

*Atlantic Sunrise Project – PA DEP Chapter 105 Joint Permit Application
Transcontinental Gas Pipe Line Company, LLC
Lebanon County*

ATTACHMENT L -4
ENVIRONMENTAL ASSESSMENT FORM ENCLOSURE C

ENCLOSURE C DESCRIPTION OF AQUATIC HABITAT

Transcontinental Gas Pipe Line Company, LLC (Transco) is submitting an application to the Pennsylvania Department of Environmental Protection (PADEP) for a Joint Permit under the Chapter 105 Pennsylvania Water Obstruction and Encroachment guidelines. This permit application only addresses the portions of the Project located in Pennsylvania, subject to PA Code Title 25 Chapter 105 and within the jurisdiction of the Northeast, North Central and South Central Regions of the PADEP. For Project-related impacts to waters of the United States subject to jurisdiction under Section 404 of the Clean Water Act, Transco has applied for an Individual Permit with the U.S. Army Corps of Engineers (USACE) Baltimore District. Transco applied for a 401 Water Quality Certification for the entire Project on April 9, 2015 at the direction of PADEP. **Attachment J** of this permit application includes a Project Description that further details the purpose and need and components of the proposed Atlantic Sunrise Project.

The Project is located primarily within the Susquehanna River drainage basin subregion (4-digit HUC) which is within the Lower Susquehanna Major Basin (6-digit HUC) and the Lower Susquehanna Subbasin (8-digit HUC). The Project is located in watersheds with water quality classifications identified as Cold Water Fishes (CWF) and Migratory Fishes (MF), Warm Water Fishes (WWF) and MF, and Trout Stocked Fishes (TSF) and MF according to PA Code Title 25 Chapter 93.

The Wetland Delineation and Stream Identification Report in Section L, Enclosure A, provides additional information regarding specific streams and watercourses in the Project study area. The total construction workspace associated with the Project located in Lebanon County is approximately ~~529.59531.65~~ acres. To date, ~~approximately 94.5100~~ percent of the workspace within Lebanon County has been surveyed for aquatic habitats including wetlands and waterways. ~~Only those resources that have been identified in the field (ground truthed) are included in this Environmental Assessment Form. Additional surveys are being completed on properties approved for access during the 2015 field season.~~ The *surveyed* wetland and watercourse boundaries ~~for ground truthed resources~~ were *initially* reviewed in the field and verified by the USACE and PA DEP in June 2015. *Additional field reviews with USACE and PA DEP were conducted in August 2016, December 2016, and April 2017.*

Field surveys conducted to date identified 40-38 wetlands and 56-54 watercourses located within the Project construction workspace.

A. Aquatic Habitat

A1. Food Chain Production

Intermittent and perennial streams in the Project study area contribute to aquatic and terrestrial food chains by serving as a breeding site for fish, insects, and amphibians. Larger wetlands that are inundated for extended periods of time may also contribute to food chain production. The larval forms of many insects and macroinvertebrates are aquatic, and amphibians spend all or part of their life cycle in aquatic habitats. Insects and amphibians produced in aquatic habitats can be locally important food organisms for a variety of fish, reptiles, birds, and mammals. Moreover, wetlands include plant food sources that may be used by a number of bird, and mammal species. Emergent plant species providing food value to wildlife include bulrush, sedge, and grass species. Shrub and woody vegetation growing within wetlands identified as PFO and PSS contain plants that may be used as a food source by various bird species. PEM wetlands can provide food to various bird species as well.

A2. General Habitat

Transco delineated and classified wetland resources within the Project area through field surveys conducted in 2014, 2015, ~~and 2016~~, and 2017. Wetlands crossed by the Project in Pennsylvania were field delineated in accordance with the United States Army Corps of Engineers USACE Wetlands Delineation Manual (Environmental Laboratory 1987), the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0) (USACE 2011).

The USFWS wetland classification system described by Cowardin, et al. (1979) was used to classify wetlands delineated within the Project area. The wetlands within the Project area were identified as PFO, PSS, and PEM, or a combination of these three Cowardin classes. Palustrine systems include all non-tidal wetlands that are dominated by trees, shrubs, persistent emergents, and emergent mosses or lichens and all wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent. The palustrine system was developed to group vegetated wetlands, commonly referred to as marshes, swamps, bogs, and prairies.

This system includes ponds and may be situated shoreward of lakes, river channels, estuaries, and river floodplains or in isolated catchments or on slopes (Cowardin et al. 1979).

To obtain regional relevance, the Cowardin classes can be described according to the *Terrestrial and Palustrine Plant Communities of Pennsylvania* (Fike 1999). Vascular plant species nomenclature presented in this section is from *The Plants of Pennsylvania* (Block and Rhoads 2007). The classification system used by Fike (1999) defines plant communities as “an assemblage of plant populations sharing a common environment and interacting with each other, with animal populations, and with the physical environment.” Though Fike classifications were not specifically conducted for each delineated wetland, those described in this chapter were noted to be present and associated with at least some of the mapped wetlands within the Project area.

Palustrine Forested Wetlands (PFO)

Cowardin class PFOs are characterized by woody vegetation that is 6 meters (approximately 20 feet) tall or taller and normally include an overstory of trees, an understory of young trees or shrubs, and an herbaceous layer (Cowardin et al. 1979). According to *Terrestrial and Palustrine Plant Communities of Pennsylvania* (Fike 1999), areas in which the canopy is closed or nearly closed, with 60 to 100 percent tree cover, are classified as Palustrine Forests. Areas in which the tree cover is sparse (between 10 and 60 percent cover) are classified as Palustrine Woodlands. Shrubs may be present in these areas, but they do not dominate the community. Herbaceous and non-vascular plant covers also are known to occur in Palustrine Woodlands. Fike (1999) palustrine forest communities correlating to Project area PFO wetlands include the following:

Coniferous Palustrine Forests: Hemlock - Mixed Hardwood Palustrine Forest

This community type is dominated by a mixture of conifers and hardwood species and typically is characterized by a mineral soil or muck over mineral soil and by some groundwater enrichment. Eastern hemlock (*Tsuga canadensis*) comprises between 25 and 75 percent of the canopy. Other conifer species include white pine (*Pinus strobus*) and red spruce (*Picea rubens*). Yellow birch (*Betula lenta*), red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), black gum (*Nyssa sylvatica*), and gray birch (*Betula populifolia*) are the predominant hardwood species found in these communities. Common shrubs include highbush blueberry (*Vaccinium*

corymbosum), winterberry (*Ilex verticillata*), and swamp azalea (*Rhododendron viscosum*). Typical herbaceous vegetation includes cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), sedge species (*Carex* spp.), and skunk cabbage (*Symplocarpus foetidus*). Sphagnum moss (*Sphagnum* spp.) often is found in hemlock-mixed hardwood palustrine forest communities (Fike 1999).

