Transcontinental Gas Pipe Line Company, LLC

Section 2-4 E&SC Plan Narrative and Drawings

Regional Energy Access Expansion Project – Compressor Station 515

April 2021
(Revised July 2021)
(Revised March 2022)

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SECTION 2.4.1
NARRATIVE

1. Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), indirectly owned by the Williams Companies, Inc. (Williams) is seeking authorization from the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act and Part 157 of the Commission's Regulations to construct, own, operate, and maintain the proposed Project facilities associated with the Regional Energy Access Expansion Project (Project). The Project is an expansion of Transco's existing natural gas transmission system that will enable Transco to provide an incremental 829,400 dekatherms per day (Dth/d) of year-round firm transportation capacity from the Marcellus Shale production area in northeastern Pennsylvania to multiple delivery points along Transco's Leidy Line in PA and Mainline in PA, NJ, and MD.

The existing Compressor Station 515 component of the Project is located at the eastern terminus of the Regional Energy Lateral in Buck Township, Luzerne County. Proposed at this facility is the addition of one gas-fired turbine driven compressor with 31,871 nominal horse power (HP) at International Organization for Standardization (ISO) conditions and modification of three existing compressors. Also proposed is the abandonment and replacement of 17,000 HP from five existing gas fired reciprocating engine driven compressors with one additional gas-fired turbine driven compressor with 20,502 nominal HP at ISO conditions. One Mainline Valve will be installed at this facility.

The E&SC Plan shall be designed and implemented to be consistent with the Post Construction Stormwater Management (PCSM) Plan under 25 Pa. Code § 102.8 (relating to PCSM requirements). Transco will use and implement the practices, measures and details outlined herein to control soil erosion and off-site sedimentation. The work and disturbed areas are located within Transco property, existing easements or legally obtained workspace. The limit of disturbance (LOD) for Compressor Station 515 will be approximately 24.83 acres, which includes the offline contractor yard. Subject to FERC's certification of the Project and receipt of the necessary permits and authorizations, Transco anticipates construction of the Project to start in second quarter 2023 to meet a proposed in-service date in fourth quarter 2024.

2. Topographic Features of the Area

A Project Location Map for Compressor Station 515 is included in Attachment 1. This map shows the topographical features of the general site vicinity and is based on the USGS 7.5 Minute topographical mapping of the Pleasant View Summit, Pennsylvania quadrangles.

3. Receiving Surface Waters

The following table (Table 1) lists each watershed located in the Compressor Station 515 Project Area, its Chapter 93 Water Quality Standards, and Pennsylvania Fish and Boat Commission classifications. A Wetland and Watercourse Delineation Report is included in Attachment A of the ESCP permit application.

Table 1 – Receiving Waters

Watershed Name	Designated Use	Existing Use	PFBC Classification
Trib 04285 Shades Creek	HQ-CWF, MF	-	Class A Wild Trout
Stony Run	HQ-CWF, MF	-	Naturally Producing Wild Trout Stream

MF: Migratory Fishes, HQ-CWF: High Quality- Cold Water Fishes

4. Types, Depth, Slope, Locations & Limitation of the Soils and Geologic Formations

The soil associations on site were identified by soil map units as mapped in the Web Soil Survey website (https://websoilsurvey.sc.egov.usda.gov/) by the United States Dept. of Agriculture (USDA), Natural Resources Conservation Service (NRCS). There are six soil mapping units located within the LOD, see Table 2 below.

Table 2 – Soils Mapping Units with Limits of Disturbance

Soil Mapping Unit	Soil Series
MsB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes
WIB	Wellsboro channery silt loam, 3 to 8 percent slopes
WIC	Wellsboro channery silt loam, 8 to 15 percent slopes
WID	Wellsboro channery silt loam, 15 to 25 percent slopes
WmB	Wellsboro channery silt loam, 3 to 8 percent slopes, extremely stony

Detailed descriptions and mapping of soil mapping units are provided in the Attachment 2. Soil use limitations (outlined in Table 3) were reviewed in relation to Compressor Station 515 and resolutions were identified in Section 4.1.

Table 3 – Limitations of Pennsylvania Soils Pertaining to Earth Disturbance Projects (Erosion and Sediment Control Best Management Practice (BMP) Manual – Technical Guidance Number 363-3134-008/Page 401)																	
SOIL NAME	**SOIL WITH SLOPE CLASS**	**CUTBANKS CAVE**	**CORROSIVE TO CONCRETE\STEEL**	**DROUGHTY**	**EASILY ERODIBLE**	**FLOODING**	**DEPTH TO SATURATED ZONE/ SEASONAL HIGH WATER TABLE**	**HYDRIC/ HYDRIC INCLUSIONS**	**LOW STRENGTH / LANDSLIDE PRONE**	**SLOW PERCOLATION**	**PIPING**	**POOR SOURCE OF TOPSOIL**	**FROST ACTION**	**SHRINK - SWELL**	**POTENTIAL SINKHOLE**	**PONDING**	**WETNESS**
Morris	MsB	X	C/S	X	X		X	X	X	X		X	X				X
Oquaga	OpD	X	C	X	X			X		X			X				
Wellsboro	WIB, WIC, WID, WmB	X	C/S	X	X		X	X	X	X	X		X				X

4.1 Resolution of Soil Limitations

Transco proposes the following resolutions to compensate for soil limitations summarized in Table 3 above:

1. To offset the caving of cutbanks, trenching operations will be conducted in accordance with the OSHA Technical Manual for Trenching.
2. Preventative coatings shall be used to prevent corrosion of concrete and/ or steel.
3. When bedrock is encountered it will be removed by mechanical methods or blasting. Blasting operations will conform with local, state, and federal regulations.
4. Precautions will be taken to prevent slope failure when working within low strength soils by flattening cut / fill slopes, not overloading, maintaining lateral support, and preventing saturation of soils. Low strength soils will not be used for roadway construction.
5. Excavation in soils prone to flooding, slow percolation, ponding, wetness, located in a seasonal high water table, or which are hydric, will likely encounter water. Compensation will involve dewatering with appropriate means such as pump water filter bags, sediment traps, etc.

6. Soils that have the potential to swell, shrink, or heave due to frost action may cause damage to roadways or pads. Where foundations are critical, compensation may require removal and replacement of soils with suitable material.

7. In circumstances where soils appear to be a poor source of topsoil, drought or prone to wetness, soil testing will be performed to determine the appropriate applications of soil amendments to promote growth. Soils onsite that are fair sources of topsoil, will be identified, stripped and stockpiled for use during restoration.

8. In order to minimize erosion of soils that are easily erodible, compensation may involve providing a protective lining, to apply seed, mulch, erosion control blankets (either in rolls or hydraulically applied), tracking slopes, upstream diversions, waterbars, etc. to minimize soil erosion.

4.2 Geologic Formations

Transco retained Civil & Environmental Consultants, Inc. (CEC) of Pittsburgh, PA to perform a geohazard assessment, the following is provided from their 2020 report. Transco utilized United States Geological Survey (USGS), Geologic Map of Pennsylvania - Map 1, dated 1980 (online), to evaluate geologic hazards on the Project. The desktop analysis completed for the Project by CEC revealed that the Compressor Station 515 does not cross known, mapped, or inferred faults. No mines or Karst formations were identified in the site vicinity. However, the analysis outlined that Compressor Station 515 lies within a zone of low landslide incidence and susceptibility.

A Geological Hazard Assessment and Mitigation Plan was completed by CEC and is submitted with this application (Attachment B). The Geological Hazard Assessment and Mitigation Plan identifies appropriate best management practices to avoid and mitigate for conditions encountered during construction.

5. Characterizations of Earth Disturbance Activities, Including Past, Present, and Proposed Land Uses

The Compressor Station 515 component of the Project is located at the eastern terminus of the Regional Energy Lateral in Buck Township, Luzerne County. The Project at Compressor Station 515 will involve the installation a gravel pad, several buildings, a new communications tower, proposed PCSM Best Management Practices (BMPs) and other compressor station modifications. Transco will use and implement the practices, measures, and details to control soil erosion and off-site sedimentation during construction. Using data taken from Google Earth and

Multi-Resolution Land Characteristics (MRLC) Consortium website (https://www.mrlc.gov/viewer/), it appears that land use for the past few decades has been utilized as a compressor station site. In the future, this site will continue to be used as a compressor station site.

6. Erosion and Sediment Control Best Management Practices

Various erosion and sediment control measures will be used during the construction of Compressor Station 515. E&S BMPs proposed to be used at the Site to control soil erosion and sediment pollution are listed below. Details of BMPs proposed to be used at the Project location are included in the Erosion and Sedimentation Control Plan sheets. BMPs listed will be used at the Project location at the discretion of the environmental inspector, when found necessary to comply with 25 PA Code Chapter 102 and to adequately address potential erosion and sediment control issues.

Rock Construction Entrances / Street Sweeping

Rock construction entrances shall be installed whenever sediment tracking onto road surfaces is a potential or if required by the county conservation district or other agency. Soil erosion control measures shall be installed, if required and as needed. In special protection watersheds, either a 100’ long rock construction entrance or a standard 50’ rock construction entrance with a wash rack will be used at the construction entrance to wash construction vehicle wheels before they enter the public roadway. The wash rack will discharge to a 24” compost filter sock (min.). Rock construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. Sediment deposited on roadways shall be removed and returned to the construction site immediately. If a standard rock construction entrance is unfeasible, public street sweeping with a vacuum sweeper and rolling of dirt and gravel roads will occur at the end of each work day (or more frequently as needed) and/or manual cleaning of tires prior to site egress may also be implemented. Vacuum sweepers can remove accumulated sediment from streets before it is washed into surface waters. Tires can be cleaned off manually with a broom prior to exiting. Rolling of dirt roads can stabilize areas affected by tracked mud.

Compost Filter Sock

Compost filter socks shall be placed downslope of disturbed areas to serve as a sediment barrier and filter. Filter socks shall be placed at existing level grade, parallel to contours, with both ends of the sock extended up slope at a 45-degree angle. In areas where it is not feasible to install compost filter sock parallel to contours, compost filter sock j-hooks will be utilized. Compost

filter sock j-hooks will be installed in accordance with DEP's list of approved alternative E&S and PCSM BMPs. Socks can be used on both steep and rocky slopes. Socks can range in size from 12" to 32" diameter depending on the site conditions. The maximum permissible slope lengths above compost filter socks will be used to determine the sizes of compost filter.

Timber Mats

Timber mats can be used for temporary wetland crossings. The timber mats are placed over the wetland to allow equipment to cross and then are removed.

Safety Fence

Safety fence shall be installed to protect sensitive environmental features as depicted on the plan drawings. The fencing shall remain in place during phases of construction.

Inlet Protection/Rock Filter

Rock filters may be used to control runoff within constructed channels or at the inlet of stormwater piping to reduce erosion and collect sediment. The efficiency may be raised by anchoring a 6" layer of compost on the upgradient side.

Diversion/Collection Channels

Diversion/Collection channels shall be used to divert runoff from disturbed areas and convey it to appropriate BMPs such as a sedimentation basin or sediment trap.

Pumped Water Filter Bag

Filter bags shall be placed in well-vegetated grassy areas and discharge onto stable, erosion resistant areas, and staked if the slope is greater than 5 percent. In the event that this is not possible, a geotextile path will be provided. A compost filter sock shall be placed below the filter bag when placed within 50 of streams or wetlands located within a HQ/EV watershed.

Tarps

Small stockpiles of soil material may be tarped to avoid contact with stormwater.

Typical Topsoil Stockpile

The maximum topsoil stockpile height shall not exceed 35 feet. Stockpile slopes shall be no steeper than 2H:1V. Stockpiles shall be stabilized in accordance with temporary seeding specifications and mulch is to be maintained until the stockpile is stabilized. Stockpile location shown on the plans are illustrative and may vary in location as construction proceeds.

7. Recycling and Disposal of Materials

The restoration of the facility will require the removal of the temporary materials. The temporary materials include, but may not be limited to, stone surfaces and associated geotextiles. The contractors are required to dispose of the materials at suitable disposal or recycling sites and in compliance with local, state and federal regulations.

Contractors are required to inventory and manage their construction site materials. The goal is to be aware of the materials on-site, ensure they are properly maintained, used, and disposed of, and to make sure the materials are not exposed to stormwater. The following materials or substances are expected to be present on-site during construction (Note: this list is not an all-inclusive list and the materials management plan can be modified to address additional materials used on-site):

- Acids
- Detergents
- Fertilizers (nitrogen/phosphorus)
- Hydroseeding mixtures
- Petroleum based products
- Sanitary wastes
- Soil stabilization additives
- Solder
- Solvents

These materials must be stored as appropriate and shall not contact storm or non-stormwater discharges. Contractor shall provide a weatherproof container to store chemicals or erodible substances that must be kept on the Site. Contractor is responsible for reading, maintaining, and making employees and subcontractors aware of Material Safety Data Sheets (MSDSs).

8. Thermal Impact

Due to the overall nature of the Project, thermal impacts to surface waters are not anticipated. The primary means to address thermal impacts on this Project is to limit the size and duration of exposed earth.

Stormwater runoff associated with the installation of the compressor units will be routed through the stormwater BMPs designed to retain and infiltrate the first surge of water from the site. The first surge of water will be the warmest water for the duration of the storm event and will quickly cool as the storm event progresses. The BMPs are designed to capture and infiltrate this

warmest surge of stormwater. Based on routing calculations, stormwater is not discharged from the BMPs for the first 11 hours during a 100-year/24-hour storm event. The retention period is longer for less intense storms. Therefore, as a result of these measures, no significant thermal impact to the receiving waters is anticipated.

9. Antidegradation Requirements

Based on the location of Compressor Station 515, impacts to HQ watersheds are unavoidable. Transco determined that there are no cost-effective and environmental sound viable non-discharge alternatives for the project.

Earth disturbance will be minimized to the extent practical and will be phased or sequenced to only disturbed portions that are necessary for the specific scope of work. Where possible, the LOD was decreased to avoid additional disturbance to the extent practical.

Anti-Degradation Best Available Combination of Technologies (ABACT) standards have been proposed for Compressor Station 515 because there are no viable non-discharge alternatives. The Erosion and Sediment Control Plan prepared for the Project outlines a more stringent design and E&S BMPs that meet ABACT standards.

Compressor Station 515 is located in an HQ watershed and construction activities in these areas will result in increased discharge of stormwater to surface waters which will be mitigated by the implementation of post construction stormwater management (PCSM) BMPs. Proposed PCSM BMPs are designed with stormwater volume reduction and water quality treatment maximized to the extent practicable within the site constraints to maintain and protect existing water quality and existing and designated uses. Based on the location of Compressor Station 515, impacts to HQ watersheds are unavoidable. Transco determined that there are no cost-effective and environmental sound viable non-discharge alternatives for the project.

10. Riparian Buffers

Temporary workspace associated with Compressor Station 515 is located within the non-forested riparian buffer of stream S77-T2. After completing the construction activities, the impacted riparian area will be restored back to pre-existing contours and reseeded with a riparian seed mix.

Because the project is temporary in nature and the site will be fully restored to its preexisting condition leaving riparian buffers undisturbed to the extent practical, it is eligible for the Riparian Buffer Waiver under 25 PA Code §102.14(d)(2)(iv). As such, a Riparian Buffer

Waiver has been requested along with this ESCP application (Section 1-7).

