Transcontinental Gas Pipe Line Company, LLC

Requirement S – Alternatives Analysis

Regional Energy Access Expansion Project – Effort Loop

April 2021

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ALTERNATIVE ANALYSIS

1.0 Introduction

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 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 (PA) to multiple delivery points along Transco's Leidy Line in PA, Transco's mainline at the Station 210 Zone 6 Pooling Point in Mercer County, New Jersey (NJ) and multiple delivery points in Transco's Zone 6 in NJ, PA, and Maryland. 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 third quarter 2022 to meet a proposed in-service date of December 1, 2023. Project components in Monroe County are limited to the 42" Effort Loop and associated valve sites and contractor yards.

The Effort Loop component of the Project will consist of approximately 13.8 miles of 42-inch pipeline co-located with existing Transco Leidy Lines between Mileposts 43.72 and 57.50 in Ross, Chestnuthill and Tunkhannock Townships, Monroe County. The new pipeline will tie-in to the existing 42-in Leidy Line "D" on both ends, completing the segment. With the segment completed, the existing pig traps (industry term for manifolds that launch or receive in-line inspection tools) at both tie-ins will no longer be needed and will therefore be removed, while the existing mainline valves will remain. Transco will be installing a new mainline valve and appurtenant equipment at Milepost 49.6 off Sugar Hollow Road. The valve installation is a means to isolate gas flows. One Contractor Yard is proposed at the east end of the pipeline at MP 43.72. One remote anode groundbed is proposed at MP 43.72.

This alternatives analysis, which solely evaluates the Project components with Chapter 105 regulated resources in Monroe County, is consistent with the requirements of 25 Pa Code Ch 105, in particular § 105.13(e)(viii), and Draft Technical Guidance Document No 310-2100-### Revised on 4/17/2020, the Federal Water Pollution Control Act (CWA) (33 U.S.C.A. §§ 1251—1388), as amended, and the Federal Energy Regulatory Commission's (FERC) regulatory requirements as set forth in 18 Code of Federal Regulations 380.15 . , In accordance with the foregoing, in particular, 25 Pa Code §105.13(e)(1)(viii), this alternatives analysis includes "[a] detailed analysis of alternatives to the proposed action, including alternative locations, routings or designs to avoid or minimize adverse environmental impacts".

2.0 No-Action Alternative

Under the No-Action Alternative, the Project would not be constructed or operated. The potential environmental impacts of construction and operation of the Project would not occur; however, this alternative would not meet the purpose and need for the Project. Under the No-Action Alternative, Transco would not be able to provide 829,400 Dth/d of firm transportation capacity from receipt points along Transco's Leidy system eastbound to existing Transco markets in PA, NJ, and MD. In addition, the No-Action Alternative would not alleviate the constrained takeaway capacity from the Marcellus production areas and support the overall reliability and diversification of energy infrastructure in the Northeast.

Transco's assessment is based, in part, on an analysis of existing Transco facilities in and near the Project area, which do not provide adequate pipeline takeaway capacity for transportation of natural gas to meet current transportation demand. The No-Action Alternative would force Transco's customers to seek other transportation services and/or depend on other future development projects with unpredictable schedules and undetermined environmental impacts. Therefore, the No-Action Alternative is not a viable alternative to the project.

3.0 System Alternatives

System alternatives are alternatives to the proposed action that would make use of other existing, modified, or proposed pipeline systems to meet the objectives of the proposed Project. A system alternative would make it unnecessary to construct all or part of the proposed Project, although some modifications or additions to another existing pipeline system may be required to increase its capacity, or another entirely new system may need to be constructed. System alternatives involving modifications or additional system facilities would also result in environmental impacts.

To be a viable system alternative to the proposed Project, potential system alternatives must meet three criteria:

- The system must be capable of transporting up to 829,400 Dth/d of natural gas to existing Transco markets in PA, NJ, and MD;

- The system alternative must be capable of transporting the required volumes within the same schedule as the proposed Project; and
- Use of an alternative system must be able to meet the criteria above and at the same time result in reduced environmental impacts when compared to the proposed Project.

3.1 Existing Pipeline System Alternatives

Transco owns and operates its Leidy Line system, Marcus Hook Lateral, Trenton Woodbury Lateral, and the Transco Mainline system within the Project area. Transco's existing systems do not have available unsubscribed capacity to service the volume under contract for the Project. Therefore, Transco's systems currently are not capable of providing an incremental 829,400 Dth/d of year-round firm transportation capacity from receipt points along Transco's Leidy system eastbound to existing Transco markets in PA, NJ, and MD. Using hydraulic modeling, Transco evaluated additional compression alternatives within the Transco system that could meet the objectives of the Effort Loop. This compression-intensive system alternatives are described in Section 3.2.

The Texas Eastern Transmission (TETCO) Pipeline System and the Columbia Gas Transmission Pipeline System have existing facilities in the vicinity of the Project delivery locations' however they do not have access to the gas source that the Project is utilizing. The Tennessee Gas Transmission System has existing facilities near the gas source of the Project; however, they do not have access to the delivery locations of the Project. For these reasons, these systems have been deemed unacceptable alternatives to the Project.

Given its proximity to the Project, Transco conducted a comparative analysis of the Project to the PennEast Pipeline Company, LLC proposed pipeline project (PennEast). Whether evaluating the PennEast project (as a whole) or PennEast Phase 1 as an independent project, Transco determined that neither would be viable alternatives to the Project. PennEast Phase 1 would only provide delivery points in PA to UGI Central Penn Gas, Inc., Columbia Gas Transmission, LLC, and Adelphia Gateway, LLC. In contrast, the Project will provide delivery points in PA, NJ, and MD, which PennEast Phase 1 would not be able to provide without significant extension of the pipeline, totaling approximately 222 miles, into NJ and MD. For these reasons, the PennEast project cannot address, nor can it be readily modified to address, the purpose and need for the Project; therefore, it is not a viable system alternative.