Coniferous - Broadleaf Palustrine Woodlands: Hemlock - Mixed Hardwood Palustrine Woodland

This category describes a group of wetland forests dominated by a mixture of conifers and hardwood species. The substrate usually is mineral soil or muck over mineral soil. There is generally some groundwater enrichment in these systems. Eastern hemlock contributes 25 percent to 75 percent of the canopy. Other conifer species that may occur with hemlock include eastern white pine, red spruce, and tamarack (*Larix laricina*). The most common hardwood species are yellow birch, red maple, black ash, black gum, and gray birch. Rosebay (*Rhododendron maximum*) often forms a dense understory; other shrubs include highbush blueberry, winterberry, swamp azalea, and witherod (*Viburnum cassinoides*). Herbaceous species include cinnamon fern, sedges (e.g., *Carex trisperma*, *Carex prasina*, *Carex leptalea*), violets (*Viola* spp.), skunk-cabbage, false hellebore (*Veratrum viride*), sensitive fern, partridge-berry (*Mitchella repens*), gold-thread (*Coptis trifolia*), Canada mayflower (*Maianthemum canadense*), crested wood fern (*Dryopteris cristata*), and purple-stemmed aster (*Symphotrichum puniceum*). The bryophyte layer usually is well developed and may be dominated by sphagnum (Fike 1999).

Broadleaf Woodlands: Red Maple – Mixed Shrub Palustrine Woodland

This community type is characterized by a tree cover between 10 and 60 percent, dominated by red maple, and has a dense understory of shrubs. The substrate usually is mineral soil or muck over mineral soil. Other tree species may include blackgum (*Nyssa sylvatica*), Eastern hemlock, eastern white pine, black willow (*Salix nigra*), swamp white oak (*Quercus bicolor*), pin oak (*Q. palustris*), and black ash. The shrub layer is typically dense and includes silky dogwood (*Cornus amomum*), winterberry, spicebush (*Lindera benzoin*), smooth alder (*Alnus serrulata*), silky willow (*Salix sericea*), swamp rose (*Rosa palustris*), and buttonbush (*Cephalanthus occidentalis*). Ferns typically are the dominant vegetation within the herbaceous layer and include marsh fern (*Thelypteris palustris*), cinnamon fern, sensitive fern, crested wood fern (*Dryopteris cristata*), and royal fern (*Osmunda regalis*). Other herbs include skunk-cabbage, beggar-ticks (*Bidens*

spp.), and jewelweed (*Impatiens capensis*). Areas of the woodland floor with long-duration hydrology support the growth of arrow-arum (*Peltandra virginica*), wapato (*Sagittaria latifolia*), and marsh-marigold (*Caltha palustris*) (Fike 1999).

Palustrine Scrub-Shrub Wetlands (PSS)

Cowardin class PSS wetlands include freshwater wetlands dominated by woody vegetation less than 20 feet in height or with trunks less than 3 inches diameter at breast height (dbh). PSS wetlands include true shrubs, saplings, young trees, and trees or shrubs that are small or stunted because of environmental conditions (Cowardin et al. 1979). PSS wetlands are widespread, highly variable communities with shrub-dominated wetlands that occur on mineral or mucky mineral soils that are either seasonally or temporarily flooded. They are typically found in flat areas in which the water table is at or above the soil surface for most of the year. Shrub swamps generally are found on the transition zone of emergent and forested areas that have been previously disturbed.

Review of Project area PSS wetlands did not identify any direct correlations between this Cowardin class and Fike (1999) palustrine shrubland communities. Regardless, typical vegetation within Project area PSS wetlands include multiflora rose (*Rosa multiflora*), black willow, red maple, highbush blueberry, tussock sedge (*Carex stricta*), and jewelweed. Multiflora rose is listed as a noxious weed within the Commonwealth of Pennsylvania.

Palustrine Emergent Wetlands (PEM)

Cowardin class PEM wetlands are non-tidal wetlands characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. Hydrophytic vegetation is present for a majority of the growing season in most years. PEM wetlands usually are dominated by perennial herbaceous plants, though some woody plants may be present. Plant communities present in PEM wetlands can be very dynamic due to the variable hydrologic conditions through the growing season and between growing seasons (Cowardin et al. 1979). Fike (1999) herbaceous emergent wetland communities correlating to Project area PEM wetlands include the following:

Emergent Wetland: Mixed Forb – Graminoid Wet Meadow

This is a common, statewide, diverse wetland type characterized by poorly drained clay loam soils, few to scattered trees, and may occur as old fields, grasslands, or alluvial bottoms where

trees have been removed. This type of wetland may be subject to seasonal grazing or mowing. Plant species composition is diverse, though some sites may be dominated by one or two species. Representative species include a combination of grass, grass-like (Graminoid) and forb species. Species include goldenrods (*Solidago* spp.), rice cutgrass (*Leersia oryzoides*), woolgrass (*Scirpus cyperinus*), bugleweed (*Lycopus uniflorus*), smartweeds, sedges (*Carex stipata* var. *stipata*, *C. canescens*, *C. lurida*, *C. cristatella*, *C. tribuloides*, *C. vesicaria*, *C. stricta*), soft rush (*Juncus effusus*), Joe-Pye-weed (*Eutrochium* spp.), boneset (*Eupatorium perfoliatum*), cinnamon ferns, Canadian St. John's-wort (*Hypericum canadense*), bluejoint (*Calamagrostis canadensis* var. *canadensis*), New York ironweed (*Vernonia noveboracensis*), beggar-ticks (*Bidens* spp.), dwarf St. John's-wort (*Hypericum mutilum*), bulrush (*Scirpus* spp.), marsh St. John's-wort (*Triadenum virginicum*), rattlesnake mannagrass (*Glyceria canadensis*), and spike-rushes (*Eleocharis* spp.). Scattered shrubs may be present, including steeplebush (*Spiraea tomentosa*), silky dogwood (*Cornus amomum*), gray dogwood (*Cornus racemosa*), red-osier dogwood (*Cornus sericea*), and arrow-wood (*Viburnum recognitum*). Noxious weed species such as purple loosestrife (*Lythrum salicaria*) and a variety of non-native grasses, such as reed canary-grass (*Phalaris arundinacea*) are frequently found in these meadows (Fike 1999).