11. Project Site Runoff

The construction of Compressor Station 515 will increase the volume of stormwater runoff due to the increase in the type and size of the impervious area. The contractor will construct stormwater BMPs to mitigate the increase in volume and peak rates associated with construction. Refer to the Post-Construction Stormwater Management (PCSM) Plan for additional information (Section 3 of this ESCP Application). Changes in stormwater runoff between pre- and post-development conditions for 2-year rainfall event and changes in peak discharge rates for 1, 2,10, 25, 50, and 100-yr storms are given in the tables below.

Pre- and Post-Construction Stormwater Volume for 2-yr Rainfall event

Pre-construction (cf)	Post-construction before BMPs (cf)	Post-construction after BMPs (cf)	Net (cf)
25,269	39,014	21,255	-4,014

Pre-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
4.58	6.19	11.74	16.10	19.64	24.34

Post-Construction Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
11.55	14.31	23.16	29.76	35.00	41.89

Post-Construction w/ BMPs Peak Discharge Rates (cfs)

1-year	2-year	10-year	25-year	50-year	100-year
1.04	2.55	10.18	15.89	19.57	24.23

Difference between Pre-Construction and Post-Construction w/ BMPs

	1-year	2-year	10-year	25-year	50-year	100-year
NET Difference	-3.54	-3.64	-1.56	-0.21	-0.07	-0.11

12. Offsite Discharge Analysis

The stormwater BMPs being constructed at Compressor Station 515 are in areas that will discharge stormwater to offsite non-surface water. These areas have been analyzed to reduce the likelihood that these discharges will be erosive to adjacent property owners. The analysis has been performed in accordance with PADEP Document 3150-FS-DEP4124, “Off-Site Discharges of Stormwaters to Areas That Are Not Surface Waters”. The full analysis is presented in Attachment 4 – Offsite Discharge Report. A summary of the findings for Compressor Station 515 is presented below.

At Compressor Station 515 a series of channels will be installed to direct runoff water to

an infiltration berm. Stormwater collected by the infiltration berm will be released over a spillway and across a level spreader. The level spreader will allow stormwater to be discharged as sheet flow and travel along a vegetative flow path until it reaches the delineated wetland, W21-T1 PFO, northwest of the Limits of Disturbance. The area downgradient of the proposed infiltration berm is primarily forestland and vegetated. Calculations indicated that the discharge velocity at the riprap apron for the 25-yr 24-hr storm is 2.13 feet per second (fps). Since the outlet velocity is below 2.5 fps, downstream erosion will be minimal, if not negligible.

13. Site Restoration Plan

13.1 Previous Land Use

Using data taken from Google Earth and Multi-Resolution Land Characteristics (MRLC) Consortium website (https://www.mrlc.gov/viewer/), it appears that land use for the past few decades has been as a compressor station.

13.2 Disturbance Activities, Changes to Permanent Topographic Land Cover

The Compressor Station 515 portion of the Project will involve the installation of a gravel pad, several buildings, a new communications tower, proposed BMPs, infiltration berm and other compressor station modifications. Transco will use and implement the practices, measures, and details to control soil erosion and off-site sedimentation during construction.

13.3 Restoration Measures

Stormwater controls which will be installed during construction have been designed to avoid impacts to natural drainage features. These controls will only have temporary impacts while installed and will be removed once the site is stabilized with vegetation. Minimal impacts to wetland resources are anticipated, as these functions are generally limited when compared to watercourses.

Construction debris will be removed from construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration. The disturbed area will be vegetated and rocks will be removed. Temporary sediment barriers will be removed and replaced by permanent erosion control measures or when revegetation is successful.

Soil Compaction Measures

BMPs will not be over-compacted. Should they become over-compacted, the soil will be de-compacted. Also, areas that do not successfully revegetate because of compaction will also

be de-compacted and then reseeded.

Revegetation Plan and Procedures

The construction site should be stabilized as soon as possible after completion. Establishment of final cover must be initiated no later than 7 days after reaching final grade. Temporary erosion and sedimentation control BMPs can be removed when the site meets final stabilization. Final stabilization means that soil-disturbing activities are completed, and that either a permanent vegetative cover with a density of 70% or greater has been established or that the surface has been stabilized by hard cover such as pavement or buildings. It should be noted that the 70% requirement refers to the total area vegetated and not just a percent of the site.

13.4 Maintenance and Evaluation for Effectiveness

Follow-up inspections of disturbed areas will be conducted as necessary, to determine the success of revegetation. At a minimum, conduct inspections after the first and second growing seasons. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. Continue revegetation efforts until revegetation is successful.

The PCSM BMP for Compressor Station 515 is an infiltration berm with an overflow spillway to a level spreader. These structures should be properly maintained to ensure their effectiveness. Sheet flow conditions and infiltration must be sustained throughout the life of the BMP. BMPs should be inspected for clogging from sediment of debris, damage by foot or vehicular traffic, and flow channelization. Inspections should be made on a quarterly basis for the first two years following installation, and then twice per year thereafter. Inspections should also be made after every storm event greater than 1 inch during the establishment period.

Vegetated areas will be inspected weekly and after runoff events until permanent vegetation is achieved. Once the vegetation is established, inspections of health, diversity, and density should be performed at least twice per year, during both the growing and non-growing season. Vegetative cover should be sustained at 85% and reestablished if damage greater than 50% is observed. Damaged BMPs will be repaired as soon as possible upon discovery. Repairs will be made to restore damaged BMPs to their original design condition.

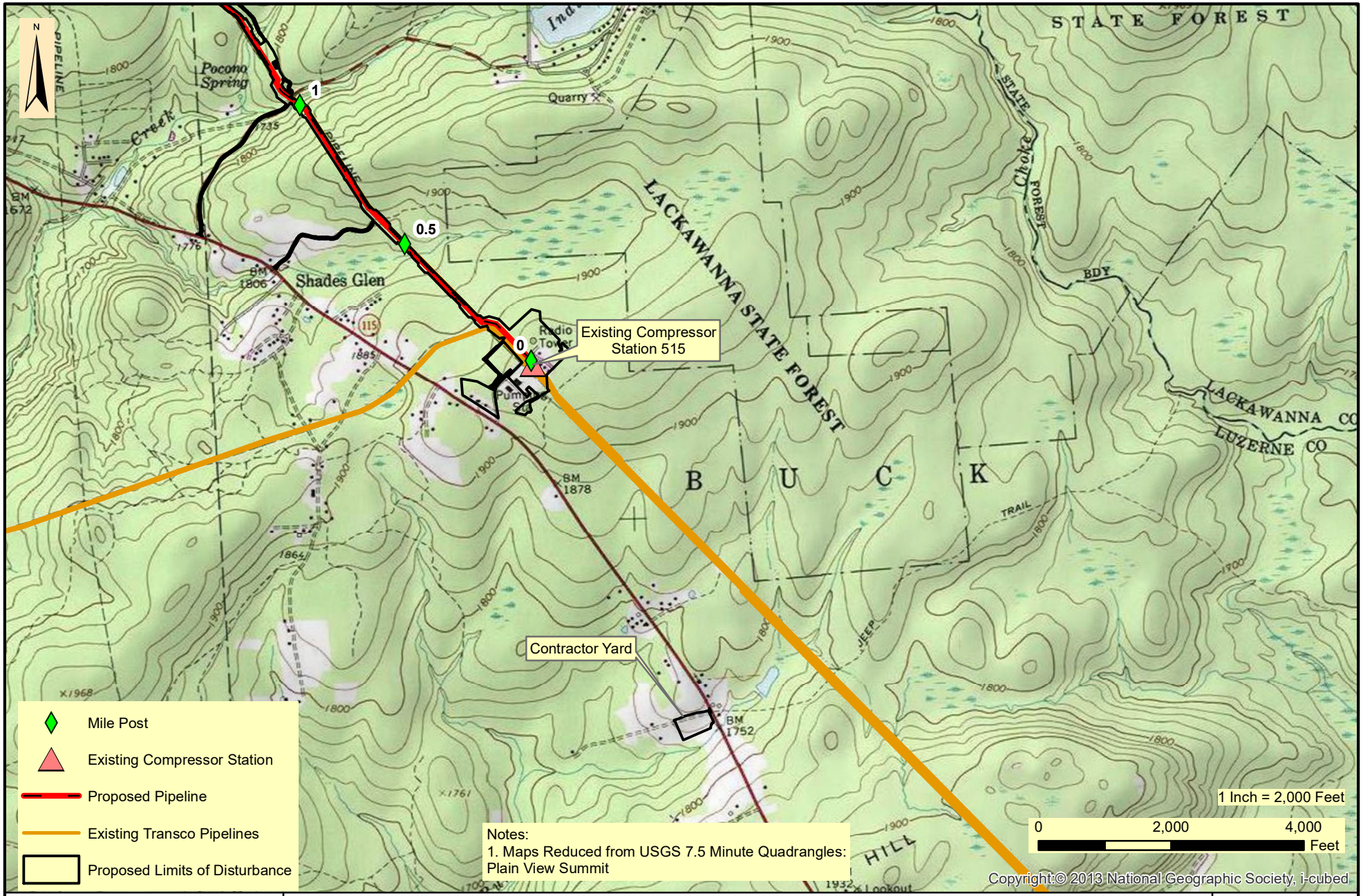
Transco will limit routine vegetation mowing or clearing within wetlands and adjacent to waterbodies. Transco will not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

Contractor shall provide a weatherproof container to store chemicals or erodible substances that must be kept on the site. Contractor is responsible for reading, maintaining, and making employees and subcontractors aware of Safety Data Sheets (SDSs).

14. The Erosion and Sediment Control Plan Shall be Prepared by a Person Trained and Experienced in Erosion Control Methods and Techniques

These plans and narrative were prepared by Patrick Wozinski, PE (BAI Group, LLC) of State College, PA in accordance with the Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual, March 2012. Plan preparer's resume is provided in Attachment C of the ESCP permit package.

ATTACHMENT 1
PROJECT LOCATION MAP



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Williams®

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

REGIONAL ENERGY ACCESS EXPANSION PROJECT

EXISTING COMPRESSOR STATION 515

PROJECT LOCATION MAP

BUCK TOWNSHIP | LUZERNE COUNTY | PENNSYLVANIA

Date: 2/10/2022

Drawn By: FTN

Figure Number: CS515-1

ATTACHMENT 2
SOILS MAP AND 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 Luzerne County, Pennsylvania

December 30, 2020

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: 1:4,090 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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—Jul 7, 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
CnB	Chippewa silt loam, 0 to 8 percent slopes, extremely stony	0.6	0.9%
MsB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	10.3	16.8%
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	0.3	0.4%
WmB	Wellsboro channery silt loam, 3 to 8 percent slopes, extremely stony	50.1	81.8%
Totals for Area of Interest		**61.3**	**100.0%**

Map Unit Descriptions

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

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

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

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Luzerne County, Pennsylvania

CnB—Chippewa silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vcjf
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa, Extremely Stony

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: silt loam
Eg - 5 to 15 inches: channery silt loam
Bxg - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Volusia, extremely stony

Percent of map unit: 8 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, extremely stony, very poorly drained

Percent of map unit: 7 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

MsB—Morris channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vxct
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Morris, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: channery silt loam
Bw - 5 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam

Bx - 16 to 60 inches: channery silt loam
C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.9 inches)

Interpretive groups

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

Minor Components

Norwich, extremely stony

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope, head slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

OpD—Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9yhm
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 60 percent
Lordstown and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 30 inches: very channery silt loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 15.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
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 capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Typical profile

A - 0 to 7 inches: channery silt loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
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 capacity: Low (about 3.8 inches)

Interpretive groups

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

WmB—Wellsboro channery silt loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vckl
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Wellsboro, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: channery silt loam
Bw - 3 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.9 inches)

Interpretive groups

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

Minor Components

Morris, extremely stony

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

Oquaga, extremely stony

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, upper third of mountainflank, side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Luzerne County, Pennsylvania

February 12, 2021

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.

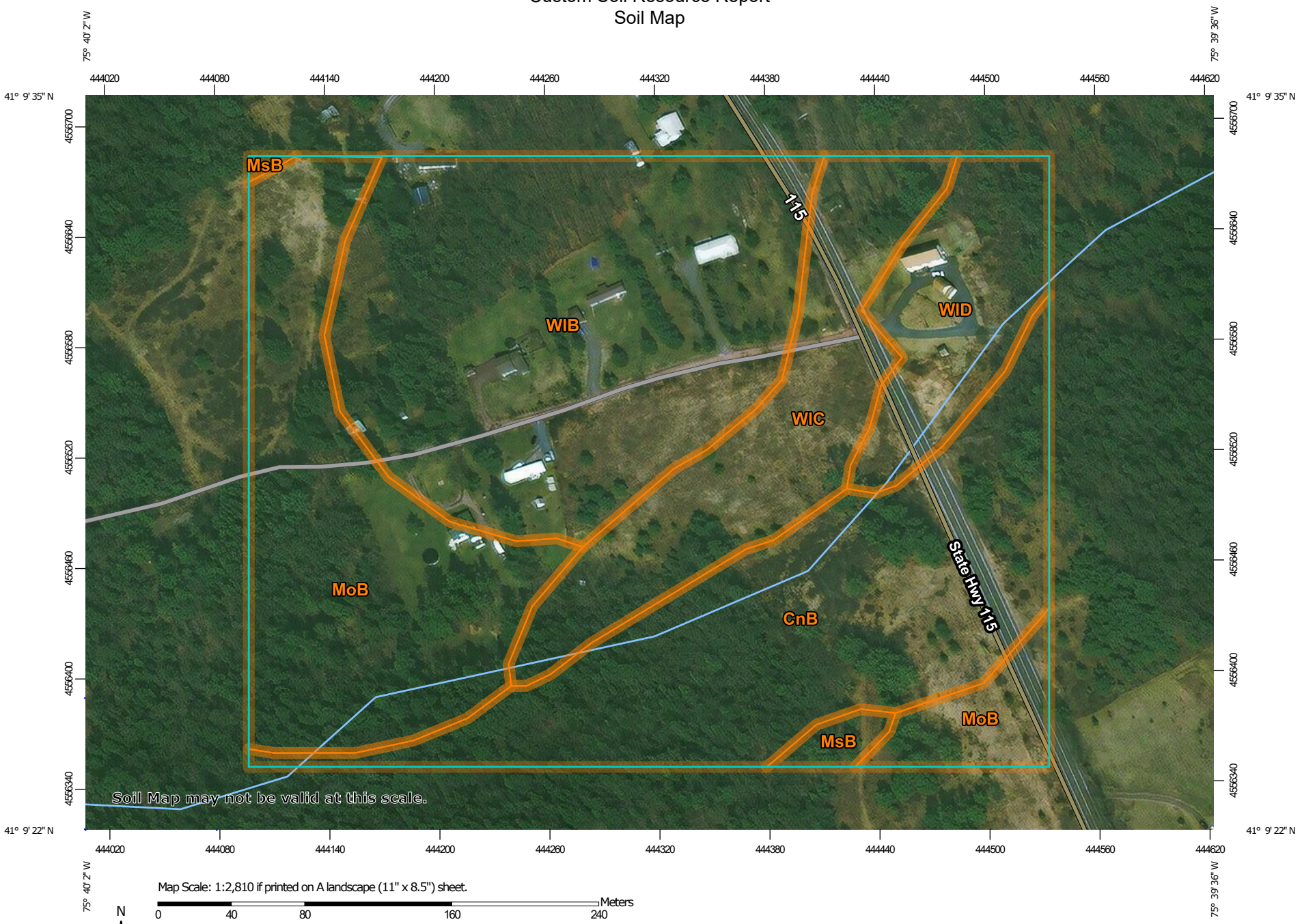
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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—Jul 7, 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
CnB	Chippewa silt loam, 0 to 8 percent slopes, extremely stony	8.6	23.8%
MoB	Morris channery silt loam, 0 to 8 percent slopes	8.4	23.2%
MsB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	0.4	1.0%
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes	11.1	30.9%
WlC	Wellsboro channery silt loam, 8 to 15 percent slopes	4.7	13.0%
WlD	Wellsboro channery silt loam, 15 to 25 percent slopes	2.9	8.1%
Totals for Area of Interest		**36.0**	**100.0%**

