Prepared for:

Tennessee Gas Pipeline
an El Paso company

Houston, TX

HIGHLANDS APPLICABILITY DETERMINATION
HIGHLANDS PRESERVATION AREA

COMPREHENSIVE MITIGATION PLAN

TENNESSEE GAS PIPELINE COMPANY
NORTHEAST UPGRADE PROJECT – LOOP 325
West Milford Township, Ringwood Borough, and Mahwah Township, Passaic and Bergen Counties, New Jersey

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AECOM

Contents

1.0 Introduction 1-1

1.1 Project Background 1-2
1.1.1 Purpose and Need 1-3
1.1.2 Avoidance and Minimization of Impacts 1-4
1.1.3 Summary of Project Impacts to Highlands Resources 1-7

2.0 Comprehensive Mitigation Plan Components 2-1

2.1 Upland Forest Mitigation and Restoration 2-2

2.2 Open Waters and Riparian Areas Plan 2-4
2.2.1 Open Water Buffer (Transition Area) Restoration 2-5
2.2.2 Open Water Buffer Restoration Monitoring 2-10
2.2.3 Shallow Depth to Bedrock and In-Stream Blasting of Open Waters 2-10

2.3 Steep Slope Construction Plan 2-13

2.4 Critical Habitat Mitigation Plan 2-18
2.4.1 Impact Minimization 2-20
2.4.2 State-Listed Threatened and Endangered Species 2-20
2.4.3 Vernal Pool Buffer Habitat 2-23

2.5 Carbonate Rock Plan 2-23

2.6 Lake Management 2-25

2.7 Water Resources Availability 2-25

2.8 Water Resources Quantity Protection Plan 2-25

2.9 Water Quality Protection Plan 2-26
2.9.1 Wellhead Protection 2-26
2.9.2 Hydrostatic Pressure Testing 2-27
2.9.3 Stormwater Management 2-28

2.10 Water Utility 2-29

2.11 Wastewater Utility 2-29

2.12 Septic System Yield 2-29

2.13 Agricultural Resources 2-29

2.14 Historic, Cultural, Archaeological and Scenic Resources Plan 2-29
2.14.1 Historic, Cultural and Archaeological Resources 2-29
2.14.2 Scenic Resources 2-31

2.15 Transportation 2-31

2.16 Land Use Capability 2-31

2.17 Redevelopment 2-31

2.18 Smart Growth 2-31
2.19 Housing and Community Facilities 2-32
2.20 Landowner Equity 2-32
2.21 Sustainable Economic Development 2-32
2.22 Air Quality 2-32
2.22.1 Construction Emissions 2-33
2.23 Special Environmental Zones 2-36
2.24 ROW Restoration and Monitoring Plan 2-36
2.24.1 Site Preparation, Clearing and Construction 2-36
2.24.2 Post-construction restoration and revegetation 2-37
2.24.3 Invasive Species Management 2-41
2.24.4 Long-term Maintenance 2-45
2.25 Comprehensive Mitigation Plan Summary 2-47

3.0 References 3-1

List of Tables

TABLE 1.1-1 PROPOSED PIPELINE AND ABOVEGROUND FACILITIES FOR LOOP 325 1-3

Table 1.1-2 PROPOSED HORIZONTAL DIRECTIONAL DRILL FOR THE LOOP 325 1-6

TABLE 1.1-4 ESTIMATED IMPACTS TO REGULATED AREAS WITHIN THE HIGHLANDS REGION FOR LOOP 325 ..... Error! Bookmark not defined.

TABLE 2.2-1 TYPICAL SPECIES COMPOSITION OF SEED MIXES FOR OPEN WATER BUFFER AREA 2-6

TABLE 2.2-2 CHESTNUT OAK / SCRUB OAK COMMUNITY 2-7

TABLE 2.2-3 RED OAK / SWEET BIRCH COMMUNITY 2-8

TABLE 2.2-6 WATERBODIES CROSSINGS FOR LOOP 325 WITH POTENTIALLY SHALLOW DEPTH TO BEDROCK 2-12

TABLE 2.4-1 NEW JERSEY STATE LISTED SPECIES ASSOCIATED WITH LOOP 325 2-19

TABLE 2.22-2 EMISSIONS FROM CONSTRUCTION OF PIPELINE LOOP 325 2-35

TABLE 2.22-3 LOOP 325 EMISSIONS BY COUNTY COMPARED TO GENERAL CONFORMITY THRESHOLDS 2-35

TABLE 2.24-1 INVASIVE SPECIES PLAN TIMELINE FOR LOOP 325 2-44

Appendices

Appendix A – Tennessee Gas Pipeline Company Northeast Upgrade Project Environmental Construction Plan

Appendix B – FERC Upland Erosion Control, Revegetation and Maintenance Plan

Appendix C – FERC Wetland and Waterbody Construction and Mitigation Procedures

Appendix D – Tennessee Gas Pipeline Company Northeast Upgrade Project HDD Contingency Plan and Site Specific Drawing for the Monksville River Crossing

1.0 Introduction

Tennessee Gas Pipeline Company ("Tennessee") has developed this Comprehensive Mitigation Plan ("CMP") in support of the Loop 325 ("Project") Segment of the Northeast Upgrade Project ("NEUP") currently under a Highlands Applicability Determination ("HAD") review by the Highlands Council (the "Council") and the New Jersey Department of Environmental Protection ("NJDEP"). Tennessee has requested a determination by the NJDEP that the Project is exempt from the Highlands Water Protection and Planning Act, N.J.S.A. 13:20-1 et seq. (the "Act"), as it constitutes "the routine maintenance and operations, rehabilitation, preservation, reconstruction, repair, or upgrade of public utility lines, rights of way, or systems, by a public utility" (N.J.S.A. 13:20-28.a(11)). Although the pipeline system is a natural gas system regulated by the Federal Energy Regulatory Commission ("FERC" or "Commission") under the Natural Gas Act authority, for purposes of this exemption request, Tennessee is defined under the Act. N.J.S.A.13:20-3 and NJDEP's regulations adopted pursuant thereto, N.J.A.C. 7:38-1.4 as a public utility. It is Tennessee's objective, with development and implementation of this CMP, to demonstrate and ensure the Project's consistency with the goals and purposes of the Act to support the exempt status determination by the Council and NJDEP.

Loop 325 is located within the Preservation Area of New Jersey's Highlands Region (the "Highlands"). Tennessee recognizes the sensitive resources that comprise the Highlands, as well as the requirements of the Council and the Act to properly manage and protect those resources for the benefit of the residents of New Jersey. Tennessee has developed this CMP for implementation during construction and operation of the Project, identifying the specific resources and the measures designed to avoid, minimize, and mitigate adverse impacts to the Highlands resources. The majority of the associated impact from Project construction is temporary in duration, while permanent impacts associated with the Project have been minimized to the extent practicable and primarily involve the conversion of forested land cover type to a low-shrub/herbaceous cover type.

The purpose of this CMP is to set forth a plan of construction and restoration by which Tennessee will avoid, minimize, and mitigate environmental impacts to Highlands Resources so that there will be a no net loss of such resources. This plan also describes Tennessee's FERC and United States Department of Transportation ("USDOT") Repair and Maintenance Program. The scope of this CMP focuses on areas jurisdictional only to the Highlands Council.

Therefore, this CMP addresses the following Highlands Council Policies:

1. Forest areas in non-DEP regulated wetlands, transition areas, or Green Acres areas.
2. Critical wildlife habitat in non-DEP regulated wetlands, DEP-regulated wetlands transition areas or Green Acres diversion areas.
3. Special environmental zones
4. Non-DEP regulated vernal pool buffer areas (1,000 feet from vernal pools)
5. Steep slopes.
6. Carbonate rock (KARST) topography
7. Water resources
8. Water utilities
9. Air quality

10. Lake management
11. Right-of-way vegetation management
12. Smart Growth
13. Land owner equity
14. Sustainable economic development

Should the requested exemption be granted by the Council for Project activities in the Preservation Area, Tennessee will proceed with obtaining the required environmental permits for the Project through agencies such as the NJDEP and the United States Fish and Wildlife Service ("USFWS"). Tennessee will provide copies of application packages and reports, as applicable, to the Council for review and comment. This document also addresses monitoring of mitigation measures and reporting on inspections and monitoring to the Council.

Tennessee has also submitted an application to FERC for a certificate of public convenience and necessity for the NEUP Project which FERC will review pursuant to the applicable provisions of the Natural Gas Act and the FERC's regulations. Tennessee will provide a copy of this CMP to the FERC. Construction of the Project and the implementation of the CMP are contingent upon issuance of the requested certificate of public convenience and necessity for the Project by the FERC. Following FERC issuance of a certificate order authorizing the Project, Tennessee will file with the FERC an Implementation Plan for the Project that will include applicable construction, restoration, and monitoring requirements, techniques, and standards, including the requirements of this CMP. Once the Implementation Plan for the Project is approved by the FERC, Tennessee will be required to comply with the provisions of that Implementation Plan, as well as with the requirements and conditions of the certificate order. Compliance with the Implementation Plan will be monitored by environmental inspectors ("EI"s from the FERC, as well as Tennessee's environmental inspectors ("EI's").

During the construction phase of the Project, Tennessee will be required to submit construction progress reports to the FERC (typically every two weeks), documenting status of construction, any problems experienced, and corrective actions taken. Tennessee will provide copies of these construction progress reports to the Council throughout the construction phase of the Project. Post-construction, Tennessee will be required to file periodic (monthly or quarterly, as required by the FERC in the certificate order) restoration reports with the FERC, and Tennessee will provide copies of those periodic reports to the Council as well. In addition, as discussed further in Section 2.2.2 below, Tennessee is willing to prepare and to provide to the Council an annual monitoring report, for three years following construction or until such time as wetland revegetation is successful, documenting the status of the open water buffer revegetation efforts in the Highlands region. In addition, as discussed in Section 2.24.2.6 below, Tennessee is willing to prepare and to provide to the Council an annual monitoring report, for three years following construction, documenting restoration of the Highlands resource areas in the Highlands region. In the event that the Council has any issues with any of Tennessee's construction, restoration, and monitoring activities in the Highlands area, the Council, in addition to discussing directly with Tennessee, may raise those issues directly with the FERC through the FERC's Enforcement Hotline, discussions with FERC Staff, or a formal complaint filed with the FERC.

1.1 Project Background

For over 50 years, Tennessee has owned and operated its existing 300 Line natural gas pipeline facilities for the interstate transmission of natural gas supplies throughout the northeast United States. The 300 Line facilities consist of a 24-inch diameter buried natural gas pipeline, loop pipeline segments of varying diameter,

compressor stations, and other appurtenant aboveground facilities commencing in western Pennsylvania and continuing east through Pennsylvania, New Jersey, New York, and Connecticut before terminating in western Massachusetts. Tennessee's permanent easement or right-of-way ("ROW") width associated with the pipeline facilities varies in size, but Tennessee typically maintains a 50-foot wide corridor (10 feet wide in wetlands) in a low-shrub/herbaceous vegetative cover state to facilitate routine inspection and maintenance, security patrols, and emergency access.

Tennessee's proposed Northeast Upgrade Loop 325 Project consists of an approximately 7.6-mile long section of 30-inch diameter loop pipeline originating in West Milford Township, traversing to the east into Ringwood Borough, and terminating in Mahwah Township. The entire Loop 325 alignment is located within the Preservation Area of the Highlands Region. Loop 325 will be located at a typical 25-foot offset from the existing 300 Line pipeline within the existing ROW where feasible. Additional new permanent ROW will be required along with temporary workspace and additional temporary workspace to facilitate construction of the pipeline. The routing for Loop 325 was selected to avoid significant areas of residential development, minimize the number of affected landowners, and minimize environmental impacts. Table 1.1-1 provides additional location detail of the proposed Loop 325 alignment.

TABLE 1.1-1
PROPOSED PIPELINE AND ABOVEGROUND FACILITIES FOR LOOP 325

Designation	Facility Type	Approximate Length (miles) / Area (acres)[a]	Milepost	Highlands Area	Town	County
Loop 325	30-inch natural gas pipeline	0.76 miles	MP 0.0 to MP 0.76	Preservation	West Milford	Passaic
		5.26	MP 0.76 – MP 6.02	Preservation	Ringwood	Passaic
		1.58 miles	MP 6.02 – MP 7.58	Preservation	Mahwah	Bergen
MLV 328-2	Main line valve	0.00	MP 3.41	Preservation	Ringwood	Passaic
Pig Receiver	Internal inspection piping	0.00	MP 7.58	Preservation	Mahwah	Bergen
Mahwah Meter Station	Upgrade to existing meter station	1.07	MP 7.58	Preservation	Mahwah	Bergen

a: Area is based on the extent of land that will be maintained during the operation of the facility.

1.1.1 Purpose and Need

Tennessee proposes to construct, install, and operate the NEUP Project facilities to increase pipeline capacity and to provide additional firm natural gas transportation service into northeast markets. The NEUP Project, as described further herein, includes the construction, installation, modification, and operation of the following proposed facilities in the states of Pennsylvania and New Jersey: (i) five (5) pipeline looping segments; (ii) upgrades to two (2) existing compressor stations to include an additional compressor unit installation at each compressor station, restaging an existing compressor unit at one (1) of the compressor stations, and piping

modifications to each compressor station; (iii) piping modifications to two (2) other existing compressor stations; and (iv) an upgrade to one (1) existing meter station.

Upon completion, the NEUP Project will increase natural gas delivery capacity to the northeast region of the United States by approximately 636,000 dekatherms per day ("Dth/d"). Tennessee has signed binding precedent agreements with two (2) shippers: Chesapeake Energy Marketing, Inc. and Statoil Natural Gas LLC for the additional firm transportation capacity resulting from the Project's proposed facilities. This demonstrates that the additional firm transportation capacity will be immediately utilized. Currently, there is approximately seven (7) billion cubic feet per day ("Bcf/d") of pipeline capacity on four (4) interstate pipelines, including Tennessee, to transport natural gas through Pennsylvania into New Jersey. However, all four (4) pipelines, including Tennessee, are fully subscribed in this region during the peak heating season. Therefore, unless Tennessee proceeds with the construction of the Project, it will be unable to satisfy the shippers' expressed need, as reflected in the executed precedent agreements, for additional capacity of 636,000 Dth/d on Tennessee's system.

Moreover, various consultants have reported that growth out of the Marcellus Shale region could be as high as five (5) Bcf/d by 2014. Within the last two (2) years, volumes from the Marcellus Shale region have increased from 25,000 Dth/d to one (1) Bcf/d on Tennessee's system alone. Increased regional demand in the northeast, along with the inherent geological conditions in New England, New Jersey and the eastern portions of New York and Pennsylvania preventing underground storage of natural gas volumes in those areas, will further exacerbate the already constrained pipeline capacity situation in the northeast. Even when underground storage in northwestern Pennsylvania and New York is used to meet peak day requirements for the northeast region, pipeline capacity must still be used to reach market areas.

Construction of the NEUP Project, therefore, will help alleviate this situation by increasing pipeline capacity to the high-demand markets in the northeast. The NEUP will also assist with the FERC's goal of providing more natural gas to markets by providing access to natural gas supplies in the Marcellus Shale supply area with delivery to NEUP's delivery point at Mahwah, New Jersey, which is an interconnection with another interstate pipeline serving northeast markets.

1.1.2 Avoidance and Minimization of Impacts

Tennessee has designed and engineered the NEUP Project to minimize impacts to the maximum extent practicable. Tennessee is only proposing those facilities and upgrades that are necessary to meet the requirements of its customers and satisfy the NEUP Project's purpose and need, as discussed above. Subsequently, the pipe diameter and length have been engineered to transmit the specific volume of gas required. As such, Loop 325 is designed as a concise and integral component of the complete NEUP Project. Tennessee has incorporated additional measures relative to NEUP's design, construction, and operation that further minimize impacts. Additional impact avoidance and minimization measures are detailed within the various components of the CMP and may include pre-construction planning, specialized construction techniques, and restoration measures.

1.1.2.1 Avoidance Evaluation

Alternatives to the proposed Loop 325 route through the Highlands Regions were evaluated in response to requests raised by the Highlands Council in early outreach meetings as part of Tennessee's 300 Line Project (FERC Docket No. CP09-444-000). That analysis centered on the following criteria:

- avoidance of the Highlands Region, including both the Planning and Preservation Areas,
- significant environmental advantage over the original proposal,
- ability to meet project objectives, and

- technical and economic feasibility and practicality.

The complete analysis of the alternatives to crossing the Highlands Region may be found in Resource Report 10 of the Environmental Report for the 300 Line Project in Docket No. CP09-444-000. The conclusion to that analysis for the Highlands Region crossing as part of the 300 Line Project is applicable to this Project as well and is set forth below.

Conclusion

"*In summary, to re-route the 325 loop to entirely avoid the Highlands Region is not feasible. The alternative route increases impacts to all categories evaluated within the resource reports from land use to wetlands to rare species and cultural resources. The alternative route is longer than the proposed loop and is not able to co-locate with Tennessee's existing ROW to minimize environmental effects. The residential impacts associated with the alternative are also several times greater in terms of new affected landowners, residential construction and total number of properties affected. In addition to these factors, the cost of constructing a loop that is longer compounded with the participation of local, state and federal agencies in New York eliminates this alternative from further consideration by Tennessee. The current proposed route of Loop 325 minimizes the overall environmental impacts associated with the Project while maintaining the economic viability and meeting the in-service date required by the customer*."

In the Environmental Assessment for the 300 Line Project, issued on February 25, 2010, the Commission Staff, following analysis of the proposed route through the Highlands Regions and a route that would entirely avoid the Highlands Region, concluded that the route alternative that would entirely avoid the Highlands Region was not environmentally preferable to the proposed route through that region.

Additionally, because the certificated route for the 300 Line Project ends within the Highlands Region, and the delivery point at the Mahwah Meter Station is within the Highlands Region, Loop 325 of the proposed NEUP Project cannot avoid the Highlands Region.

1.1.2.2 Co-Location within Existing Utilities Rights-of-Way

Loop 325 will generally parallel the existing Tennessee pipeline corridor and will be co-located to the extent practicable the existing, maintained ROW. By siting the Project in this manner, Tennessee has minimized the amount of new disturbance associated with the installation of the pipeline. This includes limiting the amount of temporary disturbance to land required for Temporary Work Space ("TWS") and Additional Temporary Work Space ("ATWS"). Additionally, co-location of the Loop 325 facilities within Tennessee's existing permanent easement limits long-term impacts associated with pipeline operations and ROW maintenance (e.g., vegetation management). In those areas where the proposed loop has been sited outside of the existing permanent easement for the 300 Line, the route deviation was incorporated to avoid a specific environmental resource or other site-specific condition.

1.1.2.3 Horizontal Directional Drill

Tennessee proposes to employ horizontal directional drill ("HDD") technology in select areas during construction of the Project to avoid sensitive resource areas and areas that present difficulties for conventional construction methodologies. Perhaps the greatest advantage of the HDD crossing technique is the fact that open cut trenching and other equipment disturbance within sensitive resource areas is not necessary, and, as a result, environmental impact to sensitive resource areas is minimized. Table 1.1-2 provides information on the proposed HDD crossing within the Highlands Region that may be implemented during Project construction.

However, a greater amount of equipment staging is required for HDD than the open cut crossing method. A minimum workspace footprint of 200 feet wide by 250 feet long is required at the entry and exit points to support the drilling operation. The amount of workspace required can vary significantly from site to site based

on site-specific conditions. The rig-side equipment and operations will typically include: the drilling rig and entry hole, control cab, drill string pipe storage, site office and tool storage trailers, power generators, bentonite storage, bentonite slurry mixing equipment, slurry pump, cuttings separation equipment, cuttings return/settlement pit, water trucks and water storage and the heavy construction equipment necessary to support the operation. Exit-side equipment and operations will typically include: the exit point and slurry containment pit, cuttings return/settlement pit, cuttings separation and slurry reclamation equipment, drill string pipe storage, and the heavy construction equipment necessary to support the operation. In addition to the drilling operations to be conducted within this workspace footprint, ATWS width and length is required along the pipe-side ROW (or adjacent to the ROW within ATWS in the case of points of inflection) in which to prefabricate the pipeline into one continuous section in preparation for the pull back. Once assembled, the pipeline is placed on pipe rollers so that it may be conveyed into the drill hole during the pull back operation.

Tennessee has developed a HDD Contingency Plan for the Project that establishes procedures for addressing potential impacts associated with a release of drilling fluid through hydraulically induced fractures during the HDD process. In addition, this document establishes the criteria by which Tennessee and the appropriate regulatory agencies would determine when a proposed HDD is unsuccessful and must be abandoned in favor of the approved alternate crossing method. The HDD Contingency Plan and site-specific engineering plans (See Appendix D) for the Project will be submitted for review and approval by the appropriate regulatory agencies with the appropriate permit applications.

TABLE 1.1-2
PROPOSED HORIZONTAL DIRECTIONAL DRILL FOR LOOP 325

Facility ID	MP	Length (feet)	Township	County / State	Comment
Loop 325	0.00-0.55	2850	West Milford/Ringwood	Passaic/NJ	Wanaque River/Monksville Reservoir

1.1.2.4 Access Roads

Depending upon the remoteness of a subject pipeline alignment, access road construction can involve additional temporary impacts associated with roadway construction including land clearing, grading, and wetland crossings. Within the Preservation Areas, Tennessee has largely avoided those additional impacts typically associated with access roads by minimizing its use of access roads to 13 existing private roads that would involve only minor improvements such as re-grading and vegetation trimming needed to accommodate travel by trucks and machinery typically used during pipeline construction. To access the pipeline ROW, Tennessee has committed to using existing public roadways that intersect the Project alignment to the greatest extent practicable. In this way, Tennessee has limited and minimized the Project impacts outside of the pipeline alignment and construction corridor as no new access roads will be created in connection with the Project. Table 1.1-3 details the location of the access roads within the Preservation Area proposed for use during construction of Loop 325. This CMP also applies to Project-related impacts related to the improvement of the thirteen existing access roads including the Forest Management Plan for impacts to trees greater than six-inch diameter outside of standard trimming. Restoration and mitigation activities associated with the access roads shall be documented within the reports provided to the Council by Tennessee during construction and also during post-construction monitoring. All restoration activities associated with private access roads are contingent upon landowner approval.