Emergent Wetland: Mixed Forb Marsh

This wetland community occurs along lake margins, flooded depressions, and other wetlands that remain inundated throughout the growing season. Soils may contain muck at or near the surface and many of these wetlands are associated with sandy soils. The plant composition is variable and includes aquatic emergent plants as well as submerged aquatic species.

Characteristic species include three-way sedge (*Dulichium arundinaceum* var. *arundinaceum*), halberd-leaf tearthumb (*Persicaria arifolia*), tearthumb (*Persicaria sagittata*), dock (*Rumex* spp.), sharp-fruited rush (*Juncus acuminatus*), beggar-ticks (*Bidens* spp.), jewelweed, sensitive fern, wapato, sedges (*Carex stricta*, *C. lacustris*, *C. lurida*, *C. crinita*, *C. stipata*, *C. tribuloides*, *C. scoparia*, *C. projecta*, *C. comosa*, *C. hystericina*, *C. baileyi*), sweet-flag (*Acorus calamus*), and rice cutgrass (Fike 1999).

Emergent Wetland: Skunk Cabbage – Golden Saxifrage Seep

Emergent wetlands are associated with seeps that occur where groundwater flow is expressed at the surface and saturates a broad area without forming a channel, which would otherwise promote drainage. These wetland types often form underneath a forest canopy. Species

composition is highly variable, but can include turtlehead (*Chelone glabra*), red maple, Jack-in-the-pulpit (*Arisaema triphyllum*) Pennsylvania bittercress (*Cardamine pensylvanica*), sedge (*Carex prasina*), winterberry, spicebush, hornbeam (*Carpinus caroliniana*), skunk-cabbage, golden saxifrage (*Chrysosplenium americanum*), cinnamon fern, sedge (*Carex scabrata*), jewelweed, spinulose wood fern (*Dryopteris carthusiana*), Pennsylvania bittercress (*Cardamine pensylvanica*), clearweed (*Pilea pumila*), slender mannagrass (*Glyceria melicaria*), swamp saxifrage (*Saxifraga pensylvanica*), and sensitive fern. Bryophytes include *Brachythecium rivulare*, *Bryhnia novae-angliae*, *Rhynchostegium serrulatum*, *Rhizomnium punctatum*, *Sphagnum* spp., and *Thuidium delicatulum*. Shrubs may be present, common representatives include alders (*Alnus* spp.), spicebush, viburnums (*Viburnum* spp.), and dogwoods (*Cornus* spp.) (Fike 1999).

Information on aquatic habitats was derived from three principal sources: Project-specific communication with federal and state agencies; published and unpublished natural resources data pertaining to the regional Project area; and biological field surveys. The field surveys included wetland delineations and rare species habitat evaluations. Table L-4(c)-1 lists the ecological functions served by each wetland and watercourse type within Lebanon County.

**Table L-4(c)-1
 Ecological Functions of Wetlands Associated with the Atlantic Sunrise Project within Lebanon County**

Ecological Function	Emergent Wetlands	Forested Wetlands	Scrub-Shrub Wetlands
Groundwater Re-charge/Discharge		X	
Floodflow Alteration	X		
Fish and Shellfish Habitat		X	
Sediment/Toxicant/Pathogen Retention	X	X	
Nutrient Removal/Retention/Transformation	X	X	
Production/Export			
Sediment/Shoreline Stabilization			
Wildlife Habitat	X	X	X
Recreation			
Education/Scientific Value			
Uniqueness/Heritage			
Visual Quality/Aesthetics			
Threatened or Endangered Species Habitat			

Riverine

Riverine systems are defined as wetland and deepwater habitats contained within a channel with periodic or continuously moving water. Although a multitude of intermittent and perennial stream systems are crossed by the Project route, the Susquehanna River is the most prominent Riverine feature represented within the Project area. According to Fike (1999) sparsely vegetated wetland communities, two communities have the potential to be present along the Susquehanna River: Floodplain Scour Community and Periodically Exposed Shoreline Community. Review of the crossing locations along the Project route did not identify the presence of either of these communities.

Sparsely Vegetated Wetland Communities - Periodically Exposed Shoreline Community

This community is found on all orders of streams, and in a wide variety of riverine settings including island heads, bars, spits, low terraces, and river banks. The underlying substrate also varies greatly, though it is often cobbles and sand with thin deposits of silt, muck, or organic matter.

According to Fike (1999), this community type is a component of ponds, lakes, and river floodplains, and occurs along nearly every creek and river. This community type, while common, provides important habitat for a number of rare insect species, namely tiger beetles (genus *Cicindela*), and ground beetles (order *Carabidae*) and others.

Aside from the Fike community described above, rivers/streams within the Project route have many values assigned to them by the state of Pennsylvania. Based on Pennsylvania Code (Title 25, Chapter 93), streams designated as Trout Stocking Fisheries have conditions suitable for supporting stocked trout between February 15 and July 31, and maintaining other flora and fauna indigenous to a warm water habitat. High Quality Waters support a high quality benthic macroinvertebrate and fish community, potentially including trout. Exceptional Value Waters are similar to High Quality Waters, but may maintain a healthier macroinvertebrate community and/or be located in a designated area that supports natural communities such as a state park.

Under Pennsylvania Code Title 58, Chapter 57, the Pennsylvania Fish and Boat Commission (PFBC) classifies watercourses that support trout populations (either stocked or native) or provide trout habitat as follows: Wild Trout Waters (also identified by PFBC as “Wild Trout

Streams”, “Stream Sections that Support Natural Reproduction of Trout” and “Trout Natural Reproduction Waters”), including upstream tributaries; Class A Wild Trout Streams; and Wilderness Trout Streams. In general, Wilderness Trout Streams provide the most suitable conditions for trout as reflected by natural abundance levels, followed by Class A Wild Trout Waters and then Approved Trout Waters. PFBC-designated Trout Stocked Streams and Warmwater/Coolwater fisheries are generally not cold enough to maintain trout populations, but provide suitable habitat for seasonal stocking of trout and other sport fish.