Map Unit Descriptions

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

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

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

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Luzerne County, Pennsylvania

CnB—Chippewa silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vcjf
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Chippewa, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chippewa, Extremely Stony

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by siltstone, sandstone, and shale fragments

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: silt loam
Eg - 5 to 15 inches: channery silt loam
Bxg - 15 to 45 inches: channery silt loam
C - 45 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 8 to 20 inches to fragipan
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Volusia, extremely stony

Percent of map unit: 8 percent
Landform: Hills, mountains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chippewa, extremely stony, very poorly drained

Percent of map unit: 7 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

MoB—Morris channery silt loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vclq
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Morris

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam
Bx - 16 to 60 inches: channery silt loam

C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Wellsboro

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

Norwich

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

MsB—Morris channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vxct
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Morris, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: channery silt loam
Bw - 5 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam
Bx - 16 to 60 inches: channery silt loam
C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.9 inches)

Interpretive groups

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

Minor Components

Norwich, extremely stony

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Interfluve, side slope, head slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

WlB—Wellsboro channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vck5
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wellsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wellsboro

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lackawanna
Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

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

Oquaga
Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank, crest, nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WlC—Wellsboro channery silt loam, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2vck6
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

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

Description of Wellsboro

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Morris

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

Lackawanna

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

WlD—Wellsboro channery silt loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2vck7
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Wellsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wellsboro

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 22 inches: channery silt loam
Bx - 22 to 55 inches: channery loam
C - 55 to 72 inches: very channery loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Oquaga

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Upper third of mountainflank, crest, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

Morris

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

Lackawanna

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ATTACHMENT 3

E&SC PLAN BMP DESIGN WORKSHEETS AND CALCULATIONS

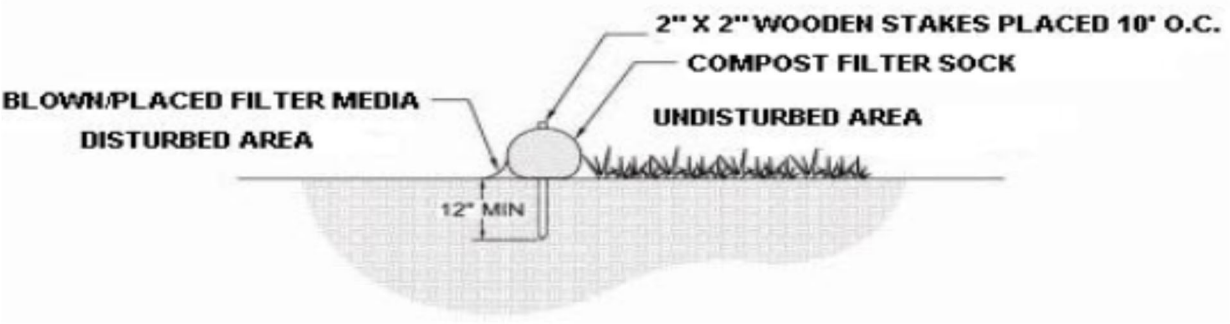
TABLE OF CONTENTS

Attachment 3

ATTACHMENT 3.1
COMPOST FILTER SOCK WORKSHEETS

STANDARD E&S WORKSHEET #1
Compost Filter Socks

PROJECT NAME: Williams REAE - Compressor Station 515
LOCATION: Buck Township, Luzerne County, PA
PREPARED BY: CD DATE: 03/01/2021
CHECKED BY: KCC DATE: 03/01/2021



SOCK NO.	Dia. (In.)	LOCATION	SLOPE PERCENT	SLOPE LENGTH ABOVE BARRIER (FT)
CS515-CFS-001	24	Along edge of NW LOD, near existing Leidy line C	5.4%	411
CS515-CFS-002	24	Along edge of NW LOD, near existing Leidy line C	5.4%	411
CS515-CFS-003	24	Along northwestern LOD	4.6%	517
CS515-CFS-004	24	Along northwestern LOD	4.6%	517
CS515-CFS-005	24	Along northwestern LOD	4.6%	517
CS515-CFS-006	12	Along northeastern LOD	3.4%	356
CS515-CFS-007	12	Along northeastern LOD	2.0%	245
CS515-CFS-008	12	Along northeastern LOD	2.0%	245
CS515-CFS-009	12	Along northeastern LOD	3.9%	129
CS515-CFS-010	12	Along northeastern LOD	4.3%	161
CS515-CFS-011	12	Along northeastern LOD	5.7%	87
CS515-CFS-012	12	Along wetland W38-T2 PEM parameter	5.5%	55
CS515-CFS-013	12	Along wetland W38-T2 PEM parameter	5.5%	55
CS515-CFS-014	12	Along wetland W38-T2 PEM parameter	5.5%	55
CS515-CFS-015	24	Along eastern LOD, near existing culvert outlet	2.1%	769.9
CS515-CFS-016	24	Along eastern LOD, near existing culvert outlet	2.1%	769.9
CS515-CFS-017	12	Along southeastern LOD	2.0%	109.7
CS515-CFS-018	12	Along southeastern LOD	3.8%	79.8
CS515-CFS-019	12	Along southeastern LOD	3.1%	97.9
CS515-CFS-020	12	Along southeastern LOD	2.0%	317.4
CS515-CFS-021	12	Along southeastern LOD	2.0%	317.4
CS515-CFS-022	12	SE Inlet Protection	2.8%	426.7
CS515-CFS-023	12	SE Inlet Protection	2.8%	426.7
CS515-CFS-024	12	SE Inlet Protection	2.8%	426.7

STANDARD E&S WORKSHEET #1
Compost Filter Socks

CS515-CFS-025	12	Along southeastern LOD, near W23-T2 PEM	2.6%	227
CS515-CFS-026	12	Along southeastern LOD, near W23-T2 PEM	2.6%	227
CS515-CFS-027	12	Along southeastern LOD, near W23-T2 PEM	2.6%	227
CS515-CFS-028	12	Along southern LOD, near W18-T2 PEM	6.6%	182
CS515-CFS-029	12	Along southern LOD, near W18-T2 PEM	6.6%	182
CS515-CFS-030	12	Along southern LOD, near W18-T2 PEM	6.6%	182
CS515-CFS-031	12	Along southern LOD, near W18-T2 PEM	6.6%	182
CS515-CFS-032	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-033	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-034	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-035	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-036	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-037	12	Along southern LOD, west of site entrance	3.3%	61
CS515-CFS-038	12	Along southern LOD, west of site entrance	4.5%	44
CS515-CFS-039	12	Along southern LOD, west of site entrance	2.5%	354
CS515-CFS-040	12	Along southern LOD, west of site entrance	2.5%	354
CS515-CFS-041	12	Along southern LOD, west of site entrance	2.5%	354
CS515-CFS-042	12	Along southern LOD, west of site entrance	2.5%	354
CS515-CFS-043	12	Along southern LOD, west of site entrance	2.5%	354
CS515-CFS-044	12	Along western LOD, near contractor laydown area	2.3%	345
CS515-CFS-045	12	Along western LOD, near contractor laydown area	2.3%	345
CS515-CFS-046	12	Along western LOD, near contractor laydown area	2.8%	248
CS515-CFS-047	12	Along western LOD, near contractor laydown area	2.8%	248
CS515-CFS-048	12	Along western LOD, along existing facility road way	5.8%	52
CS515-CFS-049	12	Along western LOD, along existing facility road way	5.5%	55
CS515-CFS-050	12	Along western LOD, along existing facility road way	11.1%	45
CS515-CFS-051	12	Along western LOD, along existing facility road way	10.0%	60
CS515-CFS-052	12	Along western LOD, along existing facility road way	10.0%	60
CS515-CFS-053	12	Along western LOD, along existing facility road way	10.0%	60
CS515-CFS-054	12	Along western LOD, along existing facility road way	10.0%	60
CS515-CFS-055	12	Along eastern LOD	7.6%	171
CS515-CFS-056	12	Along eastern LOD	7.6%	171
CS515-CFS-057	12	Along eastern LOD	7.6%	171
CS515-CFS-058	18	Along eastern LOD	7.9%	242
CS515-CFS-059	18	Along eastern LOD	7.9%	242
CS515-CFS-060	18	Along eastern LOD	7.9%	242
CS515-CFS-061	18	Eastern corner of LOD, near S77-T2	7.9%	242
CS515-CFS-062	18	Eastern corner of LOD, near S77-T2	7.9%	242
CS515-CFS-063	24	Along southern LOD	6.5%	322
CS515-CFS-064	24	Along southern LOD	6.5%	322
CS515-CFS-065	24	Along southern LOD	6.1%	426
CS515-CFS-066	24	Along southern LOD	6.1%	426
CS515-CFS-067	24	Southern corner of LOD	6.1%	426

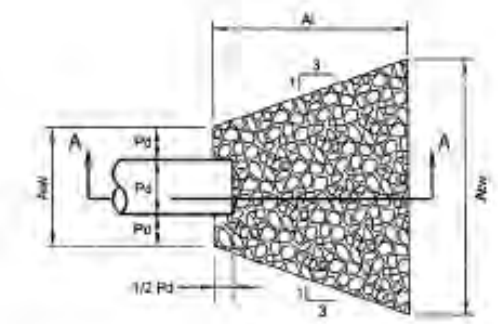
STANDARD E&S WORKSHEET #1
Compost Filter Socks

CS515-CFS-068	24	Along western LOD	6.1%	426
CS515-CFS-069	24	Along western LOD	6.1%	426
CS515-CFS-070	18	Along western LOD	5.7%	334
CS515-CFS-071	18	Along western LOD	6.0%	250
CS515-CFS-072	12	Western corner of LOD	6.1%	49
CS515-CFS-100	12	Along southeastern LOD, near W23-T2 PEM	5.5%	109

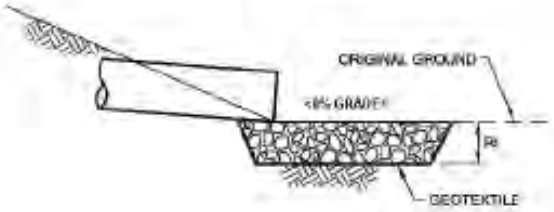
ATTACHMENT 3.2
RIPRAP APRON WORKSHEET

STANDARD E&S WORKSHEET #20
Riprap Apron Outlet Protection

PROJECT NAME: Williams REAE - Compressor Station 515
LOCATION: Buck Township, Luzerne County, Pennsylvania
PREPARED BY: JCR DATE: Jan. 2021 **[Rev 02/2022]**
CHECKED BY: PW DATE: Jan. 2021 **[Rev 02/2022]**



PLAN VIEW

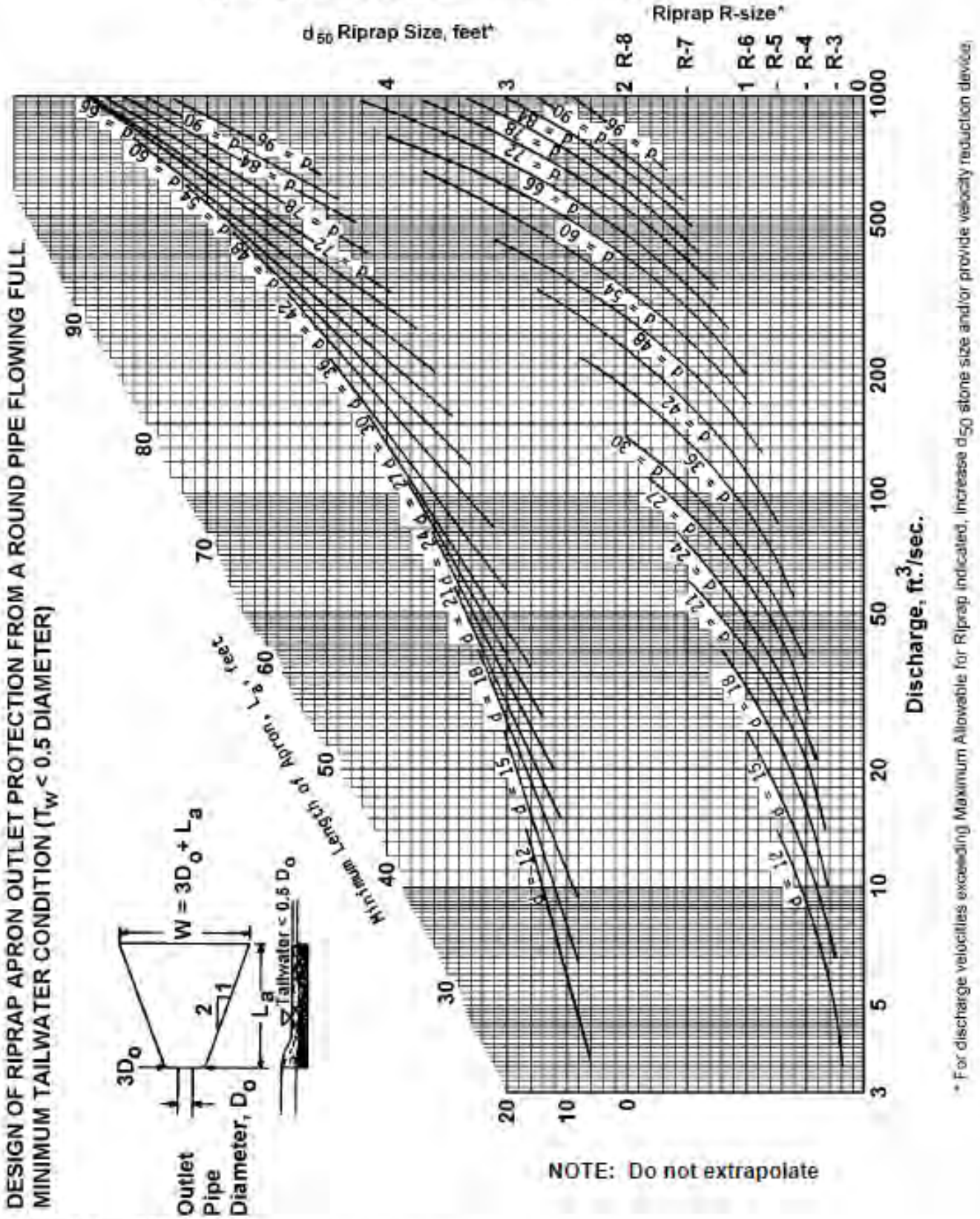


SECTION A - A

Location	Pipe Dia. Do (in)	Tail Water Cond. (Max or Min)	Man. "n" For Pipe	Pipe Slope (ft/ft)	Q (cfs)	V* (fps)	Riprap Size	Rt (in)	Al (ft)	Aiw (ft)	Atw (ft)
Channel C-5	48	Min	0.050	0.049	7.04	2.93	R-4	18	24	12	36
Culvert 1	18	Min	0.012	0.008	4.51	4.65	R-4	18	12	4.5	16.5
Trench Drain	10	Min	0.013	0.023	0.45	3.82	R-3	9	8	2.5	10.5

