SUNOCO PIPELINE L.P.

Pennsylvania Pipeline Project

Alternatives Analysis

in support of

Joint Permit Application for a

Pennsylvania Water Obstruction & Encroachment Permit and a U.S. Army Corps of Engineers Section 404 Permit Application

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ALTERNATIVES ANALYSIS

1.0 INTRODUCTION

This revised and supplemented Alternatives Analysis is being prepared as a part of Sunoco Pipeline's L.P. (SPLP) Joint Permit Application for a Pennsylvania Water Obstruction and Encroachment Permit Application and U.S. Army Corps of Engineers (USACE) Section 404 Permit Application for the Pennsylvania Pipeline Project (Project or PPP), and responds to the comments set forth in the Pennsylvania Department of Environmental Protection's (Department's or PADEP's) technical deficiency letters. SPLP has been diligent in siting the Project to avoid, minimize, and mitigate potential effects to environmental resources, as well as land uses and landowners, located along the approximately 307-mile route of the Project.

2.0 APPLICABLE REGULATIONS

The Department's regulations regarding the analysis of alternatives for proposed wetland impacts are principally set forth at 25 Pa. Code § 105.18 (a) and (b), depending upon whether the wetland is classified as an exceptional value wetland or an "other" wetland, respectively. In its review of Section 105 permit applications, the Department also determines the unavailability of alternative locations, routes and designs as set forth in 25 Pa. Code § 105.14(b)(7).

The USACE's regulations requiring an analysis of alternatives to issue its Section 404 permit is set forth at 40 CFR § 230.10.

As set forth below, the following alternatives analysis meets the requirement of both the state and federal regulations, and requests of multiple state and federal agencies, as well as addresses the technical deficiency comments made by the Department on the previously submitted Section 105 and Section 404 Joint Permit Applications.

3.0 DEVELOPMENT OF BASELINE ROUTE ALTERNATIVE

During the development and siting of the Project, SPLP considered a number of different routings, locations and designs to determine whether there was a practicable alternative to the proposed use of a wetland area. SPLP performed this determination through a sequential review of routes and design techniques, which sequential review concluded with an alternative that has the least environmental impacts, taking into consideration cost, existing technology and logistics. Specifically, the following sections describe the detailed analysis that was performed to develop the proposed alternative.

3.1 DESCRIPTION OF THE PROJECT

SPLP proposes to construct and operate the Project that would expand existing pipeline systems to provide natural gas liquid (NGL) transportation. The Project involves the installation of two parallel pipelines within an approximately 306.8-mile, 50-foot-wide right-of-way from Houston, Washington County, Pennsylvania to SPLP's Marcus Hook facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. A

20-inch diameter pipeline will be installed within the right-of-way from Houston to Marcus Hook (306.8 miles) and a second, 16-inch diameter pipeline, will also be installed in the same right-of-way. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255.8 miles.

The Project includes one new 20-inch and one new 16-inch diameter pipelines installed within or adjacent to 306.8 miles of existing or new right-of-way. The majority of the new right-of-way will be co-located adjacent to existing utility corridors, including approximately 230 miles of pipeline that will be co-located in the existing SPLP Mariner East pipeline system that is currently used for the transportation of NGLs.

The following provides the details of the proposed pipeline facilities:

- Pipeline 1: Houston, Pennsylvania to Marcus Hook, Pennsylvania – This is an incremental expansion of the capacities of SPLP to transport NGLs to the Marcus Hook facility. This Phase of the Project will include a 20 inch diameter steel pipeline, pump stations, and valve settings. The route of the pipeline is either inside or adjacent to the existing SPLP pipeline corridor for a majority of its length and is approximately 306.8 miles long.

- Pipeline 2: Delmont, Pennsylvania to Marcus Hook, Pennsylvania –The pipeline route for the second 16-inch pipeline will include 255.8 miles of pipeline that will parallel Pipeline 1.

The aboveground facilities included with the Project are the following:

- Houston, Pennsylvania has an existing facility which will connect to the pipeline. This Project will install meters on the outlets from existing storage, injection pumps, control valves, associated piping and accessory structures. New land disturbance will be required to accommodate the injection station component.

- Delmont, Pennsylvania has an existing facility and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance within the existing station site will be required to accommodate this modification.

- Ebensburg, Pennsylvania, SPLP will construct a new pump station with booster pumps, leak detection metering, associated piping and accessory structures adjacent to an existing station. Some new land disturbance within the existing station site will be required to accommodate this modification.

- Mount Union, Pennsylvania has an existing pump station and this Project will expand the pump station with added piping, pig traps and valves. Some new land disturbance will be required to accommodate this modification.

- Doylesburg, Pennsylvania has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance will be required to accommodate this modification.

- Middletown, Pennsylvania has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance will be required to accommodate this modification.

- Beckersville, Pennsylvania has an existing pump station and this Project will expand the pump station with added piping, pig traps and valves. Some new land disturbance will be required to accommodate this modification.

- Twin Oaks, Pennsylvania is an existing site and this Project will install custody transfer meters and control valves. Some new land disturbance within the existing facility will be required to accommodate this modification.

- There are 53 mainline block valve sets planned for this Project, of which 22 are sited at existing valve sites, and 5 are sited at existing pump stations. Block valves are installed for the purpose of shutting off sections of the pipeline to allow maintenance or to stop flow in the case of emergencies. Block valves are installed in accordance with U. S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) requirements, and reference recommendations from American Society of Mechanical Engineers (ASME) B. PHMSA requires block valves to be installed on the suction end and discharge end of a pump station, at locations along the pipeline system that will minimize damage or pollution from accidental hazardous liquid discharge, and on each side of a major water crossing. SPLP has determined that in the interest of facilitating operational control it will place block valves at every railroad crossing, at every water crossing wider than 100 feet, and at a minimum of one per 10 miles with closer densities in areas with denser populations.

The Project crosses 17 counties in Pennsylvania.

3.2 INITIAL ROUTE SELECTION

The initial route selected for the Project was routing to be co-located with (abut and/or overlap) the right-of-way of an existing pipeline owned and operated by SPLP. The co-location of the Project with an existing SPLP right-of-way, and ultimately also co-location of sections of the Project with other existing utility corridors, was a major means to avoid environmental impacts and impacts to sensitive resources and communities, and to minimize the site-specific and cumulative environmental impacts arising from the Project.

In addition, as set forth above, all but one of the pump stations incorporated with the Project will be an expansion of an existing pump station. By definition, the valve sets plans for the Project are required to be located within the right-of-way of the Project. All pump station sites and valve sets were located to avoid direct impacts to wetlands.

Governor's Pipeline Infrastructure Task Force Report Recommending Co-Location

Sharing existing utility right-of-way corridors, which has been implemented with the Project, is identified by resource agencies as a preferred pipeline routing method, and was also a key recommendation of Pennsylvania Governor Tom Wolf's Pipeline Infrastructure Task Force Report (the "Report"). As set forth in the Report, Governor Wolf created the Pipeline Infrastructure Task Force "to engage stakeholders in a transparent, collaborative process to achieve responsible development of pipeline infrastructure in the Commonwealth." The Governor appointed 48 volunteers to serve on the Task Force who represented academia, government, industry and citizen's groups. The work of the Task Force members were aided by more than 100 additional volunteers appointed by the Governor serving on 12 individual topic-specific work groups.

The conclusion of the Task Force's work was the publication of the Report, which defined best practices in specific topic areas related to pipeline infrastructure development and operation. Although the Report identifies a total of 184 recommendations for pipeline infrastructure development in Pennsylvania, there were 12 recommendations gaining the most support from the Task Force members. These 12 recommendations are identified as the "Top Recommendations." Within the category of "Planning, Siting and Routing pipelines to avoid/reduce environmental and community impacts," one of the two Top Recommendations listed is to **"Identify Barriers to Sharing Rights-of-Way."** As set forth in more detail in County Government Work Group Recommendation #9, the full recommendation is described as follows:

> State should establish a requirement to co-locate, to the extent possible, new pipeline infrastructure within existing or planned utility right-of-ways (by regulation or statute), including other pipelines, electric transmission lines, etc. to reduce the impact on existing development, available land for development and natural resources, and to be consistent with the county comprehensive plan. Any requirement should include a maximum number of pipelines, regardless of product, in any single right-of-way.

The Project, even prior to the Task Force's recommendations, started with a routing that co-located the new pipeline within the right-of-way of SPLP's existing pipeline corridor. SPLP was able to select this initial routing for the Project because it possessed the legal right to add additional pipelines within or adjacent to most of the existing right-of-way of SPLP's existing pipeline corridor. This initial routing decision for the Project produced the benefits described in the Report, namely a reduction in the impact on natural resources which could have occurred if an entirely new, or "greenfield," alignment was initially considered for the approximately 300 mile distance across the state to achieve the purpose of the Project.

In addition to the County Government Work Group of the Task Force making a recommendation that new pipelines be co-located within existing utility corridors, the same recommendation was also made by other Task Force work groups. See, Conservation and Natural Resources Work Group Recommendations #18 ("Co-locate new pipelines along existing rights-of-way to minimize the creation of new, separate clearings"); Environmental Protection Work Group Recommendation #17 ("Where practicable, safe, and all parties are agreeable, oil and gas development and associated infrastructure should utilize existing disturbances such as road networks, rights-of-way corridors and other utility installations." "Pipelines that share existing corridors reduce the amount of disturbance and fragmentation that would otherwise occur with a separate pipeline corridor.") Therefore, a wide variety of Task Force Work Groups realized the wisdom of co-locating new pipelines "within" and/or "along" existing utility corridors, because of the reduced environmental impacts that would be created as compared to a pipeline located on a totally new "greenfield" right-of-way, to the extent possible.

USFWS-Pennsylvania Field Office Co-Location Recommendations

In addition to Governor Wolf's Task Force stating a Top Recommendation that new pipelines should be co-located with existing utility corridors, the Pennsylvania Field Office of the U.S. Fish and Wildlife Service ("USFWS") also recommends the co-location of new pipelines with already disturbed areas such as existing pipelines corridors. In its initial consultation letter to SPLP dated March 19, 2014, the USFWS recommended that SPLP follow its guidelines entitled "USFWS Pennsylvania Field Office – Adaptive Management for the Conservation of Migratory Birds" (USFWS undated). As part of these guidelines, the USFWS states five recommendations applicable to the siting of new pipelines to avoid and minimize impacts to migratory birds pursuant to its authority under the Migratory Bird Treaty Act. One of these five recommendations states as follows: "To reduce habitat fragmentation, co-locate roads, fences, lay down areas, staging areas, and other infrastructure in or immediately adjacent to already disturbed areas such as existing pipelines." In conformance with these guidelines of the USFWS, the initial routing of the Project was placed within or immediately adjacent to the right-of-way of an existing pipeline owned and operated by SPLP to avoid and minimize environmental impacts which would have otherwise occurred if a new "greenfield" location was initially selected for the routing of the Project.

Conclusion

In conclusion, SPLP selected the right-of-way of the existing pipeline corridor it owned and operated as the initial routing for the Project. This selected routing is consistent with one of the Top Recommendations of the Governor's Pipeline Infrastructure Task Force, as well as the USFWS guidelines. With the selection of this initial routing, the Project initially avoided adverse environmental impacts and caused less site-specific and cumulative environmental impact as compared to a pipeline alignment on a totally new "greenfield" right-of-way.

3.3 MAJOR ROUTE ALTERNATIVES

Once the right-of-way corridor for SPLP's existing pipeline was identified as the initial routing for the Project, SPLP then evaluated that routing, at a planning, desk-top level, to determine if there were any obvious constraints and impacts that would occur if the entire existing right-of-

way was used for the approximately 300 mile length of the Project. This evaluation included consideration of the feasibility and practicability of the initial routing of the Project with regard to current technology, cost, and logistics. The purpose of this evaluation was to determine if there were practicable major route alternatives that avoided or reduced impacts on environmentally sensitive resources, such as large population centers, scenic areas, wildlife management areas, or cultural/historically significant resources proposed to be crossed by the Project. Any major route alternative could obviously not change the origin and delivery point of the Project. However, this evaluation involved a concerted effort to identify alternative routes that would satisfy the Project need and further minimize environmental impacts and/or improve public health and safety.

The four major route alternatives evaluated and ultimately incorporated into the initial routing for the Project were re-routes around the Borough of Blairsville in Indiana County; around the heavily developed and populated area of Altoona—specifically between the Borough of Cresson, Cambria County and the Township of Frankstown in Blair County; across the U.S. Army Corps of Engineers' Raystown Lake reservoir and associated facilities in Huntington County; and around the heavily developed and populated areas of North Middleton and Mechanicsburg in Cumberland County. Even though these four re-routes deviated from SPLP's existing pipeline right-of-way, these major route alternatives were sited to the extent possible immediately adjacent to and therefore co-located with other existing utility rights-of-way to again avoid and reduce site-specific and cumulative environmental impacts that would have occurred if a new "greenfield" routing was selected.

These four major re-routes are described below.

Blairsville Northern Bypass Alternative

The initial planning route co-located with SPLP's 8-inch pipeline corridor was determined to not be practicable due to obvious constraints and impacts that would occur along an approximately 5-mile-long pipeline segment in Burrell Township, Indiana County. Specifically, the initial planning route would have crossed a heavily developed and populated area including residential, commercial, and recreational uses (i.e., Chestnut Ridge Golf Course, etc.), in the Borough of Blairsville. Appendix A: Figure 1 depicts the initial planning route (co-located with SPLP's 8-inch pipeline corridor and 40-foot-wide maintenance corridor). Accordingly, SPLP evaluated potential major route alternative corridors in this area that would allow co-location with other existing utility or other developed corridors, and avoid potential significant impacts on other (non-wetland) environmental resources and the subject developed and populated area.

The Blairsville Northern Bypass Alternative shifts the Project alignment north of the Borough of Blairsville (Appendix A: Figure 1). This re-route alternative is approximately 5.6 miles long, and would result in an approximately 0.5 mile increase in pipeline length. This route alternative is co-located with existing utility corridors for the majority of its length and to the maximum extent practicable along the subject alignment. This route alternative would avoid the heavily developed and populated area in the Borough of Blairsville, and potential impacts on associated land use, land encumbrance, residential, commercial, and recreational uses. This route

was determined to be practicable with regard to current technology, cost, and logistics, and was selected as the proposed route.

As set forth in Section 5.0, following selection of the Blairsville Northern Bypass Alternative route, SPLP implemented the Management of Change (MOC) Process. In general, implementation of the MOC Process resulted in the evaluation and adoption of minor route variations (see Section 5.1 and Table 3) and trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) permanent palustrine forested (PFO) wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies. Note that Appendix A: Figure 1 depicts the location of field-delineated wetlands along the post-MOC Process route.

Cresson-Altoona Southern Bypass Alternative

The initial planning route co-located with SPLP's 8-inch pipeline corridor was determined to not be practicable due to obvious constraints and impacts that would occur along an approximately 20-mile-long pipeline segment in Cresson and Washington Townships, Cambria County, and Juanita, Allegheny, Blair, and Frankstown Townships, Blair County. Specifically, the initial planning route would have crossed a heavily developed and populated area including extremely congested residential and commercial development in the City of Altoona. Appendix A: Figure 2 depicts the initial planning route (co-located with SPLP's 8-inch pipeline corridor and 40-foot-wide maintenance corridor).

Additionally, the initial planning route would have crossed nearly 4,600 feet of the National Register of Historic Places (NRHP)-listed Allegheny Portage Railroad National Historic Site and paralleled nearly 2,000 feet of the National Historic Landmark (NHL) District - Allegheny Portage Railroad of the Penn Canal (Key 123985). The Allegheny Portage Railroad National Historic Site was designated as a historic site by the Pennsylvania Historical and Museum Commission (PHMC) on April 1, 1947, and designated a NHL District on December 29, 1962. Both resources contain a high archaeological sensitivity for the location of both prehistoric and historic archaeological resources. Although not subjected to a historic resources reconnaissance level survey, both resources also have potential to contain associated aboveground historic resources as well.

Accordingly, SPLP evaluated potential major route alternative corridors in this area that would allow co-location with other existing utility corridors, and avoid potential significant impacts to this developed and populated area, NRHP-listed historic site, and NHL District.

The Cresson-Altoona Southern Bypass shifts the Project alignment to the south of the initial planning route, traverses south of the Borough of Cresson, continues southeast through State Game Lands 198, and then heads east/northeast to connect to the initial planning route near Frankstown Township (Appendix A: Figure 2). This re-route alternative is approximately 20.0 miles long, and would result in an approximately 2.9 mile increase in pipeline length. This route alternative is co-located with existing utility corridors for the majority of its length and to the maximum extent practicable along the subject alignment. This route alternative would avoid the

heavily developed and populated area in the City of Altoona, and potential impacts on associated land use, land encumbrance, residential, commercial, and recreational uses.

This bypass alternative route crosses the NHL District - Allegheny Portage Railroad of the Penn Canal (Key 123985) at Level Road (Cambria County). However, no adverse effects are anticipated for aboveground cultural resources due to the proposed trenchless construction method across Level Road. Furthermore, fieldwork reconnaissance indicated no aboveground indications of the NHL District at this location. No adverse effects to historic resources are anticipated for this area pursuant to field studies undertaken on behalf of SPLP, and, by letter dated July 28, 2016, PHMC concurrence with this recommendation is pending ongoing USACE consultation with other federal agencies. No archaeological resources were identified in this location pursuant to field studies undertaken on behalf of SPLP. No additional archaeological work is recommended for this area, and PHMC concurrence with this recommendation is pending.

This major route alternative avoids the heavily developed City of Altoona and the Allegheny Portage Railroad National Historic Site. Incorporation of this major route alternative avoided potentially significant environmental impacts to the City of Altoona, and specifically to cultural/historic resources in the area. This route was determined to be practicable with regard to current technology, cost, and logistics, and was selected as the proposed route.

As set forth in Section 5.0, following selection of the Cresson-Altoona Southern Bypass route, SPLP implemented the MOC Process. In general, implementation of the MOC Process resulted in the evaluation and adoption of minor route variations (see Section 5.1 and Table 3) and trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) PFO wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies. Note that Appendix A: Figure 2 depicts the location of field-delineated wetlands along the post-MOC Process route.

Raystown Lake Crossing Alternative

The initial planning route co-located with SPLP's 8-inch pipeline corridor was determined to not be practicable due to obvious constraints and impacts that would occur along an approximately 12-mile-long pipeline segment in the vicinity of U.S. Army Corps of Engineers' (USACE's) Raystown Lake and associated federal property in Penn and Union Townships, Huntington County. Specifically, the portion of initial planning route west of Raystown Lake would have crossed two small open water areas at Raystown Lake, which based on engineering review undertaken on behalf of SPLP was recommended for avoidance to minimize the risks associated with flooding during heavy rainfall events, erosion and sedimentation concerns, and potential health and safety impacts for pipeline construction and operation workers. The portion of the initial planning route east of Raystown Lake would have crossed a Raystown Lake Marina (Seven Points) and associated Trail's campground, and involved a longer and non-perpendicular HDD crossing of Raystown Lake. Appendix A: Figure 3 depicts the initial planning route (co-located with SPLP's 8-inch pipeline corridor and 40-foot-wide maintenance corridor).