A2a through A2g. Nesting, Spawning, Rearing, Resting, Migration, Feeding, and Escape Cover

Within the Project route, these forested wetland communities provide habitat for a variety of avian, mammal and amphibian species. For avian species, vegetation structure provides nesting, rearing, resting, escape cover, feeding, and migratory habitat. The intermittent water table, which excludes the presence of fish populations within these wetlands, provides diverse habitat for amphibians, including spawning and feeding habitats. Amphibian habitat is often provided by a “hummock and hollow” microtopography within this palustrine forest community (Fike 1999). Field delineated wetlands within this forest type for the Project noted that “hummock and hollow” micro-topography was often present where Eastern hemlocks (*Tsuga canadensis*) occupy hummocks, and hollows occur between trees.

Conewago Creek, Quittapahilla Creek, and Trout Run are classified by the PA Fish and Boat Commission (PFBC) as approved trout waters. The main stem of Conewago Creek and Quittapahill Creek, as well as Trout Run and two of its tributaries have been confirmed by PFBC to be stocked within 0.5 miles of the Project area. Additionally, Trout Run, Swatara Creek and their tributaries are classified by PFBC under PA Code Title 58, Chapter 57.11 as Wild Trout Streams, or a stream that supports the natural reproduction of trout. The perennial watercourses in the Project study area may provide spawning habitat for trout and/or small fish species and contribute to the water quality of downstream waters for the spawning of larger fish. The substrate within each of the watercourses crossed by the Project is variable and includes, but is not limited to: boulder, cobble, gravel, sand, silt, clay, and vegetation. All watercourses in the Project area are considered MF for the passage, maintenance, and propagation of anadromous and catadromous fishes and other fishes which move to, or from, flowing waters to complete their life cycle in other waters, according to PA Code Title 25 Chapter 93. It has been confirmed

with PFBC that there are currently no stocked anadromous fishes within the Project area. Adequate fish cover is available under cobble, undercut banks, and woody debris.

A variety of open water and vernal pool aquatic habitats were delineated within the Project route. Some of these may be classified as vernal pools, but wetland survey methods did not specifically target the identification of vernal pools. Due to long duration ponded water, these aquatic resources are typically sparsely vegetated, and in the case of vernal pools, susceptible to seasonal drying.

Watercourses within the Project area contain cobble and woody debris that may provide a resting habitat for aquatic organisms. Vegetation within wetlands provides shade and limited resting opportunities for wildlife species such as small mammals, amphibians, and insects. Larger PEM, PSS, and PFO wetlands with a greater degree of vegetation profile heterogeneity may provide additional resting habitat and escape cover for wildlife species.

Riffle-pool complexes in the streams provide minimal escape cover for aquatic species. Woody debris and undercut banks may also serve as cover for escape. Some wetlands in the Project area have sufficient vegetation to provide escape cover for small vertebrates and white-tailed deer.

Since PA falls within both the Atlantic and Appalachian Flyways for migratory birds, many bird groups utilize PA's natural habitats for resting, breeding, and nesting. Breeding populations of interior forest bird species depend upon unfragmented forests. The St. Anthony's Wilderness - SGL 211 IBA is located near Fredericksburg in Schuylkill and Lebanon Counties. In total, the Project crosses it for a distance of 4.4 miles. This IBA encompasses approximately 70,000 acres and primarily consists of SGL 211, but also includes a municipal watershed and reservoir, and private property. This mountainous area is comprised primarily of forest with a few cleared areas that serve as forage grounds for wildlife. The IBA contains a relatively large and intact forest, which provides habitat for interior forest species such as cerulean warbler (*Setophaga cerulea*), red-headed woodpecker (*Melanerpes erythrocephalus*), and eastern wood-pewee (*Contopus virens*). A majority of the area crossed by the Project consists of continuous mixed forest or deciduous forest habitat, as well as some patches of cropland/pastureland and shrubland.

Transco developed a Migratory Bird Plan in coordination with the USFWS Pennsylvania Field Office. The plan outlines conservation measures proposed to minimize potential impacts on migratory birds. [Transco's Migratory Bird Plan includes compensatory mitigation to offset the removal of upland forest and forest fragmentation, and was approved by USFWS on February 6, 2017.](#) ~~Transco is also developing a Memorandum of Agreement (MOA) with the USFWS that includes mitigation to offset the removal of upland forest and forest fragmentation.~~

A2h. Other

The proposed route for the Project in Lebanon County crosses Swatara Creek at MP 49.3. This portion of Swatara Creek is approximately 145 feet wide and is designated as the Swatara Creek Water Trail. The PFBC designates water trails; however, individual trails are created and maintained by volunteers, property owners, and associations. Water trails are boat routes suitable for canoes, kayaks, and small motorized watercraft. Like conventional trails, water trails are recreational corridors between specific locations. Water trails are comprised of access points, boat launches, day use sites, and overnight camping areas. The Swatara Creek Water Trail is a 42-mile-long segment of Swatara Creek extending from Jonestown, Lebanon County, to the PFBC's Middletown access, in Middletown, Dauphin County. The Project crosses Swatara Creek in a parcel owned by the Commonwealth of Pennsylvania, and the crossing is 0.5 mile from the nearest access point.

A3. Habitat for Threatened and Endangered Plant and Animal Species

Coordination has been initiated with the PA DCNR, PFBC, PGC and USFWS, and field surveys have been completed to determine the presence of sensitive plant and wildlife species within the Project area. A summary of this correspondence and field survey results is included in **Attachment G** of this permit application package.

A4. Environmental Study Areas

The Project is not located near any known Environmental Study Areas.

A4a. Sanctuaries

The Project will not affect areas dedicated for use as sanctuaries by state or federal agencies or non-profit organizations.

A4b. Refuges

The Project will not affect areas dedicated for use as refuges.

A5. Description of Instream Macroinvertebrate Communities

The Project does not involve stream relocation, placement of fill, placement of a water obstruction or dredging. cursory visual inspections were recorded for streams in the Project area, which will be temporarily impacted by construction. Macroinvertebrates and amphibians observed were recorded in Section L, Enclosure A on each watercourse's corresponding data sheet.