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

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



Adapted from USDA - NRCS

Not to be used for Box Culverts

ATTACHMENT 3.3
PCSM CHANNEL WORKSHEETS

STANDARD E&S WORKSHEET # 11
Channel Design Data

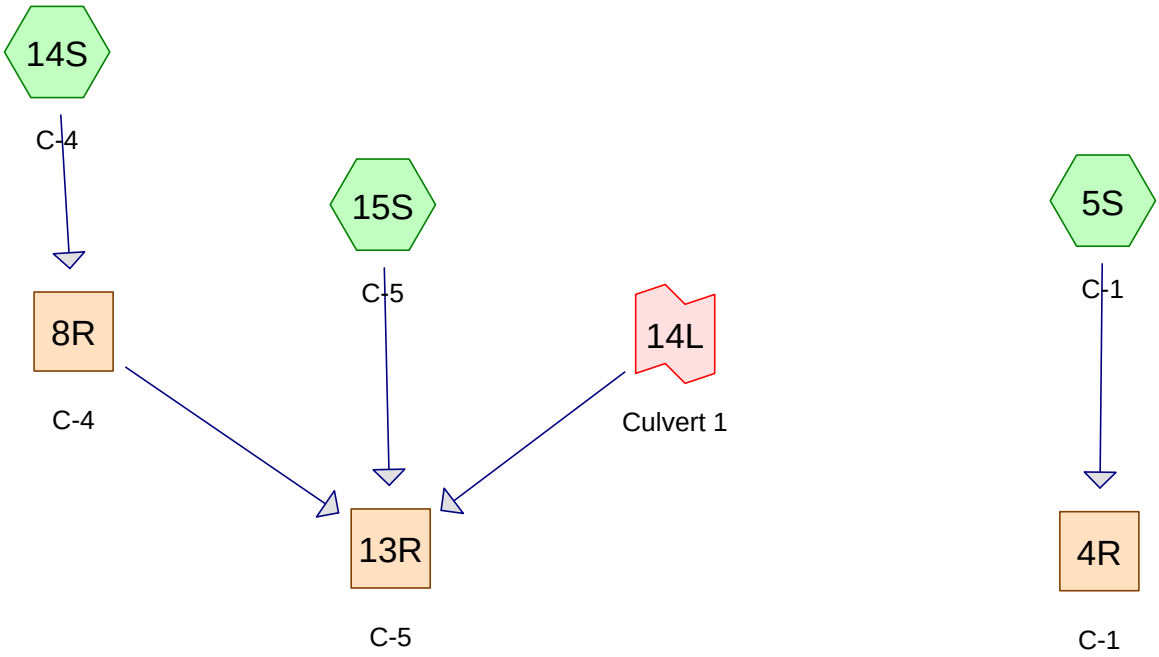
PROJECT NAME: Williams REAE – Compressor Station 515
LOCATION: Luzerne County, PA
PREPARED BY: CD DATE: 03/01/2021 **[Rev 02/2022]**
CHECKED BY: PW DATE: 03/01/2021 **[Rev 02/2022]**

CHANNEL OR CHANNEL SECTION		C-1	C-1	C-2	C-3	C-4
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	P	P
DESIGN STORM	(2, 5, OR 10 YR)	10 YR	10 YR	10 YR	10 YR	10 YR
ACRES	(AC)	1.11	1.11	0.63	0.27	0.51
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A	N/A
Q_r (REQUIRED CAPACITY)	(CFS)	5.68	5.68	3.34	1.44	2.37
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	5.68	5.68	3.34	1.44	2.37
PROTECTIVE LINING[2]		SC150BN	Grass	R-3 Riprap	R-3 Riprap	SC150BN
n (MANNING'S COEFFICIENT)[2]		0.050	0.050	0.0435	0.0566	0.050
V_a (ALLOWABLE VELOCITY)	(FPS)	8.0	4.5	6.5	6.5	8.0
V (CALCULATED AT FLOW DEPTH d)	(FPS)	2.8	2.8	1.9	2.1	1.7
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-	-	-	-	-
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	-	-	-	-	-
CHANNEL BOTTOM WIDTH	(FT)	4	4	2	2	2
CHANNEL SIDE SLOPES	(H:V)	3	3	3	3	3
D (TOTAL DEPTH)	(FT)	1.25	1.25	1.00	1.00	1.25
CHANNEL TOP WIDTH @ D	(FT)	11.50	11.50	8.00	8.00	9.5
d (CALCULATED FLOW DEPTH)	(FT)	0.39	0.39	0.50	0.25	0.42
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	6.36	6.36	4.99	3.50	4.52
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	10.16	10.16	4.01	7.97	4.77
d_{50} STONE SIZE	(IN)	-	-	3	3	-
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	2.039	2.039	1.741	0.690	1.368
R (HYDRAULIC RADIUS)	(FT)	0.314	0.314	0.338	0.193	0.294
S (BED SLOPE)[3]	(FT/FT)	0.041	0.041	0.013	0.057	0.017
S_c (CRITICAL SLOPE)	(FT/FT)	0.055	0.055	0.041	0.083	0.056
$.7S_c$	(FT/FT)	0.04	0.04	0.03	0.06	0.04
$1.3S_c$	(FT/FT)	0.07	0.07	0.05	0.11	0.07
STABLE FLOW?	(Y/N)	N	N	Y	Y	Y
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	0.61	0.61	-	-	-
FREEBOARD BASED ON STABLE FLOW	(FT)	-	-	0.5	0.75	0.58
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5	0.5
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		V	V	V	V	V

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

CHANNEL OR CHANNEL SECTION		C-4	C-5	C-5	Spillway	
TEMPORARY OR PERMANENT?	(T OR P)	P	P	P	P	
DESIGN STORM	(2, 5, OR 10 YR)	10 YR	10 YR	10 YR	100 YR	
ACRES	(AC)	0.51	1.64	1.64	4.54	
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	N/A	N/A	N/A	N/A	
Q_r (REQUIRED CAPACITY)	(CFS)	2.37	7.04	7.04	24.23	
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	2.37	7.04	7.04	24.8	
PROTECTIVE LINING[2]		Grass	SC150BN	Grass	R-4 Riprap	
n (MANNING'S COEFFICIENT)[2]		0.07	0.050	0.050	0.074	
V_a (ALLOWABLE VELOCITY)	(FPS)	4.5	8.0	4.5	9	
V (CALCULATED AT FLOW DEPTH d)	(FPS)	1.3	3.0	3.0	5.1	
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-	-	-	-	
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	-	-	-	-	
CHANNEL BOTTOM WIDTH	(FT)	2	4	4	12	
CHANNEL SIDE SLOPES	(H:V)	3	3	3	2	
D (TOTAL DEPTH)	(FT)	1.25	1.25	1.25	1.00	
CHANNEL TOP WIDTH @ D	(FT)	9.50	11.50	11.50	16.00	
d (CALCULATED FLOW DEPTH)	(FT)	0.51	0.45	0.45	0.38	
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	5.06	6.67	6.67	13.54	
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	3.93	8.99	8.99	31.25	
d_{50} STONE SIZE	(IN)	-	-	-	6	
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	1.797	2.374	2.374	4.903	
R (HYDRAULIC RADIUS)	(FT)	0.344	0.348	0.348	0.357	
S (BED SLOPE)[3]	(FT/FT)	0.017	0.041	0.041	0.250	
S_c (CRITICAL SLOPE)	(FT/FT)	0.114	0.053	0.053	0.114	
$.7S_c$	(FT/FT)	0.08	0.04	0.04	0.08	
$1.3S_c$	(FT/FT)	0.15	0.07	0.07	0.15	
STABLE FLOW?	(Y/N)	Y	N	N	Y	
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-	0.55	0.55	0.62	
FREEBOARD BASED ON STABLE FLOW	(FT)	0.5	-	-	-	
MINIMUM REQUIRED FREEBOARD[4]	(FT)	0.5	0.5	0.5	0.5	
DESIGN METHOD FOR PROTECTIVE LINING [5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		V	V	V	V	

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



Subcat Reach Pond Link

Routing Diagram for CS515 - channels 1,4,5

Prepared by {enter your company name here}, Printed 3/4/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.661	78	Meadow, non-grazed, HSG D (5S, 14S, 15S)
1.193	98	Paved parking, HSG D (5S, 14S, 15S)
1.854	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.854	HSG D	5S, 14S, 15S
0.000	Other	
1.854		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.661	0.000	0.661	Meadow, non-grazed	5S, 14S, 15S
0.000	0.000	0.000	1.193	0.000	1.193	Paved parking	5S, 14S, 15S
0.000	**0.000**	**0.000**	**1.854**	**0.000**	**1.854**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: C-1 Runoff Area=48,290 sf 81.96% Impervious Runoff Depth>4.30"
Tc=5.0 min CN=94 Runoff=5.68 cfs 0.398 af

Subcatchment 14S: C-4 Runoff Area=22,384 sf 52.25% Impervious Runoff Depth>3.67"
Tc=5.0 min CN=88 Runoff=2.37 cfs 0.157 af

Subcatchment 15S: C-5 Runoff Area=10,073 sf 6.95% Impervious Runoff Depth>2.80"
Tc=5.0 min CN=79 Runoff=0.85 cfs 0.054 af

Reach 4R: C-1 Avg. Flow Depth=0.40' Max Vel=2.68 fps Inflow=5.68 cfs 0.398 af
n=0.050 L=72.0' S=0.0382 '/' Capacity=49.04 cfs Outflow=5.53 cfs 0.397 af

Reach 8R: C-4 Avg. Flow Depth=0.40' Max Vel=1.69 fps Inflow=2.37 cfs 0.157 af
n=0.050 L=345.8' S=0.0174 '/' Capacity=22.72 cfs Outflow=2.12 cfs 0.156 af

Reach 13R: C-5 Avg. Flow Depth=0.44' Max Vel=2.93 fps Inflow=7.04 cfs 0.567 af
n=0.050 L=258.5' S=0.0406 '/' Capacity=50.57 cfs Outflow=6.72 cfs 0.566 af

Link 14L: 10-Year Outflow Imported from CS515 - channels 2.3~Reach 7R.hce Inflow=4.46 cfs 0.357 af
Area= 0.901 ac 100.00% Imperv. Primary=4.46 cfs 0.357 af

Total Runoff Area = 1.854 ac Runoff Volume = 0.609 af Average Runoff Depth = 3.94"
35.63% Pervious = 0.661 ac 64.37% Impervious = 1.193 ac

Summary for Subcatchment 5S: C-1

[49] Hint: Tc<2dt may require smaller dt

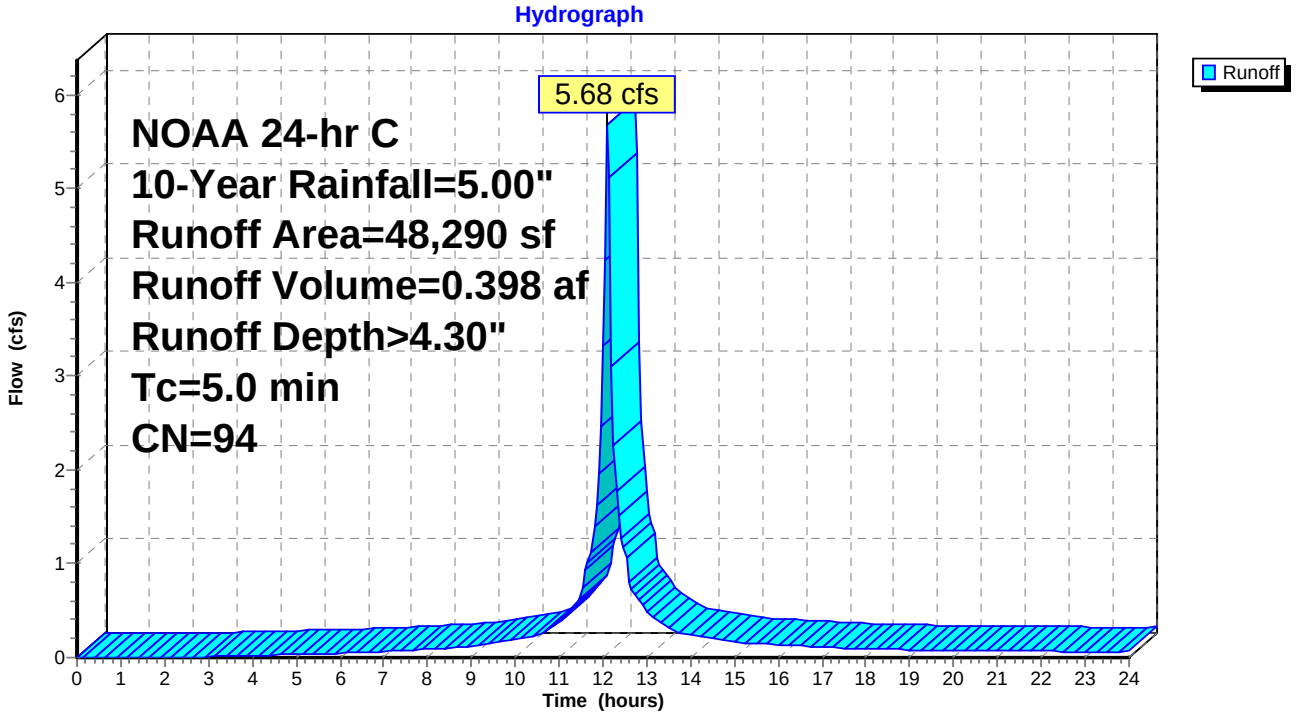
Runoff = 5.68 cfs @ 12.11 hrs, Volume= 0.398 af, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	39,580	98	Paved parking, HSG D
	8,710	78	Meadow, non-grazed, HSG D
	48,290	94	Weighted Average
	8,710		18.04% Pervious Area
	39,580		81.96% Impervious Area