3.2 Compression-Intensive System Alternatives

Transco identified one compression-intensive system alternative in lieu of the Effort Loop. The compression-intensive alternative would utilize the installation of new compression, with a new compressor station, along the existing Leidy Line System to meet the Project capacity demand. Compression-intensive alternatives are typically designed to avoid stream, wetland, and forest impacts to the extent practicable. However, new compression involves permanent above ground land use impacts for the compressor station, and is a potential source of air quality and noise impacts. Loop-intensive alternatives may also have temporary, localized air and noise impacts during construction, and, depending on the length of looping required, can result in significantly greater impacts on environmental resources than a single-site compressor station, depending on a variety of factors. The compression-intensive system alternative to Effort Loop is described below.

For the compression-intensive alternative to the Effort Loop, one new compressor station with approximately 117,325 HP capacity would need to be installed in Northampton County, PA. Table 3.2-1 provides a comparison of the environmental impacts of the Project (Effort Loop) and this compression--intensive alternative. Under the compression--intensive alternative, the Regional Energy Lateral in Luzerne County and other proposed compressor station and meter station construction/modifications would still be required to meet the Project's purpose and need.

Construction of the additional new compressor station would impact approximately 54 acres during construction and up to 31 acres during operation (new permanent ROW) and would directly impact one landowner. In contrast, the proposed Effort Loop would be collocated with Transco's existing Leidy Line System ROW and would link Transco's existing Leidy Line D from MP 43.72 to MP 57.50, thereby minimizing new impacts to sensitive species, cultural resources, and previously undisturbed habitats, though approximately 163 acres would be used during construction with greater impacts to streams, wetlands, and forested areas. In addition, by collocating with Transco's existing Leidy Line System, Effort Loop would be located on and adjacent to properties with existing Transco easements. In contrast, the compression-intensive alternative would require construction of a new station at a previously undisturbed location. In addition, the operational impacts of constructing a new above-ground compressor station would include introduction of long-term air emissions and noise impacts that would require operational mitigation. The compressor station would be designed such that emissions would not cause modeled exceedances of the applicable National Ambient Air Quality Standards (NAAQS). No long-term operational impacts would be expected with operating the loop because impacts are limited to construction activities, which are considered short-term.

Looping was also determined to be preferable over compression for operational considerations. Utilizing compression in lieu of looping would result in an extremely large pressure differential across the Compressor Station that would increase the temperature of the gas; therefore, gas cooling equipment would be required, which would likely increase noise impacts. The Compression-Intensive alternative would also reduce the pressure at multiple delivery points on the suction side of the Station, which could adversely affect existing customers' ability to receive gas from Transco's system. In addition, the compression-intensive alternative would result in significantly greater fuel consumption and fuel costs, thereby reducing Transco's competitive market position.

Because of the known reliability factors for compression versus transmission lines, the proposed pipe looping would be superior from a reliability standpoint. The typical reliability/availability of compression-related equipment for the transportation of natural gas is in the range of 90% to 99%. The typical reliability/availability of pipeline assets for the transportation of natural gas is in the range of 98% to 99.5%. This is because compression facilities require more frequent routine maintenance, whereas pipelines require repairs only on an as-needed basis.

Because the Effort Loop would: (1) minimize new impacts through collocation with the existing Leidy Line system; (2) have no long-term operational air emissions and noise impacts; (3) link segments of the existing Leidy Line D; and (4) support system operational efficiency and reliability, the compression-intensive alternative was eliminated from further consideration.

Table 3.2-1
Comparison of the Environmental Impacts of Effort Loop and the Compression-Intensive Alternative

Factor	Unit	Effort Loop	Compression-Intensive Alternative
Length of pipeline	miles	13.8	N/A
Construction ROW[a]	acres	162.6	54.4
Operation ROW[a]	acres	38.2	N/A[b]
Construction impacts on forested land	acres	71.8	2.1
Operation impacts on forested land	acres	24.7	0.0
Construction impacts on wetlands (NWI)	acres	1.9	0.0
Operation impacts on wetlands (NWI)	acres	0.7	0.0
Number of waterbody crossings (NHD)	count	0	0

Table 3.2-1
Comparison of the Environmental Impacts of Effort Loop and the Compression-Intensive Alternative

Factor	Unit	Effort Loop	Compression-Intensive Alternative
Number of stream crossings (NHD)	count	4	0
Number of residences within 50 feet of the construction ROW	count	28	1
Number of landowners crossed by the construction ROW[b]	count	224	1

Sources: USFWS 2019; USGS 2019; USGS 2016

[a] Assumes a construction ROW width of 100 feet and an operational ROW of approximately 25 feet for the Effort Loop. In some areas the Effort Loop is encompassed within the existing Leidy System ROW and no additional permanent ROW is required. Estimated construction and operation workspace for the Compression-Intensive Alternative is preliminary; upon detailed design, operational footprint could be significantly reduced.

[b] Detailed station design is not available. Facility size is dependent on detail design and site conditions.

[c] Of the landowners crossed by the Loop, an estimated 61 are new impacted landowners without an existing Transco easement. The compression-intensive alternative would be located within Transco property.

Key:
N/A = not applicable/available
NHD= National Hydrography Database
NWI= National Wetlands Inventory
ROW = Right-of-way
TBD= To be determined

3.3 System Alternatives Conclusion

Using hydraulic modeling, Transco was able to evaluate where additional compression would be required to meet the purpose and need of the Project. Transco identified one compression-intensive alternative to the Effort Loop. Based on the analysis provided, this alternative would not meet the Project purpose and/or results in more environmental impacts or reduced system operational efficiency/reliability. The Effort Loop was selected in lieu of the compression alternative to: (1) minimize new impacts through collocation with the existing Leidy Line system; (2) avoid long-term operational air emissions and noise impacts ; (3) link segments of the existing Leidy Line D; and (4) support system operational efficiency and reliability.