The Raystown Lake Crossing Alternative route involves two segments of pipeline totaling approximately 11.9 miles, including a reroute of the pipeline to the north of the initial planning route within USACE's Raystown Lake property and parallel to the existing Lancer pipeline corridor, and a reroute to the southeast of the Raystown Lake Marina across the lake to Trough Creek Valley Pike Road (Appendix A: Figure 3). This reroute alternative is approximately 11.9 miles long, and would result in an approximately 0.8 mile increase in pipeline length. This route alternative is co-located with existing utility corridors for the majority of its length and to the maximum extent practicable along the subject alignment. The western segment of the reroute avoids crossings of the two small open water areas at Raystown Lake. The eastern segment of the reroute avoids potential impacts to recreational activities at Raystown Lake, including activities at the Raystown Lake Marina and associated Trail's campground. The southern route also reduces the length of the major HDD crossing of Raystown Lake, as well as avoiding a landowners east of the lake by eliminating the number of parcels required to cross the area. This route was determined to be practicable with regard to current technology, cost, and logistics, and was selected as the proposed route.

As set forth in Section 5.0, following selection of the Raystown Lake Crossing Alternative route, SPLP implemented the MOC Process. In general, implementation of the MOC Process resulted in the evaluation and adoption of minor route variations (see Section 5.1 and Table 3) and trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) PFO wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies. Note that Appendix A: Figure 3 depicts the location of field-delineated wetlands along the post-MOC Process route.

North Middleton/Mechanicsburg Southern Bypass Alternative

The initial planning route co-located with SPLP's 8-inch pipeline corridor was determined to not be practicable due to obvious constraints and impacts that would occur along an approximately 15-mile-long pipeline segment in North Middleton, Middlesex, Silver Spring, Hampden, and Lower Allen Townships, Cumberland County. Specifically, the initial planning route would have crossed a heavily developed and populated area including residential and commercial uses in North Middleton and Mechanicsburg. Appendix A: Figure 4 depicts the initial planning route (co-located with SPLP's 8-inch pipeline corridor and 40-foot-wide maintenance corridor). Accordingly, SPLP evaluated potential major route alternative corridors in this area that would allow co-location with other existing utility or other developed corridors, and avoid potential significant impacts on other (non-wetland) environmental resources and the subject developed and populated area.

The North Middleton/Mechanicsburg Bypass Alternative route involves two segments totaling approximately 15 miles, including a reroute of the pipeline to the north of the initial planning route and parallel to the existing Buckeye pipeline and electric transmission utility lines, and a reroute to the south of the Mechanicsburg area to a crossing of the Pennsylvania Turnpike to reconnect with the existing SPLP maintenance corridor before Rossmoyne Road (Appendix A: Figure 4). This re-route alternative is approximately 15.8 miles long, and would result in an

approximately 0.5 mile increase in pipeline length. This route alternative is co-located with existing utility corridors for the majority of its length and to the maximum extent practicable along the subject alignment. In both segments, the reroute parallels existing utility corridors to avoid heavily developed and congested residential and commercial areas in North Middleton and in the Mechanicsburg area. In addition to avoidance of these constructability constraints and properties, this reroute avoided areas that were congested with existing pipelines, power lines, and drainage systems, paralleling the Pennsylvania Turnpike for approximately 2 miles. This route was determined to be practicable with regard to current technology, cost, and logistics, and was selected as the proposed route.

As set forth in Section 5.0, following selection of the North Middleton/Mechanicsburg Bypass Alternative route, SPLP implemented the MOC Process. In general, implementation of the MOC Process resulted in the evaluation and adoption of minor route variations (see Section 5.1 and Table 3) and trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) PFO wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies. Note that Appendix A: Figure 4 depicts the location of field-delineated wetlands along the post-MOC Process route.

Major Route Alternative Conclusion

Using the initial routing along SPLP's existing pipeline right-of-way, modified by the above four major re-routes which avoided obvious community, cultural, and natural resource impacts while also being co-located adjacent to other existing utility corridors to the maximum extent practicable, a Project alternative (Baseline Route Alternative) was developed to be used for comparison purposes for further route and design modifications.

The Baseline Route Alternative is co-located with other existing utility corridors for over 80 percent of its length.

3.4 BASELINE ROUTE ALTERNATIVE

The Baseline Route Alternative achieved the objectives and need for the Project, while maximizing the use of opportunities to co-locate (abut and overlap) its right-of-way with existing SPLP right-of-way and co-locate (abut) its right-of-way with other existing utility rights-of-way, avoiding potential significant impacts on other non-wetland environmental resources, allowing for feasible pipeline construction, and reducing engineering constraints. The Baseline Route Alternative established the baseline against which additional measures to avoid and minimize wetland impacts were considered.

The Baseline Route Alternative incorporated SPLP's baseline preferred approach to optimize pipeline and station construction and operation, including:

- Co-location (abut and overlap) with SPLP's existing pipeline right-of-way to the maximum extent practicable;
- Use of a 100-foot-wide pipeline construction right-of-way along the entire length of the pipeline route; and

- Use of the conventional wet open cut construction method across all wetlands and waterbodies (see Section 5.3).

It is important to note that use of wet open trench installation method is an industry-standard construction method for pipeline crossings of wetlands and waterbodies. For instance, the wet open trench installation method is identified as an available best management practice by the Federal Energy Regulatory Commission (FERC) for FERC-regulated interstate natural gas pipeline projects, via application of the FERC's *Wetland and Waterbody Construction and Mitigation Procedures* (FERC 2013). See also *Research of Wetland Construction and Mitigation Activities for Certificated Section 7(c) Pipeline Projects* (FERC 2004).

Wet open trench pipeline crossings of wetlands and waterbodies typically result in the shortest construction duration (24 hours for "minor waterbodies" less than or equal to10 feet wide, and 48 hours for "intermediate waterbodies" greater than 10 feet but less than or equal to 100 feet wide) and typically result in only temporary and minor impacts on wetlands and waterbodies.

As set forth on Table 1, the Baseline Route Alternative would have required the clearing, grading, excavation, and disturbance of approximately 118.9 acres of wetlands and approximately 124,570 linear feet of stream crossings (linear length of stream in the construction right-of-way) using conventional (wet open cut installation) construction techniques throughout its entire length. As noted above, the Baseline Route Alternative was used as a baseline for comparison with other site-specific modifications to the Project.

As set forth in the Alternatives Analysis presented herein, Table 1 presents a summary of the Project-wide reduction in total impacts to wetlands and waterbodies through the Project development process from the Baseline Route Alternative to the Proposed Route Alternative. This includes total impact reduction to EV wetlands (the number crossed and areal extent [acreage] within the construction right-of-way [CROW]), other wetlands (areal extent [acreage] within the CROW), all wetlands Project-wide (areal extent [acreage] within the CROW), PFO wetlands (areal extent [acreage] within the CROW), High Quality (HQ) and Exceptional Value (EV) streams (linear footage within the CROW), and Non-HQ and EV streams, or "other" streams (linear footage within the CROW). The stages of the Project development process presented include:

- Baseline Route Alternative – presents the total impact along the Baseline Route Alternative described above.
- Narrowed ROW at Wetlands and Waterbodies – presents the total impact along the Baseline Alternative Route, but including adoption of narrowing the construction ROW at wetland and waterbody crossings from 100-feet wide to 50-feet wide.
- Proposed Route Alternative – presents the total impact along the Proposed Route Alternative, including the adoption of Minor Route Variations and Trenchless Construction Methods
- Cumulative Impact Reduction – presents the total (cumulative) reduction in impact from the Baseline Route Alternative to the Proposed Route Alternative, based on quantitative (i.e., areal extent and linear footage) and percentage impact reduction.

As set forth more fully below, SPLP evaluated alternative routings and design techniques to further identify reductions to wetland impacts.

Table 1. Summary of Project Wide Wetland and Waterbody Impact Reduction from Baseline Route Alternative to Proposed Route Alternative

Resource	Baseline Route Alternative	Narrowed ROW at Wetlands and Waterbodies	Proposed Route Alternative[1]	Cumulative Impact Reduction	Cumulative Impact Reduction (%)
EV Wetlands (number crossed)	181	168	139	42	23.2
EV Wetlands Total (acres)	32.1	17.5	11.2 (10.6)	20.9 (21.5)	65.1 (67.0)
Other Wetlands Total (acres)	86.8	48.1	25.5 (23.3)	61.3 (63.5)	70.6 (73.2)
Project-Wide Wetland Total (acres)	**118.9**	**62.2**	**36.7 (33.9)**	**82.2 (85.0)**	**69.1 (71.5)**
PFO Wetlands Total (acres)	**35.2**	**11.7**	**1.6 (0.6)**	**33.7 (34.6)**	**95.7 (98.3)**
HQ and EV Streams Total (linear feet)	35,031	17,936	14,409	20,622	58.9
Non-HQ and EV Streams Total (linear feet)	89,539	45,923	38,722	50,817	56.8
Project-Wide Stream Total (linear feet)	**124,570**	**63,859**	**52,131**	**71,439**	**57.3**

Notes:
[1] Impact acreages based on PADEP and USACE Bore/HDD calculations (provided in parenthesis). PADEP calculates permanent disturbance impacts at Bore and HDD crossings based on the width of the pipelines (3-feet) multiplied by the length of the wetland crossing; USACE does not calculate impact acreages for Bore and HDD crossings. However, wetlands crossed via Bore or HDD may have USACE impacts due to travel lanes or clearing.

4.0 WATER DEPENDENCY OF PROJECT

Constructing and operating a natural gas liquids pipeline is not, per se, a water-dependent project. However, because of Pennsylvania's abundant water and wetland resources, any project which travels approximately 300 miles east-west across the Commonwealth requires the crossing of, and therefore access to, waters and wetlands. The Project requires access and proximity to and siting in, on, over or under waters and wetlands in order to achieve its primary purpose to transport natural gas liquids from Houston, Washington County to SPLP's existing facility in Marcus Hook, Delaware County. Therefore, the linear nature and approximately 300 mile length of the Project across 17 counties east-west in Pennsylvania makes the Project water-dependent.

As demonstrated by the following sections, SPLP has avoided and minimized potential impacts to waters and wetlands from the Project. In so doing, the analysis set forth herein concludes that there is no practicable alternative to each of the crossings to waters and wetlands that would have less effect on each water or wetland, and not have other significant adverse effects on the environment, taking into consideration construction costs, existing technology and logistics.

5.0 MEASURES TAKEN TO AVOID AND MINIMIZE HARM TO WETLANDS AND WATERBODIES TO THE MAXIMUM EXTENT PRACTICABLE

Establishment of Engineering and Environmental Survey Corridor

The Baseline Route Alternative established the centerline for a 200-foot-wide engineering, land use, biological, wetland, waterbody, and cultural resource survey corridor in which to investigate minor route variations and construction techniques to further minimize environmental impacts from the Project. This 200-foot-wide survey corridor was considered a reasonable width along the Baseline Route Alternative to perform detailed and site-specific field studies to develop additional improvements to the Project to minimize environmental impacts, as well as assess Project practicability with regard to current technology, cost, and logistics. This survey corridor width allows for flexibility in considering potential application of detailed, site-specific trenchless construction methods (conventional bore and horizontal directional drilling [HDD] techniques) along with minor pipeline route variations (realignments).

In addition to the information collected during field surveys, existing publicly-available data were also reviewed, including but not necessarily limited to aerial photography, topographic maps, National Wetland Inventory (NWI) maps, and U.S. Geological Survey quadrangle maps. All of this information was incorporated into a Project-specific geographic information system geo-database to be used for route analysis.

Consideration of Impacts Beyond Survey Corridor

By definition, because the Baseline Route Alternative is co-located (abuts and overlaps) with the existing SPLP pipeline right-of-way and co-located (abuts) with other existing utility rights-of-way to the maximum extent practicable, any minor route variation that diverges from the Baseline Route Alternative would violate the co-location principle, as well as potentially result in increased impacts on other (non-wetland) environmental resources, suboptimal pipeline construction, suboptimal pipeline operation, and increased construction cost, as described below.

Increased Site-specific and Cumulative Environmental Impact

State and federal guidelines strongly recommend routing new linear projects in co-location with existing utility rights-of-way to the maximum extent practicable. These guidelines recognize that new "greenfield" routing of linear projects has the potential to result or results in increased site-specific and cumulative environmental impacts. These increased impacts may include, but are not necessarily limited to the following:

- increased amount of new, permanent land disturbance and encumbrance on existing industrial and commercial development and associated land uses;
- increased amount of new, permanent land disturbance on existing private residential development, private land uses, and affected private landowners;
- permanent reduction in availability of land for future development;
- inconsistency with county comprehensive plans;

- increased amount of new, permanent land disturbance and landscape fragmentation, including impairment of natural landscapes, scenic uses, recreational uses, contiguous forested lands, and contiguous natural resources;
- increased amount of new, permanent forested land fragmentation, including impairment of forested ecosystem functions and values, watershed/water quality values, and availability of contiguous forest habitat for interior wildlife species and migratory birds protected pursuant to the Migratory Bird Treaty Act;
- permanent reduction in availability of land for future natural resource uses, including natural landscapes, scenic uses, recreational uses, forested lands, forest production, and other natural resources;
- increased potential to effectuate a cumulative impact on land use planning, land fragmentation, forest fragmentation, and natural resource fragmentation.

Suboptimal Pipeline Construction and Operation and Increased Cost

On a site-specific basis, and on a cumulative basis across the entire Project, increasing the length and changing the location of the pipeline to further avoid or minimize minor and temporary impacts on individual wetlands via realignment partially or entirely outside the survey corridor results in suboptimal pipeline construction, suboptimal pipeline operation, and increased pipeline construction and operation costs.

With the use of current technology, the subject pipeline realignments on a site-specific and cumulative basis potentially jeopardizes Project practicability with regard to logistics, including but not necessarily limited to suboptimal pipeline construction and/or operation process, safety, access, efficiency, and duration; as well as increased construction and operation costs. This may include, but is not necessarily be limited to, the following considerations:

- In some cases, realignment to avoid or minimize the areal extent of impacts on wetlands may necessarily realign the pipeline route across less favorable terrain and result in more complex construction. For instance, pipeline construction on side slopes or across steep ravines is more difficult than along more level terrain. This affects the construction process by extending the duration of pipeline construction and reducing pipeline construction efficiency, results in concern regarding safe access and working conditions for equipment and personnel, and increases construction cost due to the increased duration of the overall Project construction schedule.

- Cumulatively, deviation from co-location with existing SPLP pipelines increases the length of the pipeline, right-of-way, and equipment and personnel access ways, and thus increases the associated effort, duration, and cost of pipeline monitoring and maintenance activities. These activities include, but are not necessarily limited to, right-of-way vegetation maintenance, aerial inspection, ground inspection, in-line inspection, corrosion protection, anomaly detection, and pipeline repair and maintenance to ensure pipeline safety and integrity during the life of pipeline operations.

- Cumulatively, this also includes increased effort, duration, and cost of pipeline operations responding to third-party One Call requests and potential pipeline and right-of-way encroachment by third-party activities. For similar reasons stated above for pipeline monitoring and maintenance, this results in suboptimal pipeline operation and maintenance process, access, efficiency, and duration; as well as increased cost, to ensure pipeline safety and integrity during the life of pipeline operations.

- Cumulatively, a significant increase in pipeline length results in increased energy inputs to transport the NGL product. This may include, but is not necessarily limited to, increased pump station horsepower capacity, energy use, and energy cost during the life of pipeline operations.

- Cumulatively, an increased construction cost related to the direct cost of additional materials (e.g., pipe length, pipe bends), construction logistics (e.g., equipment mobilization and access, material transport and delivery), construction labor, and construction duration.

As a conservative estimate of the increased cost associated with the subject pipeline realignments on a site-specific and cumulative basis, Table 2 presents the additional direct cost of materials (based on additional pipeline length and additional pipe bends required to construct an average individual pipeline realignment) and increased cost of construction labor (for pipe bends only) for the 20-inch pipeline. As set forth in Table 2, it is estimated that adoption of minor route variations that diverge from the Baseline Route Alternative would increase the pipeline construction cost on a site-specific ($48K) and cumulative ($24.3M) basis for the 20-inch-diameter pipeline; increased costs would be similar for the 16-inch-diameter pipeline.

Table 2. Comparison of Site-Specific and Cumulative Pipeline Construction Cost for Average Trenching-Proposed and Trenching-Alternative Routes on the Project (20-inch-diameter Pipeline)

Trenching Route Alternative	Pipe Length (feet)	Total Installed Pipe Cost[1] ($K)	Additional Pipe Bend Cost ($K)	Increased Pipe Bend Labor Cost ($K)	Total Cost ($K)	Cost Increase ($K)
Average[2] Individual Site-Specific Realignment						
Trenching-Proposed Route	880	$288	-	-	$288	-
Trenching-Alternative Route	1,010	$330	$5.5	$22	$358	**+$48**
Cumulative[3] Project Realignment						
Trenching-Proposed Route	307,120	100,512	-	-	100,512	-
Trenching-Alternative Route	352,490	115,170	1,920	7,678	124,861	**+$24,349**

[1] Estimated total installed cost of 20-inch-diameter pipeline is $327 per linear foot of pipe.
[2] For the Project, the average length of an individual Crossing Area, not included as part of an adopted Management of Change (MOC) Process pipeline realignment, designed to potentially further avoid or minimize the areal extent of impacts on wetlands.
[3] For the Project, a total of 349 individual Crossing Areas, not included as part of an adopted Management of Change (MOC) Process pipeline realignment, are presented and analyzed in this Alternatives Analysis.

The above-described considerations demonstrate that minor route variations that diverge from the Baseline Route Alternative, which was co-located with existing utility rights-of-way to

reduce environmental impacts, result in site-specific and cumulative suboptimal pipeline construction and operation, increased construction cost, and increased operation costs for the life of pipeline operations. Accordingly, unless required to allow feasible and practicable pipeline and station construction and operation, were generally considered reasonable and practicable if the minor route variation further avoided or minimized potential significant impacts on wetland and/or other (non-wetland) environmental resources.

Management of Change (MOC) Process

Following establishment of the Baseline Route Alternative and associated 200-foot-wide survey corridor, SPLP conducted an integrated and detailed evaluation of the Baseline Route Alternative, which was labeled the Management of Change (MOC) Process. The MOC Process considered opportunities to change the Baseline Route Alternative to further avoid and minimize potential environmental impacts, while simultaneously considering potential construction and operational constraints presented by affected landowners, existing land uses, infrastructure obstacles, and other factors affecting use of existing technology, cost, and logistics.