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

Subcatchment 5S: C-1



Summary for Subcatchment 14S: C-4

[49] Hint: Tc<2dt may require smaller dt

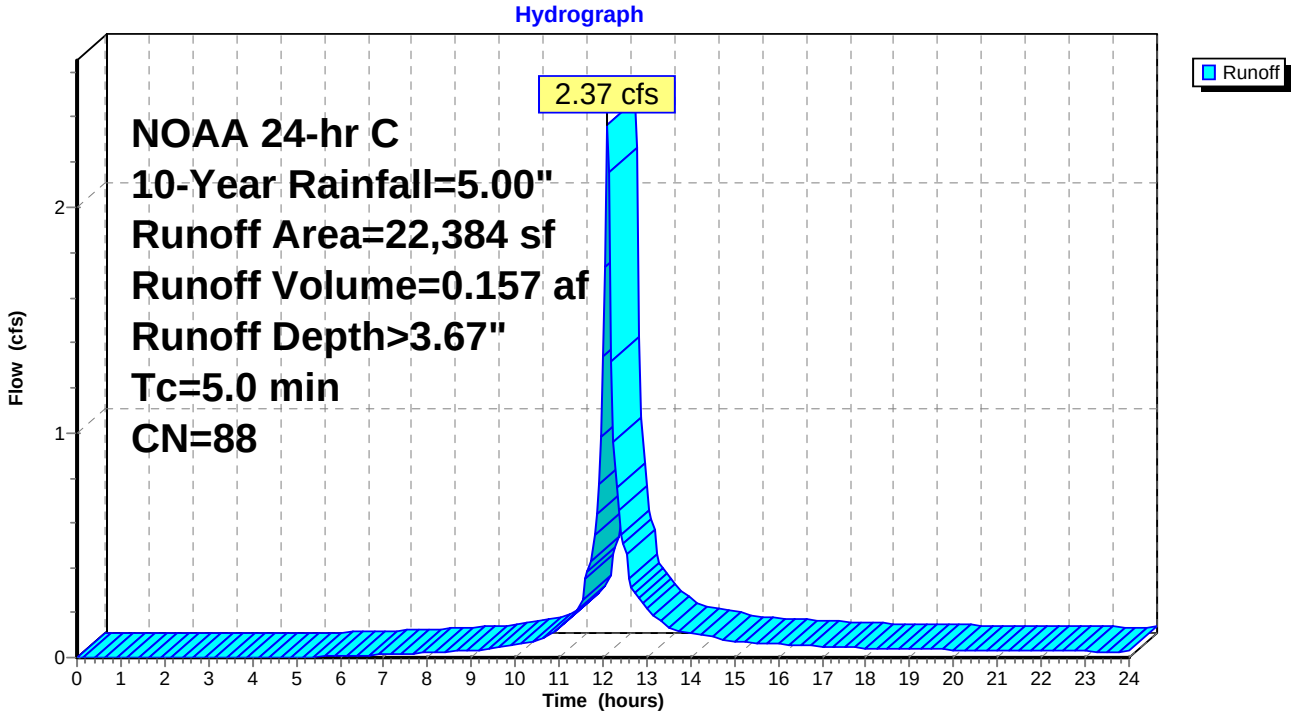
Runoff = 2.37 cfs @ 12.11 hrs, Volume= 0.157 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (sf)	CN	Description
11,695	98	Paved parking, HSG D
10,689	78	Meadow, non-grazed, HSG D
22,384	88	Weighted Average
10,689		47.75% Pervious Area
11,695		52.25% Impervious Area

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

Subcatchment 14S: C-4



Summary for Subcatchment 15S: C-5

[49] Hint: Tc<2dt may require smaller dt

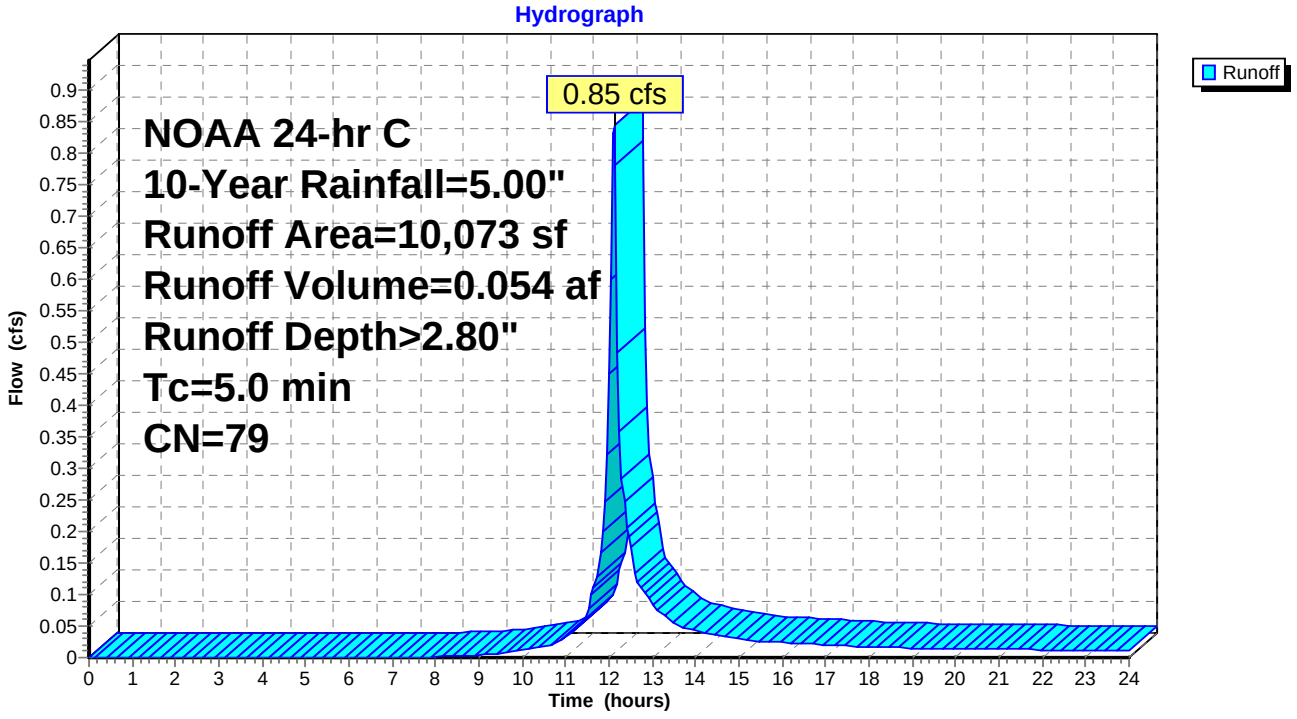
Runoff = 0.85 cfs @ 12.12 hrs, Volume= 0.054 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

Area (sf)	CN	Description
700	98	Paved parking, HSG D
9,373	78	Meadow, non-grazed, HSG D
10,073	79	Weighted Average
9,373		93.05% Pervious Area
700		6.95% Impervious Area

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

Subcatchment 15S: C-5



Summary for Reach 4R: C-1

Inflow Area = 1.109 ac, 81.96% Impervious, Inflow Depth > 4.30" for 10-Year event
Inflow = 5.68 cfs @ 12.11 hrs, Volume= 0.398 af
Outflow = 5.53 cfs @ 12.13 hrs, Volume= 0.397 af, Atten= 3%, Lag= 1.0 min

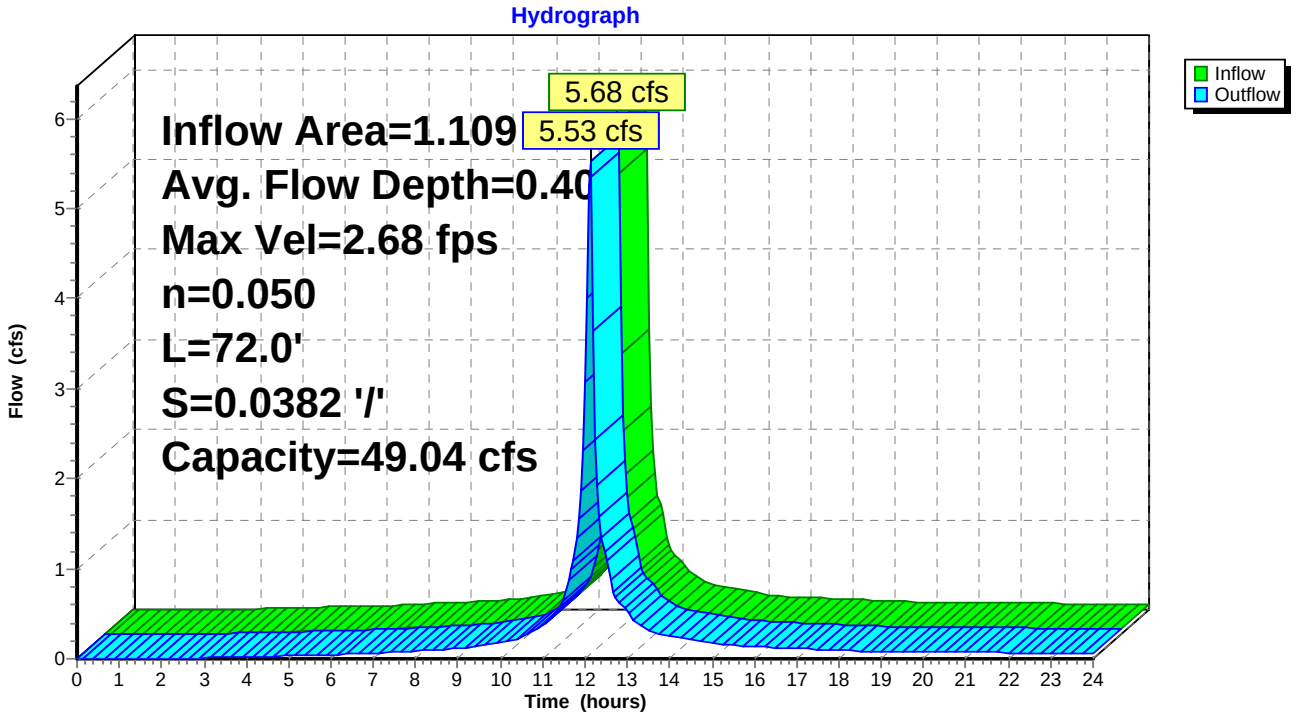
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.68 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 1.7 min

Peak Storage= 149 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.25' Flow Area= 9.7 sf, Capacity= 49.04 cfs

4.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 11.50'
Length= 72.0' Slope= 0.0382 '/'
Inlet Invert= 1,937.75', Outlet Invert= 1,935.00'

‡

Reach 4R: C-1



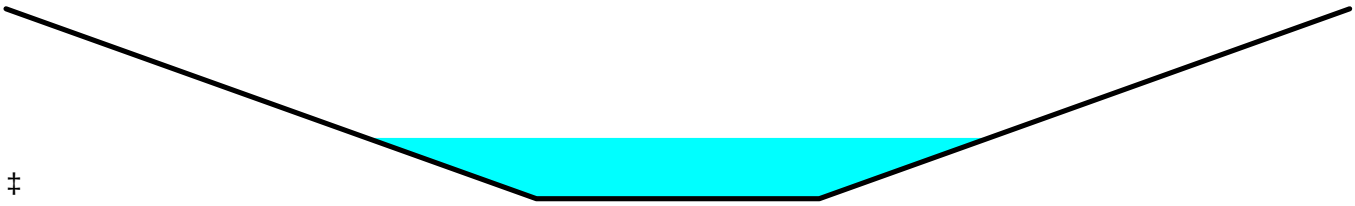
Summary for Reach 8R: C-4

Inflow Area = 0.514 ac, 52.25% Impervious, Inflow Depth > 3.67" for 10-Year event
Inflow = 2.37 cfs @ 12.11 hrs, Volume= 0.157 af
Outflow = 2.12 cfs @ 12.20 hrs, Volume= 0.156 af, Atten= 11%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.69 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 11.5 min

Peak Storage= 442 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.25' Flow Area= 7.2 sf, Capacity= 22.72 cfs

2.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 345.8' Slope= 0.0174 '/'
Inlet Invert= 1,940.00', Outlet Invert= 1,934.00'



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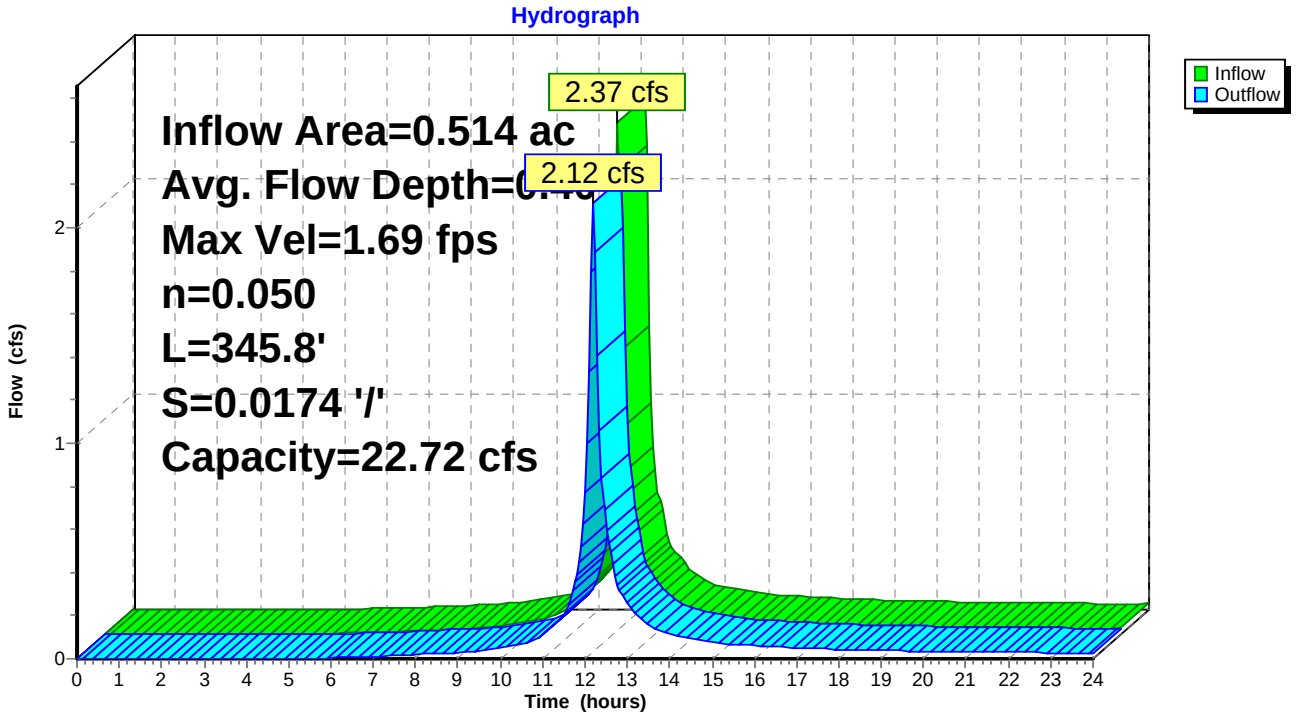
Reach 8R: C-4



Summary for Reach 13R: C-5

[62] Hint: Exceeded Reach 8R OUTLET depth by 1.57' @ 12.25 hrs

Inflow Area = 1.646 ac, 72.02% Impervious, Inflow Depth > 4.13" for 10-Year event
Inflow = 7.04 cfs @ 12.15 hrs, Volume= 0.567 af
Outflow = 6.72 cfs @ 12.20 hrs, Volume= 0.566 af, Atten= 5%, Lag= 2.6 min