The expansion of other existing pipeline systems in lieu of the Project would require additional pipeline as well as additional system upgrades such as added looping and/or compression. Transco believes that its Project design is more efficient than system alternatives that could be proposed to provide the same service. Since Transco can construct its facilities with construction and mitigation measures that would minimize environmental impacts such that they are less than the environmental impacts posed by system alternatives, system alternatives were not considered to be preferable to the Project.

4.0 Route Alternatives

The Effort Loop is 100% collocated within Transco's existing Leidy Line A, B, and C ROW, therefore no route alternatives or route deviations were considered or have been evaluated.

5.0 Impact Minimization of the Proposed Alternative

5.1 Pipeline Workspace

Construction of the pipeline facilities will require the acquisition of temporary construction ROWs, additional temporary workspace (ATWS), and permanent (operational) easements along the entire length of each pipeline route. Transco proposes to utilize the following nominal ROWs during construction of the pipeline facilities:

- A 100-foot-wide construction ROW for installation of the 42-inch-diameter Effort Loop.

The Effort Loop is entirely co-located with the existing Transco Leidy Line System. Transco proposes the construction ROWs to provide for safe and efficient construction of large diameter pipeline facilities in accordance with OSHA regulations (29 CFR 1926.650-1926.652, Subpart P) and Interstate Natural Gas Association of America's (INGAA's) workspace guidelines (INGAA 1999). Reductions or "neck-downs" of the construction ROW at resource crossings were employed to avoid and minimize resource impacts.

In wetlands, a nominal 75-foot-wide construction ROW will be utilized. During pipeline construction, machinery operates on one side of the trench (working side), and excavated materials is stockpiled on the other side (spoil side). At most wetland crossings, this workspace has been necked down to 75 feet. In a reduced 75-foot-wide ROW, the proposed working side of the ROW is typically 50 feet wide.

Within the top of bank (TOB) of streams, a 50-foot-wide construction ROW will be used, and a 75-foot-wide construction ROW will be used in floodways, except where Transco has provided site-specific justification, as outlined in Table 5.1-1. At most stream crossings, this workspace has been necked down to 50 feet within the TOB and 75 feet in the floodway. Within TOB, in a reduced 50-foot-wide ROW, the proposed working side of the ROW is typically 38 feet wide and spoil side being 12 feet. Within floodways, in a reduced 75-foot-wide ROW, the proposed working side of the ROW is typically 45 feet wide.

Table 5.1-1
Site-Specific Justification for Additional Workspace

Watercourse Feature ID	Approximate Milepost	Feature Type	ROW Width	Justification
S3-5	45.8	Stream & Floodway	113 (stream) 125 (floodway)	Due to the stream being fully contained within a culvert, and the surrounding terrain being developed and commercial land. Neckdowns of workspace would not result in any change in water quality or any reduction in environmental impacts. The culvert will remain intact for the crossing.
S1-T1	48.5	Stream	53	Due to terrain considerations and being adjacent to a road crossing, the trench will become wider than normal. Additional workspace within TOB is needed to facilitate a safe and efficient watercourse crossing.
S1-T2	49.4	Stream	63	Due to adjacent saturated wetlands, steep terrain, adjacent road crossing and workspace constraints due to existing pipelines. Additional workspace within TOB is needed to facilitate a safe and efficient watercourse crossing.
S2-T1	52.6	Stream	63	Due to steep terrain and adjacent wetlands at stream crossing, which will require a wider trench to install the pipe. Additional workspace within TOB is needed to facilitate a safe and efficient watercourse crossing.
S5-T2	53.6	Stream	63	Due to saturated wetlands on both sides of stream, ditch will become wider than normal. Additional workspace within TOB is needed to facilitate a safe and efficient watercourse crossing.

These wetland, stream, and floodway workspace neck downs are the most reasonable neck downs for pipeline installation within these resources, as it will still allow for required workspace to complete the construction activities while minimizing environmental impacts. These reductions to the workspace are considered the maximum reductions for the safe operation and passage of equipment and personnel while minimizing the length of time required to cross the features.

5.1.1 Construction Technique Alternatives

Transco evaluated the feasibility of implementing trenchless construction techniques to cross sensitive areas. These techniques may be used in an attempt to reduce impacts associated with construction in comparison with using conventional (trenching) construction techniques. While use of trenchless methods can reduce impacts on or avoid sensitive areas, these methods have limitations that must be considered before a method is selected as the proposed construction method for a given crossing. The following sections outline the factors that will be evaluated when selecting the proposed construction method for a given crossing.

5.1.1.1 Trenchless Analysis

A trenchless analysis was conducted for wetland and stream crossings to determine if either a conventional bore (bore) or a horizontal directional drill (HDD) would be a feasible construction technique for the resource crossing. If a particular technique was considered potentially feasible, the crossing was further assessed to confirm that the trenchless installation would have less impact than a dry-ditch open cut crossing. Finally, for those trenchless crossings that were both feasible and minimized impacts, field assessments including geotechnical borings were completed to confirm suitable conditions for executing the trenchless crossing.

Each crossing was first assessed to determine if a conventional bore would be a suitable construction method. If a conventional bore would be practical, a review for HDD suitability was not completed. Conversely, if a conventional bore crossing was not suitable for a given resource, an assessment was completed to determine if an HDD would be a suitable construction method. Should neither trenchless method be suitable, a dry-open cut methodology would be utilized. Below is a summary of the trenchless analysis for conventional bore and HDD. Appendix S-1 includes a flow chart that was utilized during the trenchless analysis.

Conventional Bore Analysis

A conventional bore trenchless analysis was not completed for wetland resources as outlined in Appendix S-1. Typically, a conventional bore is not a practical crossing method for a wetland due to the augmented upland workspace requirements and relatively short crossing length capabilities of a conventional bore, typically limited to 300 feet. In addition, not all impacts to the resource are completely avoided with a conventional bore, as a 10-foot corridor is maintained as emergent cover to allow for pipeline inspection, and a travel lane through the resource could be required during construction. However, where certain infrastructure crossings require a conventional bore, adjacent wetlands may be incorporated where practicable.