The MOC Process was initiated on a site-specific basis as opportunities or constraints were raised by an Integrated Project Team. The Integrated Project Team consisted of representatives from SPLP project management, engineering, land/right-of-way, and environmental specialists. Any member of the Integrated Project Team that identified an opportunity or constraint along the Baseline Route Alternative route then raised the subject issue to the rest of the team for consideration of a minor route variation or trenchless construction method. Thus, any type of opportunity or constraint – practicability, constructability, engineering design, landowner concerns, land use, environmental impacts, or any other relevant concern – could initiate the MOC Process.

Upon initiation of the MOC Process, each member of the Integrated Project Team was engaged and solicited for input on the subject alternative minor route variation or trenchless construction method (i.e., conventional bore or HDD) under consideration. The Integrated Project Team then worked together to review, consider, and provide subject matter expertise regarding the feasibility and practicability of the potential change with regard to each area of expertise – design requirements, land constraints, environmental resources, existing technology, cost, and logistics. Approval from each member of the Integrated Project Team, including environmental, was required in order to adopt the suggested change. By definition, each adopted change was determined to avoid significant impacts on other (non-wetland) environmental resources, to avoid and minimize impacts on wetlands to the maximum extent practicable, and to be practicable (feasible, constructible, operable) with regard to current technology, cost, and logistics.

Implementation of this MOC Process resulted in the evaluation and adoption of 72 minor route variations (see Section 5.1 and Table 3) and a significant number of trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) PFO wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies.

5.1 MINOR ROUTE VARIATIONS

SPLP implemented the MOC Process to evaluate the entire Baseline Route Alternative using the detailed, site-specific engineering, land use, biological, wetland, waterbody, and cultural resource data collected within the 200-foot-wide survey corridor to consider potential alternatives to co-locating with existing pipeline and other utility rights-of-way for construction and operation of the pipeline. This evaluation included an assessment of the practicability of the Baseline Route Alternative with regard to constraints to Project construction and operation in consideration of existing technology, cost and logistics. This evaluation also included an assessment of all wetlands, as well as waterbodies, to be crossed, including consideration of exceptional value designation, the areal extent of potential impacts, the functions and values of the wetlands, and unique functions and values of the wetlands. This evaluation also considered the presence and potential impacts on other (non-wetland) significant federal and state lands or sensitive environmental resources.

Based on this evaluation (the MOC Process), SPLP developed, assessed, and adopted a total of 72 minor route variations to the Baseline Route Alternative that avoided or minimized impacts on other (non-wetland) environmental resources, including potential significant impacts, and wetlands and waterbodies. Table 3 presents for each of these minor route variations the county, location, length, and other significant and/or sensitive resources avoided, as well as breakdown of total impact change (compared to the Baseline Route Alternative route) to wetlands and waterbodies.

Cumulatively, compared to the Baseline Route Alternative, the adoption of the minor route variations presented in Table 3 illustrates the avoidance of impacts to significant other (non-wetland) environmental resources. As a result of this effort to first avoid impacts to significant other (non-wetland) environmental resources, in some cases at individual crossings (or cumulatively for HQ and EV streams) the net impact to wetlands and waterbodies increased. Table 3 illustrates the individual crossing area, county-specific, and Project-wide avoidance and minimization of impacts to wetlands and waterbodies. Specifically, the adoption of the subject 72 minor route variations results in significant cumulative impact avoidance and reduction to Exceptional Value (EV) Wetlands (9.33 acres), Other Wetlands (16.05 acres), PFO wetland conversion (9.26 acres), HQ/EV Waterbodies (an increase of 1,103 linear feet), and other waterbodies (6,207 linear feet).

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide

MOC ID	Location Coordinates		Length (miles)	Crossing Method	Crossing Areas	Significant Resource Impact Avoided[1,2]	EV Wetland Impact Reduction (acres)	Other Wetland Impact Reduction (acres)	PFO Conversion Impact Reduction (acres)	HQ and EV Stream Impact Reduction (linear feet)	Other Stream Impact Reduction (linear feet)
	Start	End									
Washington County											
S1B-0001	40.2370, -80.1833	40.2359 -80.1707	0.88	Open Cut	-	Commercial Development	-	-	-	-144	-
						Subtotal	-	-	-	-144	-
Allegheny County											
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
						Subtotal	n/a	n/a	n/a	n/a	n/a
Westmoreland County											
S2-0103-E-Rev5[1]	40.4437, -79.3250	40.4447, -79..3057	0.85	Open Cut/ HDD	CA-073	Commercial Development	-	2.88	0.85	-	-142
S2-0067-Rev 2	40.4449, -79.3035	40.4456 -79.2968	0.36	HDD	CA-074	-	-	0.66	0.43	-	72
S2-0049-AP	40.4297, -79.5129	40.4305, -79.5082	0.43	Open Cut	CA-050	Residential Development	-	-0.25	-	-98	138
S2-0052-Rev2-AP	40.425, -79.5429	40.4251, -79.5379	0.36	Open Cut	-	Residential Development	-	0.08	-	-57	-
S2-0062-AP	40.4337, -79.4902	40.4346, -79.4860	-	Open Cut	-	Residential Development	-	-	-	-	167
S2-0078-AP	40.4272, -79.5616	40.4268, -79.5572	0.27	Open Cut	-	-	-	0.20	0.20	-	1
						Subtotal	-	3.57	1.48	-155	236
Indiana County											
S2-0077-Rev2	40.4521, -79.2643	40.4533, -79.2478	0.88	Open Cut	CA-078 CA-079	-	-	0.01	-	-	38
S2-0034-Rev2	40.4328, -79.0695	40.4325, -79.0655	0.28	HDD	CA-098 CA-099	Cemetery	-	<0.01	-	-	50
S2-0102-AP	40.4321, -78.9677	40.4308, -78.9638	0.26	Open Cut	CA-115	Cemetery	0.02	-	-	-98	-11
S2-0074-Rev3-AP	40.4464, -79.2913	40.4490, -79.2826	0.49	Open Cut	CA-075 CA-076	Commercial Development	-	0.14	0.01	50	-
S2-00017-AP	40.4311, -79.0282	40.4308, -79.0247	0.22	Open Cut	CA-106	Residential Development	-0.02	-	-	-	-50

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide											
MOC ID	**Location Coordinates**		**Length (miles)**	**Crossing Method**	**Crossing Areas**	**Significant Resource Impact Avoided[12]**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
	Start	**End**									
S2-0026-Rev2-AP	40.4311, -78.9884	40.4321, -78.9677	1.24	Open Cut	CA-112 CA-113 CA-114	Residential Development	-0.12	-0.02	-0.02	-60	-166
S2-0063-AP	40.4307, -78.9969	40.4308, -78.9912	0.39	Open Cut	CA-111	Residential Development	-0.12	-	-	-219	-
S2-0069-AP	40.4520, -79.2179	40.4500, -79.2089	0.59	HDD	-	-	-	0.24	-	-	127
S2-0095-AP	40.4522, -79.2703	40.4529, -79.2668	0.22	Open Cut	-	-	-	-	-	-	-166
						Subtotal	-0.24	0.37	-0.01	-327	-178
Cambria County											
S2-005	40.4506, -78.6079	40.4461, -78.6079	0.81	HDD	-	Residential Development	-	1.05	0.58	-	52
S2-0073-AP[2]	40.4265, -78.5818	40.4077, -78.5543	2.01	Open Cut/ HDD	CA-177 CA-178 CA-179 CA-180 CA-183 CA-185	-	1.10	0.95	0.28	1	1012
S2-0010-Rev2-AP	40.4526, -78.6565	40.4527, -78.6523	0.25	Open Cut	CA-159	Residential Development	-	-0.02	-	-	-
S2-0042-Rev2-AP[3]	40.4452, -78.601	40.4307, -78.5854	1.68	Open Cut	CA-170 CA-171 CA-172 CA-173 CA-174	-	-	0.58	<0.01	-	126
S2-0051-Rev2-AP	40.4306, -78.5853	40.4287, -78.5826	0.24	Open Cut	CA-175	-	-	<0.01	-	-	-
						Subtotal	1.10	2.56	0.86	1	1,190
Blair County											
S2-0070-AP	40.4302, -78.2833	40.4323, -78.2806	0.22	Open Cut	-	State Game Land 147	0.12	-	0.12	-	122
S2-0094-E-AP	40.4027, -78.5443	40.0225, -78.5410	0.18	Open Cut	-	T&E Species	-	-	-	-	-

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide											
MOC ID	**Location Coordinates**		**Length (miles)**	**Crossing Method**	**Crossing Areas**	**Significant Resource Impact Avoided[12]**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
	Start	**End**									
S2-0104-AP	40.4308, -78.3375	40.4353, -78.3342	0.41	Open Cut/ Bore	-	-	0.68	-	0.30	1	52
S3 - 0002[4]	40.4339, -78.3339	40.4477, -78.3213	1.277	HDD	CA-202 CA-204 CA-205 CA-206	-	1.57	<0.01	0.47	3	236
S2-0029-AP	40.4073, -78.4661	40.4089, -78.4547	0.7	HDD/ Open Cut	-	Commercial Development	-	-	-	-	-107
S2-0048-AP[5]	40.4375, -78.3013	40.4355, -78.2784	1.6	HDD/ Open Cut	CA-209	-	-0.04	0.09	0.05	-38	-20
						Subtotal	2.33	0.09	0.95	-34	283
Huntingdon County											
S2-0033-Rev2-AP	40.3256, -77.8101	40.3242, -77.8048	0.33	Open Cut	-		-	0.01	-	-	-
S2-0058-Rev3-AP[6]	40.4046, -78.1646	40.3980, -78.1480	1.28	Open Cut	CA-215 CA-216	Residential Development	-	-0.03	-	-	931
S2-0089-AP	40.3435, -77.8559	40.3426, -77.8509	0.27	HDD	-		-	-	-	-	158
S2-0092-E-AP	40.3173, -77.7700	40.3164, -77.7654	0.30	Open Cut	-		-	-	-	-	-
S2-0106-AP	40.3426, -77.8509	40.3419, -77.8492	0.13	Open Cut	-		-	-	-	-	26
S2-0014-AP[7]	40.3723, -78.0724	40.3515, -77.9727	5.61	HDD/ Open Cut	CA-220 CA-221 CA-222 CA-223 CA-224 CA-225 CA-226	-	-	0.78	-	-	-145
S2-0057-AP	40.3407, -77.8954	40.3411, -77.8912	0.23	Open Cut	-	Residential Development	-	-	-	-	-21
S2-0044-Rev3-AP[8]	40.3964, -78.1440	40.3791, -78.0793	4.09	HDD/ Open Cut	CA-218 CA-219	Residential, Commercial Development	-	-0.22	0.06	-	192
						Subtotal	-	0.53	0.06	-	1,141

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide											
MOC ID	**Location Coordinates**		**Length (miles)**	**Crossing Method**	**Crossing Areas**	**Significant Resource Impact Avoided[12]**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
	Start	**End**									
Juniata County											
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
						Subtotal	n/a	n/a	n/a	n/a	n/a
Perry County											
S2-0093-E-AP	40.2658, -77.5041	40.2654, -77.5024	0.11	Open Cut	-	T&E Species	-	-	-	-	-
S3-007	40.2696, -77.5179	40.2656, -77.5039	0.79	Open Cut	-	T&E Species	0.10	0.09	-	-152	11
S2-0109-AP	40.2738, -77.5410	40.2733, -77.5382	0.17	Open Cut		Cultural Site	-	-	-	-73	-
						Subtotal	0.10	0.09	-	-225	11
Cumberland County											
S2-0065-AP	40.2288, -77.1382	40.2284, -77.1303	0.11	Open Cut	-	Cemetery	0.11	-	0.05	-	-
S2-0037-Rev3-AP	40.2407, -77.2247	40.2403, -77.2192	0.30	Open Cut	CA-316	Residential Development	0.25	-	0.10	-	-8
S2-0040-Rev2-AP	40.2405, -77.1815	40.2372, -77.1646	0.98	Open Cut/ HDD	CA-323 CA-325	Cultural Site, CNHI Supporting	0.15	2.74	1.31	-	344
S2-0043-Rev3-AP	40.2351, -77.1515	40.2287, -77.1449	0.64	Open Cut	-	-	-	0.11	0.09	-	3
S2-0085-L-AP	40.2423, -77.2901	40.2421, -77.2868	0.22	Open Cut	CA-308	-	-	0.10	-	-	-
S2-0003-AP	40.237, -77.1631	40.2361, -77.1566	0.36	Open Cut	-	-	-	-	-	-	-22
S2-0005-AP	40.2426, -77.3136	40.2424, -77.3066	0.44	Open Cut	-	Residential Development	-	0.01	-	-	-24
S2-0039-AP	40.2435, -77.2076	40.2440, -77.1944	0.74	Open Cut	CA-317 CA-318 CA-319 CA-320	-	0.02	0.03	0.02	-	125
S2-0072-AP	40.1973, -76.9901	40.1971, -76.9596	1.63	Open Cut	CA-329 CA-330	Commercial Development	0.02	0.01	-	-	300

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide											
MOC ID	**Location Coordinates**		**Length (miles)**	**Crossing Method**	**Crossing Areas**	**Significant Resource Impact Avoided[12]**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
	Start	**End**									
S2-0097-AP	40.2202, -77.0971	40.2138, -77.0784	1.27	Open Cut	CA-328	-	-	0.05	-	-	-50
						Subtotal	0.56	3.04	1.56	-	668
York County											
S3-0053-Rev2-AP[9]	40.1924, -76.8661	40.1920, -76.8515	0.83	Open Cut	-	Residential Development	-	-	-	-	62
S2-0041-AP	40.1949, -76.8113	40.2035, -76.7819	1.67	HDD/ Open Cut	-	Cultural Site - Avoided	-	1.04	0.97	-	287
S2-0002-Rev2	40.1920, -76.8209	40.1950, -76.8114	0.68	HDD/ Open Cut	CA-337 CA-338 CA-339 CA-340	-	-	-0.06	-	-	-240
						Subtotal	-	0.98	0.97	-	109
Dauphin County											
S3-0002-Rev 2-AP	40.2219, -76.7155	40.2228, -76.7112	0.24	HDD	-	-	-	0.04	-	-	81
S3-0036-Rev5-AP	40.2062, -76.7683	40.2080, -76.7666	0.16	Open Cut	CA-341	-	-	-0.08	-0.08	-	-30
S3-0005-Rev2-AP	40.2487, -76.6123	40.2505, -76.6054	0.4	Open Cut	-	Commercial, Residential Development	-	0.07	-	-	216
						Subtotal	-	0.03	-0.08	-	267
Lebanon County											
S3-0006-AP	40.2867, -76.3326	40.2860, -76.3276	0.29	HDD	-	Commercial Development	0.31	-	-	-	188
						Subtotal	0.31	-	-	-	188
Lancaster County											
S3-0043-Rev2-AP	40.2858, -76.2286	40.2842, -76.1819	2.69	Open Cut/ HDD	CA-376	Cultural Site – HDD, Commercial Development	2.45	1.06	0.32	-52	363
						Subtotal	2.45	1.06	0.32	-52	363

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide

MOC ID	Location Coordinates		Length (miles)	Crossing Method	Crossing Areas	Significant Resource Impact Avoided[12]	EV Wetland Impact Reduction (acres)	Other Wetland Impact Reduction (acres)	PFO Conversion Impact Reduction (acres)	HQ and EV Stream Impact Reduction (linear feet)	Other Stream Impact Reduction (linear feet)
	Start	End									
Berks County											
S3-0045-AP	40.2813, -76.0283	40.2793, -76.0272	0.15	Open Cut	CA-396	-	-	0.07	-	-	21
S3-0046-AP	40.2766, -76.0222	40.2772, -76.0202	0.13	HDD	-	-	-	-	-	-	-
S3-0050-Rev4-AP[10]	40.3155, -76.0405	40.3077, -76.0301	0.90	Open Cut	-	Commercial Development	-	-	-	-	569
S3-0058-AP	40.1703. -75.8636	40.1666, -75.8579	0.40	HDD	CA-411	-	-	1.01	0.43	-	455
S3-0070-AP	40.1886, -75.8933	40.1767, -75.8747	1.64	Open Cut/ Bore	-	Cultural Site - Avoided	0.03	0.97	0.53	-	159
S5-001-Rev2	40.2583, -75.9932	40.2543, -75.9893	0.41	Open Cut/ Bore/ HDD	CA-400	-	0.90	-	0.43	-49	81
S3-0065-AP	40.2876, -76.0318	40.2912, -76.0292	0.31	Open Cut	-	Landfill	0.03	-	-	-	-95
						Subtotal	0.96	2.04	1.39	-49	1,190
Chester County											
S3-0072-AP	40.0916, -75.7342	40.0861, -75.7235	0.86	HDD	CA-423	T&E Species, Marsh Creek State Park	1.52	-	0.93	-49	95
						Subtotal	1.52	-	0.93	-49	95
Delaware County											
S3-0026-AP	39.8478, -75.4058	39.8525, -75.4022	0.44	HDD	-	Commercial Development	-	0.95	0.61	-	-
S3-0055-AP	39.9135, -75.4574	39.9083, -75.4500	0.64	Open Cut	CA-429	Wastewater Plant	0.50	-	0.07	-99	135
S3-0066-AP	39.8065, -75.4019	39.8549, -75.3955	0.44	HDD	-	-	-	0.05	-	-	386
S3-0068-AP	39.9407, -75.4955	39.9397, -75.4917	0.21	HDD	-	-	0.30	-	0.12	-	261
S6-029	39.8445, -75.4178	39.8478, -75.4058	0.74	HDD/ Open Cut	CA-432	Industrial Development	-	0.45	0.04	-	169

Table 3. Summary of Minor Route Variation Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide

MOC ID	Location Coordinates		Length (miles)	Crossing Method	Crossing Areas	Significant Resource Impact Avoided[12]	EV Wetland Impact Reduction (acres)	Other Wetland Impact Reduction (acres)	PFO Conversion Impact Reduction (acres)	HQ and EV Stream Impact Reduction (linear feet)	Other Stream Impact Reduction (linear feet)
	Start	End									
S6-074-Rev1	39.8745, -75.4124	39.8729, -75.4124	0.15	Open Cut	-	-	-	0.02	-	-	-46
S3-0067-AP	39.8729, -75.4124	39.8669, -75.4082	0.49	Open Cut/ HDD	-	-	-	-	-	-	185
S3-0001[11]	39.9203, -75.4635	39.8445, -75.4177	7.70	HDD/ Open Cut	CA-429 CA-432 CA-433	Municipal Congestion	-0.56	0.21	-	30	-446
						Subtotal	0.24	1.68	0.84	-69	644
						Project-Wide Total	**9.33**	**16.05**	**9.26**	**-1,103**	**6,207**

Notes:
All individual and aggregate acreage values are rounded to the nearest hundredth of an acre, such that county subtotals and the Project-Wide total may not necessarily equal the sum of the individual rounded values presented.