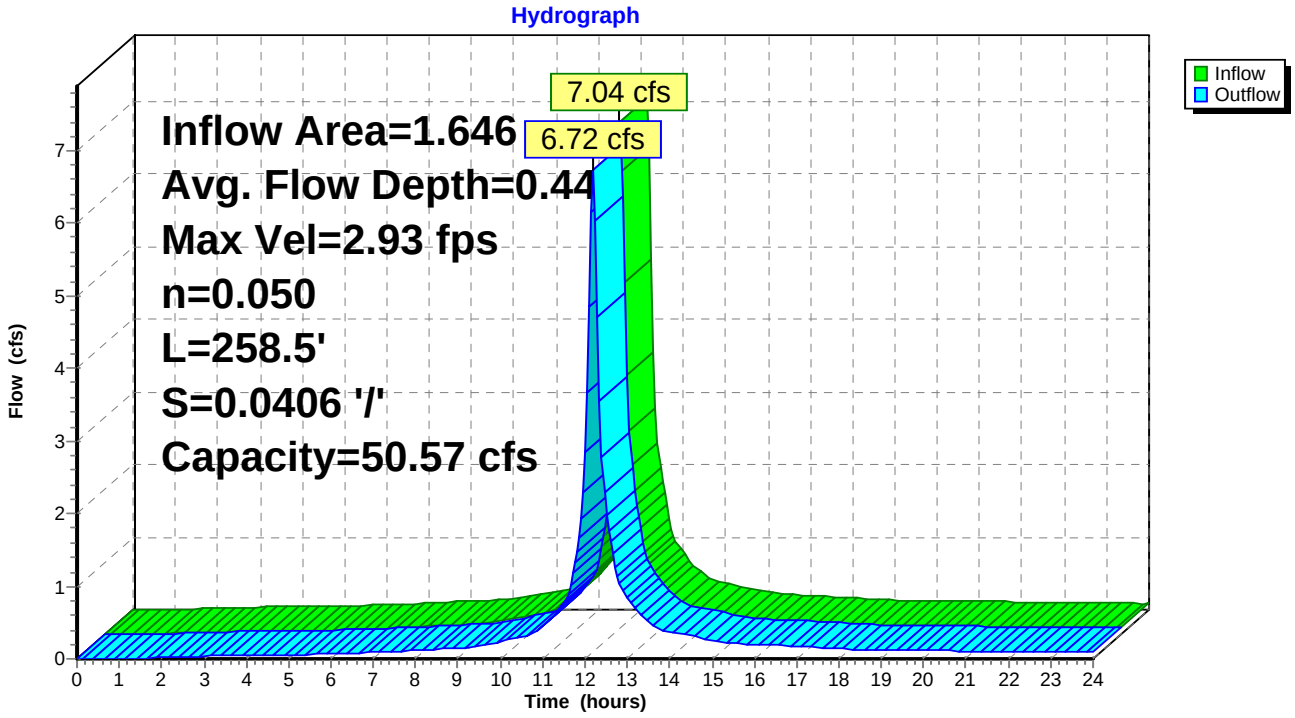
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 5.4 min

Peak Storage= 604 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.25' Flow Area= 9.7 sf, Capacity= 50.57 cfs

4.00' x 1.25' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 11.50'
Length= 258.5' Slope= 0.0406 '/'
Inlet Invert= 1,935.50', Outlet Invert= 1,925.00'

‡

Reach 13R: C-5



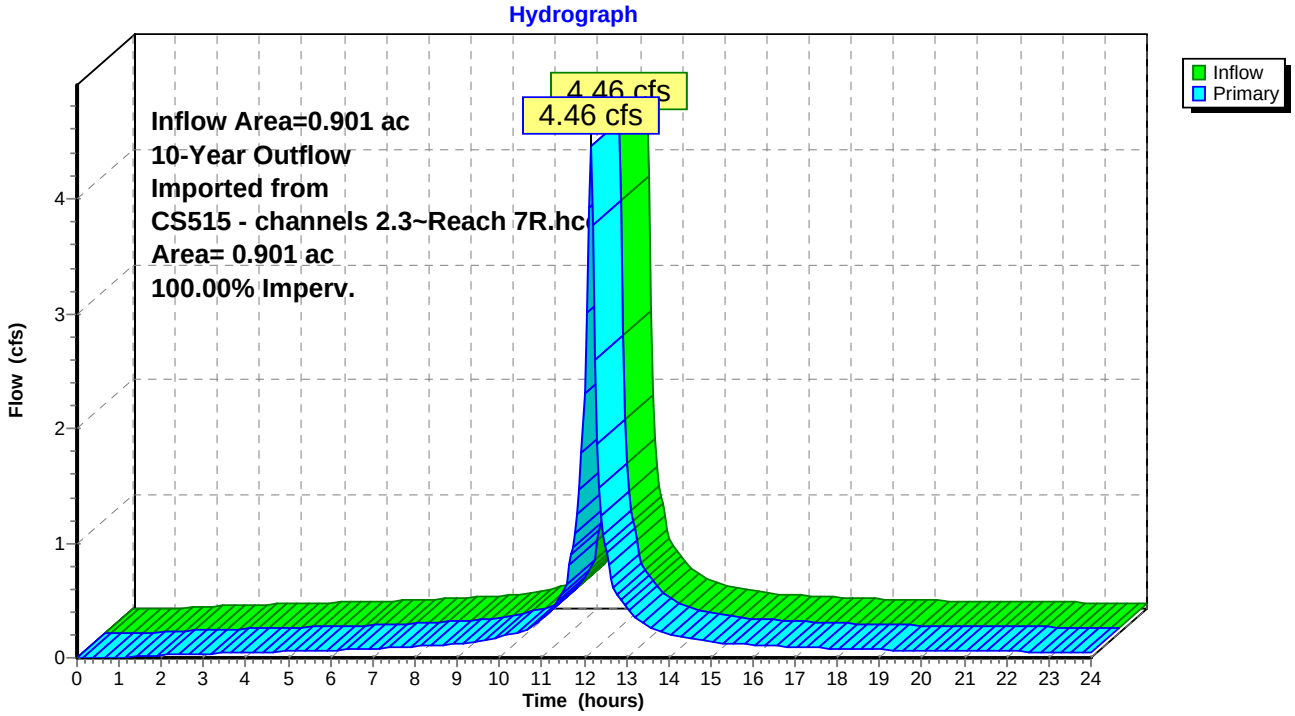
Summary for Link 14L: Culvert 1

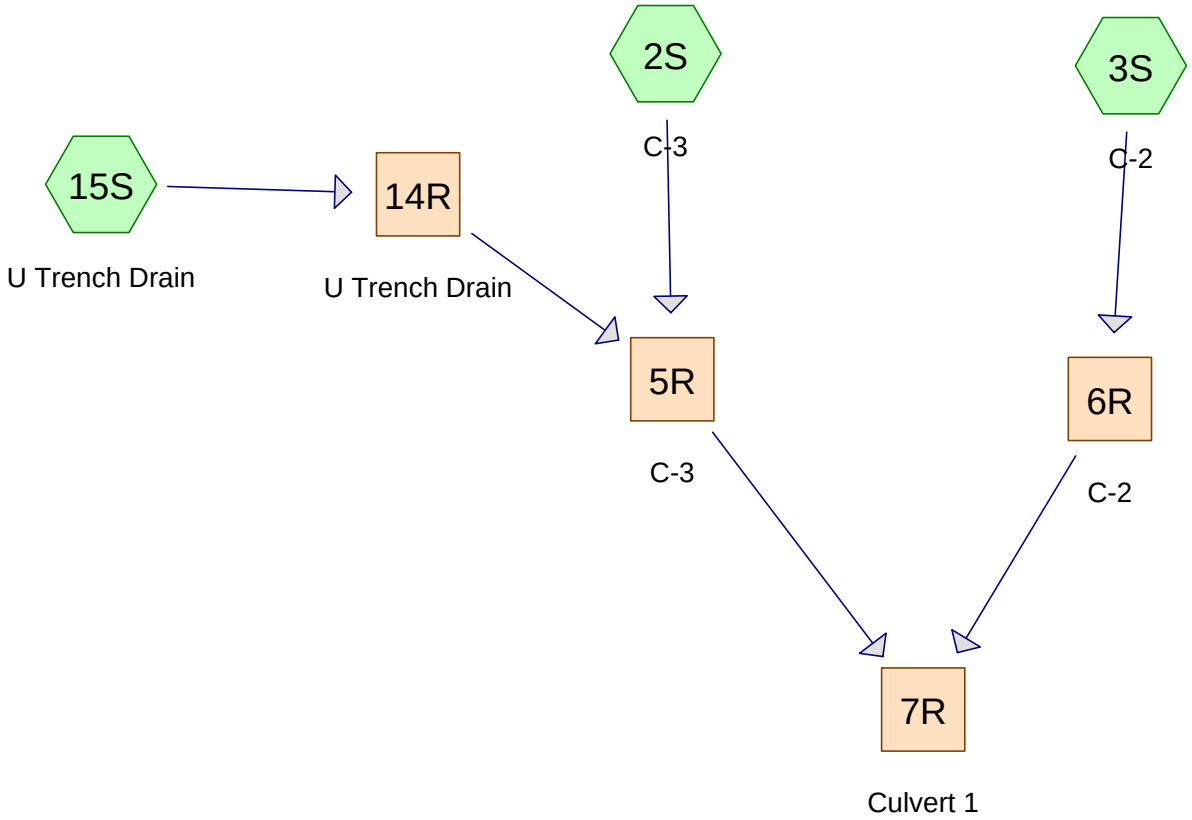
Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 4.75" for 10-Year event
Inflow = 4.46 cfs @ 12.15 hrs, Volume= 0.357 af
Primary = 4.46 cfs @ 12.15 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10-Year Outflow Imported from CS515 - channels 2.3~Reach 7R.hce

Link 14L: Culvert 1





Subcat Reach Pond Link

Routing Diagram for CS515 - channels 2.3
Prepared by {enter your company name here}, Printed 3/4/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.901	98	Paved parking, HSG D (2S, 3S, 15S)
0.901	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.901	HSG D	2S, 3S, 15S
0.000	Other	
0.901		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.901	0.000	0.901	Paved parking	2S, 3S, 15S
0.000	**0.000**	**0.000**	**0.901**	**0.000**	**0.901**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	7R	1,935.75	1,935.44	63.0	0.0049	0.012	18.0	0.0	0.0
2	14R	1,941.00	1,939.40	70.0	0.0229	0.013	10.0	10.0	0.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: C-3 Runoff Area=8,181 sf 100.00% Impervious Runoff Depth>4.76"
Tc=5.0 min CN=98 Runoff=1.00 cfs 0.074 af

Subcatchment 3S: C-2 Runoff Area=27,350 sf 100.00% Impervious Runoff Depth>4.76"
Tc=5.0 min CN=98 Runoff=3.34 cfs 0.249 af

Subcatchment 15S: U Trench Drain Runoff Area=3,721 sf 100.00% Impervious Runoff Depth>4.76"
Tc=5.0 min CN=98 Runoff=0.45 cfs 0.034 af

Reach 5R: C-3 Avg. Flow Depth=0.25' Max Vel=2.05 fps Inflow=1.44 cfs 0.108 af
n=0.057 L=60.0' S=0.0567 '/' Capacity=22.09 cfs Outflow=1.41 cfs 0.108 af

Reach 6R: C-2 Avg. Flow Depth=0.49' Max Vel=1.91 fps Inflow=3.34 cfs 0.249 af
n=0.043 L=149.5' S=0.0134 '/' Capacity=14.23 cfs Outflow=3.12 cfs 0.249 af

Reach 7R: Culvert 1 Avg. Flow Depth=0.81' Max Vel=4.65 fps Inflow=4.51 cfs 0.357 af
18.0" Round Pipe n=0.012 L=63.0' S=0.0049 '/' Capacity=7.98 cfs Outflow=4.46 cfs 0.357 af

Reach 14R: U Trench Drain Avg. Flow Depth=0.14' Max Vel=3.82 fps Inflow=0.45 cfs 0.034 af
10.0" x 10.0" Box Pipe n=0.013 L=70.0' S=0.0229 '/' Capacity=5.11 cfs Outflow=0.44 cfs 0.034 af

Total Runoff Area = 0.901 ac Runoff Volume = 0.357 af Average Runoff Depth = 4.76"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.901 ac

Summary for Subcatchment 2S: C-3

[49] Hint: Tc<2dt may require smaller dt

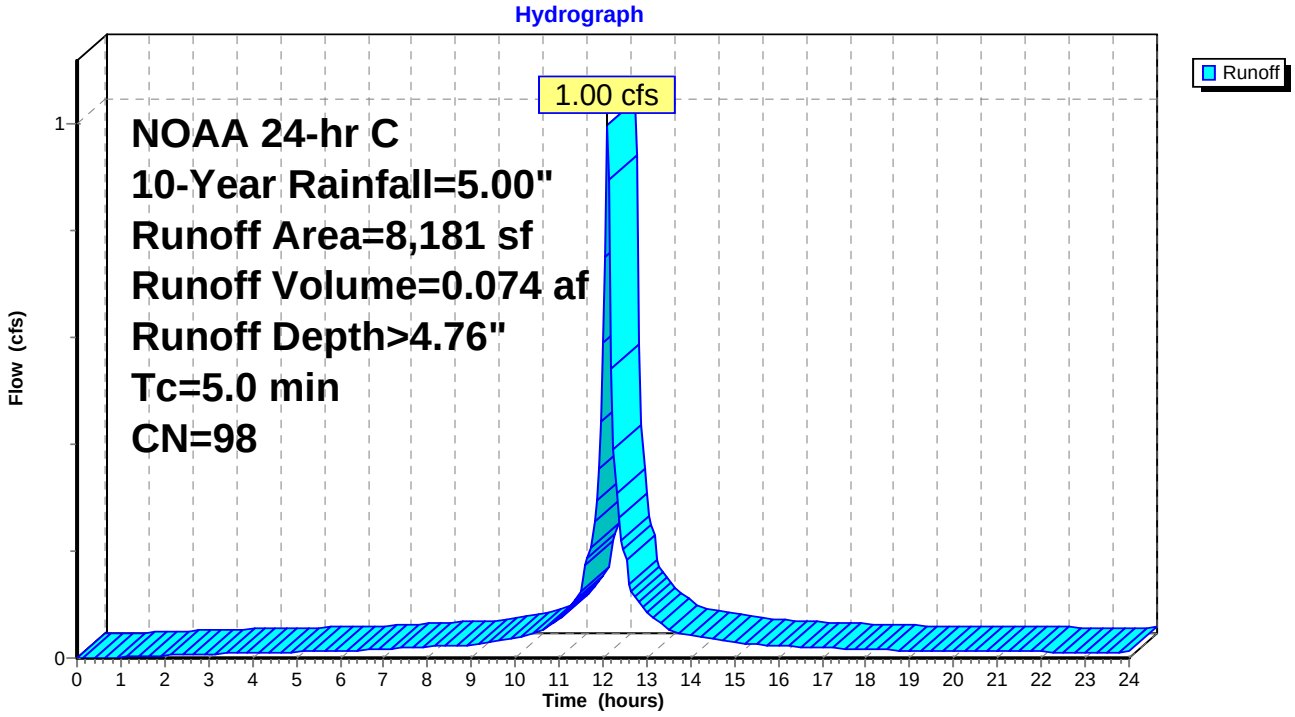
Runoff = 1.00 cfs @ 12.11 hrs, Volume= 0.074 af, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	8,181	98	Paved parking, HSG D
	8,181		100.00% Impervious Area