Where topographic and geologic conditions allow, a conventional bore can be a practical method for mitigating impacts to streams. Streams were evaluated in a phased approach, as shown in Appendix S-1. Phase I of the stream assessment is a topography evaluation that considers the bore length, pit depth, and proximity to adjacent infrastructure, such as roads. As previously noted, the typical maximum length for a standard conventional bore is 300 feet. Beyond 300 feet, alignment risks related to steering difficulties are introduced; therefore, bores exceeding 300 feet in length are avoided where possible. The bore pit depth is evaluated to ensure constructability. If the bore pit exceeds 20 feet in depth, standard trench boxes are not tall enough to maintain the integrity of the bore pit walls, and benching and spoil storage are required, necessitating a significantly larger workspace. Therefore, conventional bores are avoided when the depth of the bore pit exceeds 20 feet, where possible.

If a feature is in the immediate vicinity of existing infrastructure, such as roadways that are proposed for boring, a conventional bore may be considered appropriate for crossing both the resource and the roadway. The construction method can be completed for both crossings (stream and/or wetland and infrastructure) as the boring can capture both features within the same bore, given their close proximity.

If a stream was able to be bored based on the general parameters outlined in Phase I, or if a stream was required to be bored due to adjacent infrastructure, the Phase II evaluation was completed. The Phase II evaluation is broken into two categories that consider impacts and risk.

Phase II-A of the analysis includes an impacts assessment of the following items related to workspace required for the conventional bore:

- Impacted wetlands
  - PFO
  - PEM
  - PSS
- Impacted uplands
- Land Use
- Noise generated by construction equipment
- Anticipated construction durations

- Phase II-B included a risk assessment for the completion of the conventional bore. The assessment provides a desktop analysis of the following risk factors:
  - Site Constraints
  - Bedrock quality
  - Blasting for bore pits
  - Soil conditions

- Soil/rock interface
- Karst

If Phase II found a stream to be suitable for boring, the Phase III evaluation was completed. Phase III was an evaluation of subsurface conditions, by means of geotechnical borings, to determine if a conventional bore was feasible. A conventional bore may be considered infeasible due to various reasons including the limitations of equipment used for conventional bore, risk due to subsurface conditions, or other construction related concerns.

For the Effort Loop, none of the streams were deemed feasible to be crossed by a conventional bore. Most of the streams are either within wetlands, causing the crossing length to exceed 300 feet, or they have terrain considerations that cause bore pit depths to be in excess of 20 feet. One wetland will be conventionally bored (W1-T2) as it is adjacent to a state highway that requires a trenchless crossing.

The remaining streams and wetlands on the Project were deemed not feasible as conventional bores and moved on to the HDD assessment.

<u>Horizontal Directional Drilling Analysis</u>

Phase I of the wetland HDD assessment involved reviewing the feature characteristics of the wetland and the total acreage of impacted PFO wetland. For a wetland to be considered for an HDD crossing, it must be classified as Exceptional Value (EV) in 25 PA Code Chapter 105.17. Due to the temporary nature of impacts, wetlands not classified as EV were not considered in Phase I of the Trenchless assessment. If PFO wetland impacts are less than one acre, Transco considers open cut construction methods a better option than an HDD for minimizing overall impacts. Crossings with PFO wetland impacts exceeding one acre moved on to Phase III of the assessment (there is no Phase II assessment for wetlands), and potential HDD workspace was developed. Wetlands designated either PEM or PSS were not considered for an HDD crossing as no vegetative cover type change occurs in PEM wetlands and minimal changes occur in PSS wetlands; only a 10-foot corridor is maintained as emergent cover to allow for pipeline inspection.

Phase I of the stream assessment involved a feature characteristic review of the streams crossed by the proposed pipeline. Streams located within special protection watersheds were identified for Phase II consideration. Phase II of the stream assessment considered the width of the streams that passed the Phase I review. For streams greater than 30 feet in width, a proposed workspace was developed for Phase III consideration. Smaller streams were not identified for

Phase III consideration because the risks and impacts (i.e. workspace requirements, noise) associated with an HDD crossing categorically outweigh the benefits. The dry-open cut methodology is appropriate for smaller streams because it minimizes crossing time and avoids the risk of an inadvertent return.

Phase III of the analysis was the same for both wetlands and streams. The Phase III evaluation was broken into two categories that evaluate risk and impacts.

Phase III-A of the analysis included an impacts assessment of the following items related to workspace required for the HDD:

- Impacted Wetlands
  - PFO
  - PEM
  - PSS
- Impacted Uplands
- Land Use
- Water Consumption
- Noise generated by construction equipment
- Air emissions generated by construction equipment
- Anticipated construction durations

Phase III-B included a risk assessment for the completion of the HDD. The assessment provides an analysis of the following risk factors:

- Site Constraints and Topographic Considerations
- Elevation Differential and Dry Hole
- Hole Stability
- Obstructions
- Pilot Hole Steering
- Drilling Fluid Loss, Hydraulic Fracture and Inadvertent Returns
- Poor Cuttings Removal
- Hole Obstructions and Flushing
- Downhole Tooling Failure/Loss
- Time of Installation

Phase IV of the HDD evaluation involves field work to gather geotechnical borings. The geotechnical bores are evaluated to determine if subsurface conditions are conducive for a successful HDD. An HDD may not be considered feasible where subsurface conditions present the potential for significant construction risks.

No wetlands continued past Phase I of the HDD assessment as none had PFO impacts greater than one acre. However, during the pre-application process, DEP identified one large wetland complex (W4-T1, W3-T1) on the Effort Loop to be reviewed as a trenchless crossing.

Based on the Phase III assessment, the large wetland complex (W4-T1, W3-T1) HDD crossing was not considered feasible due to the desktop geologic subsurface conditions, as outlined in Appendix S-2 Trenchless Analysis Feasibility Study. This crossing location is not identified for Phase IV consideration.