[1] Includes MOC S2-0001.
[2] Includes MOC S2-0101-AP.
[3] Includes MOC S2-0081-L-AP.
[4] Includes MOC S2-0105-AP.
[5] Includes MOC S2-0070-AP.
[6] Includes MOC S3-009.
[7] Includes MOC S2-0084-L-AP.
[8] Includes MOC S3-0102.
[9] Includes MOC S2-0096-L-AP.
[10] Includes MOC S5-003.
[11] Includes MOCs S3-0055-A.P, S3-0067-AP, S3-0066-AP, S3-0026-AP, S6-029, and S3-074-Rev1.
[12] CNHI Supporting = Supporting Landscape of Natural Heritage Areas identified through the County Natural Heritage Inventory (CNHI) project of the Pennsylvania Natural Heritage Program.
T&E Species = Federally- or state-listed threatened and endangered species habitat.T&E Species = Federally- or state-listed threatened and endangered species habitat.

5.2 TRENCHLESS CONSTRUCTION METHODS

SPLP also evaluated the entire Baseline Route Alternative using the detailed site-specific engineering, land use, biological, wetland, waterbody, and cultural resource data collected within the 200-foot-wide survey corridor to determine whether there were potential practicable alternatives to the open cut installation of the pipeline, considering existing technology, construction cost and logistics. This evaluation included an assessment of all wetlands and waterbodies to be crossed, including consideration of the extent of potential impacts, the functions and values of the wetlands, unique functions and values of the wetlands, and other (non-wetland) significant federal and state lands or important environmental resources that could be impacted.

As described more fully in the "Impact Avoidance, Minimization and Mitigation Procedures" which are part of the permit application for the Project (Attachment 11: Enclosure E, Part 4), based on existing technology there are two primary trenchless construction measures that were evaluated and frequently proposed for use in areas where wetlands needed to be crossed. These trenchless construction measures are as follows:

- Horizontal Directional Drilling (HDD)
- Conventional Bore

Based on this evaluation, SPLP developed, assessed, and adopted a significant number of trenchless crossings (in place of conventional open cut or trenched crossings) using either conventional bore or HDD construction methods. Across the Project, SPLP adopted a total of 554 conventional bore crossings (304 on the 20-inch pipeline and 250 on the 16-inch pipeline) and a total of 237 HDD crossings (132 on the 20-inch pipeline and 105 on the 16-inch pipeline).

A significant number of these trenchless crossings were specifically designed to avoid impacts on other (non-wetland) environmental resources, and further avoid or minimize impacts to wetlands and waterbodies. For each of these trenchless crossings, Table 4 presents the county, location, proposed trenchless crossing method, and resources avoided, including a breakdown of total impact reduction (compared to the conventional open trenching installation method) to wetlands and waterbodies.

As requested by PADEP, SPLP separately conducted a *Trenchless Construction Feasibility Analysis*, which is provided as Appendix B.

Cumulatively, compared to the Baseline Route Alternative, the adoption of the trenchless construction methods presented in Table 4 illustrates the avoidance of impacts to significant other (non-wetland) environmental resources, and the further avoidance and minimization of impacts to wetlands and waterbodies. Specifically, the adoption of these conventional bores and HDDs results in significant cumulative impact avoidance and reduction to EV Wetlands (9.78 acres), Other Wetlands (22.34 acres), PFO wetland conversion (13.24 acres), HQ and EV Waterbodies (1,656 linear feet), and other waterbodies (11,730 linear feet).

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
Washington County								
HDD	40.2357, -80.1359	-	S16	-	-	-	369	-
HDD	40.2356, -80.1338	-	S250	-	-	-	69	-
HDD	40.2354, -80.1032	-	S129	-	-	-	-	50
HDD	40.2356, -80.0912	-	S130	-	-	-	-	114
HDD	40.2357, -80.0917	-	S131	-	-	-	-	192
HDD	40.2301, -79.9914	-	S142	-	-	-	-	70
HDD	40.2310, -79.9967	-	S27	-	-	-	-	63
HDD	40.2301, -79.9915	-	S28	-	-	-	-	5
HDD	40.2343, -80.1019	-	S280	-	-	-	-	294
HDD	40.2342, -80.1016	-	S281	-	-	-	-	23
HDD	40.2294, -79.9841	-	S29	-	-	-	-	55
HDD	40.2349, -80.2125	-	S7	-	-	-	-	51
HDD	40.2347, -80.1435	Cultural Site	-	-	-	-	-	-
HDD	40.2361, -80.1320	Cultural Site	-	-	-	-	-	-
HDD	40.2348, -80.0982	CNHI Supporting	-	-	-	-	-	-
HDD	40.2356, -80.0911	CNHI Supporting	-	-	-	-	-	-
Bore	40.2329, -80.0760	CNHI Supporting	-	-	-	-	-	-
Bore	40.2311, -80.0723	CNHI Supporting	-	-	-	-	-	-
Bore	40.2288, -80.0461	CNHI Supporting	-	-	-	-	-	-
Bore	40.2273, -80.0384	CNHI Supporting	-	-	-	-	-	-
Bore	40.2304, -80.0215	CNHI Supporting	-	-	-	-	-	-
HDD	40.2321, -80.0083	CNHI Supporting	-	-	-	-	-	-
HDD	40.2308, -79.9948	CNHI Supporting	-	-	-	-	-	-
HDD	40.2294, -79.9848	CNHI Supporting	-	-	-	-	-	-
HDD	40.2300, -79.9734	CNHI Supporting	-	-	-	-	-	-
			Subtotal	**0**	**0**	**0**	**438**	**917**
Allegheny County								
HDD	40.2300, -79.9709	-	S121	-	-	-	-	50
Bore	40.2232, -79.8935	-	S149	-	-	-	-	56
Bore	40.2232, -79.8934	-	S150	-	-	-	-	59
HDD	40.2223, -79.8429	-	S163	-	-	-	-	33
Bore	40.2295, -79.9600	Cultural Site	-	-	-	-	-	-
HDD	40.2300, -79.9658	CNHI Supporting	-	-	-	-	-	-
Bore	40.2294, -79.9600	CNHI Supporting	-	-	-	-	-	-
Bore	40.2229, -79.9048	CNHI Supporting	-	-	-	-	-	-
Bore	40.2232, -79.8983	CNHI Supporting	-	-	-	-	-	-
Bore	40.2232, -79.8933	CNHI Supporting	-	-	-	-	-	-
Bore	40.2229, -79.8768	CNHI Supporting	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
Bore	40.2220, -79.8711	CNHI Supporting	-	-	-	-	-	-
HDD	40.2217, -79.8455	CNHI Supporting	-	-	-	-	-	-
Bore	40.2214, -79.8211	CNHI Supporting	-	-	-	-	-	-
HDD	40.2301, -79.9693	CNHI Supporting	-	-	-	-	-	-
			Subtotal	**0**	**0**	**0**	**0**	**198**
Westmoreland County								
HDD	40.4451, -79.3013	-	Wetland N28	0	0.64	0.43	-	-
HDD	40.4420, -79.3428	-	Wetland O45	0	0.11	0.07	-	-
HDD	40.4410, -79.3618	-	Wetland P13	0	0.02	0	-	-
HDD	40.4409, -79.3631	-	Wetland P14	0	0.02	0	-	-
Bore	40.4437, -79.3269	-	Wetland P7	0	0	0	-	-
HDD	40.4257, -79.5496	-	Wetland Q4	0	0.01	0	-	-
HDD	40.4258, -79.5504	-	Wetland Q6	0	0.09	0.09	-	-
Bore	40.4431, -79.3213	-	Wetland Q69	0	0.25	0.14	-	-
HDD	40.4259, -79.5523	-	Wetland Q7	0	0.02	0	-	-
Bore	40.4403, -79.3181	-	Wetland Q70	0	0.32	0.32	-	-
HDD	40.4259, -79.5519	-	Wetland Q8	0	0.09	0	-	-
HDD	40.2374, -79.7524	-	Wetland SZ6	0	0.02	0	-	-
Bore	40.2963, -79.6508	-	Wetland W53	0	0.06	0	-	-
HDD	40.4171, -79.6071	-	Wetland W61	0	0.09	0	-	-
HDD	40.2877, -79.6698	-	Wetland W68	0	0.03	0	-	-
HDD	40.4419, -79.3432	-	S-O61	-	-	-	60	-
HDD	40.4259, -79.5524	-	S-Q7	-	-	-	56	-
Bore	40.3875, -79.6213	-	S-DQ2	-	-	-	-	29
HDD	40.4409, -79.3619	-	S-P19	-	-	-	-	49
HDD	40.4410, -79.3628	-	S-P20	-	-	-	-	94
HDD	40.4257, -79.5500	-	S-Q5	-	-	-	-	61
HDD	40.4259, -79.5511	-	S-Q8	-	-	-	-	146
HDD	40.4259, -79.5521	-	S-Q9	-	-	-	-	45
Bore	40.4430, -79.3212	-	S-R90	-	-	-	-	76
Bore	40.4428, -79.3211	-	S-R91	-	-	-	-	61
Bore	40.4405, -79.3186	-	S-R92	-	-	-	-	52
HDD	40.2634, -79.6878	-	S-Z2	-	-	-	-	10
HDD	40.2286, -79.7727	-	S122	-	-	-	-	50
HDD	40.2399, -79.7424	-	S172	-	-	-	-	20
HDD	40.2635, -79.6877	-	S182	-	-	-	-	341
HDD	40.2652, -79.6850	-	S184	-	-	-	-	134
HDD	40.2651, -79.6851	-	S185	-	-	-	-	13
Bore	40.2963, -79.6506	-	S186	-	-	-	-	33

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.3240, -79.6349	-	S198	-	-	-	-	20
HDD	40.3300, -79.6326	-	S199	-	-	-	-	53
HDD	40.3628, -79.6312	-	S201	-	-	-	-	51
HDD	40.3630, -79.6312	-	S202	-	-	-	-	55
HDD	40.4167, -79.6073	-	S215	-	-	-	-	21
HDD	40.2377, -79.7515	-	S224	-	-	-	-	52
HDD	40.2877, -79.6699	-	S227	-	-	-	-	43
HDD	40.2877, -79.6698	-	S228	-	-	-	-	42
Bore	40.2234, -79.7771	CNHI Supporting	-	-	-	-	-	-
Bore	40.2270, -79.7733	CNHI Supporting	-	-	-	-	-	-
HDD	40.2312, -79.7714	CNHI Supporting	-	-	-	-	-	-
Bore	40.2357, -79.7625	CNHI Supporting	-	-	-	-	-	-
Bore	40.2364, -79.7563	CNHI Supporting	-	-	-	-	-	-
Bore	40.2369, -79.7533	CNHI Supporting	-	-	-	-	-	-
HDD	40.2381, -79.7503	CNHI Supporting	-	-	-	-	-	-
Bore	40.2447, -79.7323	CNHI Supporting	-	-	-	-	-	-
Bore	40.2471, -79.7201	CNHI Supporting	-	-	-	-	-	-
HDD	40.3238, -79.6353	CNHI Supporting	-	-	-	-	-	-
Bore	40.3271, -79.6315	CNHI Supporting	-	-	-	-	-	-
HDD	40.3308, -79.6323	CNHI Supporting	-	-	-	-	-	-
Bore	40.3394, -79.6267	CNHI Supporting	-	-	-	-	-	-
Bore	40.3471, -79.6276	CNHI Supporting	-	-	-	-	-	-
Bore	40.3567, -79.6307	CNHI Supporting	-	-	-	-	-	-
HDD	40.3624, -79.6312	CNHI Supporting	-	-	-	-	-	-
Bore	40.3765, -79.6256	CNHI Supporting	-	-	-	-	-	-
Bore	40.3847, -79.6224	CNHI Supporting	-	-	-	-	-	-
Bore	40.3875, -79.6213	CNHI Supporting	-	-	-	-	-	-
Bore	40.3972, -79.6119	CNHI Supporting	-	-	-	-	-	-
Bore	40.4012, -79.6091	CNHI Supporting	-	-	-	-	-	-
Bore	40.4079, -79.6114	CNHI Supporting	-	-	-	-	-	-
HDD	40.4160, -79.6077	CNHI Supporting	-	-	-	-	-	-
Bore	40.4179, -79.6059	CNHI Supporting	-	-	-	-	-	-
HDD	40.4277, -79.5812	CNHI Supporting	-	-	-	-	-	-
HDD	40.2399, -79.7423	CNHI Core	-	-	-	-	-	-
Bore	40.3567, -79.6307	State Park	-	-	-	-	-	-
HDD	40.3615, -79.6312	State Park	-	-	-	-	-	-
			Subtotal	**0**	**1.77**	**1.05**	**116**	**1551**
Indiana County								
HDD	40.4307, -78.9991	-	Wetland N34	0.23	0	0.2	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.4454, -79.2992	-	Wetland J52	0	0.01	0	-	-
HDD	40.4529, -79.2251	-	Wetland J53	0	0.2	0	-	-
HDD	40.4308, -78.9980	-	Wetland N35	0	0.02	0	-	-
HDD	40.4374, -79.1245	-	Wetland N56	0	0.02	0	-	-
HDD	40.4375, -79.1253	-	Wetland N57	0	0.37	0	-	-
HDD	40.4510, -79.2106	-	Wetland N61	0	0.02	0	-	-
Bore	40.4324, -79.0667	-	Wetland O56	0	0.04	0	-	-
HDD	40.4514, -79.2113	-	Wetland O77	0	0.13	0	-	-
Bore	40.4502, -79.2788	-	Wetland P2	0	0.16	0	-	-
HDD	40.4307, -78.9989	-	S-N66	-	-	-	59	-
HDD	40.4465, -79.2911	-	S-J53	-	-	-	-	9
HDD	40.4465, -79.2910	-	S-J54	-	-	-	-	21
HDD	40.4453, -79.3000	-	S-J55	-	-	-	-	51
HDD	40.4454, -79.2991	-	S-J56	-	-	-	-	23
HDD	40.4530, -79.2257	-	S-J58	-	-	-	-	57
HDD	40.4307, -78.9990	-	S-N65	-	-	-	-	52
HDD	40.4514, -79.2113	-	S-O113	-	-	-	-	41
Bore	40.4324, -79.0667	-	S-O79	-	-	-	-	51
Bore	40.4323, -79.0670	CNHI Supporting	-	-	-	-	-	-
			Subtotal	**0.23**	**0.97**	**0.2**	**59**	**305**
Cambria County								
HDD	40.4357, -78.7695	-	Wetland CC17	0.52	0	0.15	-	-
HDD	40.4121, -78.5626	-	Wetland L62	0.07	0	0.07	-	-
HDD	40.4134, -78.5651	-	Wetland M59	0.96	0	0.69	-	-
HDD	40.4499, -78.6065	-	Wetland K31	0	1.02	0.5	-	-
Bore	40.4253, -78.5804	-	Wetland L65	0	0.14	0.13	-	-
Bore	40.4490, -78.7125	-	Wetland N1	0	0.08	0.07	-	-
HDD	40.4526, -78.6847	-	Wetland N18	0	0.39	0.23	-	-
HDD	40.4155, -78.8630	-	Wetland N20	0	0.54	0.21	-	-
HDD	40.4157, -78.8666	-	Wetland N24	0	0.31	0.08	-	-
HDD	40.4163, -78.8724	-	Wetland N25	0	0.07	0	-	-
HDD	40.4164, -78.8730	-	Wetland N26	0	0.25	0	-	-
HDD	40.4165, -78.8742	-	Wetland N27	0	0.16	0	-	-
Bore	40.4270, -78.8070	-	Wetland O17	0	0.17	0.07	-	-
HDD	40.4156, -78.8606	-	Wetland O35	0	0.02	0	-	-
Bore	40.4369, -78.7642	-	S-CC2	-	-	-	-	59
HDD	40.4360, -78.7684	-	S-CC8	-	-	-	-	109
HDD	40.4495, -78.6057	-	S-K33	-	-	-	-	62
Bore	40.4252, -78.5803	-	S-L92	-	-	-	-	87

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
Bore	40.4489, -78.7126	-	S-N1	-	-	-	-	52
Bore	40.4490, -78.7123	-	S-N2	-	-	-	-	32
Bore	40.4489, -78.7125	-	S-N3	-	-	-	-	4
HDD	40.4526, -78.6854	-	S-N34	-	-	-	-	123
HDD	40.4156, -78.8610	-	S-N35	-	-	-	-	7
HDD	40.4155, -78.8630	-	S-N36	-	-	-	-	65
HDD	40.4157, -78.8661	-	S-N39	-	-	-	-	62
HDD	40.4163, -78.8723	-	S-N41	-	-	-	-	54
HDD	40.4164, -78.8732	-	S-N42	-	-	-	-	40
HDD	40.4156, -78.8603	-	S-O43	-	-	-	-	60
HDD	40.4156, -78.8608	-	S-O44	-	-	-	-	252
HDD	40.4123, -78.5629	T&E Species	-	-	-	-	-	-
HDD	40.4141, -78.5663	State Game Land	-	-	-	-	-	-
HDD	40.4141, -78.5662	State Game Land	-	-	-	-	-	-
			Subtotal	**1.55**	**3.15**	**2.20**	**0**	**1068**
Blair County								
HDD	40.4069, -78.4622	-	Wetland BB120	0.02	0	0	-	-
HDD	40.4411, -78.3308	-	Wetland BB125	0.01	0	0	-	-
HDD	40.4125, -78.3727	-	Wetland BB58	0.14	0	0	-	-
HDD	40.4439, -78.3259	-	Wetland L54	0.83	0	0	-	-
HDD	40.4431, -78.3274	-	Wetland L55	0.23	0	0.05	-	-
HDD	40.4420, -78.3291	-	Wetland L56	0.09	0	0.02	-	-
HDD	40.4348, -78.2985	-	Wetland M24	0.08	0	0	-	-
HDD	40.4334, -78.2682	-	Wetland M26	0.01	0	0	-	-
HDD	40.4336, -78.2947	-	Wetland M29	0.15	0	0	-	-
Bore	40.4323, -78.3350	-	Wetland M35	0.25	0	0.25	-	-
HDD	40.4094, -78.4399	-	Wetland M49	0.36	0	0.36	-	-
HDD	40.4092, -78.4419	-	Wetland M79	0.3	0	0.3	-	-
HDD	40.4122, -78.3721	-	Wetland BB159	0	0	0	-	-
HDD	40.4331, -78.2668	-	S-M30	-	-	-	56	-
HDD	40.4334, -78.2682	-	S-M33	-	-	-	89	-
HDD	40.4131, -78.3741	-	S-BB48	-	-	-	-	59
Bore	40.4323, -78.3349	-	S-BB89	-	-	-	-	52
HDD	40.4410, -78.3308	-	S-BB92	-	-	-	-	65
HDD	40.4417, -78.3297	-	S-BB95	-	-	-	-	51
HDD	40.4445, -78.3250	-	S-L76	-	-	-	-	81
HDD	40.4413, -78.3304	-	S-L77	-	-	-	-	52
HDD	40.4343, -78.2969	-	S-M31	-	-	-	-	50
HDD	40.4350, -78.2991	-	S-M32	-	-	-	-	33