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

Subcatchment 2S: C-3



Summary for Subcatchment 3S: C-2

[49] Hint: Tc<2dt may require smaller dt

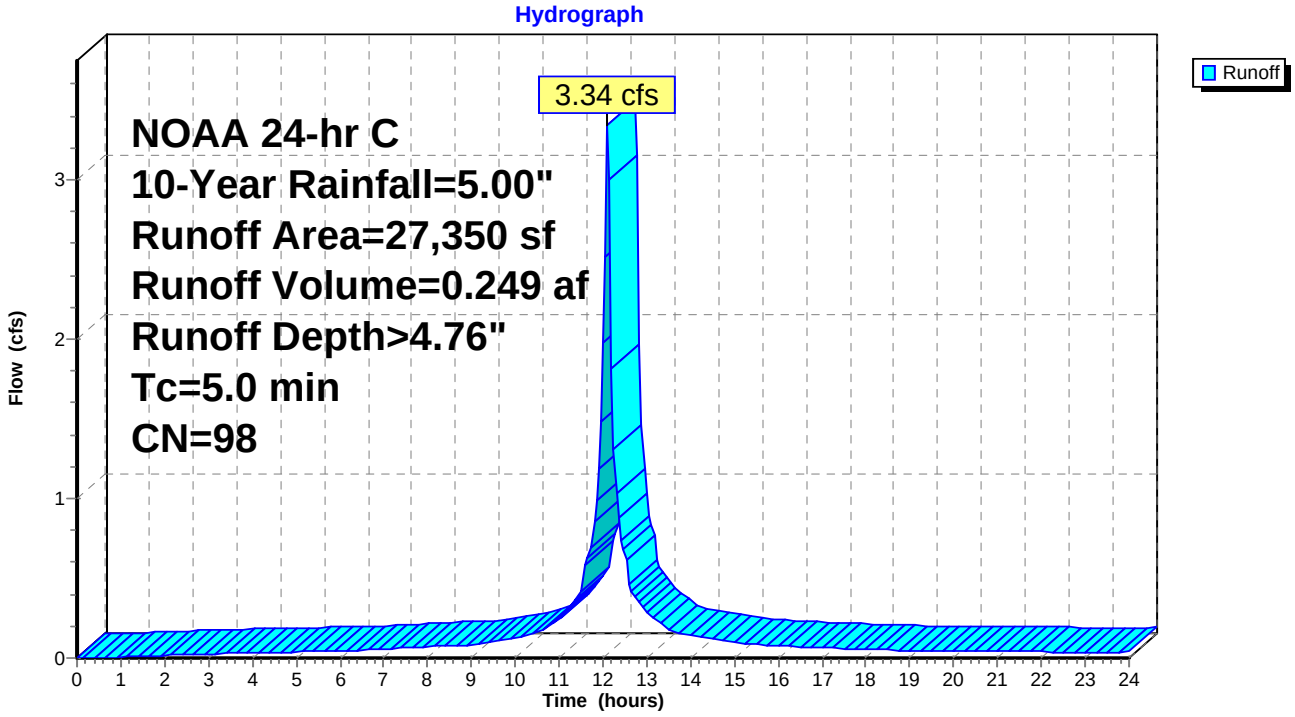
Runoff = 3.34 cfs @ 12.11 hrs, Volume= 0.249 af, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	27,350	98	Paved parking, HSG D
	27,350		100.00% Impervious Area

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

Subcatchment 3S: C-2



Summary for Subcatchment 15S: U Trench Drain

[49] Hint: Tc<2dt may require smaller dt

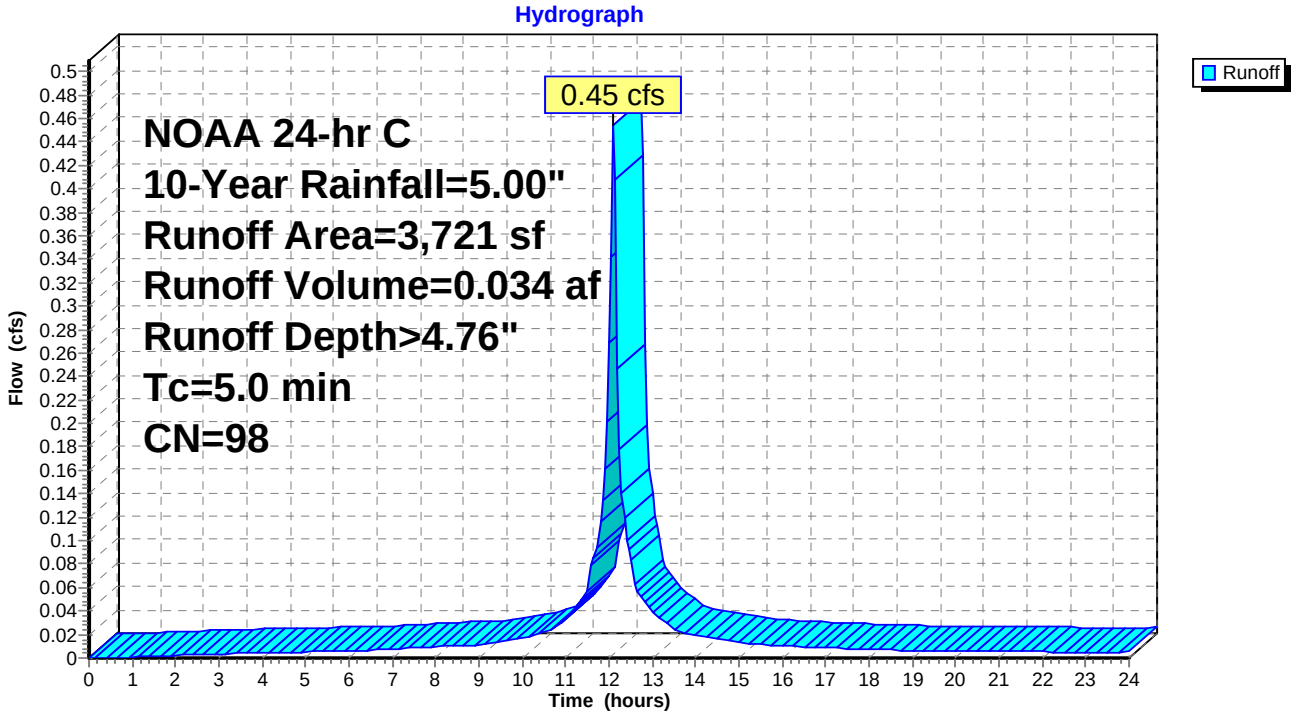
Runoff = 0.45 cfs @ 12.11 hrs, Volume= 0.034 af, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
*	3,721	98	Paved parking, HSG D
	3,721		100.00% Impervious Area

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

Subcatchment 15S: U Trench Drain



Summary for Reach 5R: C-3

[62] Hint: Exceeded Reach 14R OUTLET depth by 0.11' @ 12.15 hrs

Inflow Area = 0.273 ac,100.00% Impervious, Inflow Depth > 4.76" for 10-Year event
Inflow = 1.44 cfs @ 12.11 hrs, Volume= 0.108 af
Outflow = 1.41 cfs @ 12.13 hrs, Volume= 0.108 af, Atten= 2%, Lag= 1.0 min

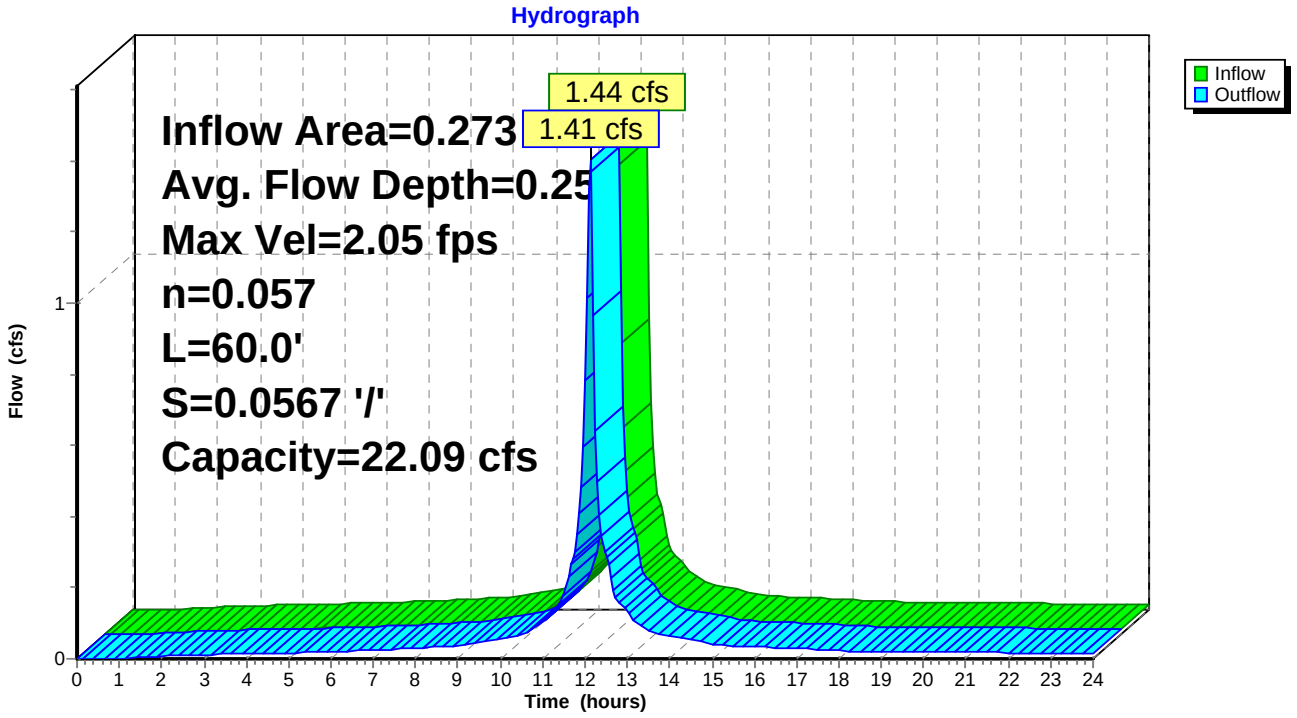
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.05 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 1.8 min

Peak Storage= 41 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 22.09 cfs

2.00' x 1.00' deep channel, n= 0.057
Side Slope Z-value= 3.0 '/' Top Width= 8.00'
Length= 60.0' Slope= 0.0567 '/'
Inlet Invert= 1,939.40', Outlet Invert= 1,936.00'

‡

Reach 5R: C-3



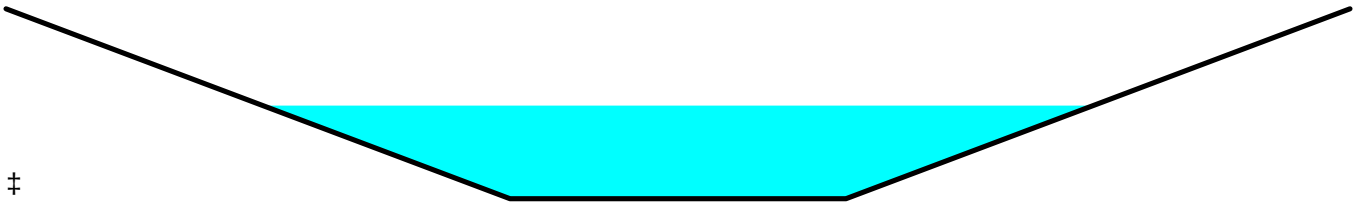
Summary for Reach 6R: C-2

Inflow Area = 0.628 ac,100.00% Impervious, Inflow Depth > 4.76" for 10-Year event
Inflow = 3.34 cfs @ 12.11 hrs, Volume= 0.249 af
Outflow = 3.12 cfs @ 12.15 hrs, Volume= 0.249 af, Atten= 7%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.91 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.58 fps, Avg. Travel Time= 4.3 min

Peak Storage= 254 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 14.23 cfs

2.00' x 1.00' deep channel, n= 0.043
Side Slope Z-value= 3.0 '/' Top Width= 8.00'
Length= 149.5' Slope= 0.0134 '/'
Inlet Invert= 1,938.00', Outlet Invert= 1,936.00'



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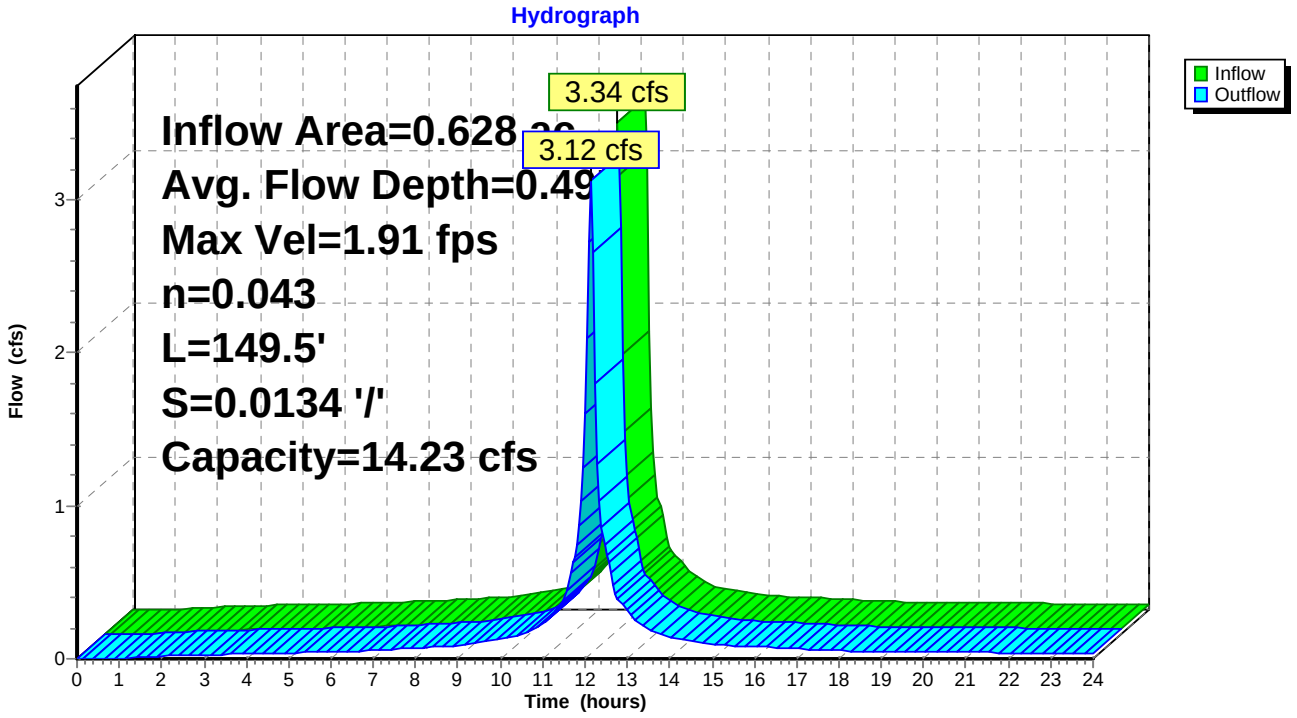
Reach 6R: C-2



Summary for Reach 7R: Culvert 1

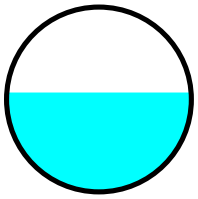
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.31' @ 12.15 hrs
[62] Hint: Exceeded Reach 6R OUTLET depth by 0.07' @ 12.15 hrs

Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 4.75" for 10-Year event
Inflow = 4.51 cfs @ 12.14 hrs, Volume= 0.357 af
Outflow = 4.46 cfs @ 12.15 hrs, Volume= 0.357 af, Atten= 1%, Lag= 0.3 min