Based on the Phase II stream assessment, UNT to Poplar Creek (Effort S2-T1) was identified for Phase III consideration. The Phase III assessment for the UNT to Poplar Creek (S2-T1) indicated that site conditions would not support an HDD alignment. An HDD at this crossing location would be extremely long or have entry/exit angles at 20° or more. The UNT to Poplar Creek (S2-T1) HDD crossing was not considered feasible and was not identified for Phase IV consideration.

6.0 Summary

An alternatives analysis has been prepared for the proposed Project, consistent with the requirements of PA Code 105.13(e)(vii). The alternatives analysis has taken a multi-tier approach, first looking at the system alternatives for Project design options, and then taking the selected system design and evaluating the alternatives, avoidance and minimization measures, and construction techniques associated with the proposed alternative design. The Project as proposed has minimized impacts to environmental resources, while meeting the Project goals. Construction measures and methods were thoroughly evaluated to minimize effects to environmental resources, including streams and wetlands. The Project is considered water dependent, as it requires siting within water to fulfill the basic purposes of the Project, as defined by PA Code 105.13(e)(x)(C). Based upon the results of the analysis, the proposed Project meets the Project goals and is consistent with state antidegradation requirements.

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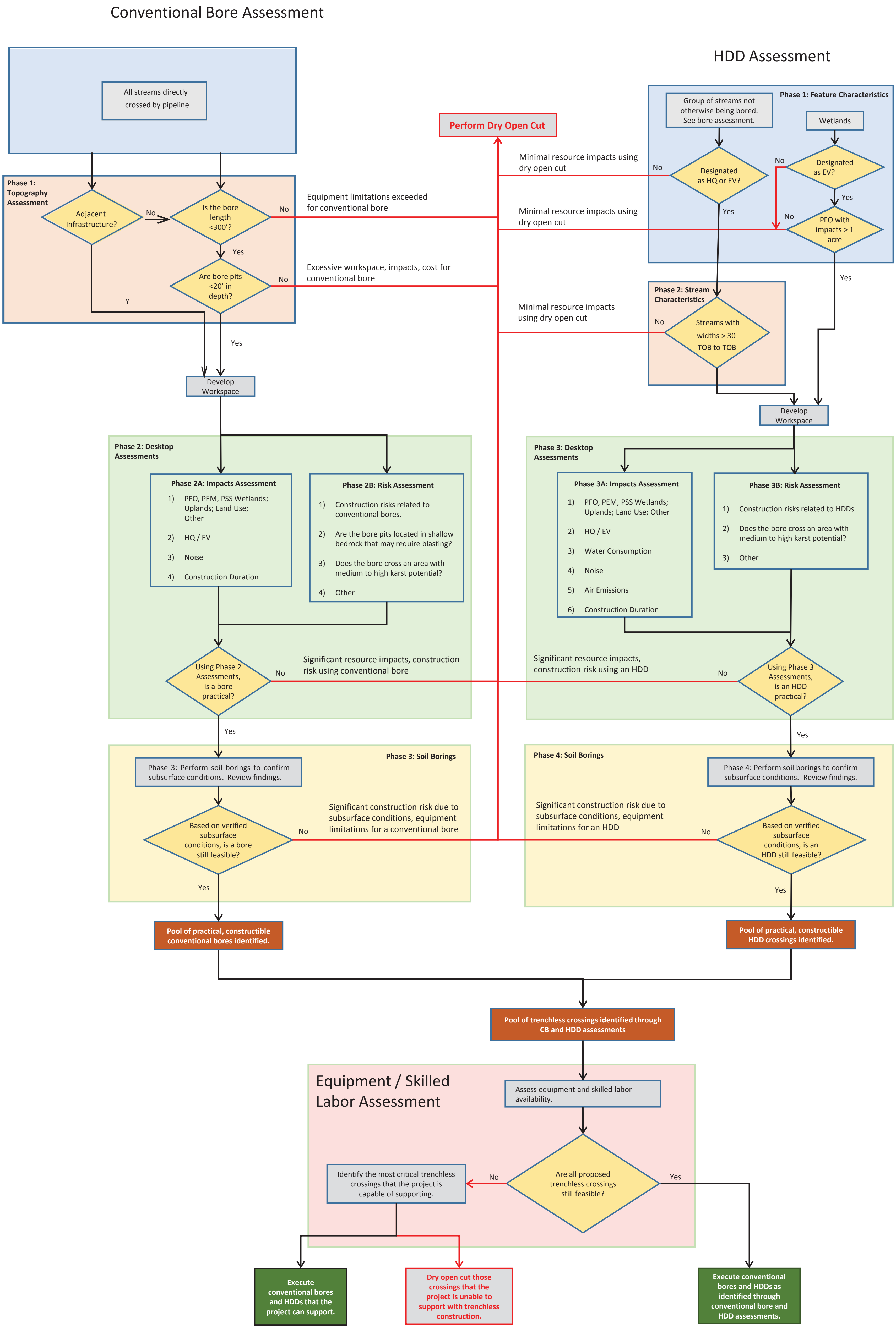
APPENDIX S-1

TRENCHLESS ANALYSIS FLOWCHART

03/10/2021

Regional Energy Access Expansion Project
Trenchless Analysis Flow Chart



APPENDIX S-2

PRELIMINARY TRENCHLESS CROSSING DESKTOP STUDY – WETLANDS (W4-T1, W3-T1)

Preliminary Trenchless Crossing Desktop Study

Regional Energy Access Effort Loop – Wetland HDD

Williams Project Execution – Transmission & Gulf of Mexico
December 15, 2020

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Project Description

The Regional Energy Access Expansion (REAE) project is proposed to add capacity to the existing Transcontinental Gas Pipe Line System (Transco). A portion of this project includes the 42-inch Effort Loop situated in Monroe County, Pennsylvania. The west end of the Effort Loop crosses a wetland complex near the Pocono Raceway, and as part of an effort to reduce environmental impacts in this area, Williams evaluated a horizontal directional drill (HDD) for this crossing. This report evaluates the proposed crossing of the wetland complex for trenchless feasibility and practicality using a variety of public data sources.