B. Water Quantity and Streamflow

B1. Natural Drainage Patterns

The Lower Susquehanna River Basin drains 5,529 square miles in Pennsylvania.

Post-construction contours will be returned to approximately the same as pre-construction contours, leaving existing drainage patterns intact. Trench plugs will be installed at all resource crossings to maintain existing hydrology within wetlands and watercourses. Crossing methods for watercourses have been designed to accommodate the drainage area and flow characteristics of each particular crossing.

B2. Flushing Characteristics

Large storm events and spring snow melt likely flush the streams and wetlands in the area. Some wetlands drain to unnamed secondary channels and may contribute flushing flows to streams within the watershed.

B3. Current Patterns

Streams in the Project area do not affect current patterns in other surface waters downstream of the Project area. Wildlife activity (i.e., beaver dams) may alter water flow out of wetland areas into watercourses.

B4 and B5. Groundwater Discharge for Baseflow Natural Recharge Area for Ground and Surface Waters

The Early Mesozoic basin aquifer is located underneath the Project from MPs 36.5 to 42.6. The aquifer is 0 to 363 feet below ground surface and has an average well yield of 0 to 800 gallons per minute. The Valley and Ridge aquifer is located underneath the Project from MPs 47.3 to 64.3. The aquifer is 0 to 584 feet below ground surface and has an average well yield of 0 to 1,300 gallons per minute. The Valley and Ridge carbonate-rock aquifer is located underneath the Project from MPs 42.6 to 47.3. The aquifer is 0 to 300 feet below ground surface and has an average well yield of 0 to 17,361 gallons per minute. Precipitation, adjacent underlying bedrock, and stream flow recharge these aquifers. Most recharge of the glacial aquifer is discharged to the Susquehanna River or withdrawn throughout the watershed via potable or non-potable water supplies. Wetlands in the Project area may provide groundwater or surface water recharge, depending on soil permeability.

Transco consulted with state drinking water agencies, county and municipal agencies, and state databases to identify the locations of potable wells and springs within 150 feet of construction workspaces that serve as public water supplies. Specifically, Transco has submitted requests for information to:

- State drinking water agencies;
- County planning departments;
- Township Officials; and
- The PADEP.

Transco sent letters to the PADEP Regional Offices requesting identification of all WHPAs within 0.25 mile of the proposed pipeline facilities. Transco provided geographic information to the PADEP Regional Offices so that PWSs and WHPAs in proximity to the project could be identified without disclosing sensitive information. Transco also reviewed PWS and WHPA information using the PADEP eMapPA online map-based query.

The PADEP Southeast Regional Office identified two Zone II WHPAs within 150 feet of the Project in Lebanon County: United Christian CH Home/Countryside Christian Community, Ono Fire Company, Ela Ches Canteen, and Lawn Fire Company.

Through correspondence with Transco, the City of Lebanon Water Authority indicated that one of their potable water intakes is located on Swatara Creek in Jonestown. This intake is located approximately 1.9 miles from CPL South MP 53.3. Pennsylvania's Drinking Water Reporting System identifies this operator as a community water supplier serving a population of 57,000 using this intake and another at Siegrist Dam. One watercourse crossing, an unnamed tributary to Swatara Creek (WW-T10-6002), is located 2.6 miles upstream of this intake. This is the only watercourse crossing within 3 miles upstream of the City of Lebanon Water Authority intake. Transco proposes to cross this unnamed tributary to Swatara Creek using the flume method.

Source Water Protection Areas (SWPAs) were developed in 1999 and 2000 by the PADEP to fulfill the requirements of the 1996 Amendments to the SDWA. SWPAs are divided into two or three zones, depending on watershed size. While the entirety of a watershed contributes to water quality, Zone A SWPAs are the areas hydrologically closest to surface potable water intakes and are identified by the PADEP as relevant considering the nature of the Project.

Zone A SWPAs are a 0.25-mile-wide corridor along a river or stream that extend from a PWS surface intake upstream to the 5-hour time of travel point. Time of travel is the linear stream distance traveled based on the average maximum flow velocities recorded over a 3-year period. In watersheds encompassing less than 100 square miles, Zone B SWPAs are the remaining watershed area upstream and outside of the Zone A SWPAs. In watersheds encompassing greater than 100 square miles, Zone B SWPAs are the area outside the Zone A SWPAs within a 2-mile-wide corridor extending upstream a 25-hour time of travel from the intake. Zone C SWPAs are the remaining watershed area upstream and outside of the Zone A and B SWPAs.

Transco sent letters to county planning offices and conservation districts in Pennsylvania and the PADEP Regional Offices requesting identification of SWPAs within 0.25 mile of the proposed pipeline facilities. Transco also reviewed PWS and SWPA information using the PADEP eMapPA online map-based query. The PADEP Southcentral Region review of SWPAs indicated that the Project centerline passes within 0.25 mile of one Zone A SWPA. Transco

obtained the locations of surface water intakes. However, the PADEP Southcentral Regional office did not provide the spatial extent of the corresponding SWPAs or any Source Water Protection Plans.

**Table L(c)-2
 Pennsylvania Source Water Protection Areas Within 0.25 Mile of the Project in Lebanon County**

Surface Water Intake PWSID	Operator	County	Surface Water Source(s) ^a	Distance from Crossing to Intake (river miles downstream)	Source Water Protection Plan
7380010	City of Lebanon Water Authority	Lebanon	Swatara Creek, Siegrist Dam	>2.6	Yes

Sources: PADEP 2015b; Beers 2015; Lewis 2015; Elizabethtown Area Water Authority 2012; Skelly 2015

Key:
 NP = Not provided by PWS operator
 PWSID = Public water system identification number

B6. Storm and Flood Water Storage and Control

Streams and wetlands in the Project area may function to attenuate flood waters and provide flood storage or control. During storm events, the Project area wetlands store stormwater that may drain to large perennial watercourses. Wetlands within the Project area would provide some capacity to store flood waters and may serve to reduce the severity of flood peaks emanating from their upstream watersheds.