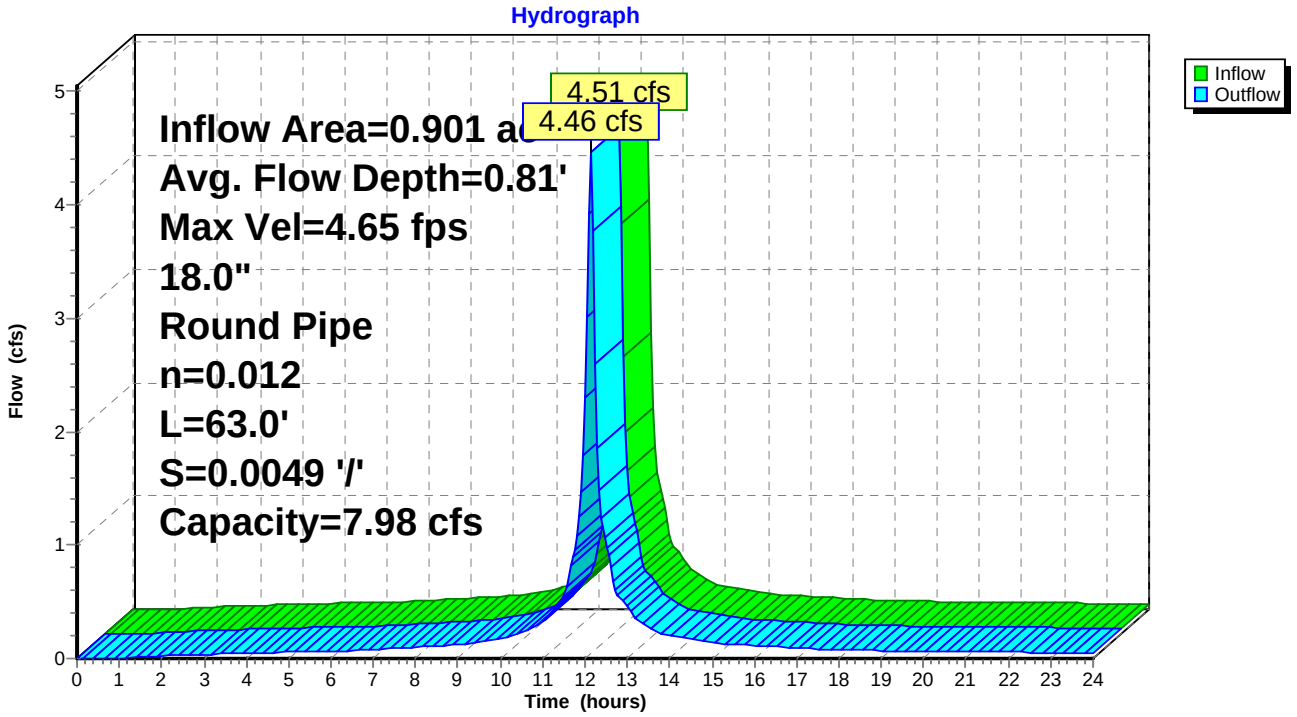
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.65 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.58 fps, Avg. Travel Time= 0.7 min

Peak Storage= 61 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.98 cfs

18.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 63.0' Slope= 0.0049 '/'
Inlet Invert= 1,935.75', Outlet Invert= 1,935.44'



Reach 7R: Culvert 1



Summary for Reach 14R: U Trench Drain

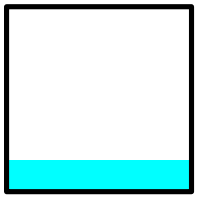
[52] Hint: Inlet/Outlet conditions not evaluated

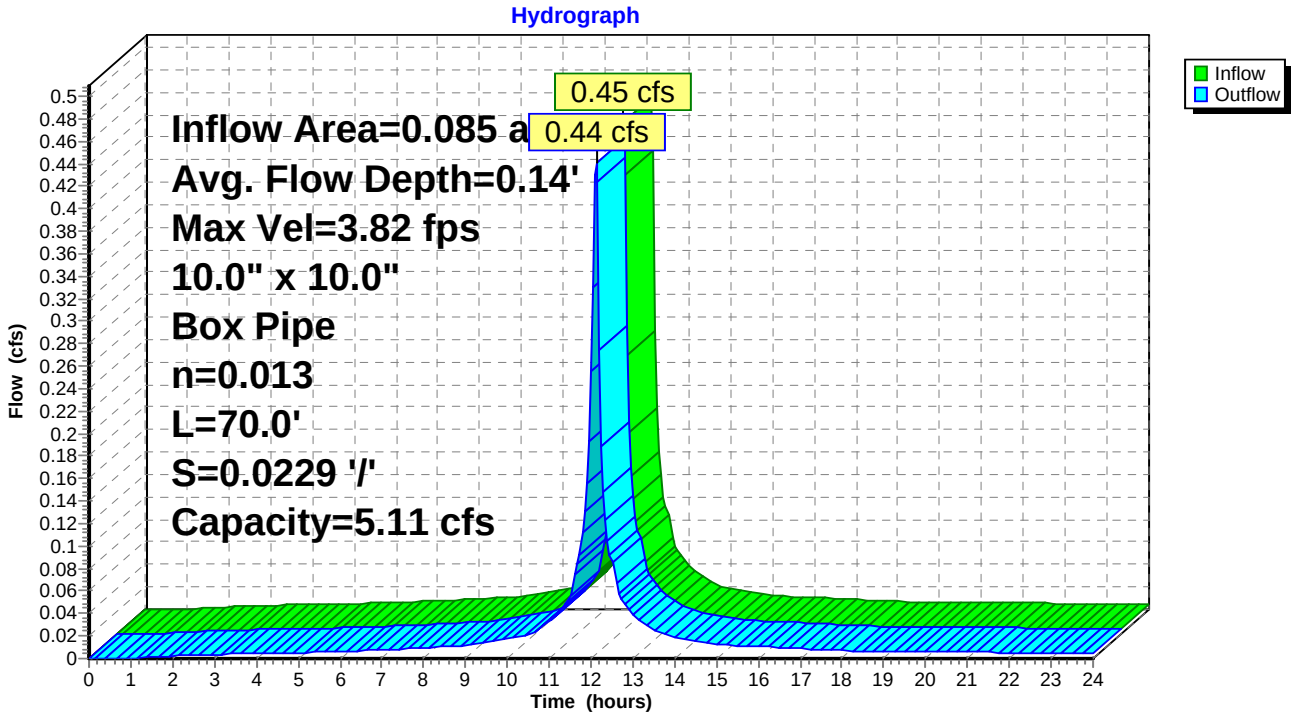
Inflow Area = 0.085 ac,100.00% Impervious, Inflow Depth > 4.76" for 10-Year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.034 af
Outflow = 0.44 cfs @ 12.12 hrs, Volume= 0.034 af, Atten= 3%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.82 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.99 fps, Avg. Travel Time= 1.2 min

Peak Storage= 8 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.83' Flow Area= 0.7 sf, Capacity= 5.11 cfs

10.0" W x 10.0" H Box Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 70.0' Slope= 0.0229 '/'
Inlet Invert= 1,941.00', Outlet Invert= 1,939.40'





ATTACHMENT 4
OFFSITE DISCHARGE REPORT

Transcontinental Gas Pipe Line Company, LLC

Offsite Discharge Report

Regional Energy Access Expansion Project

Compressor Station 515

April 2021
(Revised March 2022)

1.0 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), a subsidiary of The Williams Companies, Inc., is proposing the Regional Energy Access Expansion Project (Project). The existing Compressor Station 515 component of the Project is located at the eastern terminus of the Regional Energy Lateral in Buck Township, Luzerne County. Proposed at this facility is the addition of one gas-fired turbine driven compressor with 31,871 nominal HP at ISO conditions and modification of three existing compressors. Also proposed is the abandonment and replacement of 17,000 HP from five existing gas fired reciprocating driven compressors with one additional gas-fired turbine driven compressor with 20,502 nominal HP at ISO conditions. One Mainline Valve will be installed at this facility (MLV515RA10). Compressor Station 515 will require Erosion and Sediment (E&S) Control and Post Construction Stormwater Management (PCSM) Best Management Practices (BMPs) to manage stormwater runoff during and after construction.

Transco has developed an Offsite Discharge Report for the discharges associated with the proposed BMPs. An Offsite Discharge Report is performed to ensure that no offsite erosion will occur downstream of the proposed activities. The analysis conducted for this project followed the sequence outlined in PaDEP's factsheet for offsite discharges (Document #3930-FS-DEP4124).

2.0 Conveyance Best Management Practices

Erosion and Sediment Control and Post Construction Stormwater Management BMPs are proposed to manage stormwater runoff during and after construction. A series of channels will be installed to direct runoff water from the proposed expansion to a rip rap apron, which will release water into an infiltration berm. At the base of the spillway a level spreader will allow water to flow into the forested area northwest of the Limits of Disturbance. These BMPs will be installed to convey the net increase in volume between the pre- and post-development 2-year storm events and mitigate the increase (pre-post development) in peak runoff for the 2-, 10-, 50-, and 100-year storm events. A level spreader is proposed as the discharge structure at this location.

2.1 Infiltration Berm

The infiltration berm releases water through a spillway and it flows directly into a level spreader where it is discharged towards the forested area located northwest of the Limits of Disturbance. The stormwater is discharged as sheet flow and travels along a vegetative flow path until it reaches delineated wetland, W22-T1 PFO, northwest of the

Limits of Disturbance and ultimately to stream S18-T2. The flow path is depicted on Attachment 1.0. Soil types and the erodibility factors within the flow path are shown on Table 1.

Table 1 – Soils Mapped within Flow Path	
Soil Mapping Unit	**Soil Erodibility Factor, K_f**
WmB	**K_f = N/a**
CnB	**K_f = N/a**

The soil erodibility factors are shown in Table 1. Soil erodibility data is not provided for any of the soils in the flow path. Photos were taken along the flow path of the downstream area to show the vegetative cover.

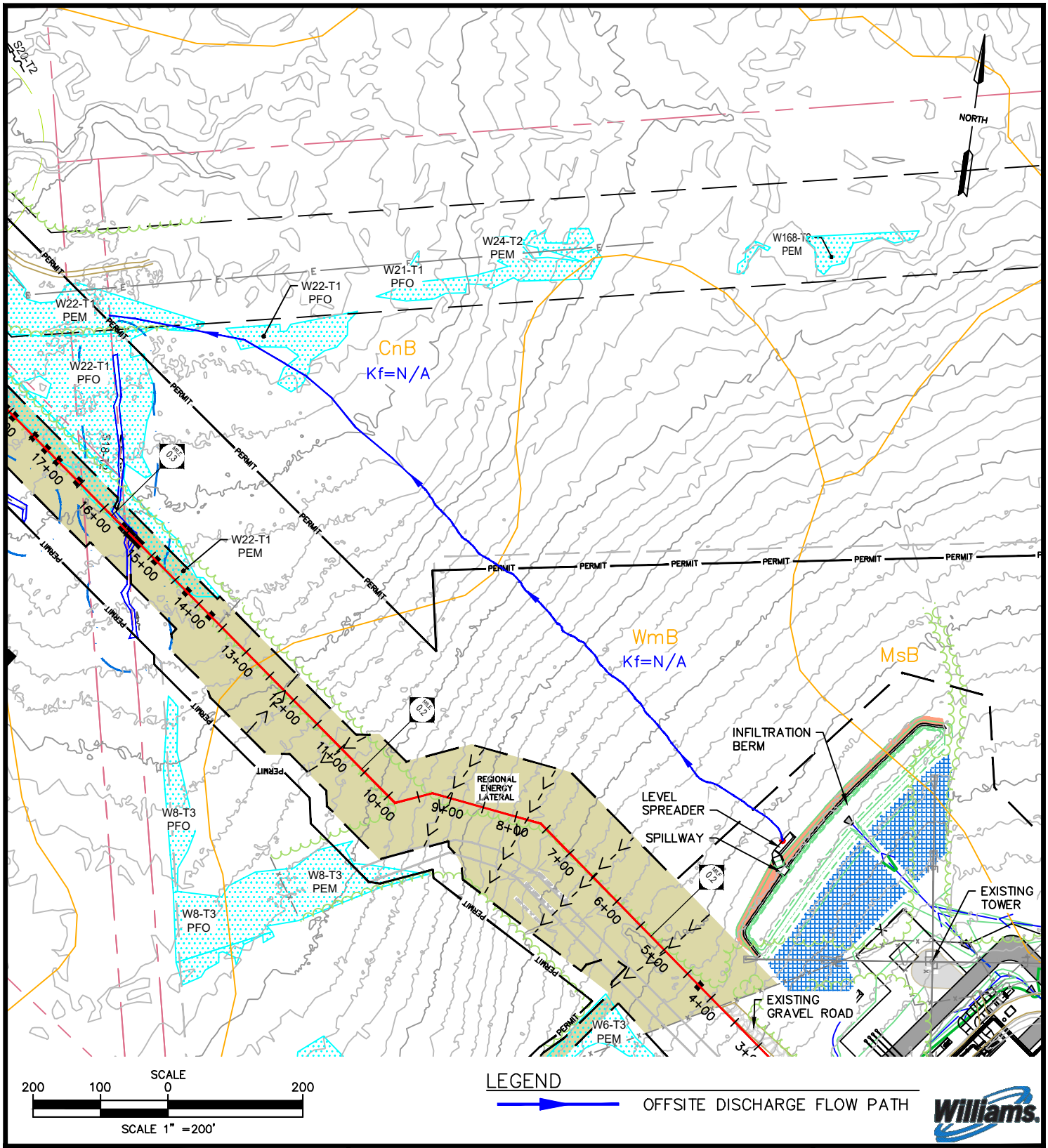
Photo 1: Existing Area at Proposed Level Spreader

Photo 2: Area Downgradient of the Proposed Level Spreader

Photo 1 shows the existing condition where the level spreader is proposed. The area will be graded to facilitate the installation of the level spreader and revegetated. Photo 2 shows the areas downgradient of the proposed level spreader, which is over 90% vegetated. In the E&S and PCSM Narrative, site calculations are provided and show the Pre- and Post-Construction runoff flow rates and volume. These calculations show a reduction in the post-construction discharge rates and volumes. Calculations indicated that the discharge velocity at the proposed level spreader is 2.13 feet per second for the for the 25 year, 24-hour storm event.

3.0 Conclusion

Based on the existing vegetative conditions, low discharge velocities from the BMPs and reduced peak flow rates and volumes from the site, downgradient soil erosion is not anticipate as a result of the proposed development of this site.



WHM consulting, INC.
designs, permits, resolutions

366 WALKER DRIVE, SUITE 300
STATE COLLEGE, PA 16801

TELEPHONE: (814)-689-1650 FAX: (814)-689-1557

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC
REGIONAL ENERGY ACCESS EXPANSION PROJECT
COMPRESSOR STATION 515

EROSION AND SEDIMENTATION CONTROL PLAN

FLOW PATH

BUCK TOWNSHIP LUZERNE COUNTY PENNSYLVANIA

DATE:	02/22/22
DRAWN BY:	RHM
CHECKED:	PW
WHM DRAWING NO:	FLOW PATH

EXHIBIT 1.0

SECTION 2.4.2
DRAWINGS