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.4093, -78.4404	-	S-M69	-	-	-	-	90
Bore	40.4048, -78.4933	-	S-M79	-	-	-	-	34
HDD	40.4330, -78.2668	Cultural Site	-	-	-	-	-	-
HDD	40.4341, -78.2962	CNHI Core	-	-	-	-	-	-
HDD	40.4341, -78.2962	CNHI Core	-	-	-	-	-	-
HDD	40.4321, -78.2896	State Game Land	-	-	-	-	-	-
HDD	40.4321, -78.2897	State Game Land	-	-	-	-	-	-
			Subtotal	**2.47**	**0**	**0.98**	**145**	**567**
Huntingdon County								
Bore	40.3537, -77.9900	-	Wetland BB127	0	0.08	0.02	-	-
HDD	40.3131, -77.7488	-	Wetland K68	0	0.81	0.39	-	-
HDD	40.3214, -77.7887	-	Wetland K69	0	0.3	0	-	-
HDD	40.3212, -77.7876	-	Wetland K70	0	0.27	0.26	-	-
HDD	40.3577, -78.0108	-	Wetland L26	0	0.01	0	-	-
HDD	40.3579, -78.0121	-	Wetland L27	0	0.48	0	-	-
HDD	40.3972, -78.1343	-	Wetland Y1	0	0.01	0.01	-	-
HDD	40.3969, -78.1332	-	Wetland Y2	0	0.41	0	-	-
HDD	40.3967, -78.1325	-	Wetland Y3	0	0.01	0	-	-
HDD	40.3961, -78.1297	-	Wetland Y4	0	0.13	0.13	-	-
HDD	40.3941, -78.1213	-	Wetland Y6	0	0.14	0.14	-	-
HDD	40.3939, -78.1204	-	Wetland Y7	0	0.33	0.33	-	-
HDD	40.3213, -77.7881	-	S-K94	-	-	-	53	-
Bore	40.3537, -77.9897	-	S-BB97	-	-	-	-	111
HDD	40.3130, -77.7486	-	S-K91	-	-	-	-	51
HDD	40.3130, -77.7487	-	S-K93	-	-	-	-	74
HDD	40.3428, -77.8520	-	S-L28	-	-	-	-	50
HDD	40.3430, -77.8523	-	S-L29	-	-	-	-	105
HDD	40.3577, -78.0112	-	S-L45	-	-	-	-	288
HDD	40.3579, -78.0120	-	S-L46	-	-	-	-	65
Bore	40.3537, -77.9895	-	S-M21	-	-	-	-	48
Bore	40.3235, -77.8011	-	S-M3	-	-	-	-	6
HDD	40.3968, -78.1325	-	S-Y1	-	-	-	-	61
HDD	40.3961, -78.1296	-	S-Y2	-	-	-	-	52
HDD	40.3960, -78.1294	-	S-Y3	-	-	-	-	42
HDD	40.3942, -78.1215	-	S-Y5	-	-	-	-	54
HDD	40.3941, -78.1214	-	S-Y6	-	-	-	-	442
HDD	40.3939, -78.1202	-	S-Y7	-	-	-	-	117
Bore	40.3453, -77.8642	CNHI Supporting	-	-	-	-	-	-
HDD	40.3431, -77.8533	CNHI Supporting	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.3431, -77.8533	CNHI Supporting	-	-	-	-	-	-
Bore	40.3235, -77.8014	CNHI Supporting	-	-	-	-	-	-
HDD	40.3967, -78.1323	CNHI Core	-	-	-	-	-	-
HDD	40.3967, -78.1322	CNHI Core	-	-	-	-	-	-
Bore	40.3507, -77.9701	State Game Land	-	-	-	-	-	-
			Subtotal	**0**	**2.98**	**1.28**	**53**	**1566**
Juniata County								
HDD	40.3013, -77.6958	-	Wetland K59	0	0.02	0	-	-
HDD	40.3011, -77.6947	-	Wetland K60	0	0.07	0.06	-	-
HDD	40.3015, -77.6964	-	S-K74	-	-	-	-	50
HDD	40.3016, -77.6972	CNHI Supporting	-	-	-	-	-	-
HDD	40.3016, -77.6973	CNHI Supporting	-	-	-	-	-	-
HDD	40.3013, -77.6958	CNHI Core	-	-	-	-	-	-
HDD	40.3013, -77.6958	CNHI Core	-	-	-	-	-	-
			Subtotal	**0**	**0.09**	**0.06**	**0**	**50**
Perry County								
HDD	40.2929, -77.6498	-	Wetland L1	0.23	0	0.2	-	-
HDD	40.2934, -77.6522	-	Wetland L2	1.06	0	0	-	-
HDD	40.2930, -77.6504	-	S-L6	-	-	-	74	-
HDD	40.2931, -77.6506	-	S-L7	-	-	-	-	26
HDD	40.2929, -77.6499	State Forest	-	-	-	-	-	-
HDD	40.2929, -77.6499	State Forest	-	-	-	-	-	-
Bore	40.2852, -77.6152	State Forest	-	-	-	-	-	-
Bore	40.2739, -77.5426	State Forest	-	-	-	-	-	-
			Subtotal	**1.29**	**0**	**0.2**	**74**	**26**
Cumberland County								
HDD	40.1925, -76.9416	-	Wetland I25	0.02	0	0	-	-
HDD	40.2287, -77.1324	-	Wetland I30	0.22	0	0	-	-
HDD	40.2288, -77.1395	-	Wetland I31	0.14	0	0	-	-
HDD	40.2287, -77.1405	-	Wetland I32	0.15	0	0.15	-	-
HDD	40.2402, -77.1806	-	Wetland J10	0.15	0	0	-	-
HDD	40.1921, -76.9123	-	Wetland I24	0	0.48	0.18	-	-
HDD	40.2398, -77.1797	-	Wetland I36	0	0.03	0.03	-	-
HDD	40.2512, -77.4451	-	Wetland I63	0	0.4	0	-	-
HDD	40.2433, -77.3169	-	Wetland J31	0	0.43	0.35	-	-
HDD	40.2445, -77.3260	-	Wetland J35	0	2.78	0.84	-	-
HDD	40.2516, -77.4469	-	Wetland J40	0	0.61	0.19	-	-
HDD	40.2400, -77.1802	-	Wetland J9	0	0.01	0	-	-
HDD	40.2374, -77.1746	-	Wetland K44	0	0.55	0.48	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.2450, -77.3494	-	Wetland W177	0	0.14	0	-	-
HDD	40.2287, -77.1324	-	S-I47	-	-	-	61	-
HDD	40.2287, -77.1400	-	S-I48	-	-	-	72	-
HDD	40.2514, -77.4460	-	S-I89	-	-	-	56	-
HDD	40.2450, -77.3490	-	S-BB120	-	-	-	-	27
HDD	40.1922, -76.9153	-	S-I34	-	-	-	-	122
HDD	40.1925, -76.9416	-	S-I40	-	-	-	-	54
HDD	40.2389, -77.1778	-	S-I53	-	-	-	-	72
HDD	40.2397, -77.1796	-	S-I54	-	-	-	-	61
Bore	40.2456, -77.3839	-	S-I85	-	-	-	-	9
HDD	40.2419, -77.1899	-	S-J18	-	-	-	-	51
HDD	40.2434, -77.3172	-	S-J34	-	-	-	-	52
HDD	40.2443, -77.3232	-	S-J36	-	-	-	-	88
HDD	40.2446, -77.3278	-	S-J37A	-	-	-	-	69
HDD	40.2445, -77.3256	-	S-J37B	-	-	-	-	93
HDD	40.2448, -77.3303	-	S-J41	-	-	-	-	113
HDD	40.2376, -77.1750	-	S-K45	-	-	-	-	56
HDD	40.2518, -77.4480	CNHI Supporting	-	-	-	-	-	-
HDD	40.2519, -77.4481	CNHI Supporting	-	-	-	-	-	-
Bore	40.2451, -77.3399	CNHI Supporting	-	-	-	-	-	-
HDD	40.2428, -77.3140	CNHI Supporting	-	-	-	-	-	-
Bore	40.2430, -77.3068	CNHI Supporting	-	-	-	-	-	-
Bore	40.2435, -77.2072	CNHI Supporting	-	-	-	-	-	-
HDD	40.2419, -77.1894	CNHI Supporting	-	-	-	-	-	-
HDD	40.2419, -77.1893	CNHI Supporting	-	-	-	-	-	-
HDD	40.2389, -77.1778	CNHI Supporting	-	-	-	-	-	-
HDD	40.2390, -77.1778	CNHI Supporting	-	-	-	-	-	-
HDD	40.2287, -77.1417	CNHI Supporting	-	-	-	-	-	-
HDD	40.2288, -77.1415	CNHI Supporting	-	-	-	-	-	-
HDD	40.1922, -76.9139	CNHI Supporting	-	-	-	-	-	-
HDD	40.1922, -76.9140	CNHI Supporting	-	-	-	-	-	-
HDD	40.2512, -77.4453	CNHI Core	-	-	-	-	-	-
HDD	40.2512, -77.4453	CNHI Core	-	-	-	-	-	-
Bore	40.2449, -77.3330	CNHI Core	-	-	-	-	-	-
HDD	40.2445, -77.3259	CNHI Core	-	-	-	-	-	-
HDD	40.2445, -77.3259	CNHI Core	-	-	-	-	-	-
HDD	40.2431, -77.3159	CNHI Core	-	-	-	-	-	-
HDD	40.2432, -77.3159	CNHI Core	-	-	-	-	-	-
HDD	40.2288, -77.1038	Appalachian Trail	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.2288, -77.1038	Appalachian Trail	-	-	-	-	-	-
HDD	40.2313, -77.1096	Appalachian Trail	-	-	-	-	-	-
HDD	40.2313, -77.1096	Appalachian Trail	-	-	-	-	-	-
			Subtotal	**0.68**	**5.43**	**2.22**	**189**	**867**
York County								
HDD	40.1990, -76.7988	-	Wetland BB1	0	0.03	0	-	-
Bore	40.1924, -76.8150	-	Wetland H51	0	0.25	0.15	-	-
Bore	40.1924, -76.8144	-	S-H61	-	-	-	-	49
Bore	40.1914, -76.8411	-	S-I25	-	-	-	-	25
HDD	40.1922, -76.9112	-	S-I36	-	-	-	-	89
HDD	40.1992, -76.7987	Cultural Site	-	-	-	-	-	-
HDD	40.1922, -76.9100	CNHI Supporting	-	-	-	-	-	-
HDD	40.1922, -76.9100	CNHI Supporting	-	-	-	-	-	-
HDD	40.1987, -76.8002	CNHI Core	-	-	-	-	-	-
HDD	40.1987, -76.8002	CNHI Core	-	-	-	-	-	-
			Subtotal	**0**	**0.28**	**0.15**	**0**	**163**
Dauphin County								
HDD	40.2026, -76.7853	-	Wetland A18	0	0.09	0.09	-	-
HDD	40.2535, -76.5935	-	Wetland A29	0	0	0	-	-
HDD	40.2333, -76.6747	-	Wetland B58	0	0.4	0.33	-	-
HDD	40.2050, -76.7697	-	Wetland B65	0	0	0	-	-
HDD	40.2342, -76.6713	-	Wetland C26	0	1.73	1.22	-	-
HDD	40.2226, -76.7122	-	Wetland CC22	0	0.04	0	-	-
HDD	40.2537, -76.5923	-	Wetland J47	0	0.14	0.55	-	-
HDD	40.2053, -76.7694	-	Wetland W118	0	0.03	0	-	-
HDD	40.2009, -76.7917	-	S-A22	-	-	-	-	60
HDD	40.2532, -76.5945	-	S-A47	-	-	-	-	88
HDD	40.2227, -76.7118	-	S-A75	-	-	-	-	84
HDD	40.2319, -76.6796	-	S-B61	-	-	-	-	52
HDD	40.2331, -76.6755	-	S-B62	-	-	-	-	54
HDD	40.2339, -76.6724	-	S-B63	-	-	-	-	508
HDD	40.2189, -76.7248	-	S-B70	-	-	-	-	50
HDD	40.2184, -76.7255	-	S-C54	-	-	-	-	80
HDD	40.2532, -76.5944	-	S-K18	-	-	-	-	66
HDD	40.2187, -76.7250	CNHI Supporting	-	-	-	-	-	-
HDD	40.2188, -76.7250	CNHI Supporting	-	-	-	-	-	-
HDD	40.2013, -76.7903	CNHI Core	-	-	-	-	-	-
HDD	40.2013, -76.7904	CNHI Core	-	-	-	-	-	-
			Subtotal	**0**	**2.43**	**2.19**	**0**	**1042**

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
Lebanon County								
Bore	40.2868, -76.3300	-	Wetland CJ2	0.02	0	0	-	-
HDD	40.2855, -76.2391	-	Wetland H13	0	0.7	0.31	-	-
HDD	40.2855, -76.2414	-	Wetland H14	0	0.53	0.19	-	-
HDD	40.2534, -76.5936	-	Wetland J47	0	0.55	0.55	-	-
Bore	40.2868, -76.3296	-	S-A25	-	-	-	-	25
HDD	40.2555, -76.5865	-	S-A49	-	-	-	-	297
HDD	40.2551, -76.5879	-	S-A51	-	-	-	-	30
HDD	40.2855, -76.2406	-	S-C85	-	-	-	-	23
HDD	40.2855, -76.2406	-	S-C86	-	-	-	-	97
Bore	40.2877, -76.3716	CNHI Supporting	-	-	-	-	-	-
Bore	40.2852, -76.2752	CNHI Supporting	-	-	-	-	-	-
Bore	40.2852, -76.2475	CNHI Core	-	-	-	-	-	-
Bore	40.2853, -76.2444	CNHI Core	-	-	-	-	-	-
Bore	40.2856, -76.2335	CNHI Core	-	-	-	-	-	-
HDD	40.2854, -76.2403	CNHI Core	-	-	-	-	-	-
HDD	40.2855, -76.2402	CNHI Core	-	-	-	-	-	-
Bore	40.2852, -76.2475	State Game Land	-	-	-	-	-	-
HDD	40.2855, -76.2402	State Game Land	-	-	-	-	-	-
Bore	40.2853, -76.2444	State Game Land	-	-	-	-	-	-
Bore	40.2856, -76.2335	State Game Land	-	-	-	-	-	-
HDD	40.2854, -76.2403	State Game Land	-	-	-	-	-	-
			Subtotal	**0.02**	**1.78**	**1.05**	**0**	**472**
Lancaster County								
HDD	40.2835, -76.1688	-	Wetland A54	0.98	0	0.06	-	-
HDD	40.2839, -76.1750	-	Wetland A55	0.81	0	0	-	-
Bore	40.2826, -76.1581	-	Wetland A56	0.17	0	0	-	-
HDD	40.2808, -76.2085	-	Wetland K32	0.73	0	0	-	-
Bore	40.2823, -76.1528	-	Wetland B72	0	0.25	0	-	-
Bore	40.2797, -76.1949	-	Wetland J54	0	0.15	0.15	-	-
HDD	40.2835, -76.1678	-	S-A77	-	-	-	66	-
HDD	40.2839, -76.1761	-	S-A82	-	-	-	56	-
Bore	40.2796, -76.1947	-	S-J59	-	-	-	55	-
HDD	40.2808, -76.2098	-	S-K34	-	-	-	72	-
HDD	40.2809, -76.2067	-	S-K35	-	-	-	51	-
HDD	40.2836, -76.1699	-	S-A78	-	-	-	-	60
HDD	40.2836, -76.1702	-	S-A79	-	-	-	-	52
HDD	40.2839, -76.1762	-	S-A83	-	-	-	-	52
Bore	40.2826, -76.1576	-	S-A87	-	-	-	-	25

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
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Bore	40.2824, -76.1517	-	S-B82	-	-	-	-	31
HDD	40.2836, -76.1722	T&E Species	-	-	-	-	-	-
HDD	40.2835, -76.1741	Cultural Site	-	-	-	-	-	-
HDD	40.2808, -76.2080	Cultural Site	-	-	-	-	-	-
Bore	40.2834, -76.1274	CNHI Supporting	-	-	-	-	-	-
HDD	40.2808, -76.2084	CNHI Core	-	-	-	-	-	-
HDD	40.2809, -76.2085	CNHI Core	-	-	-	-	-	-
Bore	40.2809, -76.2037	CNHI Core	-	-	-	-	-	-
Bore	40.2830, -76.1873	CNHI Core	-	-	-	-	-	-
HDD	40.2836, -76.1714	CNHI Core	-	-	-	-	-	-
HDD	40.2837, -76.1714	CNHI Core	-	-	-	-	-	-
Bore	40.2823, -76.1542	CNHI Core	-	-	-	-	-	-
Bore	40.2823, -76.1530	CNHI Core	-	-	-	-	-	-
Bore	40.2830, -76.1447	CNHI Core	-	-	-	-	-	-
Bore	40.2832, -76.1447	CNHI Core	-	-	-	-	-	-
Bore	40.2830, -76.1374	CNHI Core	-	-	-	-	-	-
Bore	40.2798, -76.1953	CNHI Core	-	-	-	-	-	-
Bore	40.2827, -76.1587	CNHI Core	-	-	-	-	-	-
HDD	40.2808, -76.2086	State Game Land	-	-	-	-	-	-
Bore	40.2810, -76.2170	State Game Land	-	-	-	-	-	-
HDD	40.2809, -76.2086	State Game Land	-	-	-	-	-	-
			Subtotal	**2.69**	**0.40**	**0.21**	**300**	**220**
Berks County								
Bore	40.2950, -76.0253	-	Wetland C13	0.03	0	0	-	-
Bore	40.2549, -75.9895	-	Wetland C6	0.13	0	0	-	-
Bore	40.1886, -75.8885	-	Wetland Q80	0.06	0	0.06	-	-
HDD	40.1699, -75.8630	-	Wetland A37	0	0.02	0	-	-
HDD	40.1679, -75.8598	-	Wetland J48	0	0.93	0.34	-	-
HDD	40.1701, -75.8632	-	S-A57	-	-	-	-	60
HDD	40.1698, -75.8627	-	S-A58	-	-	-	-	229
HDD	40.1700, -75.8629	-	S-A59	-	-	-	-	12
Bore	40.2345, -75.9649	-	S-B30	-	-	-	-	25
HDD	40.2772, -76.0201	-	S-B40	-	-	-	-	11
HDD	40.2772, -76.0202	-	S-B41	-	-	-	-	15
Bore	40.2551, -75.9896	-	S-C10	-	-	-	-	28
Bore	40.2549, -75.9895	-	S-C8	-	-	-	-	66
Bore	40.2549, -75.9895	-	S-C9	-	-	-	-	52
HDD	40.1689, -75.8615	-	S-J51	-	-	-	-	121
HDD	40.1669, -75.8583	-	S-J52	-	-	-	-	36