C. Water Quality

C1. Preventing Pollution

Pollution prevention is an aquatic function that includes a variety of specific pollutant removal mechanisms such as trapping sediments, removal and burial of metals and other toxic compounds, and biological transformation and degradation of nutrients and organic pollutants. Some of these pollutants may become trapped in the substrate and deposit within streams and wetlands in the Project area. A wetland’s ability to improve water quality depends on the type and density of aquatic vegetation, reduction and oxidation (redox) conditions and organic

content of the sediments, available water storage volume, and detention time within the wetland. Most of the wetlands also have a depositional environment, which aids in trapping and retaining pollutants.

Transco obtained federal and state search reports from Environmental Data Resources, Inc. (EDR) to determine the presence and location of potential groundwater contamination in the vicinity of all proposed pipeline facilities and new aboveground facilities. The search area was based on a 2-mile radius extending from the centerline of the pipeline loop to account for any subsequent route modifications. **No sites with potential groundwater contamination were identified within the search areas for the Project in Lebanon County.**

For proposed modifications to existing aboveground facilities that are not within the search radius for the pipeline EDR reports, Transco completed a search for potential sources of contaminated groundwater using the USEPA's multisystem database. The search of the USEPA's multisystem database for records of potential groundwater contamination within 0.25 mile of all existing compressor stations, meter/regulator stations, contractor/pipe yards, and MLVs did not identify any potential groundwater contamination in the vicinity of the aboveground facilities associated with the Project in **Lebanon County.**

C2. Sedimentation Control and Patterns

Sediment stabilization includes stream bank anchoring, dissipation of erosion forces and trapping of sediments. Siltation observed within some of the Project area streams demonstrated in-stream sedimentation. In general, any vegetated cover (e.g., herbaceous and scrub/shrub vegetation) within wetlands can stabilize soils and trap sediments. Some portions of the wetlands in the Project area contain dense vegetation that aids in retaining sediments and filtering water.

C3. Salinity Distribution

The Project is not located in a coastal or estuarine environment, therefore, this section is not applicable.

C4. Natural Water Filtration

Streams in the Project area may perform some functions in water filtration; there is moderate variation in the stream substrate and/or gradient. Streambed substrate observed in streams most commonly included silt, sand, gravel, and cobble, but also included vegetation, boulder, and bedrock. Wetlands, especially those with dense vegetation, can effectively detain and naturally filter water laden with nutrients and/or toxicants. In the Project area, the wetlands and riparian vegetation abutting or adjacent to streams serve to some extent to maintain natural water filtration. Most emergent portions of wetlands within the Project area contain areas of dense vegetation that could aid in the natural water filtration process.

D. Recreation

D1 and D2. Game and Non-Game Species

The Atlantic Sunrise Project area traverses habitats that support a variety of wildlife species. Vegetative cover type and density are important environmental factors influencing wildlife habitat and species distribution. Variations in vegetative community types (e.g., deciduous hardwood and conifer are community types within the forested upland vegetation cover type) and other conditions, such as topography and existing land use, influence the quality and availability of wildlife habitat within the Project area. Areas of greatest wildlife diversity and density are expected in natural habitats such as extensive, contiguous forest tracts, successional habitats (scrub-shrub), and grasslands. Habitats in agricultural land such as pastures, croplands, and hayfields harbor generalist wildlife species, consisting primarily of small mammals and white-tailed deer.

Upland Forest

Upland forests provide food resources, cover, and nesting habitat for a variety of fauna in the vicinity of the Project. The tree canopy and shrub understory provide food and cover for larger mammals such as white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*). Leaf litter on the forest floor provides food and cover for amphibians and reptiles, such as northern ringneck snake (*Diadophis punctatus edwardsii*) and American toad (*Anaxyrus americanus*). The eastern newt (*Notophthalmus viridescens*) spends the majority of its life as a juvenile roaming forested areas. Smaller mammals such as the gray squirrel (*Sciurus*

carolinensis), eastern chipmunk (*Tamias striatus*), and raccoon (*Procyon lotor*) utilize fallen logs for cover and nest cavities. Pennsylvania's official state bird, the ruffed grouse (*Bonasa umbellus*), is an example of a non-migratory bird that prefers young, thick hardwood forest stands. Thus, they can benefit from timbering or clearing activities in the long-term when the forest regenerates back to a thick young forest stand. Upland forest is also one of several cover types inhabited by wild turkey (*Meleagris gallopavo*).

Open Land

Several mammal species use shrublands and grasslands in the Project area as foraging and nesting habitat. These species include the eastern cottontail (*Sylvilagus floridanus*), gray squirrel, red fox (*Vulpes vulpes*), several small mammal species (e.g., mice and voles), and raccoon (NatureServe 2014). Previously cleared areas that are infrequently maintained or abandoned create successional growth habitats that are used by a distinct group of wildlife. These open lands include old agricultural fields and existing utility ROWs. ROWs in particular provide corridors that are used by several species to move between habitats. Within the Project area, these species may include white-tailed deer, coyote (*Canis latrans*), and eastern cottontail.

Other animal species such as the Virginia opossum (*Didelphis virginiana*), eastern garter snake (*Thamnophis sirtalis*), and turkey likewise rely on open land habitat for food, nesting, and protection from predators (e.g., in areas where vegetation is taller or denser than understory of adjacent habitat).

Forested and Scrub-Shrub Wetlands

PFO and PSS wetlands are important for providing food, shelter, migratory and wintering areas, and breeding areas for wildlife species, including red-backed salamander (*Plethodon cinereus*), wood frog (*Rana sylvatica*), and eastern garter snake. Aquatic mammals common in forested and scrub-shrub wetlands in the Project area include beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and mink (*Mustela vison*). Each of the wildlife species listed above for upland forests could also be present within forested and scrub-shrub wetlands.

Emergent Wetlands

PEM wetlands provide habitat for a variety of reptile and amphibian species, such as green frog (*Rana clamitans*), bullfrog (*Rana catesbeiana*), northern dusky salamander (*Desmognathus fuscus fuscus*), red-backed salamander, leopard frog (*Rana pipiens*), spring peeper (*Pseudacris crucifer*), northern water snake (*Nerodia sipedon*), painted turtle (*Chrysemys picta*), and snapping turtle (*Chelydra serpentina*).