TABLE 1.1-3
SUMMARY OF PRIVATELY OWNED ACCESS ROADS WITHIN THE HIGHLANDS REGION PROPOSED FOR USE DURING CONSTRUCTION OF LOOP 325

Access Road ID	Milepost at Entry of ROW	Highlands Jurisdictional Area	Municipality/County
L5 AR01	0.00	Preservation	West Milford/Passaic
L5 AR02	0.01		
L5 AR20	0.49		
L5 AR21.1	2.17		Ringwood/Passaic
L5 AR21	2.43		
L5 AR22	3.02		
L5 AR30	3.17		
L5 AR50	4.78		
L5 AR70	5.53		
L5 AR71	5.54		
L5 AR60	6.09		Mahwah/Bergen
L5 AR65	6.25		
L5 AR80	7.24		

1.1.3 Summary of Project Impacts to Highlands Resources

Within the Highlands Region, Tennessee has calculated the impact area of Loop 325 on those regulated areas identified for protection by the Highlands Council. Table 1.1-4 details these impacts. A description of each resource and the Projects impacts to that resource follows.

Table 1.1-4

Estimated Impacts to Regulated Areas Within the Highlands region FOR Loop 325

Regulated Area	Highlands Jurisdictional Area	Linear Distance Crossed (Miles)[a]	Area Impacts (Acres)[a]		
			Permanent	Temporary	Total
Total Project Dimensions within Preservation Area	Preservation	7.59	15.83	93.52	109.35
Prime Groundwater Recharge Area		4.04	9.86	52.41	62.27
Source Water Protection Area		6.50	15.83	86.1	101.93
Surface Water Reservoirs		0.26	0.97	0	0.97
Open Water Protection Area		4.88	12.34	53.21	65.55
Critical Habitat Resource Area		6.50	15.83	86.1	101.93
Forest Resource Protection Area		6.50	15.83	86.1	101.93
Steep Slopes		0.14	0.29	1.89	2.18
Agricultural Resource Area		0	0	0	0
Conservation Priority Area		7.02	15.83	89.76	105.59
Riparian Area		3.55	11.55	21.95	33.5
Lake Management Area		0.85	2.6	9.05	11.65
Special Environmental Zones		0	0	0	0

a – Distance crossed does not include those areas avoided through use of HDD installation technique.

1.1.3.1 Planning Area

No portion of Loop 325 is located within the Planning Area of the Highlands Region. All facility components of the Project within New Jersey are located within the Preservation Area or entirely outside the Highlands Region. Complete descriptions of the locations of the proposed pipeline and aboveground facilities within the Highlands Region are given in Table 1.1-1.

1.1.3.2 Preservation Area

Loop 325 crosses the Preservation Area for approximately 7.59 miles and would require approximately 109.35 acres of temporary and permanent impact for construction and operation of the pipeline facilities. Of this total, 93.52 acres are associated with temporary impacts resulting from construction of the facilities including TWS

and ATWS. These areas will be restored in accordance with this CMP, other regulatory approvals, and landowner agreements. A total of 15.83 acres will be permanently impacted for Tennessee's permanent easement and will be maintained in a low-shrub/herbaceous vegetated cover type to facilitate pipeline operation and maintenance activities.

1.1.3.3 Prime Groundwater Recharge Area

The Council has determined Draft Prime Ground Water Recharge areas based upon a method developed by the New Jersey Geological Survey to map ground water recharge areas that most efficiently provide 40 percent or more of the total recharge volume for each United States Geological Survey ("USGS") 14 digit Hydrologic Unit Code (HUC 14) subwatershed. The method used to delineate Prime Groundwater Recharge Areas uses precipitation, surface runoff, evapotranspiration, and soil moisture deficit information to estimate recharge rates. It is highly dependent on available information regarding soils, precipitation patterns, and land cover to differentiate and rank the recharge capacity of various land areas within a geographic area. Given that aquifers and streams are most stressed during drought periods, and that the Council's method for defining available water supplies is based upon data for low flows, the CMP used drought rainfall estimates as the basis for mapping prime recharge areas (NJHC 2010).

1.1.3.4 Source Water Protection Area

The Highlands Region's surface and groundwater resources provide a significant source of the State of New Jersey's potable water supply. The largest surface water supply systems of the Highlands provide water to urban and suburban parts of northern and central New Jersey. There are a few surface water supply systems for potable water supply that provide water primarily to municipalities of the Highlands Region.

The resource assessment required by the Act includes the identification of Source Water Protection Areas ("SWPA") when determining availability of water resources to support the land use capacity of the Highlands Region. The objective is to determine the areas supplying potable water through surface water supply reservoirs and intakes, and to protect the quantity of supply (Safe Yields) to these water supply systems. Source water areas include the entire drainage area that flows to or past an intake point. This delineation includes all surface waters within HUC 14 subwatersheds that contribute to a water supply reservoir or intake, as well as all overland water flow to any stream that is upstream of the intake as it is applied to the NJ Highlands Council Regional Master Plan (NJHC 2010). The New Jersey Highlands Source Water Protection Area can be defined as those subwatersheds (HUC14) that serve as contributing drainage areas upstream of potable water surface water intakes or reservoirs. This includes all tributaries and their headwaters.

1.1.3.5 Surface Water Reservoirs

Surface water reservoirs include those major surface water reservoir systems that provide water to urban and suburban areas of northern and central New Jersey and smaller reservoirs providing water supply on a local scale. The reservoirs store water during times when stream flows are higher, and then release water from storage both to serve customers and to maintain mandatory "passing flows" to downstream areas during dry periods. Highlands reservoirs provide over 600 million gallons per day ("MGD") to public water supply service areas in these regions, with individual reservoir system supplies ranging from less than one to roughly 175 MGD. A major purpose for protection of the Highlands is the Region's role in providing the vast majority of potable surface water supplies used in northern and central New Jersey, where the majority of the State's population resides. These reservoirs rely either directly or indirectly on water flowing in Highlands streams (NJHC 2010).

Loop 325 crosses the Monksville Reservoir at MP 0.17.Tennessee's existing 300 Line pre-dates the reservoir, which was constructed in 1985 as part of the North Jersey District Water Supply Commission. The Project

does not involve any temporary or permanent impacts to the reservoir, as Tennessee has incorporated a HDD crossing of the surface water resource.

1.1.3.6 Open Water Protection Area

Highlands Open Waters include all springs, wetlands, intermittent or ephemeral streams, perennial streams, and bodies of surface water, whether natural or artificial, located wholly or partially within the boundaries of the Highlands Region. The Highlands Region contains an extensive network of surface waters and associated riparian lands. The total stream length mapped in the Highlands is 3,605 miles and the extent of mapped streams and lakes acreage is 32,213 acres. The total for mapped wetlands in the Highlands Region is 90,091 acres (NJHC 2010).

These open waters and the associated Riparian Areas provide protection against floods and help to ameliorate the effects of prolonged droughts. These areas provide important habitat for numerous plant and animal species, including many rare, threatened, or endangered species in the State. Additionally, these areas provide a wealth of agricultural, recreational, and aesthetic uses for both residents and visitors alike, helping to contribute to a vibrant regional economy.

The vegetated corridors adjacent to lakes, streams, rivers, and wetlands are effective and important tools to protect water quality and stream health both in rural and urban environments. The Highlands Regional Master Plan includes a Highlands Open Waters Protection Area necessary to maintain the quality and ecological integrity of open waters and includes a 300-foot protection area buffer around all streams and wetlands. By filtering sediments and transforming nutrients so they are less damaging to the water bodies, buffers safeguard Highlands Open Waters from the impacts of adjacent land use practices.

1.1.3.7 Critical Habitat Resource Area

The Council delineated the Critical Habitat area by incorporating NJDEP-certified vernal pools including a 1,000-foot habitat buffer, Significant Natural Areas that includes regionally significant ecological communities and habitat for documented threatened and endangered plant species, and Critical Wildlife Habitat as mapped by the NJDEP's Endangered and Nongame Species Program Landscape Project (Version 3) to identify areas of habitat for rare, threatened, and endangered species habitat. The updated Landscape Project (Version 3) was developed for the Highlands Region to identify habitat ranked by documented occurrences of rare, threatened, or endangered species. This area includes lands given Landscape Rank 2 through 5 in the Preservation Area, which accounts for habitat supporting a federally listed threatened or endangered species (Landscape Rank 5), species designated as State Endangered (Landscape Rank 4), species designated as State Threatened (Landscape Rank 3), and species designated as Special Concern (Landscape Rank 2). (NJHC 2010)

1.1.3.8 Forest Resource Protection Area

The Council assessed the ecological integrity of forests through the examination of landscape level characteristics at the forest patch and subwatershed level, utilizing measures of forest fragmentation to identify where regionally significant forests are located in the Highlands Region. These are the forests that are most suited to support ecological processes. The Forest Resource Area includes high ecological value forest areas, including those forested areas that exhibit the least fragmentation and are vital for the maintenance of ecological processes. The Council spatially delineated the Forest Resource Area by including those forested areas that express one or more of the following indicators: a contiguous forest patch of equal to or greater than 500 acres in size; an area consisting of >250 acres of core forest area greater than 300 feet from an altered edge, or areas that include >45% of mean total forest cover; and mean distance to nearest patch (HUC14 only). The result of this assessment is the spatial delineation of the Forest Resource Area within the Highlands Region (NJHC 2010).

1.1.3.9 Steep Slopes

Due to the unique geologic conditions present in the Highlands Region, the area contains extreme topographic relief. Subsequently, the presence of steep slopes, as defined by the Council, provides a unique and significant environmental resource within the Highlands. Land disturbance of steep slopes can result in erosion and sedimentation, disturbance or loss of wildlife habitat, impacts to surface water quality, sedimentation of wetlands, and alteration of drainage patterns. To protect areas of steep slopes within the Highlands, the Council has mapped areas that encompassed a minimum of 5,000 square feet and that exhibited one (1) of the following grade classifications:

- Grades of slopes of 20 percent or greater;
- Grades of slope between 15 percent and 20 percent; and
- Grades of slope between 10 percent and 15 percent that occur within the Riparian Area. (NJHC 2010)

The Act specifies that linear development as defined at N.J.A.C. 7:38-1.4 shall be permitted on a slope with a grade of 20 percent or greater provided that there is no feasible alternative for the linear development outside the steep slope (N.J.A.C 7:38-3.8(c)).

1.1.3.10 Agricultural Resource Area

Agriculture has historically been and continues to be a vital component of the culture and the landscape of the Highlands Region. Agriculture plays a significant role in the economy of the Highlands through agricultural production and maintaining the rural character of Highland's communities. The protection of these agricultural resources through implementation of the Highlands Regional Master Plan is in response to the loss of farmland over recent decades.

The Agricultural Resource Area was developed to delineate an integrated coverage of regional agricultural lands within the Highlands Region. The Council utilized the following factors to assess the Region's farmland and identify the Region's most important agricultural resources:

1) Contiguous farming landscapes (Agricultural Parcels comprised of 10 percent or greater Agricultural Land-Use codes from the 2002 NJDEP Land-Use/Land-Cover dataset AND that form a contiguous farming area of at least 250 acres.
2) Farms that include important farmland soils (prime farmland, farmland soils of statewide, local and unique importance from NRCS SSURGO dataset).
3) Concentrations of existing preserved farmland (SADC Preserved farmlands). (NJHC 2010).

Loop 325 of the Project does not cross any Council-mapped Agricultural Resource Areas.

1.1.3.11 Conservation Priority Area

The Conservation Priority Area was determined by the Council to identify those lands in the Highlands with the highest ecological values to establish priority areas for land conservation. The Council evaluated the ecological values of land based upon a combination of 33 ecological indicators which measure the quantity and quality of the following regional resource values: forests, watershed condition, critical habitat, prime ground water recharge areas, open waters and riparian areas, and steep slopes (NJHC 2010).

1.1.3.12 Riparian Area

As primary mechanism of protecting, enhancing and restoring water resources, the Council has incorporated protection of lands adjacent to the Highlands Open Waters known as Riparian Areas. Riparian areas are hydrologically connected to surface waters through overland surface runoff, hydric soils, wetlands, or subsurface flow, and serve as an interface between surface water bodies (e.g., streams, rivers, lakes, or reservoirs) and terrestrial ecosystems.

The Riparian Area was defined and mapped using hydrologic properties of land cover, soil, and evidence of periodic inundation or saturation. The integration of flood prone areas, riparian soils, Highlands Open Waters, and wildlife corridors was used to generate a single riparian GIS coverage and ultimately to create a combined riparian area map. Each is described in more detail below.

1) Flood Prone Areas: defined as NJDEP documented and undocumented flood prone areas and Federal Emergency Management Agency (FEMA) 100-year floodplain.
2) Riparian Soils: defined as a hydric soil, a soil exhibiting a shallow depth to seasonal high water table, or alluvial soil.
3) Highlands Open Waters: defined as all mapped rivers, lakes, streams and wetlands that are adjacent to and hydraulically interconnected with a river or stream as identified in the Highlands Open Water Inventory.
4) Wildlife Corridors: defined as a 300-foot corridor on each mapped stream bank or from the stream centerline if no stream bank is mapped.

The Council-mapped Riparian Area is over two-fifths of the Highlands Region, emphasizing the importance of water related resources to the area (NJHC 2010).

1.1.3.13 Lake Management Area

The Council has established Lake Management Areas to protect the Highlands Region's significant surface water resources and their environments from the adverse effects of overbuilding and other poor management of shoreland areas resulting in the degradation of water quality, harm to the lake ecosystem, decrease of natural aesthetic values, and overall loss of property values for lake communities. Additionally, lakes can be harmed by pollutant sources within their contributory watershed. Studies of public lakes in the Highlands Region indicate that most are experiencing contamination, most often including excessive bacteria and nutrients resulting from outdated septic system designs (or even cesspools) on inadequately sized lots. Furthermore, many lake communities have been experiencing intensifying land uses as original buildings are torn down and replaced by larger structures.

Lake Management Areas have been defined to include four (4) tiers: A Shoreland Protection Tier consisting of an area measured 300 feet or the first public road perpendicular to the shoreline of the lake; A Water Quality Management Tier consisting of an area measured 1,000 feet perpendicular from the shoreline of the lake, including the Shoreland Protection Tier; A Scenic Resources Tier consisting of an area measured 300 to 1,000 feet perpendicular from the shoreline of the lake, scaled based upon the view distance from the opposite shoreline, and determined through the size and layout of the lake, and topography of the land area, with wider portions of lakes and greater topographic relief having longer view distances; and A Lake Watershed Tier consisting of the entire land area draining to the lake (NJHC 2010).

1.1.3.14 Special Environmental Zones

The Highlands Council has designated these areas for protection from development to protect water resources and environmentally sensitive lands based upon Regional Master Plan ("RMP") Conservation Priority Area rank, and the potential to a) protect water supply reservoirs and other critical water features, b) create large contiguous areas of environmentally sensitive lands, c) create habitat corridors, and d) connect existing preserved open space. Additionally, the Highlands Council states that existing land use patterns shall be considered to minimize conflicts between the designation of a Special Environmental Zone and ongoing land uses (NJHC 2010).

Loop 325 of the Project does not cross any Council-mapped Special Environmental Zones.

2.0 Comprehensive Mitigation Plan Components

Executive Summary

The CMP has been developed to ensure that the Project provides for "no net loss" of the functions and values associated with the various Highlands Resource Areas. Where impacts from installation of the pipeline or management of the post-construction ROW cannot be avoided, Tennessee has incorporated mitigation measures into the Project that provide in-kind resource and / or function and value compensation to a similar or greater level. These measures are detailed in the various components of the CMP and may include specialized construction techniques, acquisition of land within similar resource areas, and post-construction restoration and monitoring of the ROW.

Key highlights of the CMP include

- Specialized construction techniques to minimize resource area impacts (these techniques are located in Tennessee's Environmental Construction Plan, which will be submitted as part of the application for a certificate of public convenience and necessity to the FERC. The ECP is also located in this application as Appendix A.
- Full-time environmental inspection staff to oversee construction and ensure permit compliance.
- Post-construction restoration measures that promote wildlife habitat and re-establishment of forest.
- Long-term monitoring of restored ROW and detailed reporting specific to Highlands Resource Areas.
- Acquisition and permanent protection of land within areas designated as Conservation Priority Areas and Special Environmental Zones.

As background, Tennessee notes that it has developed an Environmental Construction Plan, or "ECP" specifically for the Project. The ECP describes the basic environmental construction techniques that Tennessee (and its contractors) will implement during and following construction and maintenance to protect the environment and to minimize potential effects of the pipeline construction and maintenance. Tennessee has based the specifications in the ECP on procedures successfully used in constructing, operating, and maintaining transmission systems throughout the United States, and on guidelines and recommendations from the U.S. Army Corps of Engineers ("ACOE" or the "Corps"), the U.S. Department of Agriculture, the Natural Resources Conservation Service ("NRCS"), and the FERC. Additionally, the ECP meets all conditions outlined in the FERC's "Wetland and Waterbody Construction and Mitigation Procedures" (the "Procedures") and FERC's Upland Erosion Control, Revegetation and Maintenance Plan (the "Plan"), except in those areas where Tennessee is requesting a waiver from specific conditions as outlined in Section 9.0 of the ECP. Copies of the Plan and Procedures are attached to this CMP.

The ECP covers the following subjects: Section 2.0 provides site description information. Section 3.0 discusses construction supervision, environmental inspection, and the responsibilities of the environmental inspector. Section 4.0 discusses preconstruction planning, standard construction methods, and erosion and sedimentation control practices. Section 5.0 discusses specialized construction methods including waterbody and wetland crossing procedures. Section 6.0 identifies site-specific construction information applicable to environmentally sensitive areas. Section 7.0 discusses measures to prevent, contain, and control spills. Section 8.0 discusses contaminated materials handling. Section 9.0 lists exceptions to the FERC's Plan and Procedures requested for this Project.

All Highlands forests will be identified in accordance with the Council's Method for Identifying Upland Forests in the Highlands Region. The Project does not affect any core forest areas. Per the RMP, core forest areas are those areas of forest greater than 300 linear feet from an altered edge. An altered edge is defined as the spatial delineation of the geographic boundary (i.e., edge) between forest and non-forest land. The existing ROW associated with the existing 300 Line pipeline meets the definition of an altered edge. All work will be performed within 300 feet of an altered edge, therefore no core forest will be affected by the Project. Additionally, no forest mitigation would be required for vegetative impacts within the existing 300 Line ROW primarily because the existing ROW is maintained in a scrub-shrub condition for access, visibility and safety per the FERC rules governing natural gas transmission lines.

2.1 Upland Forest Mitigation and Restoration

The approach to upland forest mitigation and restoration involves a combination of impact minimization during construction and vegetation re-establishment involving natural, successional processes as a key component. Tennessee believes that this approach will best minimize the long-term impacts to forested uplands and facilitate the development of an upland forest with a vegetation community composed of species best suited for the site and successional stage. Tennessee's reforestation plan shall be limited to those forested upland areas within designated temporary workspace on privately owned lands (state-owned lands will be planted in accordance with the New Jersey No Net Loss Reforestation Act (N.J.S.A. 13:1L-14.1 et seq.). In addition to reforestation, Tennessee's commitment to the acquisition of land shall also mitigate for the temporal loss of forest. Tennessee is proposing to purchase 50 acres of land designated as Highlands Forest Resource Area within the Highlands Preservation Area. This will serve to mitigation new impacts to forest resources on privately owned lands impacted by the Project.

- Minimize the amount of tree clearing to the maximum extent practicable while still allowing for safe construction of the pipeline. Although Tennessee has requested a typical 100-foot construction ROW, where possible (as determined by the Environmental Inspectors ("EI")), selected trees along the edge of the various corridors may be preserved to help minimize impacts. To the extent practicable, trees and brush will be cut and/or ground just above or to ground level, leaving the stumps and root systems intact. Tree stumps will be preserved to the maximum extent practicable and removed only over the trenchline and where the EI determines the stumps present a safety hazard for construction. Stumps requiring removal in the construction zone will typically be ground down to ground level, leaving some of the root collar and root system in place. Treating stumps and root systems in this manner will promote the potential for re-sprouting in some species.

- Re-establishment of forest will be performed using a combination of plantings and natural, successional processes. A variety of plantings and seed mixes are proposed to stabilize and restore the temporary workspace utilized during construction to quickly stabilize the area and ensure the short-term establishment of a native, non-invasive plant community and long-term re-establishment of a forested cover type. Diversity in species composition is critical to reduce the risk of widespread loss of trees to single insect and disease infestation. Therefore, similar species should not exceed 30 percent of the total planting. Components of the forest restoration plan include:

    - Restoration planting densities of 600 plants-per-acre within upland forests, 400 of which shall consist of tree species. Tree species will consist of four to six foot whip-sized individuals in a variety of native upland species obtained from a reputable plant nursery. No cultivars or other ornamental sub-species will be allowed as substitutes. Alternatively, reforestation planting may consist of 800 to 1,000 seedlings per acre.

- To ensure successful completion of the mitigation plan and increased survivorship of individual plantings, Tennessee will conduct the planting in early- to mid-fall 2012 following completion of Project construction. If actual construction timeframes do not accommodate a fall 2012 planting schedule, Tennessee shall conduct the planting as soon as practicable within the 2013 growing season with the understanding that installation of the plantings will be logistically impractical during inundated conditions that typically occur during early spring, while planting during drought or excessively hot conditions typically occurring in early- to mid-summer will greatly increase the potential for individual mortality due to heat or water stress and where supplemental irrigation of plantings is impractical if not impossible.

- Planting will be conducted by a qualified and reputable landscape contractor contracted by Tennessee to provide oversight of the restoration activities. The landscape contractor will be provided a copy of the CMP and will be apprised of Tennessee's obligations under the plan and applicable NJDEP permit conditions.

- Any inadvertent impacts that occur during restoration planting activities, including but not limited to impacts outside of permitted work limits or excessive soil rutting, shall be restored to pre-existing conditions as soon as practicable.

