---	---	---	0.000
2.50	24,596	399.75	---	---	---	---	0.00	---	---	---	---	---	0.000
2.75	27,605	400.00	---	---	---	---	1.63	---	---	---	---	---	1.625

Pond Report

CALCULATION FOR VOLUME STORAGE
FOR INFILTRATION TRENCH

Pond No. 2 - TRENCH

Pond Data

Trapezoid -Bottom L x W = 38.0 x 172.0 ft, Side slope = 0.00:1, Bottom elev. = 401.00 ft, Depth = 2.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	401.00	6,536	0	0
0.20	401.20	6,536	523	523
0.40	401.40	6,536	523	1,046
0.60	401.60	6,536	523	1,569
0.80	401.80	6,536	523	2,092
1.00	402.00	6,536	523	2,614
1.20	402.20	6,536	523	3,137
1.40	402.40	6,536	523	3,660
1.60	402.60	6,536	523	4,183
1.80	402.80	6,536	523	4,706
2.00	403.00	6,536	523	5,229

TRENCH OVERFLOW ELEVATION

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 38.00	0.00	0.00	0.00
Crest El. (ft)	= 402.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	401.00	---	---	---	---	0.00	---	---	---	---	---	0.000
0.20	523	401.20	---	---	---	---	0.00	---	---	---	---	---	0.000
0.40	1,046	401.40	---	---	---	---	0.00	---	---	---	---	---	0.000
0.60	1,569	401.60	---	---	---	---	0.00	---	---	---	---	---	0.000
0.80	2,092	401.80	---	---	---	---	0.00	---	---	---	---	---	0.000
1.00	2,614	402.00	---	---	---	---	0.00	---	---	---	---	---	0.000
1.20	3,137	402.20	---	---	---	---	0.00	---	---	---	---	---	0.000
1.40	3,660	402.40	---	---	---	---	0.00	---	---	---	---	---	0.000
1.60	4,183	402.60	---	---	---	---	3.12	---	---	---	---	---	3.125
1.80	4,706	402.80	---	---	---	---	16.23	---	---	---	---	---	16.23
2.00	5,229	403.00	---	---	---	---	34.93	---	---	---	---	---	34.93

D. Standard E&S Worksheet #22

STANDARD E&S WORKSHEET # 22
PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES

NAME OF PLAN PREPARER: MICHAEL DENICHILO

FORMAL EDUCATION:

Name of College or Technical Institute: VILLANOVA UNIVERSITY

Curriculum or Program: CIVIL AND ENVIRONMENTAL ENGINEERING (BS)
WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (MS)

Dates of Attendance: **From:** 2004 / 2009 **To:** 2008 / 2011

Degree Received BACHELOR OF SCIENCE / MASTER OF SCIENCE

OTHER TRAINING:

Name of Training:	FEDERAL ENERGY REGULATORY COMMISSION (FERC) - ENVIRONMENTAL REVIEW AND COMPLIANCE FOR NATURAL GAS FACILITIES	GAS TECHNOLOGY INSTITUTE (GTI) - TRANSMISSION PIPELINE DESIGN & CONSTRUCTION PRACTICES
Presented By:	DAVID HANOBIC / DANNY LAFFOON / MAGGIE SUTER / LARRY BROWN / TIM DRAKE / JENNIFER LEE / MIKE TIMPSON / JANELLE RIELAND / JOE HOLLER	GUS / BILL
Date:	MARCH 7-9, 2017	NOVEMBER 6-10, 2017

EMPLOYMENT HISTORY:

Current Employer: MOTT MACDONALD

Telephone: (973) 379-3400

Former Employer: N/A

Telephone: N/A

RECENT E&S PLANS PREPARED:

Name of Project:	Rahway River Pipe Replacement	Rivervale to Market Project	
County:	Union County, NJ	Bergen County, NJ	
Municipality:	Linden	Carlstadt / River Vale / Emerson / Paramus	
Permit Number:	2017-2960	18-1148	
Approving Agency:	Somerset - Union Soil Conservation District	Bergen County Soil Conservation District	

E. E&SCP Drawings

mottmac.com