Agricultural Areas

Although crop fields and livestock pastures do not generally provide the highest quality habitat, they often provide forage and nesting for several small mammal species such as the meadow vole (*Microtus pennsylvanicus*) that also utilize adjacent forest, open land, and even developed habitats. Additionally, pastures provide grazing habitat for species such as the whitetailed deer.

D3. Fishing

Within the Project area, 46-15 watercourses have a State Water Quality Designated Use Classification as Cold Water Fisheries, 26 watercourses have a State Water Quality Designated Use Classification as Warm Water Fisheries, and 9-13 watercourses have a State Water Quality Designated Use Classification as Trout Stocked Fisheries. Conewago Creek, Quittapahilla Creek, and Trout Run are classified by the PFBC as approved trout waters. The main stem of Conewago Creek and Quittapahill Creek, as well as Trout Run and two of its tributaries have been confirmed by PFBC to be stocked within 0.5 miles of the Project area. Additionally, Trout Run, Swatara Creek and their tributaries are classified by PFBC under PA Code Title 58, Chapter 57.11 as Wild Trout Streams, or a stream that supports the natural reproduction of trout. Coldwater stream sections in the Project area support trout populations. Within the workspace of the Project in Lebanon County, 32 streams have been identified as having perennial flow and could, therefore, sustain populations of fish.

**Table L(c)-3
 Representative Fish Species in Watercourses Crossed by the
 Atlantic Sunrise Project in Pennsylvania**

Common Name	Scientific Name
Warmwater Fish	
Largemouth bass	<i>Micropterus salmoides</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Rock bass	<i>Ambloplites rupestris</i>
Channel catfish	<i>Ictalurus punctatus</i>

Table L(c)-3
Representative Fish Species in Watercourses Crossed by the
Atlantic Sunrise Project in Pennsylvania

Common Name	Scientific Name
Muskellunge	<i>Esox masquinongy</i>
Chain pickerel	<i>Esox niger</i>
Black crappie	<i>Pomoxis nigromaculatus</i>
Bluegill	<i>Lepomis macrochirus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
White perch	<i>Morone americana</i>
Yellow perch	<i>Perca flavescens</i>
Walleye	<i>Sander vitreus</i>
Coldwater Fish	
Brown trout	<i>Salmo trutta</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Brook trout	<i>Salvelinus fontinalis</i>
Longnose dace	<i>Rhinichthys cataractae</i>
Eastern blacknose dace	<i>Rhinichthys atratulus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Slimy sculpin	<i>Cottus cognatus</i>
Migratory Fish	
Striped bass	<i>Morone saxatilis</i>
Blueback herring	<i>Alosa aestivalis</i>
Alewife	<i>Alosa pseudoharengus</i>
American shad	<i>Alosa sapidissima</i>
American eel	<i>Anguilla rostrata</i>
Sources: PFBC	

D4 and D5. Hiking and Observation (plant/wildlife)

Appalachian Trail

The Appalachian Trail extends west to east across the length of Lebanon County such that the route of the Project is unable to avoid crossing this feature. The proposed route for the Project crosses the Appalachian Trail at MP 59.9 in Lebanon County on land owned by the Commonwealth and managed by the Pennsylvania Game Commission (PGC) within State Game Land (SGL) 211.

The Appalachian Trail is a 2,185-mile-long public foot trail that extends from Georgia to Maine and crosses scenic, wooded, pastoral, and culturally significant lands in the Appalachian

Mountains. The Appalachian Trail is a federal, state and local partnership. The Appalachian Trail was started by Benton MacKaye in 1922 as a local or regional trail. In 1925, the Appalachian Trail Conference, now known as the Appalachian Trail Conservancy, was formed in Washington, D.C. The National Trails System Act of 1968 authorized the Appalachian Trail as a unit of the National Park System, and the National Park Service (NPS) is the lead federal agency for management of the Appalachian Trail. Today the Appalachian Trail Conservancy coordinates with 31 separate local trail clubs, the NPS, U.S. Forest Service and numerous state and local groups to mark and maintain the Appalachian Trail (NPS 2014a). The Appalachian Trail is open year-round; however, sections may temporarily close due to weather or other reasons. The Appalachian Conservancy recommends mid-April to mid-June and September to October for hiking in Pennsylvania. They recommend not hiking during summer months due to the heat and scarcity of water.

Swatara State Park

The Project is located 0.1 mile west of Swatara State Park, at MP 58.5 in Lebanon County. The Park is owned and managed by the PA DCNR. The park comprises 3,520 acres of rolling fields and woodlands in the Swatara Valley, between Second Mountain and Blue Mountain. Recreational activities within the Park include canoeing, kayaking, fishing, hiking, picnicking, bicycling, and cross-country skiing. A 2012 study estimated that 26,870 individual parties, with an estimated average party size of 2.5 individuals, visited the Park in 2010. Due to the distance between the proposed CPL South pipeline and Swatara State Park, construction and operation of CPL South will not affect the current use of the Park.

Lebanon Valley Rail Trail

The proposed route for the Project crosses the Lebanon Valley Rail Trail at MP 37.5 in Lebanon County. The Lebanon Valley Rail Trail is a 12.5-mile-long trail extending from the Lebanon/Lancaster County line to Whitman Road in Cornwall. The trail is used for biking, walking, and horseback riding. The Trail is open from dawn to dusk (Lebanon.

Horse-Shoe Trail

The proposed route for the Project crosses the Horse-Shoe Trail at MP 41.2 in Lebanon County. Transco will construct the Project within new ROW in this area. The Horse-Shoe Trail, an approximately 140-mile-long hiking and equestrian trail, originates in Valley Forge National Park

and terminates at the Appalachian National Scenic Trail north of Harrisburg, Pennsylvania. The Horse-Shoe Trail Club does not maintain records regarding peak periods of use; however, the Trail is used year-round.

D6. Other

Conewago Creek and Swatara Creek have been identified as PFBC recreationally navigable waters within Lebanon County. No other functions, values, and uses have been identified for the streams and wetlands affected by this Project.

Fort Indiantown Gap National Training Center

The Project crosses the Fort Indiantown Gap National Guard Training Center from MP 54.9 to MP 54.9, from MP 56.8 to MP 57.1, and from MP 57.6 to MP 57.7 in Lebanon County. The installation is a National Guard Training Site owned by the Commonwealth. Major facilities at the installation include Muir Army Airfield, the Eastern Army Aviation Training Site, a helicopter training center, an educational complex for combat arms training through the 166th Regiment, and the Northeast Counterdrug Training Center. The installation trains over 100,000 troops each year. The installation is the second largest employer in Lebanon County. No facilities or active training areas are known to exist within or in the immediate vicinity of the proposed pipeline route.