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
Bore	40.1886, -75.8886	-	S-Q89	-	-	-	-	85
Bore	40.2549, -75.9895	T&E Species	-	-	-	-	-	-
Bore	40.2863, -76.1015	CNHI Supporting	-	-	-	-	-	-
Bore	40.2892, -76.0947	CNHI Supporting	-	-	-	-	-	-
Bore	40.2909, -76.0917	CNHI Supporting	-	-	-	-	-	-
HDD	40.3092, -76.0552	CNHI Supporting	-	-	-	-	-	-
HDD	40.3093, -76.0550	CNHI Supporting	-	-	-	-	-	-
Bore	40.3157, -76.0431	CNHI Supporting	-	-	-	-	-	-
Bore	40.2817, -76.0292	CNHI Supporting	-	-	-	-	-	-
HDD	40.2768, -76.0190	CNHI Supporting	-	-	-	-	-	-
HDD	40.2767, -76.0190	CNHI Supporting	-	-	-	-	-	-
HDD	40.2757, -76.0124	CNHI Supporting	-	-	-	-	-	-
HDD	40.2756, -76.0124	CNHI Supporting	-	-	-	-	-	-
Bore	40.2747, -76.0095	CNHI Supporting	-	-	-	-	-	-
Bore	40.2632, -75.9981	CNHI Supporting	-	-	-	-	-	-
Bore	40.2567, -75.9905	CNHI Supporting	-	-	-	-	-	-
Bore	40.2553, -75.9896	CNHI Supporting	-	-	-	-	-	-
Bore	40.2500, -75.9854	CNHI Supporting	-	-	-	-	-	-
Bore	40.2418, -75.9757	CNHI Supporting	-	-	-	-	-	-
Bore	40.2375, -75.9750	CNHI Supporting	-	-	-	-	-	-
Bore	40.2369, -75.9715	CNHI Supporting	-	-	-	-	-	-
HDD	40.2235, -75.9481	CNHI Supporting	-	-	-	-	-	-
HDD	40.2234, -75.9481	CNHI Supporting	-	-	-	-	-	-
Bore	40.2194, -75.9420	CNHI Supporting	-	-	-	-	-	-
Bore	40.2176, -75.9391	CNHI Supporting	-	-	-	-	-	-
Bore	40.2116, -75.9293	CNHI Supporting	-	-	-	-	-	-
Bore	40.2024, -75.9154	CNHI Supporting	-	-	-	-	-	-
Bore	40.1886, -75.8883	CNHI Supporting	-	-	-	-	-	-
Bore	40.1798, -75.8748	CNHI Supporting	-	-	-	-	-	-
Bore	40.1760, -75.8737	CNHI Supporting	-	-	-	-	-	-
Bore	40.1752, -75.8725	CNHI Supporting	-	-	-	-	-	-
HDD	40.1679, -75.8599	CNHI Supporting	-	-	-	-	-	-
HDD	40.1679, -75.8599	CNHI Supporting	-	-	-	-	-	-
Bore	40.1634, -75.8533	CNHI Supporting	-	-	-	-	-	-
Bore	40.1611, -75.8492	CNHI Supporting	-	-	-	-	-	-
Bore	40.1560, -75.8431	CNHI Supporting	-	-	-	-	-	-
Bore	40.2370, -75.9715	CNHI Core	-	-	-	-	-	-
Bore	40.2346, -75.9650	CNHI Core	-	-	-	-	-	-
Bore	40.2295, -75.9571	CNHI Core	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.2249, -75.9503	CNHI Core	-	-	-	-	-	-
HDD	40.2249, -75.9504	CNHI Core	-	-	-	-	-	-
HDD	40.1698, -75.8627	CNHI Core	-	-	-	-	-	-
HDD	40.1698, -75.8628	CNHI Core	-	-	-	-	-	-
			Subtotal	**0.22**	**0.95**	**0.40**	**0**	**740**
Chester County								
HDD	40.0635, -75.6809	-	Wetland C37	0.3	0	0.02	-	-
HDD	40.0654, -75.6845	-	Wetland H1	0.06	0	0	-	-
HDD	40.0310, -75.6195	-	Wetland B71	0	0.18	0.18	-	-
HDD	40.0720, -75.6963	-	Wetland C43	0	1	0.42	-	-
HDD	40.0794, -75.7105	-	Wetland H17	0	0.16	0	-	-
HDD	40.0226, -75.6133	-	Wetland K18	0	0	0	-	-
HDD	40.0222, -75.6132	-	Wetland K21	0	0.01	0	-	-
Bore	40.0927, -75.7324	-	Wetland Q75	0	0.06	0.06	-	-
HDD	40.0909, -75.7290	-	Wetland Q76	0	0.08	0	-	-
HDD	40.0898, -75.7275	-	Wetland Q77	0	0.19	0	-	-
HDD	40.0718, -75.6959	-	S-C87	-	-	-	177	-
HDD	40.0615, -75.6776	-	S-H5	-	-	-	54	-
HDD	40.0908, -75.7288	-	S-Q83	-	-	-	51	-
HDD	39.9514, -75.5117	-	S-B35	-	-	-	-	50
HDD	40.0295, -75.6183	-	S-B79	-	-	-	-	69
HDD	40.0316, -75.6198	-	S-B81	-	-	-	-	55
HDD	40.0379, -75.6328	-	S-C59	-	-	-	-	64
HDD	40.0378, -75.6323	-	S-C60	-	-	-	-	70
HDD	40.0476, -75.6503	-	S-C63	-	-	-	-	51
HDD	40.0637, -75.6812	-	S-C67	-	-	-	-	53
HDD	40.0635, -75.6809	-	S-C68	-	-	-	-	50
HDD	40.0632, -75.6803	-	S-C69	-	-	-	-	74
HDD	40.0720, -75.6963	-	S-C89	-	-	-	-	56
HDD	40.0721, -75.6965	-	S-C90	-	-	-	-	55
HDD	40.0724, -75.6971	-	S-C91	-	-	-	-	32
HDD	40.0725, -75.6972	-	S-C92	-	-	-	-	74
HDD	40.0794, -75.7103	-	S-H10	-	-	-	-	51
HDD	40.0794, -75.7105	-	S-H11	-	-	-	-	33
HDD	40.0645, -75.6828	-	S-H3	-	-	-	-	126
HDD	40.0092, -75.5921	-	S-H30	-	-	-	-	66
HDD	40.0644, -75.6825	-	S-H4	-	-	-	-	78
HDD	40.0314, -75.6198	Cultural Site	-	-	-	-	-	-
HDD	40.0294, -75.6186	Cultural Site	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	40.0321, -75.6199	Cultural Site	-	-	-	-	-	-
Bore	40.1557, -75.8428	CNHI Supporting	-	-	-	-	-	-
Bore	40.1532, -75.8394	CNHI Supporting	-	-	-	-	-	-
Bore	40.1521, -75.8360	CNHI Supporting	-	-	-	-	-	-
Bore	40.1502, -75.8326	CNHI Supporting	-	-	-	-	-	-
Bore	40.1469, -75.8264	CNHI Supporting	-	-	-	-	-	-
Bore	40.1418, -75.8181	CNHI Supporting	-	-	-	-	-	-
Bore	40.1402, -75.8154	CNHI Supporting	-	-	-	-	-	-
Bore	40.1363, -75.8089	CNHI Supporting	-	-	-	-	-	-
Bore	40.1313, -75.8006	CNHI Supporting	-	-	-	-	-	-
Bore	40.1249, -75.7924	CNHI Supporting	-	-	-	-	-	-
Bore	40.1193, -75.7889	CNHI Supporting	-	-	-	-	-	-
Bore	40.1156, -75.7822	CNHI Supporting	-	-	-	-	-	-
Bore	40.1154, -75.7801	CNHI Supporting	-	-	-	-	-	-
Bore	40.1145, -75.7772	CNHI Supporting	-	-	-	-	-	-
Bore	40.1111, -75.7711	CNHI Supporting	-	-	-	-	-	-
Bore	40.1079, -75.7656	CNHI Supporting	-	-	-	-	-	-
Bore	40.1022, -75.7560	CNHI Supporting	-	-	-	-	-	-
Bore	40.0861, -75.7235	CNHI Supporting	-	-	-	-	-	-
HDD	40.0886, -75.7260	CNHI Supporting	-	-	-	-	-	-
HDD	40.0886, -75.7260	CNHI Supporting	-	-	-	-	-	-
HDD	40.0810, -75.7135	CNHI Supporting	-	-	-	-	-	-
HDD	40.0809, -75.7135	CNHI Supporting	-	-	-	-	-	-
HDD	40.0727, -75.6976	CNHI Supporting	-	-	-	-	-	-
HDD	40.0727, -75.6976	CNHI Supporting	-	-	-	-	-	-
HDD	40.0662, -75.6862	CNHI Supporting	-	-	-	-	-	-
HDD	40.0662, -75.6862	CNHI Supporting	-	-	-	-	-	-
HDD	40.0606, -75.6761	CNHI Supporting	-	-	-	-	-	-
HDD	40.0605, -75.6761	CNHI Supporting	-	-	-	-	-	-
HDD	40.0576, -75.6711	CNHI Supporting	-	-	-	-	-	-
HDD	40.0576, -75.6712	CNHI Supporting	-	-	-	-	-	-
Bore	40.0569, -75.6698	CNHI Supporting	-	-	-	-	-	-
Bore	40.0569, -75.6684	CNHI Supporting	-	-	-	-	-	-
HDD	40.0548, -75.6644	CNHI Supporting	-	-	-	-	-	-
HDD	40.0547, -75.6645	CNHI Supporting	-	-	-	-	-	-
HDD	40.0055, -75.5821	CNHI Supporting	-	-	-	-	-	-
HDD	40.0042, -75.5799	CNHI Supporting	-	-	-	-	-	-
HDD	40.0034, -75.5788	CNHI Supporting	-	-	-	-	-	-
HDD	39.9978, -75.5669	CNHI Supporting	-	-	-	-	-	-

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide								
Trenchless Construction Method (HDD/Bore)	**Centroid Location (Latitude, Longitude)**	**Significant Resource Impact Avoided[1]**	**Wetland and Waterbody Resource Impact Avoided**	**EV Wetland Impact Reduction (acres)**	**Other Wetland Impact Reduction (acres)**	**PFO Conversion Impact Reduction (acres)**	**HQ and EV Stream Impact Reduction (linear feet)**	**Other Stream Impact Reduction (linear feet)**
HDD	39.9977, -75.5668	CNHI Supporting	-	-	-	-	-	-
HDD	39.9938, -75.5594	CNHI Supporting	-	-	-	-	-	-
HDD	39.9938, -75.5594	CNHI Supporting	-	-	-	-	-	-
HDD	39.9883, -75.5472	CNHI Supporting	-	-	-	-	-	-
HDD	39.9882, -75.5471	CNHI Supporting	-	-	-	-	-	-
HDD	39.9858, -75.5428	CNHI Supporting	-	-	-	-	-	-
HDD	39.9859, -75.5429	CNHI Supporting	-	-	-	-	-	-
HDD	39.9806, -75.5387	CNHI Supporting	-	-	-	-	-	-
HDD	39.9805, -75.5387	CNHI Supporting	-	-	-	-	-	-
HDD	39.9787, -75.5374	CNHI Supporting	-	-	-	-	-	-
HDD	39.9779, -75.5370	CNHI Supporting	-	-	-	-	-	-
HDD	39.9676, -75.5246	CNHI Supporting	-	-	-	-	-	-
HDD	39.9676, -75.5246	CNHI Supporting	-	-	-	-	-	-
HDD	39.9530, -75.5129	CNHI Supporting	-	-	-	-	-	-
HDD	39.9531, -75.5131	CNHI Supporting	-	-	-	-	-	-
HDD	40.0055, -75.5821	CNHI Supporting	-	-	-	-	-	-
Bore	40.0931, -75.7317	CNHI Core	-	-	-	-	-	-
HDD	40.0914, -75.7295	CNHI Core	-	-	-	-	-	-
HDD	40.0913, -75.7295	CNHI Core	-	-	-	-	-	-
HDD	40.0898, -75.7276	State Park	-	-	-	-	-	-
HDD	40.0899, -75.7276	State Park	-	-	-	-	-	-
			Subtotal	**0.36**	**1.68**	**0.68**	**282**	**1107**
Delaware County								
HDD	39.9405, -75.4945	-	Wetland B51	0	0	0	-	-
HDD	39.9054, -75.4468	-	Wetland C10	0.05	0	0	-	-
HDD	39.8945, -75.4319	-	Wetland I1	0.22	0	0	-	-
HDD	39.8464, -75.4102	-	Wetland BA5	0	0.01	0.01	-	-
HDD	39.8463, -75.4104	-	Wetland BA6	0	0.03	0.03	-	-
HDD	39.9166, -75.4606	-	Wetland C19	0	0.01	0	-	-
HDD	39.9213, -75.4643	-	Wetland C21	0	0.01	0.01	-	-
HDD	39.8488, -75.4038	-	Wetland I16	0	0.37	0.32	-	-
HDD	39.9405, -75.4945	-	S-B52	-	-	-	-	6
HDD	39.9405, -75.4945	-	S-B53	-	-	-	-	6
HDD	39.9405, -75.4945	-	S-B54	-	-	-	-	79
HDD	39.9405, -75.4947	-	S-B55	-	-	-	-	66
HDD	39.9056, -75.4470	-	S-C23	-	-	-	-	63
HDD	39.9066, -75.4482	-	S-C24	-	-	-	-	52
HDD	39.9065, -75.4480	-	S-C25	-	-	-	-	51
HDD	39.9079, -75.4497	-	S-C26	-	-	-	-	58

Table 4. Summary of Trenchless Construction Significant Resource Avoidance and Wetland and Waterbody Impact Reduction by County and Project-Wide

Trenchless Construction Method (HDD/Bore)	Centroid Location (Latitude, Longitude)	Significant Resource Impact Avoided[1]	Wetland and Waterbody Resource Impact Avoided	EV Wetland Impact Reduction (acres)	Other Wetland Impact Reduction (acres)	PFO Conversion Impact Reduction (acres)	HQ and EV Stream Impact Reduction (linear feet)	Other Stream Impact Reduction (linear feet)
HDD	39.9155, -75.4595	-	S-C39	-	-	-	-	19
HDD	39.9155, -75.4596	-	S-C40	-	-	-	-	60
HDD	39.9206, -75.4637	-	S-C42	-	-	-	-	64
HDD	39.8701, -75.4112	-	S-H37	-	-	-	-	91
HDD	39.8658, -75.4065	-	S-H41	-	-	-	-	150
HDD	39.8561, -75.3990	-	S-H43	-	-	-	-	56
HDD	39.8478, -75.4059	-	S-I18	-	-	-	-	50
HDD	39.9502, -75.5105	CNHI Supporting	-	-	-	-	-	-
HDD	39.9502, -75.5106	CNHI Supporting	-	-	-	-	-	-
HDD	39.9451, -75.5038	CNHI Supporting	-	-	-	-	-	-
HDD	39.9450, -75.5037	CNHI Supporting	-	-	-	-	-	-
HDD	39.9404, -75.4943	CNHI Supporting	-	-	-	-	-	-
HDD	39.9404, -75.4943	CNHI Supporting	-	-	-	-	-	-
Bore	39.9434, -75.5013	CNHI Supporting	-	-	-	-	-	-
HDD	39.9206, -75.4637	CNHI Supporting	-	-	-	-	-	-
HDD	39.9206, -75.4638	CNHI Supporting	-	-	-	-	-	-
Bore	39.8808, -75.4145	CNHI Supporting	-	-	-	-	-	-
HDD	39.8673, -75.4087	CNHI Supporting	-	-	-	-	-	-
HDD	39.8673, -75.4087	CNHI Supporting	-	-	-	-	-	-
HDD	39.8478, -75.4058	CNHI Supporting	-	-	-	-	-	-
HDD	39.8479, -75.4058	CNHI Supporting	-	-	-	-	-	-
HDD	39.8569, -75.3995	CNHI Supporting	-	-	-	-	-	-
HDD	39.8569, -75.3995	CNHI Supporting	-	-	-	-	-	-
			Subtotal	**0.27**	**0.43**	**0.37**	**0**	**871**
			Project Total	**9.78**	**22.34**	**13.24**	**1,656**	**11,730**

Notes:
[1] CNHI Core = Core Habitat of Natural Heritage Areas identified through the County Natural Heritage Inventory (CNHI) project of the Pennsylvania Natural Heritage Program.
CNHI Supporting = Supporting Landscape of Natural Heritage Areas identified through the CNHI project of the Pennsylvania Natural Heritage Program.
T&E Species = Federally- or state-listed threatened and endangered species habitat.

As requested by PADEP in it is technical deficiency comments, SPLP evaluated a total of 43 site-specific areas proposed for trenchless construction techniques (each designated with a unique Trenchless Area [TA] identification number). Specifically, SPLP evaluated each TA with regard to potential extension of the length of the technique and/or work space reconfiguration to further avoid or minimize impacts on wetlands, which is provided as Appendix C.

For each designated TA, a wetland-specific impact avoidance and minimization assessment is presented. Each assessment presents the wetland-specific PADEP comment(s) regarding the crossing area. Each assessment includes baseline information on the wetland and a narrative qualitative assessment of the practicability of conventional bore, HDD, Trenching-Proposed route, Trenching-Alternative route, work space reconfiguration, or other action as commented by PADEP.