- Spacing of individual plants (typically six (6) to ten (10) feet on center) will be conducted so as to maintain consistent areal canopy coverage and adequate sun exposure as the plantings grow and mature. Additionally, consistent pre-determined spacing of individuals will ensure thorough and adequate replanting of the entire disturbed area, as well as limit the potential for confusion and subjective in-field spacing decisions by planting laborers.

If the timing of final grading and restoration activities associated with pipeline construction does not coincide with that of the planned restoration planting schedule, or site conditions and soil temperature are not appropriate for transplantation and seed germination, the impacted area will be temporarily seeded with annual ryegrass at an application rate of 40 pounds/acre and stabilized with two (2) to four (4) inches of straw mulch, which equates to an application rate of three (3) tons/acre, and subsequently planted at an appropriate time.

Plantings will be accomplished through the use of plant stocks chosen for their compatibility with the local environment. Commercially available plants and seeds will be utilized to accomplish this goal. The planting plan has been designed to provide a variety of plant species to promote species richness, enhance wildlife habitat, and help to "jump start" restoration of the forest community within the temporary workspace impacted during construction activities.

Spacing of individual plants will be conducted so as to maintain consistent areal canopy coverage and adequate sun exposure as the plantings grow and mature. Consistent pre-determined spacing of approximately 10-feet on-center of tree species individuals will ensure thorough and adequate densities and replanting of the entire mitigation area, as well as limit the potential for confusion and subjective in-field spacing decisions by planting laborers. However, final spacing and placement of the plantings may be determined in the field. Should supplemental irrigation of restoration plantings be required due to climatic conditions at the time of planting and immediately thereafter, the contractor will be required to maintain adequate hydration to support the plantings until successful establishment.

To reduce the immediate threat and minimize the long-term potential of degradation, the species included in the document *An Overview of Nonindigenous Plant Species in New Jersey* published by the NJDEP (2004) shall not be included as planting stock in the overall Project. Only plant materials native and indigenous to the

region shall be used. Species not specified in the mitigation plan shall not be used without prior written approval from NJDEP.

Tennessee will conduct post-construction monitoring of all forested areas affected by construction for a minimum of three (3) years to access the condition of vegetation and the success of restoration. As a component of the monitoring program, Tennessee will perform quantitative sampling to determine the type and quantity of tree and shrub species naturally colonizing and re-sprouting in the construction ROW. At the end of each growing season, the results of the field monitoring will be compared to pre-determined threshold success criteria (75% survival of plantings). Restoration shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed land. Yearly monitoring reports shall be submitted to the Council at the end of each growing season. These success criteria will identify quantities of native woody species that would be considered necessary to ensure successful forested restoration. If actual field stem counts fall short of the pre-determined threshold values, Tennessee will develop supplemental plans in conjunction with the appropriate state and federal agencies.

- The species to be included in the supplemental replanting plan will be based on those identified to be naturally colonizing and succeeding on the various construction sites. By mimicking natural processes and site ecology, and planting appropriate species at the appropriate successional stage, efforts to promote restoration of forested areas will be maximized. Through post-construction monitoring, the site will dictate which species will be better suited for supplemental planting so effort and cost will not be wasted planting species maladapted to the site conditions.

- Specifications for species, planting stock size and quality, stem quantity and spacing, and planting method will be developed for review by appropriate agency personnel. Implementation of the supplemental planting program, if necessary, will occur during the spring following the end of the second growing season.

2.2 Open Waters and Riparian Areas Plan

All new major Highlands development is prohibited within a Highlands open water and its adjacent 300-foot buffer except for linear development, which shall be permitted provided that there is no feasible alternative for the linear development outside the Highlands open water or Highlands open water buffer (Highlands Act). As discussed in Resource Report 10 of Tennessee's Environmental Report (submitted as part of Tennessee's certificate application for the Project to FERC) which provides a detailed alternative analysis for avoiding the entire Highlands region, the Project has no feasible alternative for development outside of Highlands due to the linear nature of pipeline installation. Additionally, conventional boring of open water areas is not a feasible alternative due to potential safety constraints associated with the required bore pits.

Multiple streams will be required to be crossed to facilitate the construction of Loop 325. This will require an individual freshwater wetland encroachment and flood hazard area permit from the NJDEP. The Flood Hazard Area Control Act (NJAC 7:13) regulates impacts to vegetation within the riparian zone, which can extend from 50 feet to 300 feet from the top of bank of a subject stream, depending on location and category of the stream. Tennessee will work with NJDEP to determine the riparian zone width for each stream crossed by Loop 325. Mitigation of wetland and riparian zone impacts will be addressed through the NJ DEP LURP permitting process and therefore are not included within the scope of this CMP. The following sections of the CMP pertain to the 300-foot Highlands open water buffer areas including those areas that are located outside of NJDEP wetland or flood hazard area jurisdiction.

2.2.1 Open Water Buffer (Transition Area) Restoration

The approach to open water buffer area mitigation and restoration involves a combination of impact minimization during construction, topographic restoration, and vegetation establishment involving natural, successional processes as a key component. Tennessee believes that this approach will best minimize the long-term impacts to the buffer areas and facilitate the re-establishment of the functional value with a vegetation community composed of species best suited for the site and successional stage. Functions and values of the wetland transition areas such as provision of wildlife habitat, groundwater recharge, flood prevention, etc., shall not be permanently affected through construction and operation of the Project.

The following measures will be implemented to ensure the timely restoration of the buffer areas:

- Minimize the amount of tree clearing to the maximum extent practicable while still allowing for safe construction of the pipeline. Selected trees along the edge of the various corridors may be preserved to help minimize impacts. To the extent practicable (typically in areas that will not require significant grading), trees and brush will be cut and/or ground just above or to ground level, leaving the stumps and root systems intact. Stumps will be removed in areas where significant grading is required and as necessary to maintain safe working conditions. Treating stumps and root systems in this manner will promote the potential for re-sprouting in some species in areas of temporary / additional temporary workspace.

- During the restoration phase, the pre-construction ground contours and drainage patterns will be restored to approximate original condition. If necessary, surface rock and boulders that had been windrowed during the construction phase will be distributed in a more natural configuration in the temporary workspace. Following restoration of the ground surface, the buffer areas shall be seeded and/or mulched according to Table 2.2-1 to stabilize the area and provide herbaceous cover.

- Re-establishment of forest and shrub vegetation in buffer areas will be performed using a combination of plantings and natural, successional processes. A variety of plantings and seed mixes are proposed to stabilize and restore the temporary workspace utilized during construction to quickly stabilize the area and ensure the short-term establishment of a native, non-invasive plant community and long-term re-establishment of the functions and values associated with the transition area. Components of the revegetation plan include:

    - Restoration planting densities of 600 plants-per-acre within buffer areas. In forested areas, a minimum of 400 of which shall consist of tree species (See Table 2.3-2). Tree species will consist of two-to-three foot whip-sized individuals in a variety of native species obtained from a reputable plant nursery. No cultivars or other ornamental sub-species will be allowed as substitutes.

    - To ensure successful completion of the mitigation plan and increased survivorship of individual plantings, Tennessee will conduct the planting in early- to mid-fall 2013 following completion of Project construction. If actual construction timeframes do not accommodate a fall 2013 planting schedule, Tennessee shall conduct the planting as soon as practicable within the 2014 growing season with the understanding that installation of the plantings will be logistically impractical during inundated conditions that typically occur during early spring, while planting during drought or excessively hot conditions typically occurring in early- to mid-summer will greatly increase the potential for individual mortality due to heat or water stress and where supplemental irrigation of plantings is impractical if not impossible.

- Planting will be conducted by a qualified and reputable landscape contractor under the supervision of Tennessee. The landscape contractor will be provided a copy of this wetland mitigation plan and will be apprised of Tennessee's obligations under the plan and applicable NJDEP permit conditions.

- Any inadvertent impacts that occur during restoration planting activities, including but not limited to impacts outside of permitted work limits or excessive soil rutting, shall be immediately reported to Tennessee construction managers and restored to pre-existing conditions as soon as practicable.

- Spacing of individual plants will be conducted so as to maintain consistent areal canopy coverage and adequate sun exposure within the wetland as the plantings grow and mature. Additionally, consistent pre-determined spacing of individuals will ensure thorough and adequate replanting of the entire disturbed area, as well as limit the potential for confusion and subjective in-field spacing decisions by planting laborers.

If the timing of final grading and restoration activities associated with pipeline construction does not coincide with that of the planned restoration planting schedule, or site conditions and soil temperature are not appropriate for transplantation and seed germination, the mitigation area will be temporarily seeded with annual ryegrass at an application rate of 40 pounds/acre and stabilized with two (2) to four (4) inches of straw mulch, which equates to an application rate of three (3) tons/acre, and subsequently planted at an appropriate time.

Plantings will be accomplished through the use of plant stocks chosen for their compatibility with the local environment as well as the various hydrologic regimes within the buffer area. Commercially available plants and seeds will be utilized to accomplish this goal. The planting plan has been designed to provide a variety of plant species to promote species richness, enhance wildlife habitat, and help to "jump start" restoration of a forested or scrub-shrub community as applicable within the temporary workspace impacted during construction activities. Table 2.2-1 provides the composition of the proposed seed mixes that may be applied within the proposed restoration areas. Only plant materials native and indigenous to the region will be used. No cultivars of native species shall be used. Tables 2.2-2 and 2.2-3 identify specific vegetative communities proposed for open water buffer area restoration activities. The communities listed in the Tables and the proposed planting locations were developed based on vegetative inventories performed during Loop 325 field surveys and information found in several local pertinent reference guides (see Tables 2.2-2 and 2.2-3 for additional information).

TABLE 2.2-1
TYPICAL SPECIES COMPOSITION OF SEED MIXES FOR OPEN WATER BUFFER AREA RESTORATION ACTIVITIES

Seed Mix[a]	Common Name (Scientific name)	
Custom Native Upland Wildlife Forage and Cover Mix (Ernst Seed Company)	Virginia Wild Rye (*Elymus virginicus*)	Fowl Bluegrass (*Poa palustris*)
	Little Bluestem (*Schizachyrium scoparium*)	Big Bluestem (*Andropogon gerardii*)
	Switchgrass (*Panicum virgatum*)	Black Eyed Susan (*Rudbeckia hirta*)
	Indiangrass (*Sorghastrum nutans*)	
	Eastern Gamma Grass (*Tripsacum dactyloides*)	Ox Eye Sunflower (*Heliopsis helianthoides*)

TABLE 2.2-1
TYPICAL SPECIES COMPOSITION OF SEED MIXES FOR OPEN WATER BUFFER AREA RESTORATION ACTIVITIES

Seed Mix[a]	Common Name (Scientific name)	
Custom Northeast Upland Wildlife Seed Mix (Southern Tier) Consulting)	Switch-grass (*Panicum virgatum*)	Oats (*Avena sativa*)
	Big Blue-stem (*Andropogon gerardii*)	Broom-Sedge (*Andropogon virginicus*)
	Little Bluestem (*Schizachyrium scoparium*)	Fox-Tail Bristle Grass (*Setaria italica*)
	Round-headed Lespedeza (*Lespedeza capitata*)	

a: Seed application rates should follow the manufacturer's recommendation for the individual seed mix.

TABLE 2.2-2
CHESTNUT OAK / SCRUB OAK COMMUNITY

Layer	Common Name	Scientific Name	Size	Quantity Per Acre*	Mile Post Locations
Tree	Scarlet oak	*Quercus coccinea*	2'-3'	250	MP 7.20- 7.24
	Chestnut Oak	*Quercus prinus*	2'-3'	250	
	White Oak	*Quercus alba*	2'-3'	250	
	Gray Birch	*Betula populifolia*	2'-3'	150	
	Pitch Pine	*Pinus rigida*	2'-3'	200	
	Black Cherry	*Prunus serotina*	2'-3'	200	
	Total	**-**	**-**	**1300**	
Shrub	Scrub Oak	*Quercus ilicifolia*	0.5'-1'	25	
	Lowbush Blueberry	*Vaccinium vacillans*	0.5'-1'	25	
	Black Huckleberry	*Gaylussacia baccata*	0.5'-1'	25	
	Common Juniper	*Juniperus communis*	0.5'-1'	25	
	Total	**-**	**-**	**100**	
Herb	Native Upland Wildlife Forage and Cover Mix (Ernst Seed Company) and/or Northeast Upland Wildlife Seed Mix (Southern Tier Consulting)		N/A	Application rates will follow the manufacturer's recommendation for the individual seed mix	

Chestnut oak forest community is generally found on exposed ridges with a variety of understory shrubs including scrub oak, black huckleberry, mountain laurel, sheep-laurel, and blueberry in the shrub layer.

Note: Tables were developed based on the field surveys and information in several pertinent references. References consulted in developing the tables included:
Hough, Mary y. 1983. New Jersey Wild Plants. Harmony Press, Harmony, NJ.
Ohmann, Lewis F., and Murray F. Buell. 1968. Forest Vegetation of the New Jersey Highlands. Bulletin of the Torrey Botanical Club, Vol. 95, No. 3, pp. 287-298.

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	White Oak	*Quercus alba*	2'-3'	250	
	Gray Birch	*Betula populifolia*	2'-3'	150	
	Pitch Pine	*Pinus rigida*	2'-3'	200	
	Black Cherry	*Prunus serotina*	2'-3'	200	
	Total	**-**	**-**	**1300**	
Shrub	Scrub Oak	*Quercus ilicifolia*	0.5'-1'	25	
	Lowbush Blueberry	*Vaccinium vacillans*	0.5'-1'	25	
	Black Huckleberry	*Gaylussacia baccata*	0.5'-1'	25	
	Common Juniper	*Juniperus communis*	0.5'-1'	25	

New York Natural Heritage Program. 2010. Appalachian Oak-Hickory Forest. NYNHP Conservation Guide, New York Natural Heritage Program, Albany, NY.

*Quantity per acre based on the reference: Vodak, Mark, Reforestation and Forest Tree Planting: Guidelines for New Jersey , Cooperative Extension, Cook College, Rutgers University

TABLE 2.2-3
RED OAK / SWEET BIRCH COMMUNITY

Layer	Common Name	Scientific Name	Size	Quantity Per Acre*	Mile Post Locations
Tree	Sweet Birch	*Betula lenta*	2'-3'	250	MP 0.90- 2.75; MP 5.50- 5.90; MP 7.00- 7.20; MP 7.24-7.60
	Red Oak	*Quercus rubra*	2'-3'	250	
	Black Oak	*Quercus velutina*	2'-3'	250	
	Sugar Maple	*Acer saccharum*	2'-3'	150	
	Eastern Hemlock	*Tsuga canadensis*	2'-3'	200	
	Black Cherry	*Prunus serotina*	2'-3'	200	
	Total	**-**	**-**	**1300**	
Shrub	Witch-hazel	*Hamamelis virginiana*	0.5'-1'	25	
	Black Huckleberry	*Gaylussacia baccata*	0.5'-1'	25	
	Mountain Laurel	*Kalmia latifolia*	0.5'-1'	25	
	Maple Leaf Viburnum	*Viburnum acerifolium*	0.5'-1'	25	
	Total	**-**	**-**	**100**	
Herb	Native Upland Wildlife Forage and Cover Mix (Ernst Seed Company) and/or Northeast Upland Wildlife Seed Mix		N/A	Application rates will follow the manufacturer's recommendation	

TABLE 2.2-3
RED OAK / SWEET BIRCH COMMUNITY

Layer	Common Name	Scientific Name	Size	Quantity Per Acre*	Mile Post Locations
Tree	Sweet Birch	*Betula lenta*	2'-3'	250	MP 0.90- 2.75; MP 5.50- 5.90; MP 7.00- 7.20; MP 7.24-7.60
	Red Oak	*Quercus rubra*	2'-3'	250	
	Black Oak	*Quercus velutina*	2'-3'	250	
	Sugar Maple	*Acer saccharum*	2'-3'	150	
	Eastern Hemlock	*Tsuga canadensis*	2'-3'	200	
	Black Cherry	*Prunus serotina*	2'-3'	200	
	Total	**-**	**-**	**1300**	
Shrub	Witch-hazel	*Hamamelis virginiana*	0.5'-1'	25	
	Black Huckleberry	*Gaylussacia baccata*	0.5'-1'	25	
	Mountain Laurel	*Kalmia latifolia*	0.5'-1'	25	
	(Southern Tier Consulting)			for the individual seed mix	

Red oak-sweet birch forest type may include several associate species including eastern hemlock, white ash, hickory, and American hornbeam. Eastern hemlock may occur in high percentages in one of the variants of this forest community type.

Note: Tables were developed based on the field surveys and information in several pertinent references. References consulted in developing the tables included:

Hough, Mary y. 1983. New Jersey Wild Plants. Harmony Press, Harmony, NJ.
Ohmann, Lewis F., and Murray F. Buell. 1968. Forest Vegetation of the New Jersey Highlands. Bulletin of the Torrey Botanical Club, Vol. 95, No. 3, pp. 287-298.
New York Natural Heritage Program. 2010. Appalachian Oak-Hickory Forest. NYNHP Conservation Guide, New York Natural Heritage Program, Albany, NY.

*Quantity per acre based on the reference: Vodak, Mark, Reforestation and Forest Tree Planting: Guidelines for New Jersey , Cooperative Extension, Cook College, Rutgers University

During planting, the qualified and supervising professional may relocate up to 50 percent of the plantings if as-built conditions would pose an unreasonable threat to the survival of plantings installed according to the mitigation plan. The plantings will be relocated to locations where appropriate structural context with other planting cells can be maintained. To reduce the immediate threat and minimize the long-term potential of degradation, the species included in the document *An Overview of Nonindigenous Plant Species in New Jersey* published by the NJDEP (2004) shall not be included as planting stock in the overall Project. Only plant materials native and indigenous to the region shall be used.

Tennessee will conduct post-construction monitoring of buffer areas affected by construction to access the condition of vegetation and the success of restoration. As a component of the monitoring program, Tennessee will perform quantitative sampling to determine the type and quantity of tree and shrub species naturally colonizing and re-sprouting in the construction ROW. At the end of the second growing season, the results of the field monitoring will be compared to pre-determined threshold success criteria (minimum 75 percent survival), if any, developed in consultation with the permitting agencies. These success criteria will identify quantities of native woody species that would be considered necessary to ensure successful forested wetland restoration. If actual field stem counts fall short of the pre-determined threshold values, Tennessee will develop supplemental plans in conjunction with the appropriate state and federal agencies.

- The species to be included in the supplemental replanting plan will be based on those identified to be naturally colonizing and succeeding on the various construction sites. By mimicking natural processes and site ecology, and planting appropriate species at the appropriate successional stage, efforts to promote restoration of vegetation will be maximized. Through post-construction monitoring, the site will dictate which species will be better suited for supplemental planting so effort and cost will not be wasted planting species maladapted to the site conditions.

- Specifications for species, planting stock size and quality, stem quantity and spacing, and planting method will be developed for review by appropriate agency personnel. Implementation of the supplemental planting program, if necessary, will occur during the spring following the end of the second growing season.

2.2.2 Open Water Buffer Restoration Monitoring

Tennessee will monitor buffer revegetation efforts annually for the first three years after construction or until wetland revegetation is successful. As discussed above, Tennessee will file an annual report with the Council identifying the status of the open water buffer revegetation efforts. The report will include the percent cover achieved and problem areas. An annual report will be filed until buffer revegetation is successful. Revegetation will be considered successful if the cover of herbaceous and/or woody species is at least 75 percent of the type, density and distribution of the vegetation in adjacent buffer areas that were not disturbed by construction. If the area is not showing signs of re-establishing native vegetation during the third growing season following construction, Tennessee will develop and implement (in consultation with a professional landscape ecologist and/or other state and federal regulatory agencies, as needed) a plan to revegetate the buffer with native species. Revegetation efforts will continue until revegetation is successful. A copy of the monitoring report will be provided to the Council at the end of each growing season until revegetation is successful.

2.2.3 Shallow Depth to Bedrock and In-Stream Blasting of Open Waters

The exact thickness of surficial deposits and substrates present at an individual stream crossing depend on multiple fluvial geomorphological factors. Table 2.2-6 details stream crossings in locations with substrates that have shallow depths to lithic bedrock. These are not locations where bedrock has been determined to be within 60 to 72 inches of the soil surface; however based upon the mapped soil types in the vicinity of the

stream crossing, these locations have a higher likelihood of intercepting bedrock during trenching activities, and thus may require pneumatic hammering or blasting of bedrock to provide adequate trench depth to meet U.S. Department of Transportation pipeline safety requirements related to sufficient pipeline backfill cover.

A stream or watercourse with a solid rock bottom is not the typical stream substrate and would only occur in a location and instance where a stream has eroded the surficial substrates down to expose the underlying bedrock. Should in-stream blasting or rock hammering be required for any watercourse crossing, Tennessee will restore the pre-construction streambed contours and substrates to the maximum extent practicable. Under the oversight and direction of an EI, the stream bed will be restored utilizing native materials excavated, chipped or blasted from the crossing location or vicinity. The preferred methodology will be to backfill the trench using controlled-density fill prior to the placement of the larger stones at the surface. This would provide a sufficient seal of any fissures that may have been created through the blasting / excavation process and would aid in preventing both streambed gouging and water loss. An alternative methodology will be to backfill the trench with finer native substrates, including sand, gravel, cobble, and stones, ultimately capping the backfilled trench with the largest, flattest pieces of stone available to mimic the pre-construction streambed conditions as closely as possible. While multiple flat pieces of stone would not exactly mimic a solid bedrock substrate, the additional voids, crevices and rock surface area created between the stone pieces would serve to enhance the quality and increase the density of in-stream microhabitats available to small fish species and macro-invertebrates that inhabit the stream.

Prior to the commencement of construction activities across waterbodies with a surficial bedrock substrate, Tennessee will evaluate the flow rate of the stream to ensure that the size stone selected for final substrate restoration is of sufficient size and weight that it will not become displaced by high volume / velocity flow events within the waterbody. The results of any such evaluations will be provided to the Council. Post-construction monitoring will be conducted within the summer / fall after spring runoff has occurred. This monitoring will specifically evaluate the stability and location of the stone within the waterbodies to ensure that no displacement has occurred as a result of spring runoff and significant precipitation events.