Twin Grove Resort and Campground

CPL South is located less than 0.1 mile (at its closest point) northwest of the Twin Grove resort and campground, approximate MP 62.5 in Lebanon County. The Twin Grove resort and campground is a 105-acre campground resort that features Amish-made cottages, log cabins, recreational vehicle hookups, campsites, and recreation facilities. The property has 289 lodging sites, including 200 recreational vehicle sites, 35 cottages, and 22 cabins. Due to the distance between CPL South and the Twin Grove resort and campground, construction and operation of CPL South will not directly affect the current use of this area, although some limited noise effects may occur during construction.

E. Upstream and Downstream Property

Adjoining property owners are provided in Section A, **Attachment A-2**.

The Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA) administer land conservation programs, including the Conservation Reserve Enhancement Program (CREP), the Conservation Reserve Program (CRP), the WRP and the Farm and Ranch Lands Protection Program (FRPP).

The CREP is a federal/state natural resource conservation program established to improve the water quality of the Chesapeake Bay. The program is part of a larger effort to address state and nationally significant agriculture-related environmental problems. The Pennsylvania CREP is managed jointly by the FSA and the Commonwealth of Pennsylvania, although numerous other federal and state agencies and private conservation groups are partners in the program (USDA 2011; Pennsylvania CREP 2014; Commonwealth of Pennsylvania 2013). The program helps farmers improve the water quality of the upper and lower Susquehanna and lower Potomac River basins by reducing sediment, livestock manure, and other nutrient runoff to the Chesapeake Bay. These efforts help to lower water temperatures, increase dissolved oxygen levels, and provide additional wildlife habitat in the Chesapeake Bay and its watershed (USDA 2011).

CREP was authorized under the Food Security Act of 1985, as amended, and was first announced in April 2000. The program initially targeted a total voluntary enrollment of 100,000 acres of land in 20 counties in the lower Susquehanna and Potomac River basins, including lands in Columbia, Lancaster, Lebanon, Northumberland, and Schuylkill counties. The program has expanded to include an additional 100,000 acres in 23 northern tier counties in Pennsylvania, including Luzerne, Lycoming, Susquehanna, and Wyoming counties (USDA 2011; Commonwealth of Pennsylvania 2013). Through CREP, program participants receive financial incentives from the U.S. Department of Agriculture (USDA) to voluntarily enroll in the program for contracts of 10 to 15 years. Participants remove cropland or marginal pastureland from agricultural production and convert the land to native grasses, trees, and other vegetation (USDA 2011; Pennsylvania CREP 2014).

The CRP is a land conservation program administered by the FSA. In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Contracts for land enrolled in CRP are 10 to 15 years in length. The longterm goal of the program

is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat (USDA 2014b).

Based on correspondence with the Lebanon County Planning Department, Transco has identified two properties crossed by the Project that have proposed development. Transco is coordinating with the affected landowners to obtain details regarding planned developments on these properties.

MFS, Inc., d/b/a Eastern Land and Resources Company (EL&RC), owns an approximately 535-acre parcel in South Annville Township, Lebanon County, Pennsylvania. EL&RC has stated that they intend to develop this property. Transco met with Lebanon County zoning officials to identify any filed plans of development for this property. EL&RC had filed a proposal to relocate one road within the property along with a request for a zoning change.

Stone Hill Village, LLC is a planned residential development currently under construction. The Project crosses the developed portion of this property, and Stone Hill Village LLC has expressed concerns regarding the route in this area.

F. Other Environmental Factors Determined by Site Investigation

The Project traverses multiple land use types but primarily includes open agricultural land and forested areas. During the Project siting process, Transco located all proposed facilities in such a manner as to minimize impacts to streams, wetlands, forested areas, public, and private lands. Where possible, Transco placed the proposed pipeline ROW within open areas, limiting stream and wetland crossings. More details related to the routing process for the Project is included in **Attachment P**.

G. References

Commonwealth of Pennsylvania, Department of Conservation and Natural Resources. 2013. Bureau of Topographic and Geologic Survey. Available online at www.dcnrstate.pa.us/topogeo/. Accessed March 2014.

Cowardin LM, Carter V, Golet FC, LaRoe ET. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish & Wildlife Service Pub. FWS/OBS-79/31, Washington, DC.

Fike, J. 1999. Terrestrial and Palustrine Plant Communities of Pennsylvania. Pennsylvania Natural Diversity Inventory.

Pennsylvania Fish and Boat Commission (PFBC). 2014a. *Class A Wild Trout Waters*. Available from: <http://www.fish.state.pa.us/classa.pdf>. Accessed February 2015 and reviewed with PFBC.

_____. 2014b. *Regional Listings of Approved Trout Waters*. Available from: <http://www.fish.state.pa.us/fishpub/summary/troutwaters.html>. Accessed February 2015 and reviewed with PFBC.

_____. 2014c. *Stream Section That Supports Natural Reproduction of Trout*. March 2015. Available from: http://www.fish.state.pa.us/trout_repro.htm. Accessed February 2015 and reviewed with PFBC.

Pennsylvania Natural Heritage Program (PNHP). 2015. Pennsylvania Endangered Reptile Species - bog turtle (*Glyptemys muhlenbergii*) fact sheet. Available from: <http://www.naturalheritage.state.pa.us/factsheets/11522.pdf>. Accessed June 25, 2016.

The Pennsylvania Code. Title 25 Environmental Protection, Chapter 93. Water Quality Standards. Available from: <http://www.pacode.com/secure/data/025/chapter93/chap93toc.html/>. March 2014.

U.S. Army Corps of Engineers (USACE). 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

*Atlantic Sunrise Project – PA DEP Chapter 105 Joint Permit Application
Transcontinental Gas Pipe Line Company, LLC
Lebanon County*

_____. 1987. Corps of Engineers Wetlands Delineation Manual. U.S. Army Corps of Engineers, Waterways Experiment Station, Wetlands Research Program, Technical Report Y-87-1. Vicksburg, MS. January 1987 - Final Report. 92 pp. + app.