5.3 PROGRAMMATIC IMPACT AVOIDANCE AND REDUCTION MEASURES

In parallel with the MOC Process and early in the planning process, SPLP undertook substantive programmatic measures to programmatically avoid and reduce environmental impacts, including impacts at all wetland and waterbody crossings. Specifically, SPLP evaluated and adopted the following programmatic wetland and waterbody impact avoidance and reduction measures:

- Measures to Avoid and Reduce Areal Extent of Wetland and Waterbody Impact:
    - Maximized the co-location (abut and overlap) of the Project construction and operation workspace with the existing SPLP pipeline right-of-way.
    - Where the Project diverges from the existing SPLP pipeline right-of-way, maximized the co-location (abut) of the Project construction and operation workspace with the other existing utility rights-of-way.
    - Narrowed the width of the construction right-of-way from 100 feet to 75 feet along the entire pipeline alignment.
    - Further narrowed the width of the construction right-of-way from 75 feet to 50 feet at all wetland and waterbody crossings, except in a limited number of cases where site-specific conditions required the use of a wider construction right-of-way.
- Measures to Avoid and Reduce Construction and Operation Impact:
    - Use of dry, open trench installation methods at all the remaining (i.e., non-trenchless) open trench wetland and waterbody crossings.
    - Use of wetland and waterbody crossing best management practices, as detailed in (Attachment 11: Enclosure E, Part 4) – Impact Avoidance, Minimization, and Mitigation Procedures; and Attachment 12 – Erosion & Sedimentation Control Plan.
    - As set forth in the Project Impact analyses (Attachment 11: Enclosure D, and Enclosure E, Part 2), implementation of the Project as proposed, including the proposed best management practices presented in the Impact Avoidance, Minimization, and Mitigation Procedures and Erosion & Sedimentation Control Plan, would result temporary and minor impacts to wetlands and associated wetland

functions and values (with the exception of PFO cover type conversion). The resultant impacts are not considered significant or adverse, and thus do not require compensatory mitigation.

- As set forth in the Compensatory Mitigation Plan (Attachment 11: Enclosure F), the remaining unavoidable adverse impacts resulting in PFO cover type conversion (reduced to 0.405 acres Project-wide) would be adequately mitigated via compensatory mitigation.
- As set forth in the Antidegradation Analysis (Attachment 11: Enclosure E, Part 5), the Project as proposed would comply with State antidegradation requirements contained in Chapters 93, 95 and 102 (relating to water quality standards; wastewater treatment requirements; and erosion and sediment control) and the Clean Water Act (CWA) (33 U.S.C.A. § § 1251—1376).
- As set forth in the Cumulative Impacts Assessment (Attachment 11: Enclosure E, Part 6), the Project as proposed, and in consideration of other projects, would not cause cumulative impacts that result in the impairment of the Commonwealth's EV wetland resources or a major impairment of the Commonwealth's other wetland resources.

Adoption of the above programmatic wetland and waterbody impact avoidance and reduction measures resulted in a cumulative quantitative and qualitative reduction in Project impacts on EV Wetlands, Other Wetlands, PFO wetland conversion, HQ and EV Streams, and other (non-HQ/EV) streams (see Section 5.4). Adoption of these measures demonstrate substantive site-specific and cumulative impact avoidance and minimization to the environment, including wetland and waterbodies.

5.4 RESULTS OF AVOIDANCE AND MINIMIZATION OF HARM MEASURES

With the implementation of the above described routing for the Project, and then the avoidance and minimization of harm through minor route changes and construction techniques, potential impacts to wetland and waterbody resources have been avoided and minimized to the maximum extent practicable. This Alternatives Analysis describes a process which has identified, assessed, and adopted quantitative and qualitative impact avoidance and reduction measures, including the most significant ones as follows:

- Co-location (abut and overlap) of the Project with the existing SPLP pipeline right-of-way and co-location (abut) with other utility right-of-way to the maximum extent practicable to avoid and minimize impacts to new land and additional landowners, landscape and habitat fragmentation, federal and state owned lands, and communities, as well as wetlands and waterbodies;
- Major Route Alternatives to allow avoidance of impacts to federal and state sensitive lands and significant protected resources, cultural resources, and communities at a landscape planning level;
- Minor Route Variations to incrementally and further avoid and minimize quantitative impacts to new land and additional landowners, landscape and habitat fragmentation,

federal and state owned lands and significant protected resources, and wetlands and waterbodies at site-specific locations;

- Programmatic Impact Avoidance and Minimization Measures to incrementally and further avoid and minimize quantitative impacts to new land and additional landowners, and reduce quantitative and qualitative impacts to wetlands and waterbodies on a programmatic basis, both cumulatively and on a site-specific basis, across the entire Project; and
- Trenchless Construction Methods to incrementally and further avoid and minimize quantitative impacts to new land and additional landowners, federal and state owned lands and significant protected resources, and federal and state protected wetlands and waterbodies at site-specific locations.

As presented in Table 5, adoption of these measures results in significant cumulative impact avoidance and reduction from the Baseline Route Alternative to the Proposed Route Alternative, including to:

- EV Wetlands – Compared to the Baseline Route Alternative (32.1 acres), implementation of the above measures reduced impacts (by 20.9 acres, a 65.1 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (11.2 acres);
- Other Wetlands – Compared to the Baseline Route Alternative (86.8 acres), implementation of the above measures reduced impacts (by 61.3 acres, a 70.6 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (25.5 acres);
- Total Wetlands – Compared to the Baseline Route Alternative (118.9 acres), implementation of the above measures reduced impacts (by 82.2 acres, a 69.1 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (36.7 acres); and
- PFO Wetlands – Compared to the Baseline Route Alternative (35.2 acres), implementation of the above measures reduced impacts (by 33.7 acres, a 95.7 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (1.6 acres), only 0.405 acre (across 19 wetlands) of which results in PFO wetland cover type conversion.

As presented in Table 6, adoption of these measures results in significant cumulative impact avoidance and reduction from the Baseline Route Alternative to the Proposed Route Alternative, including to:

- HQ and EV Waterbodies – Compared to the Baseline Route Alternative (35,031 linear feet), implementation of the above measures reduced impacts (by 20,622 linear feet, a 58.9 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (14,409 linear feet);
- Other (Non-HQ and EV) Waterbodies – Compared to the Baseline Route Alternative (89,539 linear feet), implementation of the above measures reduced impacts (by 50,817

linear feet, a 56.8 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (38,722 linear feet); and

- Total Waterbodies – Compared to the Baseline Route Alternative (124,570 linear feet), implementation of the above measures reduced impacts (by 71,439 linear feet, a 57.3 percent reduction), resulting in significant cumulative reduction in impacts associated with the Proposed Route Alternative (53,131 linear feet).

With the exception of several PFO wetland cover type conversions of relatively small size (0.405 acre across 19 wetlands), the remaining potential impacts to wetlands and waterbodies, with the implementation of proposed industry-standard and agency-recommended best management practices (see Attachment 11: Enclosure E, Part 4 – Impact Avoidance, Minimization, and Mitigation Procedures; and Attachment 12 – Erosion & Sedimentation Control Plan), are considered temporary and minor (see Attachment 11: Enclosure D – Project Impacts [County-specific], and Attachment 11: Enclosure E, Part 2 – Resource Identification and Project Impacts [Project-wide]).

5.5 PFO WETLAND COVER TYPE CONVERSION COMPENSATORY MITIGATION

As requested by PADEP in its technical deficiency comments, SPLP proposes to provide compensatory mitigation for PFO wetland cover type conversion associated with the Project. With the implementation of the preceding comprehensive pipeline routing and construction design methodology development process (the MOC Process described in Section 5.0), potential impacts to wetland and waterbody resources have been avoided and minimized to the maximum extent practicable (see Section 5.4 and Tables 5 and 6). The effort to avoid and minimize harm resulted in a significant cumulative quantitative impact reduction of PFO wetlands (from 35.2 acres for the Baseline Route Alternative to only 1.6 acres for the Propose Route Alterantive), a reduction of 95.7 percent. Additionally, PFO wetland cover type conversion associated with the Proposed Route Alternative is further reduced to 0.693 acre.

For this remaining, unavoidable, and minor PFO wetland cover type conversion, SPLP has developed and proposes implementation of a tree replanting plan on 0.288 acre of PFO wetlands within the permanent right-of-way, as presented the Impact Avoidance, Minimization, and Mitigation Procedures provided in Attachment 11, Enclosure E, Part 4. The resultant final PFO wetland cover type conversion is limited to 0.405 acre across 19 wetlands falling in 12 counties (a net 98.8 percent impact reduction compared to the Baseline Route Alternative). A conceptual Wetland Compensatory Mitigation Plan provided in Attachment 11: Enclosure F has been developed for the Project to offset the loss associated with the permanent conversion of the PFO cover type.

Table 5. Wetland Impact Reduction from Baseline Route Alternative to Proposed Route Alternative by County and Project-Wide

County/Resource	Baseline Route Alternative (acres)	Narrowed ROW Width at Wetlands (acres)	Proposed Route Alternative[1] (acres)	Cumulative Impact Reduction (acres)	Cumulative Impact Reduction (%)
Washington					
EV Wetlands (Number)	0	0	0	0	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	0.6	0.5	0.6 (0.6)	0 (0)	0 (0)
Subtotal	**0.6**	**0.5**	**0.6 (0.6)**	**0 (0)**	**0 (0)**
PFO Wetlands	0	0	0 (0)	0 (0)	0 (0)
Allegheny					
EV Wetlands (Number)	0	0	0	0	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	0.5	0.4	0.4 (0.4)	0.1 (0.1)	20.0 (20.0)
Subtotal	**0.5**	**0.4**	**0.4 (0.4)**	**0.1 (0.1)**	**20.0 (20.0)**
PFO Wetlands	0	0	0 (0)	0 (0)	0 (0)
Westmoreland					
EV Wetlands (Number)	1	1	0	1	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	8.3	4.5	3.5 (3.3)	4.8 (5.0)	57.8 (60.2)
Subtotal	**8.3**	**4.6**	**3.5 (3.3)**	**4.8 (5.0)**	**42.2 (39.8)**
PFO Wetlands	2.7	0.9	0.1 (0)	2.6 (2.7)	96.3 (100.0)
Indiana					
EV Wetlands (Number)	16	16	13	3	18.8
EV Wetlands	1.4	0.7	0.4 (0.4)	1.0 (1.0)	71.4 (71.4)
Other Wetlands	3.3	1.9	1.0 (0.9)	2.3 (2.4)	69.7 (72.7)
Subtotal	**4.7**	**2.5**	**1.4 (1.3)**	**3.3 (3.4)**	**70.2 (72.3)**
PFO Wetlands	0.4	0.2	0 (0)	0.4 (0.4)	100.0 (100.0)
Cambria					
EV Wetlands (Number)	35	27	20	15	42.9
EV Wetlands	4.6	2.4	1.0 (0.9)	3.6 (3.7)	78.3 (80.4)
Other Wetlands	11.3	6.3	3.8 (3.5)	7.5 (7.8)	66.4 (69.0)
Subtotal	**15.9**	**8.7**	**4.8 (4.4)**	**11.1 (11.5)**	**69.8 (72.3)**
PFO Wetlands	5.1	2.4	0.4 (0.2)	4.7 (4.9)	92.2 (96.1)
Blair					
EV Wetlands (Number)	44	37	29	15	34.1
EV Wetlands	9.8	4.7	3.0 (2.9)	6.8 (6.9)	69.4 (70.4)
Other Wetlands	3.3	1.4	0.2 (0.2)	3.1 (3.1)	93.9 (93.9)
Subtotal	**13.1**	**6.1**	**3.2 (3.1)**	**9.9 (10)**	**75.6 (76.3)**
PFO Wetlands	2.3	1.1	0.1 (0)	2.2 (2.3)	95.7 (100.0)
Huntingdon					
EV Wetlands (Number)	0	0	0	0	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	8.4	6.2	3.5 (3.1)	4.9 (5.3)	58.3 (63.1)

Table 5. Wetland Impact Reduction from Baseline Route Alternative to Proposed Route Alternative by County and Project-Wide

County/Resource	Baseline Route Alternative (acres)	Narrowed ROW Width at Wetlands (acres)	Proposed Route Alternative[1] (acres)	Cumulative Impact Reduction (acres)	Cumulative Impact Reduction (%)
Subtotal	**8.4**	**6.2**	**3.5 (3.1)**	**4.9 (5.3)**	**58.3 (63.1)**
PFO Wetlands	1.9	1.2	0.2 (0)	1.7 (1.9)	89.5 (100.0)
Juniata					
EV Wetlands (Number)	0	0	0	0	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	0.7	0.2	0.3 (0.2)	0.4 (0.5)	57.1 (71.4)
Subtotal	**0.7**	**0.2**	**0.3 (0.2)**	**0.4 (0.5)**	**57.1 (71.4)**
PFO Wetlands	0.2	0	0 (0)	0.2 (0.2)	0 (0)
Perry					
EV Wetlands (Number)	19	25	14	5	26.3
EV Wetlands	3.6	2.7	1.0 (0.9)	2.6 (2.7)	72.2 (75.0)
Other Wetlands	0.5	0.4	0.2 (0.2)	0.3 (0.3)	60.0 (60.0)
Subtotal	**4.1**	**3.1**	**1.2 (1.1)**	**2.9 (3.0)**	**70.7 (73.2)**
PFO Wetlands	0.6	0.2	0.1 (0.1)	0.5 (0.5)	83.3 (83.3)
Cumberland					
EV Wetlands (Number)	5	5	11	-6	-120.0
EV Wetlands	0.9	0.5	2.4 (2.3)	-1.5 (-1.4)	-166.7 (-155.6)
Other Wetlands	21.9	10.8	3.2 (2.8)	18.7 (19.1)	85.4 (87.2)
Subtotal	**22.8**	**11.3**	**5.6 (5.1)**	**17.2 (17.7)**	**75.4 (77.6)**
PFO Wetlands	6.4	1.8	0.2 (0)	6.2 (6.4)	96.9 (100.0)
York					
EV Wetlands (Number)	0	0	0	0	0
EV Wetlands	0	0	0 (0)	0 (0)	0 (0)
Other Wetlands	0.8	0.7	0.4 (0.4)	0.4 (0.4)	50.0 (50.0)
Subtotal	**0.8**	**0.7**	**0.4 (0.4)**	**0.4 (0.4)**	**50.0 (50.0)**
PFO Wetlands	0.4	0.1	0 (0)	0.4 (0.4)	0 (0)
Dauphin					
EV Wetlands (Number)	1	0	1	0	0
EV Wetlands	0.1	0	0 (0)	0.1 (0.1)	100.0 (100.0)
Other Wetlands	7.0	3.9	1.9 (1.6)	5.1 (5.4)	72.9 (77.1)
Subtotal	**7.1**	**3.9**	**1.9 (1.6)**	**5.2 (5.5)**	**73.2 (77.5)**
PFO Wetlands	3.8	1.3	0.2 (0.1)	3.6 (3.7)	94.7 (97.4)
Lebanon					
EV Wetlands (Number)	5	5	4	1	20.0
EV Wetlands	1	0.5	0.5 (0.5)	0.5 (0.5)	50.0 (50.0)
Other Wetlands	4	2.5	0.7 (0.6)	3.3 (3.4)	82.5 (85.0)
Subtotal	**4.9**	**3.0**	**1.2 (1.1)**	**3.7 (3.8)**	**75.5 (77.6)**
PFO Wetlands	2.7	0.7	0.1 (0.1)	2.6 (2.6)	96.3 (96.3)
Lancaster					
EV Wetlands (Number)	7	9	5	2	28.6
EV Wetlands	5.4	3.0	0.4 (0.2)	5.0 (5.2)	92.6 (96.3)

Table 5. Wetland Impact Reduction from Baseline Route Alternative to Proposed Route Alternative by County and Project-Wide

County/Resource	Baseline Route Alternative (acres)	Narrowed ROW Width at Wetlands (acres)	Proposed Route Alternative[1] (acres)	Cumulative Impact Reduction (acres)	Cumulative Impact Reduction (%)
Other Wetlands	2.2	1.2	1.1 (1.1)	1.1 (1.1)	50.0 (50.0)
Subtotal	**7.6**	**4.3**	**1.5 (1.3)**	**6.1 (6.3)**	**80.3 (82.9)**
PFO Wetlands	0.6	0.2	0 (0)	0.6 (0.6)	100.0 (100.0)
Berks					
EV Wetlands (Number)	31	31	30	1	3.2
EV Wetlands	3.0	1.8	1.6 (1.6)	1.4 (1.4)	46.7 (46.7)
Other Wetlands	3.0	1.7	0.6 (0.5)	2.4 (2.5)	80.0 (83.3)
Subtotal	**6.0**	**0**	**2.2 (2.1)**	**3.8 (3.9)**	**63.3 (65.0)**
PFO Wetlands	1.9	0.5	0 (0)	1.9 (1.9)	100.0 (100.0)
Chester					
EV Wetlands (Number)	16	11	10	6	37.5
EV Wetland	1.8	0.9	0.6 (0.6)	1.2 (1.2)	66.7 (66.7)
Other Wetland	7.3	4.6	3.1 (2.9)	4.2 (4.4)	57.5 (60.3)
Subtotal	**9.1**	**5.5**	**3.7 (3.5)**	**5.4 (5.6)**	**59.3 (61.5)**
PFO Wetlands	3.6	0.7	0.1 (0.1)	3.5 (3.5)	97.2 (97.2)
Delaware					
EV Wetlands (Number)	1	1	3	-2	-200.0
EV Wetlands	0.5	0.3	0.3 (0.3)	0.2 (0.2)	40.0 (40.0)
Other Wetlands	3.7	0.9	1.0 (1.0)	2.7 (2.7)	73.0 (73.0)
Subtotal	**4.3**	**1.2**	**1.3 (1.3)**	**3.0 (3.0)**	**69.8 (69.8)**
PFO Wetlands	2.6	0.4	0 (0)	2.6 (2.6)	100.0 (100.0)
Project-Wide Total					
EV Wetlands (Number)	**181**	**168**	**138**	**43**	**23.8**
EV Wetlands Total	**32.1**	**17.5**	**11.2 (10.6)**	**20.9 (21.5)**	**65.1 (67.0)**
Other Wetlands Total	**86.8**	**48.1**	**25.5 (23.3)**	**61.3 (63.5)**	**70.6 (73.2)**
Project-Wide Total	**118.9**	**62.2**	**36.7 (33.9)**	**82.2 (85.0)**	**69.1 (71.5)**
PFO Wetlands Total	**35.2**	**11.7**	**1.6 (0.6)**	**33.7 (34.6)**	**95.7 (98.3)**

Notes:

[1] Impact acreages based on PADEP and USACE Bore/HDD calculations (provided in parenthesis). PADEP calculates permanent disturbance impacts at Bore and HDD crossings based on the width of the pipelines (3-feet) multiplied by the length of the wetland crossing; USACE does not calculate impact acreages for Bore and HDD crossings. However, wetlands crossed via Bore or HDD may have USACE due to travel lanes or clearing.