TABLE 2.2-6
WATERBODIES CROSSINGS FOR LOOP 325 WITH POTENTIALLY SHALLOW DEPTH TO BEDROCK

Feature ID	Waterbody Name	County	Town	Approx MP	Water-body Type[a]	Crossing Width (feet)	Stream Attributes[c]			Timing Restriction[f][d]	Crossing Method[e]	Comment
							Bank Height (feet)	Bank Width (feet)	Water Depth (Inches)			
L5 S059A	Wanaque River UNT	Passaic	Ringwood	1.96	I	2	0-1	2-4	3-6	June 16-March 14	I or II	Associated with W093
L5 AR22 S057	Ringwood Creek UNT	Passaic	Ringwood	3.04	P	16	2-4	10	0-3	June 16-March 14	II	Associated with Acce Road 22; Discharges W090 and S058

N/A = Not Applicable

a: I = Intermittent; P = Perennial; POW = Palustrine Open Water

b: MI = Minor (<10 feet); I = Intermediate (10 - 100 feet); MA = Major (>100 feet).

c: Stream attributes were estimated in the field and are approximate

d: Timing restrictions for warm water and cold water fisheries are from Tennessee's ECP (Volume II – Appendix D). Timing restrictions reflect dates during which construction activities are allowed to occur.

e: I = Conventional, Open- Cut Crossing Method; II = Dry Crossing Method including Flume and Dam and Pump. Intermittent streams containing stream flow at the time of construction will be crossed using a dry crossing method.

2.3 Steep Slope Construction Plan

The Project includes clearing, grading, and excavation disturbing more than one (1) acre of land, therefore a soil erosion and sediment control plan ("SESCP") will be developed for the Project in accordance with N.J.A.C. 2.90-1. The SESCP, also known as the ECP, will be submitted to the Passaic and Bergen County Soil Conservation Districts for review and approval. The ECP, as discussed above, will cover all areas of construction, including the ROW, access roads, staging areas and pipeyards and additional temporary workspace. The ECP also identifies locations for the placement of silt fence, construction staging, gravel tracking pads and other requirements of the applicable County Soil Conservation District.

Loop 325 has been designed to avoid steep slopes where possible and has minimized workspace areas within steep slope areas to the extent practicable to allow for safe working conditions during construction. In areas where steep slopes are unavoidable, specialized construction techniques, including the following, will be included within the ECP:

- Identification by milepost of areas with steep slopes (greater than 20 degrees) prior to commencement of construction. Table 2.3-1 below identifies all areas with greater than 20 degree slopes by milepost.

- Use of two-tone construction technique in areas of rugged/steep topography.

- During grade restoration, the spoil will be placed back in the cut and compacted. Any springs or seeps found in the cut will be carried down-slope through PVC pipe and/or gravel French drains installed as part of the cut restoration.

- In the areas of construction where the slope exceeds 20 degrees or more, a special means of manipulating the construction equipment must be utilized. The preferred method will be "winching" the equipment. This process consists of placing and anchoring a tractor at the top of the slope and using a winch to manipulate the equipment up and down the slope.

- Use of erosion control matting on new access roads to prevent soil loss. Placement of fencing along access roads to limit unnecessary access during construction. Re-establishment of slope profile and replanting of the access road post-construction with grass and shrubs to stabilize the soils.

- Permanent trench breakers consisting of sandbags or foam (though gravel or cement filled sacks may also be used) will be installed in the ditch over and around the pipe in areas of slope with high erosion potential. Trench breakers will be used to isolate wet areas and to minimize channeling of groundwater along the ditch line.

- Additional erosion controls in riparian areas including silt fencing and multi-barrier approaches. Use of advanced techniques in silt fencing and strong materials to avoid undercutting, toppling or splitting of the fence. This is especially true where down gradient threatened and endangered species habitat may be affected.

- When impacts to steep slopes are unavoidable, emphasize disruption of the least sloped areas over the more steeply sloped areas.

- Minimize length of traverse across steep slopes while controlling erosion/disruption potential (i.e., having a short traverse down a severe slope may be more disruptive than a longer traverse that avoids the steep slope).

- Strictly limit vegetation removal on either side of access roads in steep slope areas.
- Diffusion of stormwater flow in sloped areas should be emphasized using measures appropriate to rural areas, such as slope intercepts and off-flow points and swales.
- In forested wetlands, mulch shall be anchored immediately after placement on steep slopes and stream banks.
- In areas of rugged topography, ROW restoration will begin within 10 days of final pipeline installation to minimize potential erosion and sedimentation control problems.
- Use of geotextile fabric (such as jute matting or curlex) to assist in maintaining slope stability, preventing erosion of topsoil, and assisting in revegetation of slope.

Post-construction mitigation would include installation of permanent trench and/or slope breakers, revegetation and monitoring to ensure stabilization of the site. Slope breakers would be installed to slow down the flow of water and increase stormwater infiltration. Swales lined with grass and shrubs may also be designed so as to trap sediment as it comes down the slope.

Table 2.3-1

Steep Slopes (≥ 20 percent) crossed by Loop 325 of the Northeast Upgrade Project[1]

Facility ID	MP	Distance (feet)
Loop 325	0.01	15
	0.02	182
	0.07	153
	0.10	165
	0.14	38
	0.15	73
	0.16	50
	0.46	54
	0.47	84
	0.50	397
	0.57	483
	0.67	17
	0.68	17
	0.70	18
	0.70	62
	0.72	30
	0.73	1,127
	1.02	121

Table 2.3-1

Steep Slopes (≥ 20 percent) crossed by Loop 325 of the Northeast Upgrade Project[1]

Facility ID	MP	Distance (feet)
	1.06	97
	1.09	16
	1.17	27
	1.19	84
	1.25	74
	1.26	17
	1.27	17
	1.29	35
	1.30	28
	1.35	252
	1.40	22
	1.50	61
	1.54	134
	1.77	323
	1.83	41
	1.86	78
	2.08	148
	2.14	117
	2.16	16
	2.25	36
	2.38	15
	2.44	23
	2.46	15
	2.48	86
	2.51	31
	2.55	167
	2.60	158
	2.63	67
	2.64	79
	2.68	44
	2.69	25
	2.74	44

Table 2.3-1

Steep Slopes (≥ 20 percent) crossed by Loop 325 of the Northeast Upgrade Project[1]

Facility ID	MP	Distance (feet)
	2.84	130
	2.86	25
	2.88	48
	2.92	41
	2.93	24
	2.95	76
	3.00	66
	3.06	21
	3.07	35
	3.20	53
	3.21	22
	3.35	60
	3.38	23
	3.46	18
	3.47	29
	3.50	35
	3.50	42
	3.53	105
	3.57	392
	3.68	157
	3.77	26
	3.93	90
	4.15	37
	4.20	84
	4.34	39
	4.39	15
	4.40	15
	4.42	28
	4.43	130
	4.46	268
	4.53	39
	4.53	51

Table 2.3-1

Steep Slopes (≥ 20 percent) crossed by Loop 325 of the Northeast Upgrade Project[1]

Facility ID	MP	Distance (feet)
	4.56	18
	4.59	47
	4.61	29
	4.62	28
	4.69	101
	5.03	25
	5.06	81
	5.12	15
	5.26	22
	5.30	28
	5.44	511
	5.55	19
	5.59	41
	5.61	74
	5.68	59
	5.70	236
	5.76	44
	6.04	225
	6.20	43
	6.23	45
	6.32	62
	6.43	16
	6.44	16
	6.49	46
	6.58	152
	6.63	28
	6.64	60
	6.65	100
	6.69	76
	6.73	22
	6.85	16
	7.04	258

Table 2.3-1

Steep Slopes (≥ 20 percent) crossed by Loop 325 of the Northeast Upgrade Project[1]

Facility ID	MP	Distance (feet)
	7.14	98
	7.47	152
	7.53	18
	7.53	46
	7.55	86
	7.57	55
PROJECT TOTAL		**10,685**

1: Based on LIDAR survey. Locations shown are those where the centerline slope is ≥20 percent for more than 15 feet in distance.

2.4 Critical Habitat Mitigation Plan

As described in Section 1.1.3.6 above, Critical Habitat Resource Areas as mapped by the Highlands are crossed by the proposed Loop 325 within the Preservation Area. Field surveys for various Federal and state-listed plant and animal species were conducted in this area by qualified biologists and botanists during the summer and fall of 2010 and the spring and summer of 2011. Survey results and biological assessments will be submitted when all field surveys have been completed. Ongoing coordination with the Natural Heritage Program ("NHP"), and the Endangered and non-game program biologists within NJDEP, and the USFWS will continue through the permitting and construction of the Project to avoid and mitigate for impacts on sensitive species including rare, threatened or endangered species. Mitigation for any species listed on the Federal Register will occur in compliance with USFWS requirements. Tennessee will provide the Council with copies of relevant correspondence with USFWS pertaining to federally-listed species for review and comment.

Tennessee has initiated consultations with the USFWS, NJDEP Division of Fish and Wildlife – Bureau of Land Management, NJ Division of Parks and Forestry, NJDEP Division of Fish and Wildlife to identify significant wildlife habitats and wildlife managed lands. The NJDEP has been consulted and identified Federal and state-listed plant and animal species potentially present in the Project area, as well as vegetative communities of special concern in the vicinity of the Project area.

The NJNHP has identified one Natural Heritage Priority site within the vicinity of the Project that is crossed by one access road associated with the Project (Lord 2010). The NJNHP identifies priority sites for preserving natural diversity, including rare and endangered species and ecological communities. The Ursus Majus NHP Site was designated for the deciduous wetland habitats along Bear Swamp Lake, which contain the only known occurrence of a state critically imperiled plant species (Williams 2011). An existing paved access road will be utilized. No modifications are planned for the existing paved access road through this site, and only light duty trucks will utilize this road given the width and bridge weight limits associated with existing stream crossings on the road. Light duty trucks excludes pipe stringing and heavy equipment hauling trucks and may include pickup trucks, flat bed trucks and trailers similar to those currently using the access road for operation of the Mahwah Meter Station. Some areas may need to be paved or re-paved if pieces of the road are

unpaved (or once paved and now deteriorated). No tree clearing is proposed adjacent to the roadway, only minor trimming of vegetation 2" and less in diameter. Therefore, no impacts to this NHPS are anticipated as a result of the Project.

The species-specific approach that Tennessee is taking toward surveying the Project area will identify any occurrences of federal and state-listed species present. Based upon the results of these field surveys, Tennessee will work cooperatively with the USFWS and the NJDEP to develop impact avoidance and mitigation measures for federal species and those state species with habitats located in wetlands, transition areas and flood hazard areas. The scope of proposed impact mitigation measures outlined within this CMP also extends to those upland areas outside of the jurisdiction of either USFWS or NJDEP. Table 2.4-1 identifies state-listed species associated with Loop 325.

TABLE 2.4-1
NEW JERSEY STATE LISTED SPECIES ASSOCIATED WITH LOOP 325

Species	Scientific Name	State Status [a]
Mammals		
Bobcat	*Lynx rufus*	E
Birds		
Bald Eagle	*Haliaeetus leucocephalus*	E
Barred Owl	*Strix varia*	T
Cerulean Warbler	*Dendroica cerulea*	S
Cliff Swallow	*Petrochelidon pyrrhonota*	S
Cooper's Hawk	*Accipiter cooperii*	T
Great Blue Heron	*Ardea herodias*	S
Northern Goshawk	*Accipiter gentilis*	E
Red-shouldered Hawk	*Buteo lineatus*	E
Dragonflies		
Arrowhead spiketail	*Cordulegaster oblique*	S
Brush-tipped emerald	*Somatochlora walshii*	S
Sable clubtail	*Gomphus rogersi*	S
Mosses		
Sphagnum	*Sphagnum angustifolium*	E/HL
Sphagnum	*Sphagnum majus ssp. norvegicum*	E/HL
Reptiles and Amphibians		
Northern Copperhead	*Agkistrodon c. contornix*	S
Timber Rattlesnake	*Crotalus horridus horridus*	E
Wood Turtle	*Glymptemys insculpta*	T
Other		
Potential Vernal Habitat Area		NA
Vernal Habitat Area		NA

Source: Lord 2010

a: Key: E = Endangered; T = Threatened; S = Species of Special Concern ; NA = Not applicable; HL = taxa protected by the *Highlands Water Protection and Planning Act* within the jurisdiction of the Highlands Preservation Area

As it relates to the Council-designated Critical Habitat, the post-construction restored ROW and workspace will be substantially equivalent to the existing field conditions given the existing pipeline and maintained easement present. Currently, the existing maintained easement within the Critical Habitat area provides "edge" habitat that attracts a variety of wildlife that preferentially utilize this type of habitat for specific behaviors. Wildlife species that preferentially avoid this type of habitat would not be expected to currently utilize the area or would be expected to be present intermittently as they move through the area to other preferred habitat types. As a result, the short- and long-term increase in the amount of edge habitat present as a result of clearing activities required for construction and operation will likely only serve to increase the habitat value for the species currently utilizing the Project area. Those species that do not preferentially utilize edge habitat would not be substantially impacted by the increased post-construction edge habitat, as they likely do not currently utilize the existing edge habitat present.

2.4.1 Impact Minimization

Long-term impacts to wildlife habitat due to construction and operation of the Project will be limited to clearing of upland and wetland forests required for temporary workspace and new permanent easement. To the extent practicable, Tennessee has routed the pipeline loops to follow existing line ROWs (and thus follow existing forest edges), thereby minimizing the acreage of forest lands crossed and the relatively greater impacts that would be associated with clearing an entirely new ROW through a contiguously forested area. Temporary workspace areas needed for construction activities will be returned to pre-existing elevations, stabilized with a conservation seed mix according to SESCP and either replanted with native trees and shrubs or allowed to naturally revegetate, pursuant to landowner agreements and/or regulatory agency requirements. Areas of early successional habitat that are impacted by construction and that are allowed to naturally re-vegetate will return to their pre-construction condition and cover type within one or two growing seasons.

The wildlife populations that utilize the Project areas will not be permanently adversely affected by the proposed Project. While temporary impacts upon food, cover and water sources may occur, none of the species located within the Project area are specialized in such a way that construction of the pipeline will inhibit the overall fitness or reproductive output of the populations as a whole. Most species are not dependent on the ROW or transitional areas to provide all of their habitat requirements. Many of the mammal, bird, reptile, and amphibian species are adaptive to changing habitat conditions and possess the capability to expand or shift their home ranges to find alternative sources of food, water and shelter until the disturbed habitats become re-established (DeGraaf et al. 1992). Restoration and re-vegetation will occur after construction has been completed, and the restored areas will be closely monitored until final site stabilization and re-vegetation has been achieved.

Tennessee is in the process of conducting species-specific field surveys for federal and state-listed plant and wildlife species. Tennessee is coordinating and negotiating directly with the USFWS regarding impact avoidance and mitigation measures associated with federal species that may potentially occur within the vicinity of the Project (bald eagle, dwarf wedgemussel, and Indiana bat) such that there will be no net loss of habitat for or a regulatory taking of either species. Tennessee will also coordinate and negotiate directly with the NJDEP relative to state-listed species that may be present within wetlands, wetland transition areas, and flood hazard areas. The Council will be provided copies of relevant survey reports and correspondence between Tennessee and USFWS and/or NJDEP relative to Federally-listed species present within the Project ROW. Potential impacts to rare species identified within areas solely subject to Council jurisdiction such as additional wetland transition areas and uplands shall be addressed below.

2.4.2 State-Listed Threatened and Endangered Species

Field surveys for two rare plant species were completed in 2010. Surveys for raptors and vernal pools were also conducted in 2011. Based on the result of these surveys, Tennessee will work with the NJDEP to

develop and implement appropriate avoidance and mitigation measures including timing restrictions, as necessary, to avoid adverse impacts to any rare plants and wildlife identified within the Project area. Once completed, survey reports will be submitted to the Council and NJDEP.

2.4.2.1 General Rare Species Mitigation Measures

Tennessee will observe the following general rare species mitigation measures:

- EI's job responsibilities will include understanding and implementing the components of the federal and state-listed threatened and endangered species mitigation measures. The EIs will not be selected for the Project until the necessary regulatory approvals are received by Tennessee. Credentials of the on-site EIs will be forwarded to the Council prior to the commencement of construction.

- Before being allowed to conduct work on the Project site, all field personnel including all construction contractors and subcontractors will be required to complete an environmental training session during which they will be advised on the potential presence of applicable species, specified habitats where they are likely to found, visual or other identifying features, and specific activity protocols to be followed in the event that a species is encountered.

- Signage posted at applicable locations in the field along the ROW alerting personnel to the potential presence of rare species, including representative color photographs of the species, and notification protocols and contact information for EI personnel or dedicated rare species monitors.

- Tennessee will provide mitigation for each species' habitat that is permanently disturbed through construction activities. Mitigation should be four-part and account for no net loss of habitat value in terms of quality, quantity, type and function, and is not injurious to occurrences of rare plant species or rare ecological communities.

- A field survey of the Project area, including all proposed temporary and permanent access roads, staging areas, etc, and an inventory of rare plant species (in cooperation with NJDEP). The inventory shall include a description of the survey method, all vegetation communities, and occurrences of rare, threatened and endangered species within the Project areas to the extent physically or visually accessible. The inventory shall include a map depicting surveyed species and associated habitat.

2.4.2.2 Timber Rattlesnake & Northern Copperhead

NJDEP's Landscape Program identified habitat for timber rattlesnake & northern copperhead along portions of the Project route. Due to overlapping habits and habitat types, considerations (and surveys) for one species are often valid for both. These areas are considered known habitat based primarily on previous records.

Tennessee conducted gestation habitat surveys for timber rattlesnake in summer 2010 and submitted these results to NJDEP in March 2011. Tennessee utilized a qualified/recognized timber rattlesnake surveyor to conduct den presence/absence surveys during the appropriate den survey window between April 15 and May 15, 2011 along the same public lands and other lands with suitable habitats. Reports documenting the results of these surveys will be prepared immediately after surveys have been completed and will be forwarded to the NJDEP Land Use Regulation Program, Endangered and Non-game Species Program, and the Council.

The NJDEP provided Tennessee with the following feedback regarding impact avoidance / mitigation for the timber rattlesnake:

- All blasting and digging must be restricted to the June 1 - September 30 time period each year to avoid disturbance or harassment of denning snakes and those basking in the vicinity of dens during egress/ingress.

- A trained (and Endangered Species Program ("ENSP") -approved) contractor should be on site to locate and safely capture and move rattlesnakes located on the ROW (since snakes frequently bask on ROWs during the summer months). All snakes, with the exception of timber rattlesnakes, will be captured and moved off the ROW to a safe location. All timber rattlesnakes will be captured and temporarily held in captivity by the ENSP-approved contractor until an ENSP biologist is contacted. An ENSP biologist will determine the course of action to be taken regarding all captured timber rattlesnakes. Timber rattlesnakes may be held in captivity by the ENSP until all work on that section of the ROW has been completed.

- Access roads through rattlesnake areas would be silt fenced and would be retrofitted with culverts and directional funnels to facilitate snake movement.

2.4.2.3 Wood Turtles

Due to the linear nature of pipeline routing and construction, avoidance of waterbodies that may provide suitable habitat for wood turtles is not feasible. Tennessee has conducted surveys to identify wood turtle habitat within the Project ROW and has, through consultation with NJDEP, identified several impact avoidance measures, including:

- Locating a qualified biologist on-site during construction taking place between March and November to relocate any turtles found in the work area.

- Installation of silt fence and seeding disturbed areas immediately upon completion of construction activities to prevent sediment from reaching adjacent streams.

- Planting of hedgerows, where feasible, across the ROW in non-wetland areas, to facilitate connectivity between fragmented forests.

- No use of pesticides or herbicides in wood turtle habitat.

- Additional consultation will be conducted with NJDEP through the permitting process to ensure protection of individual wood turtles and wood turtle habitat. The Council will be provided copies of applicable correspondence for review during the process.

2.4.2.4 Other State-Listed Species

- Surveys for barred owl and red-shouldered hawk have been completed, and final results are being prepared in a survey report to be submitted to NJDEP. Additionally, any other raptor species observed were noted and will be included in the survey report. Based on final survey results, Tennessee will continue to consult with NJDEP relative to any appropriate timing restrictions to be implemented during construction to prevent impacts to woodland raptor species.

- Seeding of warm season grasses within upland portions of the ROW is encouraged for enhancement of Bobolink and Savannah sparrow habitat. Tennessee's standard ROW management techniques require that the ROW be maintained in a herbaceous state that promotes the production and maintenance of upland grassland bird breeding habitat.

2.4.2.5 Rare Plants

If found to be present during field surveys, mitigation would include avoidance and fencing of known populations of these species, removal and replanting of the population outside of the construction workspace area or removal, translocation to an approved plant nursery during construction and replanting during restoration.

2.4.3 Vernal Pool Buffer Habitat

The Project alignment passes through one NJDEP-certified vernal pool within the ROW at MP 5.41. Additionally, the Project passes through the 1,000-foot buffer to a certified vernal pool at MP 6.63. The proposed Project activities are located close to the limits of the dispersal habitat (800 to 1,000 feet from the vernal pool).

Potential project-related impacts will be limited to the upland dispersal habitat potentially used by obligate and facultative vernal pool species such as wood frogs (*Rana sylvatica*) and mole salamanders (*Ambystoma* spp.). Due to the linear nature of pipeline routing and construction, avoidance of areas located within the 1,000-foot buffer to vernal pools is not feasible. To avoid impacts to upland dispersal and overwintering habitat within the 1,000-foot vernal pool buffer, Tennessee proposes the following measures to be implemented during construction:

- Installation of silt fence along the southern limit of temporary workspace to prevent dispersal of individuals into the construction area.
- Installation of signage along the ROW to identify the area as vernal pool habitat.
- Daily sweeps of the construction workspace by the EI to identify and remove any individual frogs or salamanders that may be located within the workspace.
- Specialized environmental training for contractor personnel to identify species of concern and protocol for contacting the EI should an individual animal be found within the workspace during active construction.
- Placement of wood debris on the ground within the restored temporary workspace to provide for escape cover and overwintering habitat post-construction per landowner agreements.