Figure 1: Effort Loop Pipeline Route

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Effort Loop Wetland HDD Geology Data

According to the Natural Resources Conservation Service (NRCS) web soil survey, the following soil types are identified to be within the area of the proposed HDD.

Monroe County, Pennsylvania (PA089)

Map Unit Symbol	**Map Unit Name**	**Acres**	**Percent**
AwB	Alvira and Watson very stony loams, 0 to 12 percent slopes	1.1	0.5%
BxB	Buchanan extremely stony loam, 0 to 8 percent slopes	102.7	49.1%
CxB	Clymer extremely stony loam, 0 to 8 percent slopes	92.5	44.3%
DxB	Dekalb channery loam, 0 to 8 percent slopes, rubbly	8.4	4.0%
DxC	Dekalb very channery loam, 8 to 25 percent slopes, extremely stony	0.2	0.1%
SpB	Shelmadine very stony silt loam, 0 to 8 percent slopes	4.1	1.9%
Totals for Area of Interest		208.9	100.0%

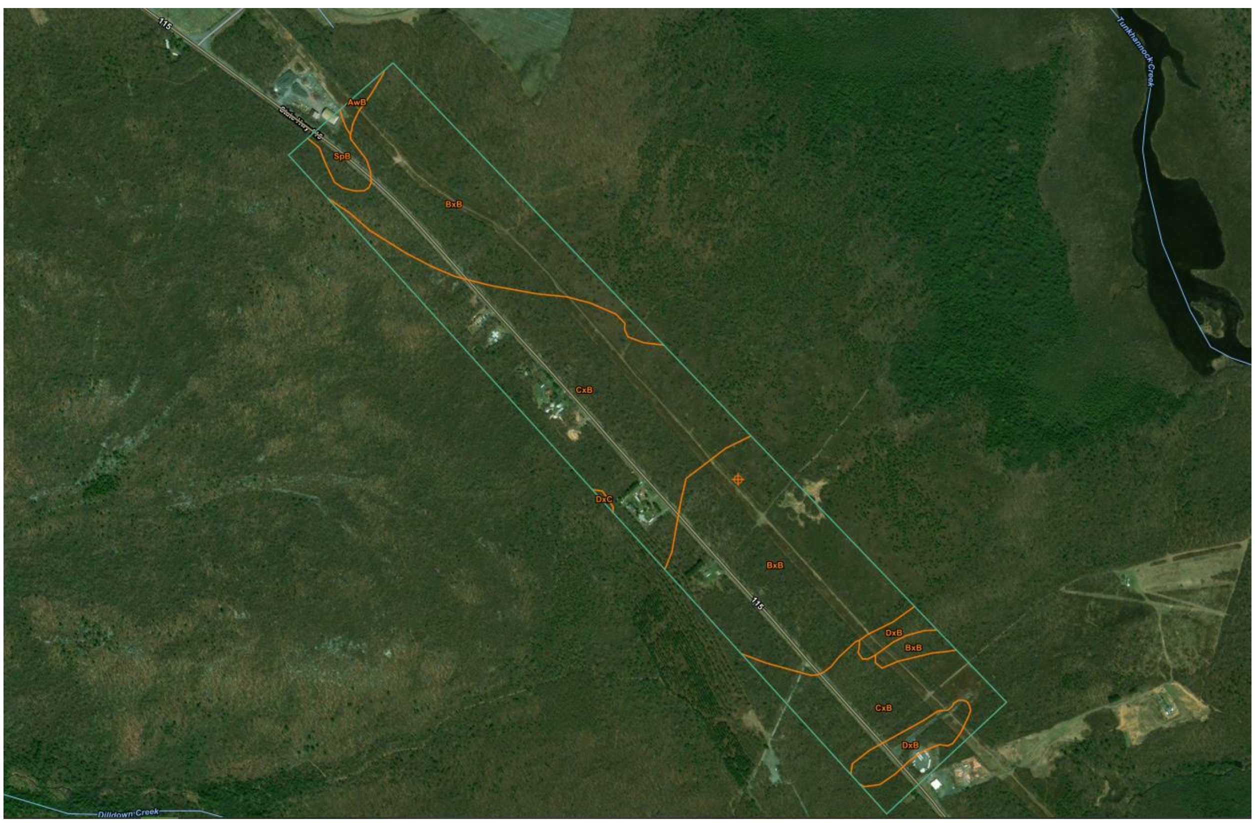

Figure 2: NRCS Web Soil Survey Area of Interest (AOI)

Detailed descriptions of these soil types can be found in APPENDIX A. As shown, these soil types identify areas of gravel, cobbles, stones, and boulders which can cause major issues in HDD construction. Gravel and larger sized cobbles/boulders increase the risk of inadvertent returns and hole instability. These materials can also cause problems with HDD steering during pilot hole operations increasing the risk of misalignment and the drill path exceeding tolerance zones.

The United State Geological Survey (USGS) specifies that the bedrock formation in this area is the Poplar Gap Member of the Catskill Formation. This formation is typically known to be primarily siltstone and sandstone with interbedded shale pockets. The depth to the bedrock is currently unknown at this time as the USGS did not have any available public data on bedrock depth.

This location is also identified to be within the Late Wisconsinan Glacial Border in Pennsylvania, suggesting that there is a high likelihood of encountering glacial till material. Glacial till is known to be quite variable in content also containing varying amounts of gravels cobbles and boulders.

Karst Features

According to the PA USGS public data, the closest identified karst feature is approximately 20 miles from the HDD location. This feature is an identified surface depression at approximate location 40°44'26.88"N, 75°26'52.44"W. Therefore, karst is not likely to be located within the area of this HDD but could impact the feasibility of this method if found.