Table 6. Waterbody Impact Reduction from Baseline Route Alternative to Proposed Route Alternative by County and Project-Wide

County/Resource	Baseline Route Alternative (linear feet)	Narrowed ROW at Waterbodies (linear feet)	Proposed Route Alternative (linear feet)	Cumulative Impact Reduction (linear feet)	Cumulative Impact Reduction (%)
Washington					
HQ and EV Streams	3,214	1,880	1,702	1,512	47.0
Non-HQ and EV Streams	3,324	1,886	984	2,340	70.4
Total	**6,538**	**3,767**	**2,686**	**3,852**	**58.9**
Allegheny					
HQ and EV Streams	0	0	0	0	0
Non-HQ and EV Streams	2,383	1,744	1,540	843	35.4
Total	**2,383**	**1,744**	**1,540**	**843**	**35.4**
Westmoreland					
HQ and EV Streams	4,522	2,367	2,494	2,028	44.8
Non-HQ and EV Streams	8,804	6,112	5,064	3,740	42.5
Total	**13,326**	**8,479**	**7,558**	**5,768**	**43.3**
Indiana					
HQ and EV Streams	2,083	1,232	887	1,196	57.4
Non-HQ and EV Streams	8,391	3,670	3,727	4,664	55.6
Total	**10,474**	**4,903**	**4,614**	**5,859**	**55.9**
Cambria					
HQ and EV Streams	6,647	3,288	3,057	3,590	54.0
Non-HQ and EV Streams	6,733	3,913	3,143	3,590	53.3
Total	**13,380**	**7,200**	**6,200**	**7,180**	**53.7**
Blair					
HQ and EV Streams	1,363	349	188	1,175	86.2
Non-HQ and EV Streams	7,383	2,585	2,096	5,287	71.6
Total	**8,746**	**2,934**	**2,284**	**6,462**	**73.9**
Huntingdon					
HQ and EV Streams	2,324	1,114	1,047	1,277	54.9
Non-HQ and EV Streams	13,657	6,926	6,088	7,569	55.4
HU Total	**15,981**	**8,039**	**7,135**	**8,846**	**55.4**
Juniata					
HQ and EV Streams	0	0	0	0	0
Non-HQ and EV Streams	3,588	2,293	2,204	1,384	38.6
Total	**3,588**	**2,293**	**2,204**	**1,384**	**38.6**
Perry					
HQ and EV Streams	3,353	2,230	1,761	1,592	47.5
Non-HQ and EV Streams	0	0	0	0	0
PE Total	**3,353**	**2,230**	**1,761**	**1,592**	**47.5**
Cumberland					
HQ and EV Streams	2,448	1,064	910	1,538	62.8
Non-HQ and EV Streams	11,044	5,374	4,416	6,628	60.0
Total	**13,492**	**6,438**	**5,326**	**8,166**	**60.5**

Table 6. Waterbody Impact Reduction from Baseline Route Alternative to Proposed Route Alternative by County and Project-Wide

County/Resource	Baseline Route Alternative (linear feet)	Narrowed ROW at Waterbodies (linear feet)	Proposed Route Alternative (linear feet)	Cumulative Impact Reduction (linear feet)	Cumulative Impact Reduction (%)
York					
HQ and EV Streams	0	0	0	0	0
Non-HQ and EV Streams	2,995	1,331	1,540	1,455	48.6
Total	**2,995**	**1,331**	**1,540**	**1,455**	**48.6**
Dauphin					
HQ and EV Streams	0	0	0	0	0
Non-HQ and EV Streams	6,146	2,783	2,271	3,875	63.0
Total	**6,146**	**2,783**	**2,271**	**3,875**	**63.0**
Lebanon					
HQ and EV Streams	0	0	0	0	0
Non-HQ and EV Streams	5,019	2,516	2,112	2,907	57.9
Total	**5,019**	**2,516**	**2,112**	**2,907**	**57.9**
Lancaster					
HQ and EV Streams	1,050	618	64	986	93.9
Non-HQ and EV Streams	1,318	554	715	603	45.8
Total	**2,368**	**1,173**	**779**	**1,589**	**67.1**
Berks					
HQ and EV Streams	4,059	1,717	1,266	2,793	68.8
Non-HQ and EV Streams	2,458	1,415	1,340	1,118	45.5
Total	**6,517**	**3,131**	**2,606**	**3,911**	**60.0**
Chester					
HQ and EV Streams	3,823	1,969	983	2,840	74.3
Non-HQ and EV Streams	1,038	518	164	874	84.2
Total	**4,861**	**2,487**	**1,147**	**3,714**	**76.4**
Delaware					
HQ and EV Streams	145	108	50	95	65.5
Non-HQ and EV Streams	5,258	2,303	1,318	3,940	74.9
Total	**5,403**	**2,411**	**1,368**	**4,035**	**74.7**
Project-Wide Total					
HQ and EV Streams	**35,031**	**17,936**	**14,409**	**20,622**	**58.9**
Non-HQ and EV Streams	**89,539**	**45,923**	**38,722**	**50,817**	**56.8**
Project-Wide Total	**124,570**	**63,859**	**53,131**	**71,439**	**57.3**

6.0 WETLAND-SPECIFIC PRACTICABLE ALTERNTIVES ANALYSIS

6.1 ALTERNATIVES ANSLYSIS NARRATIVES

As presented in this Alternatives Analysis, SPLP designed the proposed Project to be co-located (abut and overlap) with existing SPLP pipeline right-of-way and co-located (abut) with other existing utility rights-of-way (Section 3.2), adopt major route alternatives to avoid and minimize obvious impacts on other (non-wetland) significant environmental resources and communities (Section 3.3), and adopt further quantitative and qualitative impact avoidance and minimization measures (Section 5.0) in a concerted and successful effort to avoid, minimize, and mitigate site-specific and cumulative impacts to wetlands, as well as waterbodies and other (non-wetland) environmental resources, to the maximum extent practicable. This process resulted in the avoidance, minimization, and mitigation of adverse impacts to wetlands and waterbodies from the Project as a whole by investigating successively more site-specific information regarding potential environmental impacts, and developing alternative routing, locations, and designs to avoid and minimize those potential environmental impacts.

Following establishment of the Baseline Route Alternative and associated 200-foot-wide survey corridor (Section 3.4), SPLP conducted the integrated evaluation of the route via the MOC Process (Section 5.0). This MOC Process considered opportunities to change the Baseline Route Alternative to further avoid and minimize potential environmental impacts, while simultaneously considering potential construction and operational constraints presented by affected landowners, existing land uses, infrastructure obstacles, and other factors affecting use of existing technology, cost, and logistics.

As presented in Section 5.0, the MOC Process was initiated on a site-specific basis as opportunities or constraints were raised by an Integrated Project Team, consisting of representatives from SPLP project management, engineering, land/right-of-way, and environmental specialists. The MOC Process engaged and solicited input from each member of the Integrated Project Team on a given alternative minor route variation or trenchless construction method (i.e., conventional bore or HDD) under consideration. With the approval from each member of the Integrated Project Team, including environmental, each adopted change was determined to avoid significant impacts on other (non-wetland) environmental resources, to avoid and minimize impacts on wetlands (as well as waterbodies) to the maximum extent practicable, and to be practicable (feasible, constructible, operable) with regard to current technology, cost, and logistics.

Implementation of this MOC Process resulted in the evaluation and adoption of 72 minor route variations (see Section 5.1 and Table 3) and a significant number of trenchless crossings (see Section 5.2 and Table 4) to avoid or minimize: 1) significant impacts on other (non-wetland) environmental resources, 2) permanent PFO wetland cover type conversion, and 3) remaining temporary and minor site-specific impacts on wetlands and waterbodies.

In response to PADEP comments, a detailed, site-specific practicable alternatives assessment embodied in the MOC process is presented. This assessment addresses each crossing

area (CA) that contains an individual or group of proximate individual wetland (and waterbody) resources that are proposed for open trench pipeline installation; crossing areas determined to be suitable, practicable, and proposed for trenchless construction methods (e.g., conventional bore and HDD) to entirely avoid surface impacts to wetland and other (non-wetland) sensitive environmental resources are previously presented in Section 5.2. Each crossing area represents a reasonable area of analysis for the consideration of alternative construction techniques (e.g., conventional bore, HDD, and trenching) potentially available based on current technology, cost, and logistics. The Project contains a total of 349 crossing areas, encompassing a total of 405 wetland (inclusive of 303 waterbody) resource crossings initially proposed for open trench pipeline installation.

For each CA, a wetland (site)-specific practicable alternatives assessment narrative is presented in Appendix D. Each wetland (site)-specific practicable alternatives assessment narrative includes baseline information on wetland, as well as waterbody, resources within the crossing area, and any specific PADEP comment(s) regarding the resources within the crossing area. Each assessment includes a narrative qualitative comparison of conventional bore, HDD, Trenching-Proposed, and Trenching-Alternative routes. This includes a qualitative assessment of impacts to resources or constraints (e.g., other significant resources, wetlands, waterbodies, and other site-specific and cumulative environmental and community resource impacts), and a summary of technical feasibility and practicability for each alternative with regarding to current technology, cost, and logistics. Additionally, each assessment includes a figure with aerial photographic background depicting the location of a Trenching-Proposed route and a Trenching-Alternative route (or MOC-considered routing), as well as wetland and waterbody resources delineated within the 200-foot-wide survey corridor, and other (non-wetland) sensitive environmental resources identified within (via field delineation or desk-top databases) or adjacent to (via desk-top databases) the survey corridor.

For each wetland (site)-specific practicable alternatives assessment, the MOC reference number is noted if applicable, as well as notation whether the MOC was adopted, and the proposed construction method.

6.2 SUMMARY TABLE OF ALTERNATIVES ANSLYSIS

Table 7 (Appendix D) provides a summary of the results of the wetland (site)-specific practicable alternatives assessment. This table identifies the CA identification number, latitude and longitude centroid location, county, and wetland (including breakdown by EV wetlands [and EV wetland designation] vs other wetlands) and waterbody (including breakdown by HQ and EV waterbodies vs. other waterbodies) resources encompassed within the CA. This table also identifies the field-determined wetland functions and values encompassed within the CA.

For each CA, a summary of the results of the Trenchless Construction Feasibility Analysis (Appendix A), as further evaluated in the wetland (site)-specific practicable alternatives analysis herein, is provided. For each the CAB and the HDD construction methodologies, the table notes whether the subject methodology is technically feasible, and practicable, noted as yes ("Y"), potentially ("P"), or no ("N").

For each CA, a summary comparison of the the Trenching-Alternative or Trenching-Proposed route is provided. For each the Trenching-Alternative or Trenching-Proposed routes, the table notes whether the subject methodology is technically feasible, and practicable, noted as yes ("Y"), potentially ("P"), or no ("N").

In addition, for each the Trenching-Alternative or Trenching-Proposed routes, 12 environmental impact avoidance or reduction criterion are presented, including evaluation of the following:

- Avoid Other (Non-Wetland) Significant Impact – this criterion identifies whether the subject route avoids a significant other (non-wetland) resource, such as a cultural resource site, T&E species record, sensitive or protected land, or residential, commercial, or industrial structures and associated infrastructure.
- Avoid & Minimize Wetland Impacts – this criterion identifies whether the subject route avoids and minimizes the areal extent of disturbance to wetlands compared to the alternative route. This assessment was based on in-field wetland delineation data within the 200-foot-wide survey corridor; and review of aerial photographs, NWI maps, and in-field wetland continuation lines (in-field observation that the delineated wetland continues beyond the 200-foot-wide survey corridor) beyond the 200-foot-wide survey corridor.
- Avoid & Minimize Waterbody Impacts – this criterion identifies whether the subject route avoids and minimizes the linear footage of disturbance to waterbodies (streams) compared to the alternative route. This assessment was based on in-field waterbody delineation data within the 200-foot-wide survey corridor; and review of aerial photographs and National Hydrologic Database data beyond the 200-foot-wide survey corridor).
- Decreased Land Encumbrance – this criterion identifies whether the subject route, compared to the alternative route, decreases the amount of new, permanent land disturbance and encumbrance on existing industrial and commercial development and associated land uses; decreases the amount of new, permanent land disturbance on existing private residential development, private land uses, and affected private landowners; futher avoids permanent reduction in availability of land for future development; and facilitates consistency with county comprehensive plans.
- Decreased Land Fragementation – this criterion identifies whether the subject route, compared to the alternative route, decreases the amount of new, permanent land disturbance and landscape fragmentation, including impairment of natural landscapes, scenic uses, recreational uses, contiguous forested lands, and contiguous natural resources.
- Decreased Forest Fragmentation – this criterion identifies whether the subject route, compared to the alternative route, decreases the amount of new, permanent forested land fragmentation, including impairment of forested ecosystem functions and values, watershed/water quality values, and availability of contiguous forest habitat for interior

wildlife species and migratory birds protected pursuant to the Migratory Bird Treaty Act.

- Decreased Forested Land Impact – this criterion identifies whether the subject route, compared to the alternative route, decreases the permanent reduction in availability of forested land for future forested land uses, forest production, and associated forest natural resources.
- Decreased Natural Resource Impact – this criterion identifies whether the subject route, compared to the alternative route, decreases the permanent reduction in availability of land for future natural resource uses, including natural landscapes, scenic uses, recreational uses, and other natural resources.
- Decreased Cumulative Impacts – this criterion identifies whether the subject route, compared to the alternative route, decreases the potential to effectuate a cumulative impact on land use planning, land fragmentation, forest fragmentation, and natural resource fragmentation.
- Optimal Pipeline Construction – this criterion identifies whether the subject route, compared to the alternative route, facilitates optimal pipeline construction with regard to process, safety, access, efficiency, and duration, on a site-specific and cumulative basis.
- Optimal Pipeline Operations – this criterion identifies whether the subject route, compared to the alternative route, facilitates optimal pipeline operation with regard to process, safety, access, efficiency, and duration, on a site-specific and cumulative basis.
- Decreased Costs – this criterion identifies whether the subject route, compared to the alternative route, results in decreased pipeline construction and operation costs.

For each CA, Table 7 provides a summary comparison as to whether the Trenching-Alternative or Trenching-Proposed route meets each environmental impact reduction criterion. Each environmental impact reduction criterion is noted with one of three analysis outcomes:

- Yes ("Y"), meaning the subject route meets the environmental impact reduction criterion when compared to the alternative route;
- Potentially ("P"), meaning the subject route potentially meets the environmental impact reduction criterion when compared to the alternative route, but such determination requires additional site-specific information (e.g., in-field wetland delineation outside of 200-foot-wide survey corridor) to confirm; or
- No or neutral (blank), meaning either the subject route does not meet the environmental impact reduction criterion when compared to the alternative route, or both routes equally meet the environmental impact reduction criterion.

Appendix D presents Table 7 (results summary), followed by a legend depicting the typology used on the site-specific practicable alternatives assessments maps, then the site-specific practicable alternatives assessment narratives for each of the 349 crossing areas.

7.0 STREAM-SPECIFIC IMPACT AVOIDANCE AND MINIMIZATION ASSESSMENT

As requested by PADEP in it is technical deficiency comments, SPLP evaluated a total of 16 site-specific areas of proposed stream crossings not associated with any wetland crossing area (each designated with a unique Stream Area [SA] identification number). Specifically, SPLP evaluated each SA with regard to PADEP's site-specific comments regarding use of new or the potential extension of the length of currently proposed trenchless construction techniques, work space reconfiguration, or other actions to further avoid or minimize impacts on streams, which is provided as Appendix E.

For each designated SA, a stream-specific impact avoidance and minimization assessment is presented. Each assessment presents the stream-specific PADEP comment(s) regarding the crossing area. Each assessment includes baseline information on the stream and a narrative qualitative assessment of the practicability of conventional bore, HDD, Trenching-Proposed route, Trenching-Alternative route, work space reconfiguration, or other action as commented by PADEP.

8.0 SUMMARY AND CONCLUSIONS

In conclusion, SPLP has assessed and balanced potential environmental impacts to develop a practicable proposed pipeline route and station and valve setting locations. Specifically with regard to the Project, SPLP has done the following:

- Co-location With Existing Rights-of-Way – In accordance with state and federal guidance, has routed the Project to be co-located with existing pipeline and other utility corridors, and to avoid new "greenfield" routing alignments, to the maximum extent practicable. This avoids and minimizes new and permanent impacts on previously undisturbed land, land use encumbrance, and site-specific and cumulative impacts on land, environmental, and community resources.
- Avoid Significant Environmental Impacts – SPLP has adopted re-routes and trenchless construction method as part of the Project to avoid significant impacts on both wetland and other (non-wetland) environmental resources.
- Minimize and Mitigate Temporary Impacts – In all areas where there will be construction-related impacts to wetlands, SPLP plans to restore the area to its prior condition making the impact temporary and minor.
- Compensatory Mitigation of Unavoidable Permanent Impacts – When SPLP could not avoid or further minimize permanent impacts, it has provided for compensatory mitigation of wetland impacts.

Cumulatively, the Project meets all federal, state, and local environmental (as well as critical non-environmental) regulations and guidance. Specifically, the Project maximizes co-location with existing rights-of-way (over 80 percent), utilizes the minimum amount of construction workspace practicable, utilizes a significant number of trenchless construction

methods (conventional bore and HDD crossings) to cross sensitive resources such as waters and wetlands, and adopts carefully considered, site-specific route variations to avoid and minimize environmental impact while ensuring construction and operation of the Project.

Through these substantial planning efforts, the Project avoids permanent significant impacts on regulatory-protected sensitive environmental resources, avoids and minimizes permanent encumbrance on new lands, avoids and minimizes permanent PFO wetland conversion (0.405 acres), and avoids and minimizes impacts on PADEP-protected wetlands (as well as waterbodies) including exceptional value wetlands, and with regard to areal extent, functions and values, unique functions and values, and other federal and state regulatory protections on other wetlands. With the implementation of industry-standard and additional federal, state, and local agency-required best management practices, the remaining, unavoidable impacts to wetlands (and waterbodies) are temporary and minor. Based on the above measures and planning results, the proposed Project by definition also avoids and minimizes potential cumulative effects on the environment, including wetlands (and waterbodies), as required by PADEP regulations.

9.0 REFERENCES

Federal Energy Regulatory Commission (FERC). 2004. Research of Wetland Construction and Mitigation Activities for Certificated Section 7(c) Pipeline Projects. Federal Energy Regulatory Commission, Office of Energy Projects. Washington, D.C. 53 pp. + app.

Federal Energy Regulatory Commission (FERC). 2013. Wetland and Waterbody Construction and Mitigation Procedures. May 2013 Version. 20 pp.

Pennsylvania Department of Environmental Protection (PADEP) – Pipeline Infrastructure Task Force. 2016. Governor's Pipeline Infrastructure Task Force (PITF) Report. February 2016. 658 pp. (unnumbered).

U.S. Fish and Wildlife Service (USFWS). Undated. USFWS Pennsylvania Field Office – Adaptive Management for the Conservation of Migratory Birds. USFWS, Pennsylvania Field Office. 2 pp. (unnumbered).

APPENDIX A

Major Route Alternatives Figures

APPENDIX B

Trenchless Construction Feasibility Analysis

APPENDIX C

Trenchless Area Practicable Alternatives Assessment

APPENDIX D

Wetland-specific Practicable Alternatives Assessment

APPENDIX E

Stream Area Impact Avoidance and Minimization Assessment