Due to the linear nature of pipeline routing and construction, avoidance of areas located within the vernal pool or the 1,000-foot buffer to vernal pools is not feasible. In general, the Project is designed to minimize adverse impacts to environmental resources including vernal habitat. Tennessee will comply with all state regulations pursuant to vernal habitat throughout construction of the Project. Additionally, Tennessee will continue to coordinate with the NJ DEP LURP to agree on appropriate mitigation and/or avoidance measures relative to vernal habitats.

2.5 Carbonate Rock Plan

Geographical information system (“GIS”) data available from the United States Geological Survey (“USGS”) displays mapping of karst in the U.S. (2004), showing karst terrain underlying the entire length of the Project area from MP 0.0 to MP 7.59. Consultation with the New Jersey Geological Society (NJGS) identified that carbonate rocks such as limestone, dolomite, and marble are prone to sinkhole development in the Project area. While there has been no detailed mapping of sinkholes in Passaic or Bergen Counties, portions of Loop 325 can expect to encounter other solution features where the trench crosses several areas of carbonate bedrock and several geological formations. The Project area crosses many different bedrock units which

range from sandstone, shale, limestone, and dolomite to igneous and metamorphic rocks such as granite, gneiss, and marble. Carbonate rocks such as limestone, dolomite, and marble are prone to sinkhole development in the area. In addition, the Project crosses several different limestone formations including the Onondaga Limestone which has several mapped sinkholes. Portions of Loop 325 remain totally within metamorphic rocks (Monteverde 2010).

Due to the specialized nature of pipeline construction and in consideration that only a relatively minor amount of the required construction workspace will be trenched, a full scale geotechnical subsurface exploration program for the Project area is not necessary for the planning, design or construction phases of the Project. The presence of karst features will be determined during the ditch excavation. During trenching activities, mitigation measures include, but are not limited to, grouting, re-grouting, and backfilling with supportive flowable fill material. Stormwater control measures will be implemented to limit surface water runoff within known karst features. If voids are encountered, then the ditch may be grouted or impermeable plugs may be installed to minimize adverse impacts to karst features from groundwater. Additionally, during hydrostatic testing, care would be taken to avoid releasing large volumes of water onto land that is susceptible to sinkhole development.

Tennessee will restore the excavated area to pre-construction contours and elevations to maintain the existing drainage at the site, and to prevent diversion of stormwater to the area identified by NJGS as prone to sinkhole development. Trench breakers may also be used to prevent stormwater from collecting in the identified area. Tennessee will monitor the identified area on an annual basis post-construction to identify any evidence of sinkhole development and will implement any measures necessary to prevent further solution of the soils. A summary of the mitigation measures to be implemented during construction of the Loop 325 segment are detailed below.

- During trenching activities, mitigation measures include, but are not limited to, grouting, re-grouting, and backfilling with supportive flowable fill material.
- Stormwater control measures will be implemented to limit surface water runoff within known karst features.
- If voids are encountered, then the ditch may be grouted or impermeable plugs may be installed to minimize adverse impacts to karst features from groundwater.
- Trench plugs will be incorporated prior to backfill operations to prevent or limit subsurface water flow within the trench or along the pipeline.
- Restoration of the construction workspace as rapidly as possible following pipeline installation and backfill to quickly re-establish vegetative cover and limit the amount of time that the site will be exposed to periods of concentrated flows as well as preventing excessive drying of the soils.
- During hydrostatic testing, Tennessee will not release large volumes of water directly onto land that is susceptible to sinkhole development. A dewatering structure or energy dissipating device will be used to prevent scouring or erosion.
- Restoration of the excavated area to pre-construction contours and elevations to maintain the existing drainage at the site and to prevent diversion of stormwater to the areas identified as prone to sinkhole development. Trench breakers may also be used to prevent stormwater from collecting in the identified area.

- Remediate sinkholes that develop during construction in accordance with the *Standards for Soil Erosion and Sediment Control in New Jersey* (1999) guidelines as detailed in Appendix A10 pages 17 to 35 of the guidelines.

- Monitoring the identified area on an annual basis post-construction to identify any evidence of sinkhole development and implementing any measures necessary to prevent further solution of the soils.

2.6 Lake Management

To ensure that water quality within Lake Management Areas is protected, Tennessee will construct the Project facilities in accordance with its ECP as well as all applicable regulatory approvals. Standard construction techniques, such as use of erosion and sedimentation controls, dewatering structures, trench plugs and water bars, will ensure that both storm and groundwater are managed in a manner that minimizes the potential for adverse impacts on water quality.

2.7 Water Resources Availability

The Project does not result in the expansion or creation of a public water supply system, public wastewater collection and treatment system or a community on-site treatment facility. Additionally, the Project does not result in the generation of wastewater nor require a permanent water source. Therefore, mitigation measures are not required for this resource.

2.8 Water Resources Quantity Protection Plan

Portions of the Project within the Preservation Areas will be located within the Prime Groundwater Recharge Area. The requirement for compliance under the Highlands RMP is the provision of 125% of the pre-construction recharge volumes for the affected Prime Groundwater Recharge Area. Since there is no new impervious area associated with the Project, and all disturbed areas will be revegetated or restored upon completion of construction, there will be no decrease in the groundwater recharge area. Therefore, 100% of the groundwater recharge area will be maintained.

The modification (lowering) of the land elevation post-construction to provide additional groundwater recharge volume is not a viable option for providing the additional 25% recharge volume for several reasons. First, it directly conflicts with FERC's standard to restore the ROW to pre-construction condition, which would require a formal variance from the FERC Plan. Second, any proposed post-construction land modification would need to be approved by the applicable landowner(s) since all TWS areas revert back to the landowner(s) once the Project is complete. Lastly, modifications to the ROW may pose significant safety complications during operation of the pipeline facilities since Tennessee's operations personnel must be able to safely and efficiently access the ROW in the event of an emergency. Variable topography that could potentially include retention basins or significant changes to land elevation are likely to create situations where emergency access is compromised.

Additional measures incorporated into the Project design to ensure protection of groundwater recharge volume includes:

- Restoration of the site to maintain pre-construction hydrology.

- Use of slope and trench breakers to slow down the flow of water and increase stormwater infiltration.

- Any travel lanes developed within TWS areas to allow access by construction traffic shall be removed when use is no longer required. Soils within the travel lane shall be decompacted and restored in accordance with the CMP.

- The topsoil and subsoil shall be tested for compaction by a third-party monitor within each segment of Prime Groundwater Recharge Area crossed by the Project. Cone penetrometers or other appropriate devices will be used. Tests shall be conducted at intervals sufficient to determine the need for decompaction. Tests shall be done on the same soil type under the same moisture conditions. Tests shall be conducted in the following areas:

    a. undisturbed areas;

    b. the trenched zone;

    c. the work area; and

    d. travel lanes.

- If necessary, soil shall be decompacted by using a harrow, paraplow, paratill or other equipment. Deep subsoil shattering shall be performed with a subsoiler tool having angled legs. The subsoil shall be decompacted prior to final restoration of the pre-construction contours and shall be consistent with adjacent soils at the limits of the ROW. Test results will be provided to the Council.

- To mitigate for the additional 25% of recharge volume as required by the RMP, Tennessee is proposing to acquire and protect an area of land within a designated Prime Groundwater Recharge Area (see Sections 2.20 and 2.23 below for further information regarding land parcels to be used for mitigation purposes). By protecting the property against development, Tennessee will be preventing potential impacts to groundwater recharge. Additionally, should the property acquired contain previous development such as a residence or impervious area, Tennessee will remove all structures, driveways, parking areas and lawns and replace them with grassland or forest to provide a significant increase in the recharge volume than the current condition of such property. Tennessee will coordinate with the Council to ensure that the selected parcel provides significant additional groundwater recharge volume. If a suitable parcel is not identified, Tennessee will provide monetary compensation for mitigation for the additional 25% of recharge volume.

- Tennessee is currently in the process of calculating the groundwater recharge volumes in mapped Prime Groundwater Recharge Areas crossed by the Project as well as those associated with potential mitigation properties. Upon completion of the calculations, they will be submitted to the Council in a supplement to this CMP that will also include an assessment and justification for the use of preserved lands to mitigate for the additional 25% recharge volume requirement.

2.9 Water Quality Protection Plan

2.9.1 Wellhead Protection

The Project is not anticipated to adversely impact groundwater quality and/or supply. Tennessee proposes to implement construction practices designed to reduce and/or mitigate potential impacts on groundwater during construction as detailed within Tennessee's ECP. Tennessee and its contractors will adhere to these practices related to groundwater protection including specifications for trench breakers and dewatering as well as restrictions on refueling and storage of hazardous substances.

During the initial landowner contacts for survey permission, Tennessee's land representatives requested information on the location of wells and septic systems from landowners whose residences were in close proximity to the proposed pipeline loops and work spaces. In many locations, this information was used to reduce work areas or re-align the pipeline route to avoid impacts to these structures. As part of the

negotiations with landowners for work space, additional easements (if required), and/or damages, Tennessee's land representatives will again request information on the location of wells and septic systems, in order to prepare and inventory for any required pre- and post-construction monitoring and tests. To the extent that any septic systems or wells encroach into Tennessee's existing permanent easement, Tennessee will work with the landowner to resolve the encroachment.

Owners of wells identified that are within 150 feet of the construction work area shall be offered pre- and post construction well testing. This testing shall be conducted by a qualified independent inspection service and shall include tests of water quality and in the case of shallow dug wells or springs, sufficient analysis on quantity to determine if pipeline construction has created an impact. In the unlikely event that construction of the Project temporarily impacts private or public well quality or yield, Tennessee will provide alternative water sources or other compensation to the well owner(s). In the event where it is determined that permanent impacts have occurred to a well, Tennessee shall repair or replace the well, to as near pre-construction condition as possible.

All equipment used in construction of the pipeline will be refueled and lubricated within the limits of the ROW at a minimum distance of 100 feet from all wetlands and waterbodies. Auxiliary fuel tanks will be used to reduce the frequency of refueling operations. The impact minimization measures will prevent the discharge of hydraulic fluids or fuels from leaving the ROW and/or leaching into the groundwater.

2.9.2 Hydrostatic Pressure Testing

In compliance with USDOT specifications, Tennessee will conduct hydrostatic testing on all Project pipeline loops, including Loop 325, prior to placement in-service. Upon completion of the hydrostatic tests, the wastewater will be discharged to an upland area through a filtration device. Environmental impacts from withdrawal and discharge of test water will be minimized by utilizing the measures outlined in Tennessee's ECP as well as by complying with all applicable permit requirements.

Multiple test sites are required to meet the required pressure requirements for an acceptable test. Test segments were selected based on several factors: the pipe parameters, the elevation changes within the loop, the target design pressure of 1170 pound force per square-inch gauge ("psig"), and the class locations of the pipeline. Pipe was allocated as necessary to minimize the quantity of test segments in each loop and to meet DOT design standards. Tennessee will require approximately 1.7 million gallons of water to test Loop 325 and has designated the Monksville Reservoir and/or Ringwood Creek as its primary sources of water. To the maximum extent practicable, Tennessee will transfer hydrotest water from one test segment to the next within a loop (cascaded), to reduce the volume of water required per loop.

In accordance with Sections VII.C.2 and VII.D.2 of the FERC Procedures, hydrostatic test water will not be obtained from, or discharged to, high quality streams unless approved by the applicable state permitting agency. For hydrostatic pressure testing of the pipeline, Tennessee shall obtain a Highlands Water Allocation Permit or Highlands Water Use Registration from NJDEP. Tennessee will consult directly with the NJDEP relative to the rate of water withdrawal and the combined pump capacity. Tennessee will provide the Council with any correspondence and/or permit approvals from NJDEP for the withdrawal and/or discharge of water from/to high quality (C1) waterbodies. If withdrawal/discharge of testwater within C1 streams/watersheds is not permitted, Tennessee will submit to NJDEP and the Council any change in the source and/or discharge location for hydrostatic testwater. Tennessee does not anticipate the use of any additives within the hydrostatic testwater. Should it be determined that additives are necessary based on the source and composition of the testwater, Tennessee will submit detailed information on any chemicals, such as concentration at discharge and proposed treatment / disposal methods, to NJDEP and the Council for review and approval prior to use.

Environmental impacts associated with the withdrawal and discharge of test water shall be minimized by:

- Using state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species or waterbodies designated as public water supplies only upon written permission from the appropriate Federal, state and/or local permitting agencies.
- Performing inspection of all welds or hydrostatic testing the pipeline sections before HDD installation under waterbodies or wetlands.
- Locating hydrostatic test manifolds outside of wetlands and riparian areas as practical.
- Withdrawing from and discharging to water sources shall comply with appropriate agency requirements which consider the protection of fisheries resources on a case-by-case basis.
- Complying with all appropriate permit requirements. Water samples (grab) shall be taken at the beginning and end of the discharge period for a minimum of 2 sampling events.
- Screening the intake to avoid entrainment of fish.
- Maintaining adequate stream flow rates to protect aquatic life, provide for all waterbody uses, and downstream withdrawals of water by existing users.
- Anchoring the discharge pipe for safety.
- Discharging test water to a suitable receiving body of water, across a well-vegetated area or filtered through a filter bag or erosion control barriers.
- Discharging test water against a splash plate or other energy dissipating device approved by the EI in order to aerate, slow, and disperse the flow (ECP Figure ED2).
- Controlling the rate of discharge at a level that appropriately prevents flooding or erosion.
- Not allowed to discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies without written permission from the appropriate Federal, state and local permitting agencies.
- Coordinating hydrostatic test water withdrawal and discharge activities with the EI, the Tennessee Division Environmental Coordinator (“DEC”), Houston Environmental Coordinator (“EC”), and NJ DEP.

2.9.3 Stormwater Management

The ECP incorporates as one document Tennessee's Erosion and Sediment Control Plan, Wetland and Waterbody Crossing Plan and Spill Prevention and Control Plan. By incorporating the above plans into one concise document and adding site specific information, Tennessee was able to tailor the ECP to the requirements of the Storm Water Pollution Prevention Plan required under the U.S. Environmental Protection Agency (“EPA”) storm water permit or equivalent state program.

The ECP has been modified to include additional requirements that have been imposed by the NJDEP, NRCS Soil and Water Conservation Districts, County Conservation Districts, the Corps, and other federal, state, and local agencies. More specifically, the ECP was modified to include the additional requirements of NJDEP’s *Standards for Soil Erosion and Sediment Control in New Jersey* (July 1999). This combined approach will allow contractors and EI to reference all environmental conditions in one document. The ECP will be included as part of the construction contract.

Tennessee’s objective is to minimize the potential for erosion and sedimentation during pipeline construction, and to effectively restore the ROW and other disturbed areas. Tennessee will meet these objectives by employing the erosion and sediment control measures contained in this section. These erosion and sediment

control measures will serve as minimum standards during construction. In general, the measures are designed to minimize erosion and sedimentation by:

- minimizing the quantity and duration of soil exposure;
- protecting critical areas during construction by reducing the velocity of and redirecting runoff;
- installing and maintaining erosion and sediment control measures during construction;
- establishing vegetation as soon as possible following final grading; and
- inspecting the ROW and maintaining erosion and sediment controls as necessary until final stabilization is achieved.

The EIs are the primary responsible party(ies) for ensuring that Tennessee's contractors implement and maintain erosion and sediment control measures on a daily basis during the construction phase. Specific responsibilities of the EI are described in Section 3.0 of the ECP. By implementing the measures detailed in the ECP, Tennessee will meet the objectives of the RMP with respect to stormwater management.

2.10 Water Utility

The Project does not result in the expansion or creation of a public water supply system, public wastewater collection and treatment system or a community on-site treatment facility. Therefore, mitigation is not required for this objective.

2.11 Wastewater Utility

The Project does not result in the expansion or creation of a public water supply system, public wastewater collection and treatment system or a community on-site treatment facility. Additionally, the Project does not result in the generation of wastewater nor require a permanent water source. Therefore, mitigation measures are not required for this objective.

2.12 Septic System Yield

Septic system yields are not applicable to the Project; therefore no mitigation is required for this objective.

2.13 Agricultural Resources

There are no Agricultural Resource Areas crossed by the Project; therefore the Agricultural resource policies and objectives are not applicable to the Project and no mitigation is required.

2.14 Historic, Cultural, Archaeological and Scenic Resources Plan

2.14.1 Historic, Cultural and Archaeological Resources

Section 106 of the NHPA requires federal agencies, including the FERC, to take into account the effect of that undertaking on cultural resources listed or eligible for listing in the National Register of Historic Places ("National Register") (36 CFR § 60). The Section 106 process is coordinated at the state level by the State Historic Preservation Office ("SHPO"), represented in New Jersey by the Historic Preservation Office ("HPO") and includes review of Highlands historic, cultural and archaeological resources.

The primary goals of cultural resource investigations conducted as part of the Section 106 review are to:

- locate, document, and evaluate buildings, structures, objects, landscapes, and archaeological sites that are listed, or eligible for listing, in the National Register;
- assess potential impacts of the Project on those resources; and
- provide recommendations for subsequent treatment, if necessary.

In addition to Section 106 requirements, cultural resources investigations were conducted for the Project in accordance with the FERC's Office of Energy Project's Guidelines for Reporting on Cultural Resources Investigations (2002), and the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 Fed. Reg. 44716-42, Sept. 29, 1983); Section 380.3 of the FERC's regulations; 18 CFR § 380.3 (2010). In New Jersey the relevant state law is the New Jersey Register of Historic Places Act of 1970.

Tennessee has conducted the necessary consultations with the applicable federal, state and tribal agencies relative to the potential presence of sensitive cultural or archaeological resources. Additionally, Tennessee has conducted the necessary field investigations of the Loop 325 Segment survey corridor to identify any previously unidentified or undocumented occurrences of any historic or archaeological resources.

During Phase I surveys within the Highlands Preservation Area, Tennessee has identified 11 new archaeological sites and three (3) architectural resources. The Phase I surveys on Loop 325 are partially complete, with 7.2 miles having been surveyed of a total length of 7.7 miles. The remaining portions of the ROW that remain to be surveyed are "No Access" properties. Additional ancillary facilities also remain to be surveyed. Tennessee is recommending no additional survey work in regard to four (4) of the 11 new archaeological sites. For the remaining 7 new archaeological sites Tennessee recommends avoidance of the sites. If any of the sites cannot be avoided, it is recommended by Tennessee that further work be conducted at the Phase II level. The Phase II work plan would be produced in consultation with the HPO. The three (3) architectural resources are located on access roads associated with Loop 325. One (1) of these resources is a structure that will be evaluated before and after construction vehicles use the access road to insure no vibrational damages have occurred. For the remaining two (2) architectural resources Tennessee recommends that only pick-up trucks and SUVs are to be permitted to use the associated access roads to avoid potential damage due to collision or vibration. The privileged and confidential nature of potentially significant cultural resources prevents any additional detailed discussion as it relates to this document; however the results of Tennessee's field investigations have been conferred to the HPO for concurrence.

Tennessee recognizes that despite intensive cultural resource field investigations that are typically performed prior to project construction, or a determination that a particular area exhibits low archaeological sensitivity, it is nonetheless possible that cultural resource deposits could be discovered during Project construction or maintenance activities, particularly during excavation. Tennessee also recognizes the requirement for compliance with federal and state regulations and guidelines regarding the treatment of human remains, if any are discovered. Subsequently, Tennessee has proposed additional mitigation as it relates to cultural resources through the implementation of Tennessee's "Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains" document, which has been previously provided to the HPO for approval and concurrence. The aforementioned document details specific procedures that must be followed in the case of an unanticipated discovery to maintain compliance with all applicable federal and state laws governing cultural resources. These procedures including the immediate suspension of all activities at the discovery site, agency notification requirements including applicable contact information and additional assessments of the discovered materials by a qualified cultural resources expert. That document has been incorporated into Tennessee's construction conditions and procedures proposed for the Project and will be implemented during Project construction upon final review and approval by the applicable federal and state regulatory agencies. Additional correspondence between Tennessee and SHPO shall be provided to the Council for review and comment.

2.14.2 Scenic Resources

Permanent visual impacts associated with installation of the pipeline loop will not occur within non-forested areas; however, tree clearing for construction and maintenance of the permanent ROW in forested areas may result in temporary visual impacts. To minimize this potential, Tennessee has sited the proposed loop segment adjacent to the existing 300 Line corridor to the greatest extent possible to limit the amount of tree clearing. This also concentrates utilities in existing areas and reduces the degree of disturbance within previously undisturbed areas. Temporary impacts of limited duration will be mitigated through restoration practices to revegetate the ROW in a timely manner in accordance with the measures identified within this CMP.

2.15 Transportation

Transportation issues are not applicable to the Project; therefore no mitigation is required for this objective.

2.16 Land Use Capability

Tennessee has prepared and will construct the Project in accordance with its ECP as well as all other applicable local, state, and federal approvals. Oversight of the Project will be conducted by various regulatory agencies throughout construction; however, ultimate oversight and compliance will be conducted by FERC. Tennessee must construct, operate, and maintain the Project in accordance with the FERC's certificate order approving the Project, Tennessee's subsequent Implementation Plan (which will include the ECP). There will be third-party oversight of construction by the FERC or its designated agent to ensure that the Project is constructed as approved. There are stringent reporting requirements (typically every two weeks) to document construction progress as well as procedures for requesting any variances to the approved certificate conditions. This oversight will extend to this CMP as well as other regulatory approvals that are submitted by Tennessee under its Implementation Plan and will extend through the post-construction monitoring period. Non-compliance with the FERC certificate or Tennessee's approved Implementation Plan may result in significant enforcement action and fines. The various levels of regulatory oversight of the Project as well as Tennessee's commitment to full-time environmental inspection during construction will ensure the implementation of this CMP as well as Tennessee's ECP.

2.17 Redevelopment

Redevelopment issues are not applicable to the Project; therefore no mitigation is required for this objective.

2.18 Smart Growth

The RMP goals, policies, and objectives relative to Smart Growth relate directly to the management of stormwater associated with Project construction activities. As detailed within Section 2.9.3 of this CMP, Tennessee has developed a Project-specific ECP that is based on industry standards pertaining to erosion control, stormwater management, and post-construction best management practices. There is no new impervious area associated with the Project; therefore no structural stormwater management facilities such as detention basins, wet swales, bio-swales will be implemented during construction. These types of stormwater management practices are better suited for residential and commercial development projects where long-term or permanent controls may be required.