Effort Loop Wetland HDD Mining Data

Mining Activity

According to available public data from the USGS, the closest coal field is the Eastern Middle Anthracite Coal Field, approximately 14 miles away. According to the WPA Brookville Raster Catalog, the entire location has been mined. There is no public data indicating coal mining activity in the vicnity of the subject wetland complex. These mine maps can be found at the following web addresses:

- ftp://data1.commons.psu.edu/pub/minemaps/Map_Repository/DEP_Pottsville/SID_Images/geor_BMSA_0860.zip

Water Well Data

Although there was no public data found in regard to public water wells within the vicinity of the HDD, Transco is aware of wells maintained by the Pocono Raceway. There are residential developments in the area, but none within 1,000 ft of a possible HDD alignment.

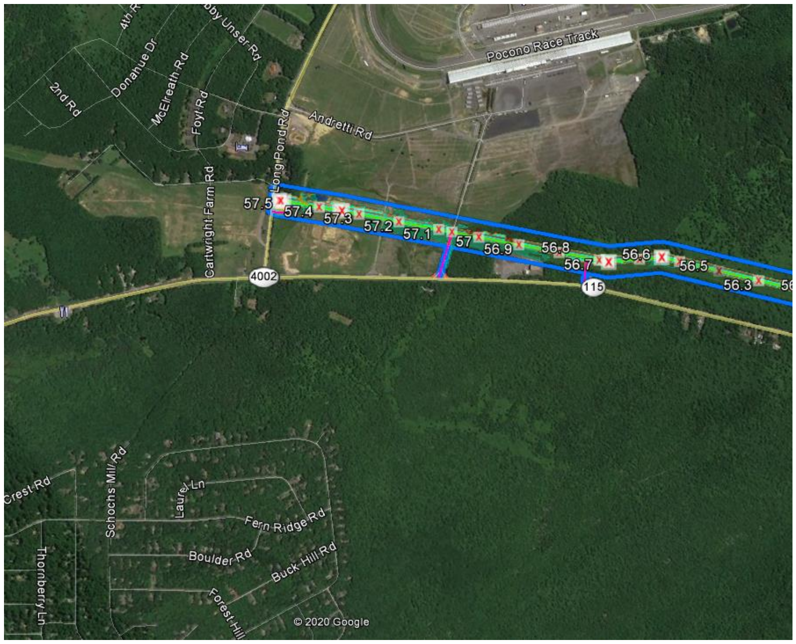

Figure 3: Residential Areas - Water Wells Likely

Preliminary HDD Geometry

A preliminary HDD alignment and profile was generated with the existing ground elevation data to get a better understanding of the geometric feasibility for an HDD at this location. The HDD would go through soils consisting mostly of glacial till with interbedded gravel, cobbles, and boulders. This will likely cause hole instability and increase the risk of inadvertent returns as previously mentioned above in the geology section of this report. Since the HDD would have to go through these high-risk areas near entry and exit, where there is less overburden to oppose fluid pressures, the chance of inadvertent returns and/or hydraulic fracture increases even more. Overall, the geometry is feasible, but the geology presents unacceptable risks during construction. Please see APPENDIX B for the HDD drawings.

Other Impacts

An HDD crossing would require approximately xxxx gallons of water for consumptive use – the creation of drilling mud. As there are no readily available water sources nearby, all water would need to be trucked in and stored in frac tanks.

Regarding threatened and endangered plant species, Showy Goldenrod and Blunt Managrass are both present in the area. They would largely be avoided with an HDD.

Conclusion

Due to the geologic and geotechnical conditions near the Pocono Raceway, an HDD at this location is not recommended. The prevalence of glacial till deposits in the area can contribute to hole instability, drill bit steering issues, hydraulic fracture, and inadvertent returns, ultimately putting the HDD at risk for failure. Furthermore, known karst features have been identified within a 20 mile range of this location, making it possible to come across karst during an HDD as well. Due to these risks, Williams believes that an open cut crossing of the wetland is the most environmentally responsible construction method for this crossing.

APPENDIX A: Effort Loop Wetland HDD Soil Descriptions

Alvira and Watson Very Stony Loams:

Alvira Typical profile

- H1 - 0 to 10 inches: gravelly loam
- H2 - 10 to 21 inches: gravelly silt loam
- H3 - 21 to 60 inches: very gravelly silt loam

Properties and qualities

- Slope: 0 to 12 percent
- Surface area covered with cobbles, stones or boulders: 1.6 percent
- Depth to restrictive feature: 15 to 28 inches to fragipan
- Drainage class: Somewhat poorly drained
- Runoff class: Very high
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 6 to 18 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water capacity: Low (about 3.4 inches)

Watson Typical profile

- H1 - 0 to 10 inches: gravelly loam
- H2 - 10 to 27 inches: gravelly silty clay loam
- H3 - 27 to 60 inches: gravelly clay loam

Properties and qualities

- Slope: 0 to 12 percent
- Surface area covered with cobbles, stones or boulders: 1.6 percent
- Depth to restrictive feature: 18 to 32 inches to fragipan
- Drainage class: Moderately well drained
- Runoff class: Very high
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 18 to 36 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water capacity: Low (about 3.9 inches)

Buchanan Extremely Stony Loam

Typical profile

- H1 - 0 to 4 inches: channery loam
- H2 - 4 to 25 inches: gravelly loam
- H3 - 25 to 60 inches: gravelly loam

Properties and qualities

- Slope: 0 to 8 percent
- Surface area covered with cobbles, stones or boulders: 15.0 percent
- Depth to restrictive feature: 20 to 36 inches to fragipan
- Drainage class: Moderately well drained
- Runoff class: High
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 18 to 36 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water capacity: Low (about 3.3 inches)

Clymer Extremely Stony Loam

Typical profile

- H1 - 0 to 9 inches: very channery loam
- H2 - 9 to 49 inches: loam
- H3 - 49 to 72 inches: channery clay loam

Properties and qualities

- Slope: 0 to 8 percent
- Surface area covered with cobbles, stones or boulders: 9.0 percent
- Depth to restrictive feature: More than 80 inches
- Drainage class: Well drained
- Runoff class: Low
- 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: Moderate (about 6.2 inches)