Pipeline construction incorporates a "design with nature" approach by implementing temporary stormwater control measures that ensure the control of both stormwater runoff rate and volume. Standard industry practices such as water diversion berms, temporary and permanent trench plugs, and permanent water bars are used to manage stormwater during construction. The ECP not only provides narrative descriptions of the stormwater management practices implemented during construction but also provides typical details of the facilities that may be used. As discussed above, the ECP incorporates the FERC's Plan and Procedures.

Both this CMP and the ECP demonstrate that stormwater will be managed in a manner that is consistent with the RMP goals, policies and objectives for Smart Growth.

2.19 Housing and Community Facilities

Housing and Community Facilities are not applicable to the Project; therefore no mitigation is required.

2.20 Landowner Equity

Tennessee has identified a parcel of land that will likely be suitable for potential mitigation purposes. Tennessee anticipates to dedicate approximately 50 acres for mitigation on a parcel within the Highlands Preservation Area that includes both prime groundwater recharge and forest resource areas (as well as Conservation Priority Area, Critical Habitat Area, Open Water Protection Area, and Riparian Area). Once the Council has approved the parcel as part of the overall mitigation plan for the Project, Tennessee will provide site-specific information subsequent to further consultation with NJDEP and additional environmental analysis."

2.21 Sustainable Economic Development

Through the implementation of this CMP, Tennessee believes that the Project qualifies as environmentally compatible development. While there may be temporary impacts associated with construction of the Project, the expenditures in local economies represent a significant expansion of the economic base. Tennessee estimates that during the 24-week construction season, non-local workers temporarily relocating to the Project vicinity would spend in excess of $7.5 million on local goods and services. Tennessee estimates that some additional money would be spent locally on the purchase of equipment and vendors, and common supplies (e.g., stone and concrete, landscaping supplies, tires, automotive supplies, etc.) would be purchased, as available, from vendors within the Project area. Subsequent to construction, an increase of approximately $2.07 million dollars in property tax revenue will be generated by the Project for the affected municipalities that will continue after implementation of the CMP and restoration of the functions and values of the various resource areas.

Tennessee plans to construct and/or modify existing buildings, resulting in an increase in property tax revenue in New Jersey. Tennessee also would pay taxes on the installed pipeline in New Jersey. The municipalities located along the proposed Loop 325 are estimated to receive combined property tax revenue increases of $900,000, and increasing approximately $112,500 per year, beginning in the year 2014. The Project's impact on agri-, eco- and historical tourism opportunities will be limited to the construction period and are further limited by the general lack of tourism opportunities within the Project area. Additional demonstration of mitigation of any impacts on agri-, eco- and historical tourism is accomplished through implementation of the mitigation efforts described within the CMP. The operation of the Project facilities within the same area/corridor as Tennessee's existing 300 Line pipeline, which has been in operation for over 50 years, will not adversely affect the potential tourism opportunities within the Project area.

2.22 Air Quality

As discussed above in the section demonstrating the purpose and need for the Project (Section1.1.1), there are several justifications supporting the need for incremental transportation of domestic natural gas supplies to the northeast region, including the loss of natural gas imports from Canada. One of the underlying reasons contributing to the loss of those Canadian supplies to the region is Canada's early election to support the Kyoto Protocol and the decision to convert many coal fired power plants in Ontario to natural gas. Colin Anderson, CEO, Ontario Power Authority, has stated that "Ontario is on-track to replace 20 percent of our electricity supply by phasing out coal fired electricity generation by 2014, North America's biggest climate

change initiative."[1] These conversions, already underway, require an increased percentage of Canada's domestic supplies to remain in Canada, and have created a need for U.S supplies to replace that loss. Thus, on an indirect basis, this Project will contribute to the reduced use of dirty resources such as coal and an increased use of cleaner resources such as natural gas, as well as reducing the Unites States' reliance on imported energy.

Additionally, there are several proposals for new LNG import terminals on the east coast, including in and adjacent to New Jersey. The transportation of domestically produced natural gas into the region by this Project has the potential to reduce the imports of LNG into those terminals which would not only reduce the country's reliance on imported energy, but potentially could minimize environmental impacts, including impacts on air quality, considering the more complex construction and operation of LNG terminals as compared to installation of the best available technology equipment for natural gas compressor stations as proposed for the Project. Additionally, as part of the Project, Tennessee will be replacing older equipment at several of its existing compressor stations with new state of the art equipment.

2.22.1 Construction Emissions

Air quality impacts associated with construction and installation of Loop 325 in the Highlands will include emissions from fossil-fueled construction equipment and fugitive dust. Such air quality impacts, however, will generally be temporary, localized, and insignificant. Large earth-moving equipment and other mobile sources may be powered by diesel or gasoline engines and are sources of combustion-related emissions including NO_x, CO, VOCs, SO_2, PM_{10}, and small amounts of HAPs. Air pollutants from construction equipment will be limited to the immediate vicinity of the construction area and will be temporary.

The majority of air emissions produced during construction activities will be PM_{10} and $PM_{2.5}$ in the form of fugitive dust. Fugitive dust will result from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. The amount of dust generated will be a function of construction activities, soil type, moisture content, wind speed, frequency of precipitation, vehicle traffic, vehicle types, and roadway characteristics. Emissions will be greater during dry periods and in areas of fine-textured soils subject to surface activity.

Tennessee will comply fully with state regulations that address fugitive dust impacts from construction activities. NJDEP regulates construction-related particulate emissions through N.J.A.C. 7:27-22.16. The rule prohibits the emissions of any air contaminant in a quantity and duration which tends to be injurious to human health or welfare, animal or plant life or property, or which would unreasonably interfere with the enjoyment of life or property.

Tennessee will employ proven construction practices to control fugitive dust emissions during construction. Construction of the Project facilities will result in intermittent and temporary fugitive emissions. Construction equipment will be operated only during the day time. These emissions will be released near ground level and will not disperse far from the construction site. All areas disturbed by construction will be stabilized. Tennessee will require its contractors to comply with best management practices discussed in Tennessee's Northeast Upgrade Project ECP related to air quality during construction, including dust suppression (e.g., watering) and utilizing newer, cleaner operating equipment and encourage its construction contractors to

[1] Ontario's 20-Year Vision for Sustainable Electricity Supply", presentation by Colin Andersen, Chief Executive Officer, Ontario Power Authority ,at Ontario Energy Forum 2009 (University of Ontario Institute of Technology, Oshawa, Wednesday, May 6, 2009).

use low emission fuels. Given all of these factors, it is reasonable to assume that during construction of all Project facilities fugitive dust emissions and the impacts from these emissions will be insignificant.

New Jersey is located in the Ozone Transport Region which is treated as a moderate ozone nonattainment area for VOCs and NO_x. Tennessee estimated fugitive dust and exhaust emissions from construction/modification of the pipeline loop to facilitate a comparison of the Project to the General Conformity Thresholds. Under 40 CFR Section 93.153(b)(1), a review for VOC and NO_x emissions is required for ozone non-attainment areas, such as Sussex County. The de minimis emissions levels as defined by the General Conformity Regulations are listed in Table 2.22-1.

TABLE 2.22-1 GENERAL CONFORMITY THRESHOLDS	
Pollutant/NAA	**Tons/Year**
Ozone (VOCs or NO_X):	
Serious non-attainment areas (NAAs)	50
Severe NAAs	25
Extreme NAAs	10
Other ozone NAAs outside an ozone transport region	100
Other ozone NAAs inside an ozone transport region:	
VOC	50
NO_X	100
Carbon monoxide: All NAAs	100
SO_2 or NO_2: All NAAs	100
PM–10:	
Moderate NAAs	100
Serious NAAs	70
$PM_{2.5}$:	
Direct emissions	100
SO_2	100
NO_X(unless determined not to be a significant precursor)	100
VOC or ammonia (if determined to be significant precursors)	100
Pb: All NAAs	25

Total emissions from construction activities of Loop 325 are presented in the table below (Table 2.22-2). All site locations where construction will take place are in attainment for CO, SO_2, PM_{10}, and $PM_{2.5}$; therefore, demonstration of compliance to the General Conformity thresholds for these "attainment" pollutants is not required. Anticipated CO, SO_2, PM_{10}, and $PM_{2.5}$ emissions are provided for informational purposes.

TABLE 2.22-2
EMISSIONS FROM CONSTRUCTION OF PIPELINE LOOP 325

Loop ID	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Loop 325	9.29	1.65	24.04	0.02	18.23	2.48

Emissions from construction of the pipeline loop were aggregated according to county to compare against the de minimis emission levels. This comparison is provided in Table 2.22-3.

TABLE 2.22-3
LOOP 325 EMISSIONS BY COUNTY COMPARED TO GENERAL CONFORMITY THRESHOLDS

County / State	Source(s)	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Bergen, NJ	Mahwah Meter Station	5.50	0.37	2.06	0.004	1.93	0.64
Bergen, NJ	Pipeline Loop 325	1.81	0.32	4.69	0.005	3.55	0.48
	County Total:	7.31	0.69	6.75	0.009	5.48	1.13
Passaic / NJ	Pipeline Loop 325	7.48	1.33	19.35	0.20	14.67	2.00

The summary reflects the Project to be in conformity with the respective de minimis levels.

2.23 Special Environmental Zones

There are no Special Environmental Zones crossed by the Project; therefore no mitigation is required.

2.24 ROW Restoration and Monitoring Plan

The ROW Restoration and Monitoring Plan developed for Loop 325 will incorporate measures outlined in the ECP, which incorporates the FERC's Plan and Procedures. The purpose of this CMP is to support multiple environmental and operational safety objectives for the proposed Loop 325 ROW through the Highlands Region. This CMP will support management techniques for maintaining high water quality standards including minimizing impacts to riparian zone vegetation and wetland communities crossed by Loop 325 during construction and maintaining vegetation and hydrology in these communities post-construction.

Long-term impacts to successional habitats will be limited to forest and scrub-shrub areas during operation of the Project facilities. The siting of the alignment along a previously disturbed and maintained pipeline corridor was the preferred alternative as it reduces the clearing of forested areas during construction and minimizes the potential for habitat fragmentation. In areas where workspace within forested areas is unavoidable, the forested areas will be cleared, and standard erosion control/cover species will be planted after construction is completed. Temporary workspace that was identified as forest during the field surveys will be restored to pre-construction contours and grades, stabilized with a conservation seed mix according to the SESCP and either replanted with native trees and shrubs or allowed to naturally revegetate pursuant to landowner agreements and/or regulatory agency requirements. Areas that are already vegetated with grasses or early successional species will be restored after the conclusion of construction activities

The primary impact minimization measure to reduce the impact of the Project on forested uplands consists of locating the proposed pipeline loop segments within the existing cleared ROW to the extent practicable to limit the extent of forest clearing required for construction and operation of the facilities. Additionally, Tennessee has located ATWS areas outside of forested land where possible to further minimize impacts. Impact minimization, post-construction restoration methods, and long-term maintenance for the ROW are described in the following sections.

2.24.1 Site Preparation, Clearing and Construction

The following techniques and standards will be adhered to during site preparation and construction to minimize impacts to vegetated communities crossed by Loop 325:

- Delineation and marking of wetlands and waterbodies prior to the commencement of construction.
- In wetlands, stumps shall be removed only in the trenchline except where construction constraints or safety concerns require their removal.
- Installing temporary erosion control measures such as silt fence and/or hay bale barriers.
- No rubber-tired equipment will be allowed to work in wetlands unless it will not damage the root systems and its use is approved by the EI. Bulldozers will not be used for clearing. Trees and brush will be cut by hand at ground level by hydroaxes, tree shears, grinders or chain saws.
- Within wetlands, the minimum clearing necessary to safely construct the pipeline will be done. As many trees as possible will be left on stream banks. The frequency of machine movement across riparian zones and stream ecosystems will be minimized.
- Within wetlands, Tennessee will use amphibious excavators (pontoon mounted backhoes) or tracked backhoes (supported by fabricated timber mats) to dig trenches.
- Within wetlands, grading will be limited to the areas directly over the trenchline, except where topography requires additional grading for safety reasons. Where grading is required, topsoil will be segregated and returned as an even layer to all graded areas.
- A trained EI will be employed to oversee wetland construction and monitor erosion and sedimentation controls.

2.24.2 Post-construction restoration and revegetation

Restoration and revegetation of the ROW incorporates permanent erosion and sediment control measures. However, in the event that final restoration cannot occur in a timely manner due to weather or soil conditions, temporary erosion and sediment control measures will be maintained until the weather is suitable for final cleanup and revegetation. In no case shall final cleanup be delayed beyond the end of the next recommended seeding season.

2.24.2.1 Temporary erosion control

- Stabilization measures shall be initiated as soon as practical on upland portions of the ROW where activities have temporarily or permanently ceased except when the initiation of stabilization measures by the seventh day is precluded by weather. Stabilization measures shall be initiated as soon as machinery is able to obtain access to the ROW.
- Stabilization of waterbodies and wetlands shall be initiated immediately after backfilling, weather permitting.
- If construction is completed more than 20 days before the perennial vegetation seeding season, the construction work area shall be mulched with 3 tons/acre of straw, or its equivalent (Refer to Tables 9.2-1 through 9.2-3 in the ECP).
- Temporary upland plantings will be fertilized in accordance with Table 9.2-2 in the ECP.

- All temporary sediment barriers will be removed when an area is successfully revegetated (i.e., when the ROW surface condition is similar to adjacent undisturbed lands), or when permanent erosion controls are installed.

2.24.2.2 Permanent Restoration Methods

- Permanent restoration of waterbodies and wetlands shall be initiated immediately after backfilling, weather permitting.

- Final grading shall be completed, including topsoil replacement and permanent erosion control measures, within 20 days after backfilling the trench (10 day in residential areas), weather permitting. Table 9.2-3 in the ECP provides seeding and fertilizer application rates for permanent restoration in New Jersey.

- Construction debris shall be removed from the ROW and the ROW shall be graded so that the soil is left in the proper condition for planting.

- Where trench compaction has not been done, the ROW shall be graded to pre-construction contours, as practical, with a small crown of soil left over the ditch (except in waterbodies) to compensate for settling, but not to interfere with natural drainage.

- Where topsoil has been segregated, the topsoil shall be spread back along the ROW in an even layer.

- Permanent water bars shall be constructed to the same specifications as temporary water bars after final grading and prior to seeding.

- Permanent water bars will be constructed to replace temporary erosion control barriers upslope of road and railroad crossings, and on both sides of all wetland and waterbody crossings, where appropriate.

- Within 30 days of the in-service date of the Project facilities, Tennessee will prepare a summary report identifying:

    a. quantity and type of fertilizer, seed and mulch used;

    b. the amount of lime applied (if required);

    c. the equipment used to implement this process;

    d. the acreage treated;

    e. the dates of backfilling and seeding;

    f. the number of landowners specifying other seeding requirements and a description of the requirements;

    g. and any problem areas, and how they were addressed.

2.24.2.3 Revegetation and Seeding

- The ROW shall be limed, fertilized, seeded, and mulched in accordance with the ECP, unless otherwise requested by the landowner. Fertilizer, lime and mulch will not be used within wetlands unless required in writing by the appropriate land management or state agency. Where possible, lime and fertilizer will be incorporated into the top 2 inches of soil. If seeding cannot be done within the recommended seeding dates, temporary erosion and sediment controls shall be used and seeding of permanent cover shall be done at the beginning of the next growing season.

- The ROW will be seeded within 20 working days (10 days in residential areas) of final grading in accordance with recommended seeding dates, weather and soil conditions permitting. Seeding must utilize native species and must target habitat type and function.

- Turf, ornamental shrubs and other landscaping materials shall be restored in accordance with landowner agreements.

- Where broadcast or hydro-seeding is to be done, the seedbed will be scarified to ensure sites for seeds to lodge and germinate.

- Where hand broadcast seeding is used, the seed shall be applied at one-half the rate in each of two separate passes. The passes will be made perpendicular to each other to ensure complete and uniform coverage.

- The seedbed will be prepared to depth of 3 to 4 inches using appropriate equipment to provide a firm, smooth seedbed, free of debris.

- Slopes steeper than 3:1 shall be stabilized immediately after final grading in accordance with recommended seeding dates, weather permitting.

- Seed shall be purchased in accordance with the Pure Live Seed ("PLS") specifications for seed mixes and used within 12 months of testing.

- Legume seed will be treated with species-specific inoculants per manufacturer's specifications.

- The seed shall be applied and covered uniformly per local soil conservation authorities' recommendations, depending on seed size. A seed drill equipped with a cultipacker is preferred, but broadcast or hydro-seeding may be used at double the recommended seeding rates. Where broadcast seeding is used, the seedbed shall be firmed after seeding.

- Other alternative seed mixes specifically requested by the landowner or land-managing agency may be used.

- A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed, inspected and maintained as specified. When access is no longer required, the travel lane shall be removed, decompaction of the travel lane will occur, and the travel lane restored.

- Habitat for threatened and endangered species may be created through modifications of existing habitat conditions for species such as the bog turtle.

- Access roads would be graded to support access and planted with an interspersion of warm grass species that can be used to delineate the roadway from the maturing shrub species and cultivars of low and slow growing tree species which will not need to be trimmed.

2.24.2.4 Mulching

- Where seeding is permitted, mulch will be applied according to Tables 9.2-1 and 9.2-3 in the ECP on the entire ROW except lawns, agricultural (crop) areas, and areas where hydro-mulch is used.

- If construction or restoration activity is interrupted for extended periods (more than 20 days), mulch will be applied before seeding.

- If mulching before seeding, mulch application will be increased on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre.

- Up to 1 ton/acre of wood chips may be added to mulch if areas are top-dressed with 11 pounds/acre of available nitrogen, 50% of which must be slow release.

- If a mulch blower is used, the strands of the mulching material shall be at least 8 inches long to allow anchoring.

- Mulch shall be anchored immediately after placement on steep slopes and stream banks. Slopes that are too steep for crimping with tracked equipment or a mulch anchoring tool (i.e., slopes >15%) will be anchored manually by the use of matting or netting.

- When mechanically anchoring mulch, a mulch anchoring tool or tracked equipment will be used to crimp the mulch to a depth of 2 to 3 inches.

- When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Liquid mulch binders will not be used within 100 feet of wetlands or waterbodies.

2.24.2.5 Matting/Netting/Erosion Control Fabric

- Matting or netting consists of jute, wood excelsior, or similar materials, and is used to anchor mulch and stabilize the surface of the soil during the critical period of vegetative establishment, as directed by the EI. Specific manufacturer's installation instructions should be followed to ensure proper performance of the product.

- Matting or netting will be applied to critical, sensitive areas (i.e., steep slopes [typically slopes >15%], banks of waterbodies, bar ditches, etc.), as specified by the EI. Matting or netting will also be applied to any areas where temporary/permanent vegetation is not taking/working to assist is protecting the seed bank.

- Matting or netting will be anchored with pegs or staples.

2.24.2.6 Post-Construction Monitoring (Standard Construction)

- For three (3) years following construction, Tennessee will file with the Council annual monitoring reports documenting restoration of the Highlands resource areas, any problems experienced (including those identified by the landowner) and corrective actions taken, as well as how the restoration is working to protect and promote the resource area functions and values.

- Tennessee will conduct follow-up inspections after the first three growing seasons following seeding to determine the success of revegetation. Revegetation will be considered successful if non-nuisance vegetation is similar in density to adjacent undisturbed lands, based on representative random sampling in the field (e.g., visual survey). If vegetative cover is not successful or if there is a need for noxious weed control measures, an experienced agronomist shall be used to determine the need for additional restoration measures.

- Tennessee will use one or more of the following measures in cooperation with the landowner, if warranted or required, to control off-road vehicles:

    a. posting, as necessary, appropriate signage;

    b. installing a locking gate with fencing to prevent bypassing the gate;

    c. in extremely sensitive areas, planting conifers or other appropriate shallow-rooted trees and/or shrubs across the ROW except where access is required for Tennessee's use. The spacing of trees and/or shrubs and length of ROW planted will make a reasonable effort to prevent unauthorized vehicle access and screen the ROW from view. A gate may be used in conjunction with the screening. This method will be used only when reflected on site-specific plans or other specifications; or

    d. installing a barrier across the ROW consisting of slash and timber, piping, a line of boulders or a combination thereof.

- Signs, gates, and marker posts shall be maintained as necessary

2.24.3 Invasive Species Management

Tennessee intends to control the spread of invasive species within the ROW during construction and after construction, with a comprehensive monitoring and removal program. During construction, the contractor will be responsible to ensure that all vehicles and equipment are washed before being brought on-site and before be moved around the Project Area. High pressure wash stations will be established by the contractor in selected areas to remove vegetation debris from the vehicles and equipment before being relocated.

After construction, the specific objective of invasive species management is to control invasive plant species within areas subject solely to Council jurisdiction by means of limited herbicide use in concert with other control methods such as mechanical removal, mowing and cutting, if necessary. The rationale for controlling invasive species with herbicides is to ensure that the existing ecosystem is not compromised by the colonization and dominance of these species. Invasive species reduce the effectiveness of the ecosystem by competing with existing native species for light, nutrients and water. They can also change habitat structure, adversely affect native seed production and alter hydrologic regimes. Tennessee's certificate application for the Project includes a Draft Invasive Species Management Plan. That plan is intended to serve as a guideline for the eradication and/or control of invasive plant species that occupy the Project area and provide the necessary tools for successful eradication and/or control of invasive species. That plan is subject to modifications as data collection warrants. Invasive species management will be conducted on the permanent pipeline easement as well as in temporary workspace areas, unless otherwise requested by the landowners.

Although it may be impossible to totally eliminate all invasive species in the Project area because of such issues as seed drift or colonization from off-site locations, Tennessee's overall goal is to control the invasive

species to a level such that uplands are not dominated by the invasive species listed below to a point where the function of the system is compromised. Tennessee will follow a program to reduce the levels of invasive species to a non-dominant position during the first five (5) years following construction.

2.24.3.1 Invasive Species Potentially Present

The following invasive species may potentially be present within the Project area:

- Norway Maple *(Acer platanoides)*
- Tree-of-heaven *(Ailanthus altissima)*
- Garlic mustard *(Alliaria petiolata)*
- Porcelain berry *(Ampelopsis brevipedunculata)*
- Japanese barberry *(Berberis thunbergii)*
- Asian bittersweet *(Celastrus orbiculatus)*
- Spotted knapweed *(Centaurea biebersteinii)*
- Canadian thistle *(Cirsium arvense)*
- Wild teasel *(Dipsacus fullonum)*
- Cut-leaf teasel *(Dipsacus laciniatus)*
- Autumn olive *(Elaeagnus umbellata)*
- Winged spindletree *(Euonymus alata)*
- Chinese bush-clover *(Lespedeza cuneata)*
- Japanese honeysuckle *(Lonicera japonica)*
- Morrow's Bush-honeysuckle *(Lonicera morrowii)*
- Tartarian Honeysuckle *(Lonicera tatarica)*
- Purple Loosestrife *(Lythrum salicaria)*
- Yellow sweetclover *(Melilotus officinalis)*
- Japanese stiltgrass *(Microstegium vimineum)*
- Eurasian water-milfoil *(Myriophyllum spicatum)*
- Common reed *(Phragmites australis), or Phragmites*
- Japanese knotweed *(Polygonum cuspidatum)*

- Mile-a-minute *(Polygonum perfoliatum)*
- Curly leaf pondweed *(Potamogeton crispus)*
- Common buckthorn *(Rhamnus cathartica)*
- Black locust *(Robinia pseudoacacia)*
- Wineberry *(Rubus phoenicolasius)*
- Multiflora rose *(Rosa multiflora)*

2.24.3.2 General Management Activities

Tennessee plans to use a foliar herbicide method to control invasive species along the proposed loop segments and at aboveground facilities. Invasive species management will be conducted within the ROW and compressor station properties during the same time period as wetland monitoring activities and restoration of the wetlands impacted by the Northeast Upgrade Project. Herbicides will be applied according to manufacturers' printed recommendations and in accordance with Federal and state regulations governing herbicide application.

A qualified contractor will be consulted to determine the best management practice for the application of the approved herbicides and may suggest methods other than foliar herbicide application.

With guidance from a qualified contractor, Tennessee will also identify the most effective herbicide to use for each application and may modify application techniques or herbicide brands, based on results, site conditions, etc. However, if herbicides are not approved by FERC, the United States Army Corps of Engineers ("USACE") and/or the NJDEP, than mechanical methods will be used in lieu of herbicides. The following herbicides are being considered for use:

1) **Glyphosate (Roundup / Rodeo)** – applied to foliage for control of invasive herbaceous (including grasses) and woody plants; also used as a treatment on cut stumps to prevent re-sprouting. Because Glyphosate is non-selective, selective application methods and seasonal timing will be used to prevent impacts on non-target species.

2) **Triclopyr (Garlon)** – applied to foliage for control of invasive, broadleaf herbaceous and woody plants; also used as a treatment on cut stumps to prevent re-sprouting, or as a basal bark application to kill woody plants.

3) **Clopyralid (Transline)** – applied to foliage for selective control of herbaceous woody plants belonging to certain taxonomic groups including Japanese Knotweed.

If applicable, in order to provide stabilization of the ROW post-construction and re-growth of native species, Tennessee can provide clean (invasive / weed free) topsoil as necessary to re-establish preconstruction surface contours. Disturbed wetland areas within the ROW will be seeded and mulched in accordance with Tennessee's Environmental Construction Plan ("ECP") as provided in the Environmental Report. Tennessee's ECP incorporates New Jersey state standards as well as requirements contained within the FERC's 2003 *Wetland and Waterbody construction and Mitigation Procedures* and *Upland Erosion Control, Revegetation, and Maintenance Plan.* Mulching will be accomplished utilizing weed-free straw or hay.

Mechanical cutting methods will also help to control some species of invasives on the loop segments, although only limited cutting will occur in wetlands. The removal of invasive species will be incorporated in the ROW maintenance/mowing plan for the NEUP.

Reapplication of herbicides will occur as needed based on the findings of the monitoring listed below. Additionally, mechanical methods may be warranted to remove future growth of invasive species and will be coordinated as needed.

TABLE 2.24-1
INVASIVE SPECIES PLAN TIMELINE FOR LOOP 325

Month	Application/Removal Method	Comments
2013[a]		
June	Foliar Herbicide & Mechanical Removal[b]	Spray upland areas prior to start of construction & excavate root masses in wetland areas
September	Foliar Herbicide & Mechanical Removal	Spray immediately following construction in upland and wetland areas
2014		
May	Foliar Herbicide	
July	Foliar Herbicide / Manual Removal[c]	
	Row mowing[d]	Conducted on a 5 year basis
2015		
May	Foliar Herbicide	
July	Foliar Herbicide / Manual Removal	
2016		
May	Foliar Herbicide	
July	Foliar Herbicide / Manual Removal	
2017		
May	Foliar Herbicide	
July	Foliar Herbicide / Manual Removal	
2018		
May	Foliar Herbicide	
July	Foliar Herbicide / Manual Removal	
2019		
	ROW mowing	Conducted on a 5 year basis

a: Certain aspects of construction, including (i) winter tree clearing to avoid Indiana bat breeding periods and to comply with the Migratory Bird Treaty Act ("MBTA"), (ii) installation of HDD segments, and (iii) crossing of sensitive commercial and/or residential areas may begin during the second half of 2012. The remaining construction activities for the Project are scheduled for spring 2013, pending specific construction windows imposed on the project.
b: Mechanical method will consist of the excavation of the root stocks
c: Manual removal will consist of the cutting and digging up of the root stocks
d: ROW mowing is conducted on a continual 3 to 5-year rotational basis.

2.24.4 Long-term Maintenance

There is a pervasive federal statutory and regulatory scheme that occupies, to the exclusion of state regulation, the field of interstate natural gas pipeline maintenance and repairs. Included in that federal scheme are the following federal statutes and regulations:

- The Natural Gas Act, 15 USC Sec. 717 et seq.
- The Natural Gas Policy Act, 15 USC Sec. 3301 et seq.
- The National Environmental Policy Act, 42 USC Sec 4321 et seq.
- The Natural Gas Pipeline Safety Act, 49 USC Sec 60101 et seq.
- Regulations promulgated by the FERC, located at 18 CFR Parts 154, 157, 284, and 380
- Regulations promulgated by the USDOT, located at 49 CFR arts 190-199.

Tennessee, as a federally regulated interstate natural gas pipeline company, is legally bound to comply with these statutes and regulations. To further assist the Highlands Council staff in understanding some of the federal regulation to which Tennessee's maintenance and repair activities are subject, Tennessee is identifying below, for informational purposes only, maintenance and repair activities that may be required for interstate natural gas pipeline facilities and the environmental compliance required for by the FERC for such activities.

2.24.4.1 Interstate Natural Gas Pipeline Maintenance and Repair Activities

After initial construction activities of interstate natural gas pipeline facilities (performed pursuant to the conditions of the specific certificate order for the Project, the FERC-approved Implementation Plan, and applicable regulations), post-construction and restoration pipeline maintenance and repair activities will take place as needed. These activities include but are not necessarily limited to:

- Testing pipeline facilities including activities such as:
  - pigging the pipeline (i.e. running cleaning and instrumentation tools through the pipeline);
  - hydrostatic testing (i.e. isolating a pipeline segment and testing strength by filling and pressuring the pipeline segment with water); and
  - excavating the pipeline for direct inspection.
- Anomaly remediation (corrective action taken as a result of pipeline inspections) such as:
  - repairing pipeline coating;
  - replacing pipeline coating;
  - adding steel sleeves to reinforce a pipeline segment; and
  - replacing pipeline segment.
- Mowing and clearing right-of-way.
- Controlling erosion and maintaining cover over pipeline.
- Installing signage (e.g., "Do not dig" and "One Call").
- Installation, modification, or replacement of appurtenant equipment such as:
  - pig launchers and receivers,

- cathodic protection equipment,
- drips,
- ball valves,
- check valves,
- blowdown valves,
- relief valves,
- valve guards,
- valve operators,
- concrete saddles and pads to protect pipe,
- communication equipment,
- electronic gas measurement equipment,
- transducer,
- flanges,
- gas sampler,
- flow control equipment,
- flow computer,
- check meters,
- jumper pipeline,
- yard piping, and
- pressure regulation.

2.24.4.2 Maintenance and Repair Activities Pursuant to Original Certificate Order

Although routine post-construction maintenance and repair activities may be done without any further authorization from the FERC beyond the certificate order authorizing the initial construction and operation of the facilities (if such activities can be accomplished within the original footprint of construction), interstate natural gas pipelines are required to adhere to the FERC's maintenance requirements in Section 380.15 of the FERC's regulations, 18 C.F.R § 380.15 (2008). These requirements include the following:

- Avoid or minimize effect on scenic, historic, wildlife, and recreational values.
- The requirements of Section 380.15 of the FERC's regulations do not affect a pipeline's statutory obligations to comply with the safety regulations of the U.S. Department of Transportation.
- The desires of the landowners should be taken into account so long as the result is consistent with applicable requirements of law, including laws relating to land-use and any requirements imposed by the FERC.
- Vegetative covers established on a right-of-way should be properly maintained.
- Access and service roads should be maintained with proper cover, water bars, and the proper slope to minimize soil erosion. They should be jointly used with other utilities and land-management agencies where practical.
- Chemical control of vegetation should not be used unless authorized by landowner or land-managing agency. When chemicals are used for control of vegetation, they should be approved by EPA for such use and used in conformance with all applicable regulations.
- Unobtrusive sites should be selected for the location of above-ground facilities.
- Above-ground facilities should cover the minimum area practicable.
- Noise potential should be considered in locating compressor stations, or other above-ground facilities.
- The exterior of above-ground facilities should be harmonious with surroundings and other buildings in the area.

- The site of above-ground facilities that are visible from nearby residences or public areas should be planted with trees and shrubs surrounding it or other appropriate landscaping, and should be installed to enhance the appearance of the facilities consistent with operating needs.

In addition to the above-listed requirements, the FERC imposes conditions related to maintenance and repair activities in its orders issuing certificate authorizations. Such conditions may relate to construction techniques, restoration requirements or on-going maintenance of pipeline right-of-way. For example, the FERC routinely includes the following condition in orders authorizing pipeline construction:

> Routine vegetation maintenance clearing shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in a herbaceous state. Routine vegetation maintenance clearing shall not occur between April 15 and August 1 of any year. This condition is also one of the myriad of provisions in FERC's "Upland Erosion Control, Revegetation and Maintenance Plan". By including the provision in its order, FERC is placing this requirement on the pipelines for the life of the pipeline.

When repair and maintenance activities require excavation, Tennessee will restore excavated sites to pre-excavation contours and will monitor the disturbed area until the site is successfully revegetated. As noted above, the desires of the landowner will be taken into account so long as the result is consistent with applicable requirements of law and any requirements imposed by the Commission. Tennessee follows the applicable FERC guidelines as stated in FERC's Plans and Procedures. Copies of the Plan and Procedures are enclosed with this CMP.

2.25 Comprehensive Mitigation Plan Summary

This report has been prepared to provide an overview of the Project, identify the Highlands resource areas affected, and to detail the components that are proposed to be included within the CMP to minimize impacts to the Highlands. Tennessee is currently preparing to submit several required permit applications which will finalize details of the proposed Project. Through the FERC certification and state permitting processes, Tennessee has benefited from the public and agency input received on the Project, and has redesigned elements of the Project in direct response to the concerns presented. The proposed development of the various components of the CMP as detailed in this document will also provide stakeholders, including landowners and agencies, with the opportunity for additional input as to ways that Tennessee may reduce, minimize, and mitigate for the environmental impacts of the Project. Through implementation of this CMP during the construction and restoration process for the Project, Tennessee believes that the Project will meet the goals and purposes of the Act.

3.0 References

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APPENDIX A

TENNESSEE GAS PIPELINE COMPANY
NORTHEAST UPGRADE PROJECT
ENVIRONMENTAL CONSTRUCTION PLAN

APPENDIX B

FERC UPLAND EROSION CONTROL, REVEGETATION AND MAINTENANCE PLAN

APPENDIX C

FERC WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

APPENDIX D

HDD CONTINGENCY PLAN AND SITE SPECIFIC DRAWING FOR THE MONKSVILLE RIVER CROSSING

NORTHEAST UPGRADE PROJECT

ENVIRONMENTAL REPORT

HDD CONTINGENCY PLAN

PUBLIC

Submitted by:

Tennessee Gas Pipeline Company
1001 Louisiana Street
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MARCH 2011

TABLE OF CONTENTS

1.0 Introduction 1
2.0 Feasibility Assessment 1
2.1 Technical Feasibility 1
2.2 Duration of Work 1
2.3 Contingency Plans for Flooding 1
2.4 Contingency if HDD is Unsuccessful 2
3.0 Site Preparation 2
3.1 Rigsite and Pull Section 2
3.2 Bore Pits 3
3.3 Laydown Yards 3
3.4 Spoil Piles 3
3.5 Depth and Diameter of Bore Hole 3
3.6 Water Source 4
4.0 Drilling Fluid Contingency Plan 4
4.1 Background 4
4.2 Drilling Fluid Functions 4
4.2.1 Jetting 4
4.2.2 Power Downhole Mud Motor 4
4.2.3 Transportation of Spoil 4
4.2.4 Hole Stabilization 5
4.2.5 Cooling and Cleaning of Cutters 5
4.2.6 Reduction of Friction 5
4.3 Drilling Fluid Composition 5
4.4 Disposal of Excess Drilling Fluid 5
4.5 Minimization of Environmental Impact 6
4.6 Monitoring 7
4.7 Notification 9

1.0 INTRODUCTION

Tennessee Gas (Tennessee) proposes to use horizontal directional drilling (HDD) to install a 30-inch pipe at three locations along the Northeast Upgrade Project (NEUP). Each of the drilling locations is associated with a waterbody crossing, and Tennessee is proposing to use HDD to avoid sensitive resource areas that present difficulties for conventional construction methodologies. HDD is a widely-used trenchless construction method that accomplishes the installation of pipelines and buried utilities with minimal impact to the obstacle being crossed; however, the amount of workspace required for equipment staging is greater than the open-cut crossing method. The purpose of this document is to present Tennessee's HDD feasibility assessment as well as Tennessee's plan for site preparation and for minimizing environmental impact associated with HDD drilling fluids.

2.0 FEASIBILITY ASSESSMENT

2.1 TECHNICAL FEASIBILITY

Tennessee has completed geotechnical site investigation of the proposed HDDs (see Attachment A). This effort includes performing multiple boreholes at the HDD crossings along the proposed pipeline alignment, reviewing the boring logs from the subsurface investigation, and conducting soil and core sample laboratory testing. Tennessee's geotechnical investigations have determined that the Susquehanna River, Delaware River and Monksville Reservoir crossings are all geotechnically feasible.

2.2 DURATION OF WORK

The duration of HDD operations at each crossing location is dependent upon crossing length, pipe diameter (30 inches), and subsurface conditions. Based on design lengths ranging from roughly 2,300 at the Delaware River to 2,870 feet at Monksville Reservoir, and the specific conditions at each crossing location, HDD operations are anticipated to last approximately 30 to 160 days at each crossing location.

2.3 CONTINGENCY PLANS FOR FLOODING

Tennessee recognizes the potential for localized short-term flooding events and longer term flooding events during construction. Tennessee will be prepared for both types of events through diligent planning, attentive monitoring, and proper site preparation.

If a short term flooding event occurs before construction crews have mobilized to a particular site, the construction crews will wait until the water level subsides before mobilizing and setting up. If a short term flooding event occurs after construction crews have mobilized and set up, construction crews will react appropriately depending on the water level. If the water level is such that work can be performed safely and in accordance to Tennessee's ECP, construction will continue using site preparation techniques for saturated conditions and proper monitoring will continue to ensure the water does not reach a level that is unmanageable. If there is a potential the water could reach a level

that could jeopardize safety and/or compliance to Tennessee's ECP, Tennessee will demobilize crews and equipment until the water level subsides.

In preparation for longer term/seasonal flooding events near major waterbodies, Tennessee will plan to schedule construction during the months when historical data indicates lower streamflow. If flooding occurs during the historically lower streamflow months, Tennessee will wait until conditions improve so that work can be performed safely and in accordance with Tennessee's ECP. Due to the configuration of the drills at Susquehanna River and Monksville Reservoir, it is highly unlikely that flooding will have an impact on HDD operations. The location of the Delaware River HDD, with the entry location on Mashipacong Island could be delayed by intermittent flooding of back channel or river, but this drill will be the shortest duration drilling operation (estimated 30 days required).

2.4 CONTINGENCY IF HDD IS UNSUCCESSFUL

In the event that an HDD installation is unsuccessful, Tennessee will evaluate the failed installation to determine if the conditions that resulted in the failure can be effectively mitigated. However, if it is determined that a second HDD attempt has a reasonable chance of success, Tennessee will relocate the entry and/or exit point as necessary and proceed with a second attempt to install the crossing by HDD. Should this second HDD attempt fail, the crossing will be installed by open cut excavation or other alternative construction method along roughly the same alignment as the initial HDD attempt. In the event that a drilled hole is abandoned, the hole will be filled with a mixture of bentonite and drilled spoil.

Tennessee would provide on-site inspection during the HDD process to maintain adequate daily progress reports, as-built information, and other applicable construction documentation that would describe the events leading up to an HDD failure. Tennessee would submit this documentation to the appropriate agencies, notifying them of the HDD failure and the subsequent schedule for implementing the approved alternate crossing method. The HDD Contractor would not demobilize until Tennessee approval has been received. The alternate crossing method would not be implemented until Tennessee has received confirmation that appropriate agencies have received the documentation of HDD failure and approved an alternative crossing method.

3.0 SITE PREPARATION

3.1 RIGSITE AND PULL SECTION

A typical large rig horizontal drilling spread can be moved onto a site in seven to ten tractor-trailer loads. Workspace dimensions of 250 feet by 200 feet are required at entry and exit points to support the drilling operation. Positioning of equipment within this work area will vary due to differing contractor preferences and setup requirements, however; the entry point fixes the location of the rig, control cab, and drill pipe. The rig must be aligned with the drilled segment and generally will be positioned no more than 25 feet back from the entry point. The control cab and drill pipe must be positioned adjacent to the rig.

The rigsite must be cleared and graded as necessary to allow movement and erection of equipment. Equipment typically is supported on the ground surface although timber mats may be used where soft

ground is encountered. In the event that the water level does not allow the use of timber mats, a working platform will be constructed with geotextile fabric underneath rock. The perimeter of the workspace will be lined with sediment barriers to prevent sediment or drilling fluids from leaving the site. As with any construction, the Contractor will have adequate supplies of pumps, hay bales, silt fence, and sand bags onsite.

Wheeled vehicle access to the rigsite must be maintained throughout the course of construction for delivery of fuel and supplies. If soft ground is encountered, access will be maintained with timber mats or geotextile fabric underneath rock. Access to support HDD operations in the immediate vicinity of the exit point will require a dry work site and vehicle access. These activities will be carried out in accordance with Tennessee's ECP.

Pull section fabrication is accomplished using the same construction methods used to lay a pipeline; therefore, similar workspace is required. It is preferable to have workspace in line with the drilled segment and extending back from the exit point the length of the pull section plus 200 feet. This length allows the pull section to be prefabricated in one continuous length prior to installation. If space is not available, the pull section may be fabricated in two or more sections, which are welded together during installation. Workspace for pull section fabrication must be cleared but need not be graded level. Equipment typically is supported on the ground surface although timber mats may be used where soft ground is encountered. These activities will be carried out in accordance with Tennessee's ECP.

3.2 BORE PITS

Drilling fluid collection pits will be excavated within roughly 20 feet of both the entry and exit points to contain drilling fluid returning from the hole until it can be pumped into aboveground tanks for processing. The specific locations and dimensions of these collection pits will be determined by the selected HDD contractor based on such factors as positioning of equipment and anticipated drilling fluid pumping rates. Typically, drilling fluid collection pit dimensions are on the order of 10 feet long by 10 feet wide by 5 feet deep.

3.3 LAYDOWN YARDS

Temporary workspace for pull section fabrication is shown on the alignment sheets and the site specific HDD plan and profile drawings.

3.4 SPOIL PILES

Spoil resulting from HDD operations will either be stored within the limits of the temporary workspace or hauled to a remote disposal site in accordance with applicable environmental regulations, right-of-way and workspace agreements, and permit requirements.

3.5 DEPTH AND DIAMETER OF BORE HOLE

The depths of the proposed HDD installations are shown on the site specific HDD plan and profile drawings. The minimum diameter of the pre-reamed boreholes for pipeline installations are anticipated

to be 12 inches greater than the diameter of the product pipe in accordance with HDD industry standards.

3.6 WATER SOURCE

Fresh water required for HDD operations typically is drawn from the waterway being crossed. Tennessee plans on drawing the water required for the HDD crossings from the waterbody being crossed. On crossings of waterways where sufficient amounts of fresh water are not available, water may be obtained from a nearby municipal source or hauled to the crossing location. Substantial amounts of water are required; therefore, ample trucking and storage are critical if water must be hauled to the site. Tennessee has not proposed HDD crossings at any locations where a lack of sufficient amounts of freshwater are anticipated.

4.0 DRILLING FLUID CONTINGENCY PLAN

4.1 BACKGROUND

All stages of HDD involve circulating drilling fluid from surface equipment, through the drill pipe to the down-hole assembly, and back to the surface through the annular space between the pipe and the wall of the hole. Drilling fluid returns collected at the entry and exit points are processed through the cleaning system, which removes spoil from the drilling fluid and allows it to be reused. The cleaning system uses mechanical separation by shakers, de-sanders, and de-silters. Drilling fluid and cuttings will be transported to an approved disposal site.

4.2 DRILLING FLUID FUNCTIONS

The principal functions of drilling fluid in HDD pipeline installation are listed below.

4.2.1 Jetting

On crossings through soft soils, soil is excavated by jetting high velocity fluid streams through nozzles on drill bits or reaming tools.

4.2.2 Power Downhole Mud Motor

On crossings through harder soils or rock, power required to turn the bit and mechanically drill a hole is transmitted to a downhole motor by the drilling fluid.