Dekalb Channery Loam

Typical profile

- Oa - 0 to 1 inches: highly decomposed plant material
- A - 1 to 4 inches: channery loam
- E - 4 to 6 inches: very channery sandy loam
- Bw - 6 to 19 inches: very channery loam
- C - 19 to 24 inches: extremely channery sandy loam
- R - 24 to 34 inches: bedrock

Properties and qualities

- Slope: 0 to 8 percent
- Surface area covered with cobbles, stones or boulders: 25.0 percent
- Depth to restrictive feature: 20 to 32 inches to lithic bedrock
- Drainage class: Somewhat excessively drained
- Runoff class: Very low
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water capacity: Very low (about 2.4 inches)

Dekalb Very Channery Loam

Typical profile

- Oi - 0 to 1 inches: slightly decomposed plant material
- A - 1 to 4 inches: very channery loam
- E - 4 to 7 inches: very channery loam
- Bw - 7 to 26 inches: very channery sandy loam
- C - 26 to 34 inches: extremely channery sandy loam
- R - 34 to 44 inches: 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 (0.57 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water capacity: Low (about 3.2 inches)

Shelmadine Very Stony Silt Loam

Typical profile

- H1 - 0 to 7 inches: channery silt loam
- H2 - 7 to 24 inches: silty clay loam
- H3 - 24 to 50 inches: channery loam
- H4 - 50 to 70 inches: channery loam

Properties and qualities

- Slope: 0 to 3 percent
- Surface area covered with cobbles, stones or boulders: 1.6 percent
- Depth to restrictive feature: 18 to 30 inches to fragipan
- Drainage class: Poorly drained
- Runoff class: Very high
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 0 to 6 inches
- Frequency of flooding: None
- Frequency of ponding: None

Available water capacity: Low (about 3.1 inches)

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APPENDIX B: Effort Loop Wetland HDD Preliminary Geometric Design

DIRECTIONAL DRILL DATA

DESCRIPTION	STATION (FT)	ELEVATION (FT)
ENTRY @ 12°	10+00.00	0.00
PC 1	12+28.98	-48.67
PT 1	21+02.22	-140.45
PC 2	25+24.21	-140.45
PT 2	31+08.74	-99.58
EXIT @ 8°	42+81.74	65.40
HORIZONTAL LENGTH = 3281.74 FT		
DIRECTIONAL DRILL LENGTH = 3306.71 FT		

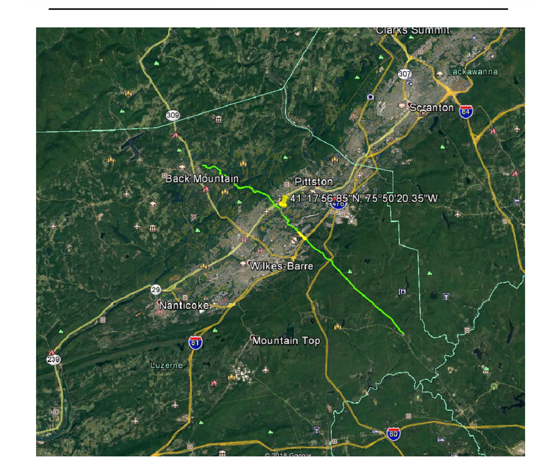
NOTES

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

LEGEND

- PROPOSED HDD PATH
- PROPOSED EFFORT LOOP
- ESTIMATED GROUND SURFACE
- WETLAND

PROJECT LOCATION



The Williams Companies, Inc.
Transcontinental Gas Pipeline Company
2800 Post Oak Blvd.
Houston, TX 77056

Regional Energy Access Pipeline
42" Diameter Effort Loop Wetland HDD Preliminary
Trenchless Feasibility Study Drawing
Luzerne County, PA

DRAWN BY: BRIAN E. HALCHAK	D-001 REV. (0)
DATE:	SHEET 1 OF 2
REA_EffortWetlandHDD_PreliminaryTrenchless	Coordinate System: NAD 1983 Pennsylvania North

DIRECTIONAL DRILL DATA

DESCRIPTION	STATION (FT)	ELEVATION (FT)
ENTRY @ 12°	10+00.00	0.00
PC 1	12+28.98	-48.67
PT 1	21+02.22	-140.45
PC 2	25+24.21	-140.45
PT 2	31+08.74	-99.58
EXIT @ 8°	42+81.74	65.40
HORIZONTAL LENGTH = 3281.74 FT		
DIRECTIONAL DRILL LENGTH = 3306.71 FT		

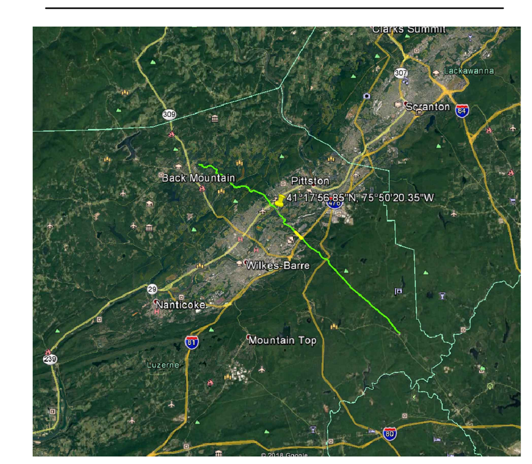
NOTES

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

LEGEND

- PROPOSED HDD PATH
- PROPOSED HDD PATH ALT
- ESTIMATED GROUND SURFACE
- WETLAND

PROJECT LOCATION



The Williams Companies, Inc.
Transcontinental Gas Pipeline Company
2800 Post Oak Blvd.
Houston, TX 77056

Regional Energy Access Pipeline

30" Diameter Effort Loop Wetland HDD Preliminary Trenchless Feasibility Study Drawing

Luzerne County, PA

DRAWN BY: BRIAN E. HALCHAK	D-001 REV. (0)
DATE:	SHEET 2 OF 2
REA_EffortLoopWetland_PreliminaryTrenchless	Coordinate System: NAD 1983 Pennsylvania North