4.2.3 Transportation of Spoil

Drilled spoil, consisting of excavated soil or rock cuttings, is suspended in the fluid and carried to the surface by the fluid stream flowing in the annulus between the pipe and the wall of the hole.

4.2.4 Hole Stabilization

Stabilization of the drilled hole is accomplished by the drilling fluid building up a "wall cake", which seals pores and holds soil particles in place. This process is critical in HDD pipeline installation as holes are often in unconsolidated formations and are uncased.

4.2.5 Cooling and Cleaning of Cutters

The downhole assembly gets hot during drilling. The drilling fluid cools the bits and cutters on the downhole assembly. Drilled spoil build-up on the bit or reamer cutters is removed by high velocity fluid streams directed at the cutters. Cutters are also cooled by the fluid.

4.2.6 Reduction of Friction

Friction between the pipe and the drilled hole is reduced by the lubricating properties of the drilling fluid.

4.3 DRILLING FLUID COMPOSITION

The major component of drilling fluid used in HDD pipeline installation is fresh water obtained at the crossing location. In order for water to perform the required functions, it is generally necessary to modify its properties by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling fluids is naturally occurring bentonite clay typically mined by “open pit” methods from locations in Wyoming and South Dakota. Bentonite is a soft clay, formed by the weathering of volcanic ash, with the unique characteristic of swelling to several times its original volume when contacted by water. It is not a hazardous material as defined by the U.S. Environmental Protection Agency's characteristics of ignitability, corrosivity, reactivity, or commercial chemicals. It is also used to seal earth structures such as ponds or dams and as a suspending component in livestock feeds.

The properties of bentonite used in drilling fluids are often enhanced by the addition of polymers. This enhancement typically involves increasing the yield. That is, reducing the amount of dry bentonite required to produce a given amount of drilling fluid. Non-treated bentonite yields in excess of 85 barrels (3,570 gallons) of drilling fluid per ton of material. Addition of non-toxic polymers to produce high yield bentonite can increase the yield to more than 200 barrels (8,400 gallons) per ton of material. Typical HDD drilling fluids are made with high yield bentonite and are composed of less than 4% viscosifier by volume, with the remaining components being water and drilled spoil. The drilling fluid is non-toxic and meets NSF/ANSI Standard 60 for safe drinking water requirements. This is the same drilling fluid used for drilling drinking water wells, so there is no risk to drinking water from its use.

4.4 DISPOSAL OF EXCESS DRILLING FLUID

Disposal of excess drilling fluid will be the responsibility of the selected HDD contractor. Prior to beginning HDD operations, the contractor will be required to submit its proposed drilling fluid disposal procedures to Tennessee for approval. Tennessee will review these procedures and verify that they comply with all environmental regulations, right-of-way and workspace agreements, and permit requirements.

The method of disposal applied to each crossing will be dependent upon the size and location of the crossing as well as any applicable regulations. Potential disposal methods include transportation to a remote disposal site and land farming on the construction right-of-way or an adjacent property. Land farming involves distributing the excess drilling fluid evenly over an open area and mechanically incorporating it into the soil. Where land farming is employed, the condition of the land-farming site will be governed by Tennessee's standard clean up and site restoration specifications. Land-farming will not be employed where prohibited by state and local regulations.

4.5 MINIMIZATION OF ENVIRONMENTAL IMPACT

The most effective way to minimize environmental impact associated with HDD drilling fluids is to maintain drilling fluid circulation to the extent practical. However, resources spent in an effort to maintain circulation should be weighed against the potential benefits achieved through full circulation. It should be recognized that in subsurface conditions that are not conducive to annular flow, restoration of circulation may not be practical or possible. In such cases, environmental impact can often be minimized most effectively by completing HDD operations in the shortest possible amount of time.

Steps that may be taken by the contractor to either prevent lost circulation or regain circulation include, but are not limited to, the following:

- Size the hole frequently by advancing and retracting the drill string in order to keep the annulus clean and unobstructed.
- When drilling fluid flow has been suspended, establish circulation slowly before advancing.
- Minimize annular pressures by minimizing density and flow losses. Viscosity should minimally meet hole cleaning and stabilization requirements.
- Minimize gel strength.
- Control balling of material on bits, reaming tools, and pipe in order to prevent a plunger effect from occurring.
- Control penetration rates and travel speeds in order to prevent a plunger effect from occurring.
- Seal a zone of lost circulation using a high viscosity bentonite plug.
- Employ the use of lost circulation materials. Note that any lost circulation materials proposed for use must be approved by Tennessee prior to utilization.
- Suspend drilling activities for a period of 6 to 8 hours.

If inadvertent surface returns occur on dry land, it will be the responsibility of the HDD contractor to contain, collect, and restore the disturbed area in accordance with the requirements of Tennessee's construction specifications. Should inadvertent returns occur within a waterway, Tennessee will notify appropriate parties and evaluate the potential impact of the release on a site-specific basis in order to determine an appropriate course of action. In general, Tennessee does not believe that it is environmentally beneficial to try to contain and collect drilling fluid returns in a waterway. HDD drilling fluids are nontoxic and discharge of the amounts normally associated with inadvertent returns does not pose a threat to public health and safety (see section 4.3, above). Placement of containment structures and attempts to collect drilling fluid within a waterway often result in greater environmental impact than simply allowing the drilling fluid returns to dissipate naturally.

4.6 MONITORING

In order to ensure that HDD operations are conducted in accordance with established requirements and standard HDD Industry practice, Tennessee will provide an engineer experienced in HDD construction to monitor the HDD contractor's performance at the jobsite. The primary functions of Tennessee's field engineer will be to document construction activities, report on the HDD contractor's performance, and notify Tennessee if the HDD contractor fails to conform to established requirements. Established requirements to which the HDD contractor must conform include, but are not limited to, the construction drawings, technical specifications, permits, easement agreements, and contractor submittals.

The monitoring protocol that will be applied by Tennessee's field engineer relative to drilling fluid related issues is described in detailbelow.

Drilling Fluid Monitoring Protocol

The drilling fluid monitoring protocol to be applied will vary depending upon the following operational conditions.

- Condition 1: Full Circulation
- Condition 2: Loss of Circulation
- Condition 3: Inadvertent Returns

Monitoring Protocol for Condition 1 – Full Circulation

When HDD operations are in progress and full drilling fluid circulation is being maintained at one or both of the HDD endpoints, the following monitoring protocol will be implemented.

- The presence of drilling fluid returns at one or both of the HDD endpoints will be periodically documented.

- Land-based portions of the drilled alignment will be periodically walked and visually inspected for signs of inadvertent drilling fluid returns as well as surface heaving and settlement. Waterways will be visually inspected from the banks for a visible drilling fluid plume.

- Drilling fluid products present at the jobsite will be documented.

If an inadvertent drilling fluid return is detected during routine monitoring, the monitoring protocol associated with Condition 3 will be implemented immediately.

Monitoring Protocol for Condition 2 – Loss of Circulation

When HDD operations are in progress and drilling fluid circulation to the HDD endpoints is lost or severely diminished, the following monitoring protocol will be implemented. It should be noted that lost circulation is common and anticipated during HDD installation and does not necessarily indicate that drilling fluid is inadvertently returning to a point on the surface.

- Tennessee's field engineer will notify Tennessee that drilling fluid circulation to the HDD endpoints has been lost or severely diminished.

- Tennessee's field engineer will document steps taken by the HDD contractor to restore circulation. Should the contractor fail to comply with the requirements of the HDD Specification, Tennessee's field engineer will notify Tennessee so that appropriate actions can be taken.

- If circulation is regained, Tennessee's field engineer will inform Tennessee and resume the monitoring protocol associated with Condition 1.

- If circulation is not re-established, Tennessee's field engineer will increase the frequency of visual inspection along the drilled path alignment as appropriate. Additionally, Tennessee's field engineer will document periods of contractor downtime (during which no drilling fluid is pumped) and the contractor's drilling fluid pumping rate in case it should become necessary to estimate lost circulation volumes.

Monitoring Protocol for Condition 3 – Inadvertent Returns

If an inadvertent return of drilling fluids is detected, the following monitoring protocol will be implemented.

- Tennessee's field engineer will notify Tennessee that an inadvertent drilling fluid return has occurred and provide documentation with respect to the location, magnitude, and potential impact of the return.

- If the inadvertent return occurs on land, Tennessee's field engineer will document steps taken by the HDD contractor to contain and collect the return. Inadvertent surface returns of drilling fluids shall be contained immediately with hand placed barriers (i.e., hay bales, sand bags, silt fences, etc.) and collected using pumps, as practical. If the amount of the surface return is not great enough to allow practical collection, the affected area shall be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of the surface return exceeds that which can be contained with hand placed barriers, small collection sumps (less than 5 cubic yards) may be used. If the amount of the surface return exceeds that which can be contained and collected using small sumps, drilling operations shall be suspended until surface return volumes can be brought under control. Should the contractor fail to comply

with the requirements of the HDD Specification, Tennessee's field engineer will notify Tennessee so that appropriate actions can be taken.

- If the inadvertent return occurs in a waterway, Tennessee, in consultation with appropriate parties, will determine if the return poses a threat to public health and safety

- If it is determined that the return does not pose a threat to public health and safety, HDD operations will continue. Tennessee's field engineer will monitor and document the inadvertent return as well as periods of contractor downtime and the contractor's drilling fluid pumping rate in case it should become necessary to estimate inadvertent return volumes.

- If it is determined that the return does pose a threat to public health and safety, drilling operations will be suspended until containment measures can be implemented by the contractor. Documentation of any containment measures employed will be provided by Tennessee's field engineer. Once adequate containment measures are in place, the contractor will be permitted to resume drilling operations subject to the condition that drilling operations will again be suspended immediately should the containment measures fail. Tennessee's field engineer will periodically monitor and document both the inadvertent return and the effectiveness of the containment measures. Periods of contractor downtime and the contractor's drilling fluid pumping rate also will be documented in case it should become necessary to estimate inadvertent return volumes. Upon completion of the HDD installation, Tennessee will clean up the drilling fluid returns to the satisfaction of governing agencies and any affected parties.

4.7 NOTIFICATION

In the event of an inadvertent drilling fluid return within a waterway, Tennessee will immediately contact the following agencies, but no later than 24 hours after detection; United States Army Corp of Engineers (USACE), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Fish and Boat Commission (PAFBC), New Jersey Department of Environmental Protection (NJDEP), NJDEP Division of Fish and Wildlife (DFW), and the Federal Energy Regulatory Commission (FERC). The United States Fish and Wildlife Service (USFWS) will also be contacted in the event of potential impacts to federally listed species. Details of the inadvertent return within a waterway will contain at a minimum:

- The location and nature of the release;

- Corrective actions being taken; and

- Whether the release poses any threat to public health and safety.

NORTHEAST UPGRADE PROJECT

Pennsylvania & New Jersey

HDD CONTINGENCY PLAN

ATTACHMENT A – FEASIBILITY ASSESSMENT

WILLBROS Engineering

2087 East 71st Street
P.O. Box 701650 (74170-1650)
Tulsa, OK 74136
Tel 918-496-0400
Fax 918-493-3430

March 28, 2011

Mr. Jerry Creel
El Paso TGP
Colonial Brookwood Center
569 Brookwood Village
Birmingham, AL 35209

Re: NEUP HDD Executive Summary of Feasibility Assessments

Dear Mr. Creel:

Willbros Engineering has completed an executive summary of the feasibility and design assessments of 30" pipeline water crossings for the Northeast Expansion Project (NEUP).

Scope of Services

Tennessee Gas Pipeline (TGP) has engaged Willbros Engineering to evaluate, determine the feasibility, and design 30" pipeline crossings for the Northeast Expansion Project (NEUP) at the Susquehanna River, the Delaware River, the Monksville Reservoir, and the Wyalusing Creek. The Scope of Work required an onsite reconnaissance of the proposed crossing locations, a compilation of preliminary information listing the relevant features at the river crossing site, civil survey to delineate distances and exact elevations of the pipeline route, and river topography. At each site the soil strata was penetrated and core samples retrieved for testing of soil and rock, preparation of core logs, performance of laboratory testing, and preparation of a final geotechnical report. Additionally, industry engineering consultants and contractors where furnished preliminary designs, geotechnical information and made site visits to provide a review and comments concerning each crossing.

General Discussion

The Horizontal Directional Drilling (HDD) pipeline construction method allows installation of pipelines under rivers, lakes, highways, railroads, runways, or other obstacles to conventional pipeline construction. The HDD method is an application of oilfield drilling technology using a down-hole survey system and a steer-able Bottom Hole Assembly (BHA). The BHA is used to drill underground along an HDD design profile from the designated entry point to the designated exit point. Pilot-hole drilling along the design profile is subject to the same problems experienced in the oilfield, yet complicated because of the horizontal application. Subsurface voids, cracks, and caverns may offer an alternate flow path to the drilling fluids, other than back to surface. The alternate flow paths may result in off right of way mud fractures, but technically more important, the loss of pilot-hole cleaning resulting in the loss of steering, and possibly stuck drill pipe. When drilling through gravel, cobble, fractured rock, or boulders it may be impossible to keep the annulus open due to the loss of the drilling fluids. Although some drilling problems are equipment related, most drilling problems are soils related and may occur at any time during the pilot-hole drilling, during the reaming process, or when pulling back the prefabricated pipe string. The HDD design profile is created by engineers after analysis of site location and soil conditions and by using stress analysis calculations, to insure the loads produced on the final pipeline installation are at or below accepted standards and values for safe operation of the pipeline, once in service. Through experience,

research, and geotechnical studies certain soil characteristics have been identified as unsuitable for the HDD installation method, often resulting in a failed drill. It is the intention of the feasibility assessment to identify adverse conditions in advance, in order that a given HDD installation should result in a successful outcome and does not result in a failed drill.

A list is attached of proposed crossing plan drawings. The information included in the drawing is a result of careful consideration of the relevant factors including:

1. Pipeline installation design, operational flow allowances, material specifications, safety codes and regulations,
2. Assessment of the physical site conditions, workspace limitations and requirements at the proposed crossing location for minimizing environmental impacts while meeting permit requirements, and
3. Crossing installation considerations and the use of specialized construction equipment for execution of the work.

The HDD crossing design outlines a crossing plan that will minimize disturbance to the river crossing land areas while providing little or no impact to the river itself or other associated features, and resulting in a good chance of a successful completion.

For several of the crossings an alternate plan has been developed in the event the HDD fails. We have defined an HDD failure as 1) a failure to complete the pilot hole per the tolerances and specifications after 2 attempts, 2) unable to ream a hole suitable for the pipe, or reaming resulting in a stuck reamer that cannot be removed, or 3) pull back resulting in stuck pipe that is not removable.

Final Geotechnical Report

A final Geotechnical Engineering Report describing the soil sampling procedures and defining the soils found at each of the sampling locations was compiled. The report included as follows:

- Written narrative describing work site, equipment used, and procedures.
- Location map that shows the locations and coordinates of each boring
- Tables, logs and/or charts for each boring
- Drilling logs, field reports, and laboratory test results

The design drawings show the location of each sample location and a log of the soil type or rock encountered.

SUSQUEHANNA RIVER

Design Considerations The study of each element of the HDD crossing resulted in a design plan and profile that minimizes impacts, reduces risks, and provides for a successful HDD crossing installation. The design parameters have been adequately defined and minimum requirements met or exceeded. The workspace requirements were specified and the site conditions were found to be suitable for construction using the HDD installation method.

HDD Feasibility The logistics of pipe fabrication, testing and pullback are adequate. The subsurface soil conditions have been investigated and assessed. Based on the subsurface soil conditions defined in the geotechnical report the proposed HDD installation attempt at this site should be successful. During consultations with other HDD design engineers, independent consultants (J.D. Hair & Associates and

Geo-Engineers Inc.), and HDD contractors, this Susquehanna River HDD crossing design received favorable reviews. Additionally it is known that HDD crossings designed in soil conditions similar to these have resulted in the successful completion of the crossing. Therefore based on the assessments and evaluations, the Susquehanna River HDD Crossing at this site is considered feasible.

Contingency for a Failed Crossing As an alternative method to crossing the Susquehanna River a design for an open cut dry flumed crossing was also completed. Based on the hydrology of the river, and the archeological and cultural features near the river's edge, it was determined that the HDD method was the preferred method and the open cut would be an alternative crossing method in the event of a failed HDD, but only when flow conditions in the river were at or below the flow design limits for in river construction.

DELAWARE RIVER

Design Considerations A long HDD crossing design was originally considered starting in the agricultural field on the east side of the river extending to the west and ending on the high elevation of the hilltop well west of I-84 for a 3,950 foot crossing length. Overall, with the hard rock, and the rock to soft soils interface, the high elevation differential, the difficult access to the west side, and challenging pipe stringing area, the long HDD design for the Delaware River equated to a very high risk installation design, unfavorable due to the many negative impacts and possible complications that could occur from the physical, geotechnical, and logistical factors. Consultations with J.D. Hair & Associates and Geo-Engineering concurred with our conclusions that the long HDD design had a high risk of failure. As a result a shorter 2,300 foot HDD design was chosen as the preferred alternative. Special considerations in designing the shorter crossing were the residences and location of an eagle nest on the west side of the river. In order to minimize noise impacts the drill rig and pipe fabrication will be on the south side of the river. Once the pilot hole and reaming are completed, the drill rig will moved to the east side for the pull back of the pipe string which will be fabricated on the east side of the river in a cultivated field away from the residences or eagles nest on the west side of the river.

HDD Feasibility Considerations of each element of the 2,300' HDD design resulted in a design plan that minimizes impacts, reduces risks, and provides for a successful HDD crossing installation. The design parameters have been adequately defined and minimum requirements met or exceeded. The workspace requirements and the site conditions are suitable for construction using the HDD installation method. The logistics of pipe fabrication, testing and pullback are adequate. The subsurface soil conditions have been investigated and assessed. Based on the subsurface soil conditions the HDD installation attempt should be feasible. During consultations with other HDD design engineers, independent consultants (J.D. Hair & Associates and Geo-Engineers Inc.), and HDD contractors, this Delaware River HDD crossing design received favorable reviews. Additionally it is known that HDD crossings designed in soil conditions similar to these have resulted in successful completion of the crossing. Therefore based on the assessments and evaluations, the Delaware River HDD Crossing at this site is considered feasible.

MONKSVILLE RESERVOIR

Design Considerations A long HDD crossing design was originally considered starting at the rock quarry on the west side of the reservoir, crossing under the reservoir and under the hill to the east, ending on the lower elevation of the hilltop well east of the Monksville Reservoir for a 4,830 foot crossing length. The

long HDD crossing design for the Monksville Reservoir was deemed by Willbros and our independent consultants (J.D. Hair & Associates and Geo-Engineers Inc.) to be extremely difficult. This unfavorable design is due to very hard rock, abandoned mines near the exit point, elevated (21' high) and potentially unsafe drill pipe handling during pullback, and the limited pipe stringing layout. Location of houses, drives and the Greenwood Lake Turnpike limit the area for fabrication such that 5 pull back sections are required. During pullback, the operation must be halted to move, well, inspect and coat pullback sections. These delays in a continuous pullback operation increase the risk of sticking the pipe.

A shorter HDD design (2,870') was developed for the crossing. This design allows makeup of pullback sections across an existing quarry on the west side of the lake thus reducing impacts to the ROW. On the east side of the lake there will be impact of clearing and excavating a drill box area. This excavation is required to fit the drill profile. Excavated material will be hauled and temporally stored away from the ROW and the returned to restore the area. The shorter design was determined to have a significantly better chance of a successful drill. Additionally, Ringwood Borough has a noise restriction from 10 pm to 7am. This noise restriction would significantly lengthen the time required for installing the crossing at the time of pullback which traditionally runs 24 hours per day to reduce the risk of stuck pipe.

HDD Feasibility Considerations of each element of a shorter 2,870' HDD design resulted in a design plan and profile that minimizes impacts, reduces risks, and provides for a more successful HDD crossing installation. The design parameters have been adequately defined and minimum requirements met or exceeded. The workspace requirements at the entry point were designed to adequately accommodate the large excavation required. The exit site conditions are suitable for construction using the HDD installation method. The logistics of pipe fabrication, testing and pullback are challenging yet adequate. The subsurface soil conditions have been investigated and assessed. Based on the subsurface soil conditions the HDD installation attempt should be successful. During consultations with other HDD design engineers, independent consultants (J.D. Hair & Associates and Geo-Engineers Inc.), and HDD contractors, this Monksville Reservoir HDD crossing design received favorable reviews. Additionally it is known that HDD crossings designed in soil conditions similar to these have resulted in the successful completion of the crossing. Therefore based on the assessments and evaluations, the Monksville Reservoir HDD Crossing at this site is considered feasible.

Contingency for Failed Crossing As an alternative method to crossing the lake, a design for a direct bottom lay crossing was also completed in the event of HDD failure. The alternate method is to utilize concrete coated pipe and lay the pipeline directly on the bottom of the lake. The pipe would be buried at the shore lines and covered with a concrete mat to add additional protection to the pipeline.

WYALUSING CREEK

HDD Feasibility The design parameters of the Wyalusing Creek crossing have been adequately defined, but other conditions relevant to a suitable, hence successful, HDD crossing design were not met. The workspace requirements and the soil conditions were undesirable for using the HDD installation method due to broken rock and large gravel, and extreme elevation differentials. The logistics of pipe fabrication, testing and pullback are also less than adequate. The subsurface soil conditions have been investigated and assessed to be of high risk for successful completion. Based on the subsurface soil conditions in regards to the definition of a failed drill, the HDD installation attempt would most likely not be successful. During consultations with other HDD design engineers, independent consultants (J.D. Hair & Associates

and Geo-Engineers Inc.), and HDD contractors, this Wyalusing Creek crossing design information received unfavorable reviews. Additionally it is known that HDD crossings designed in soil conditions similar to these have resulted in complications leading to an unsuccessful completion of the crossing. Therefore based on the assessments and evaluations, a Wyalusing Creek HDD crossing at this site is considered not feasible.

Open Cut Crossing The crossing has been designed as an open cut dry flumed crossing and is as shown on the design drawing.

Best Regards,

Jim Elmore
Project Manager

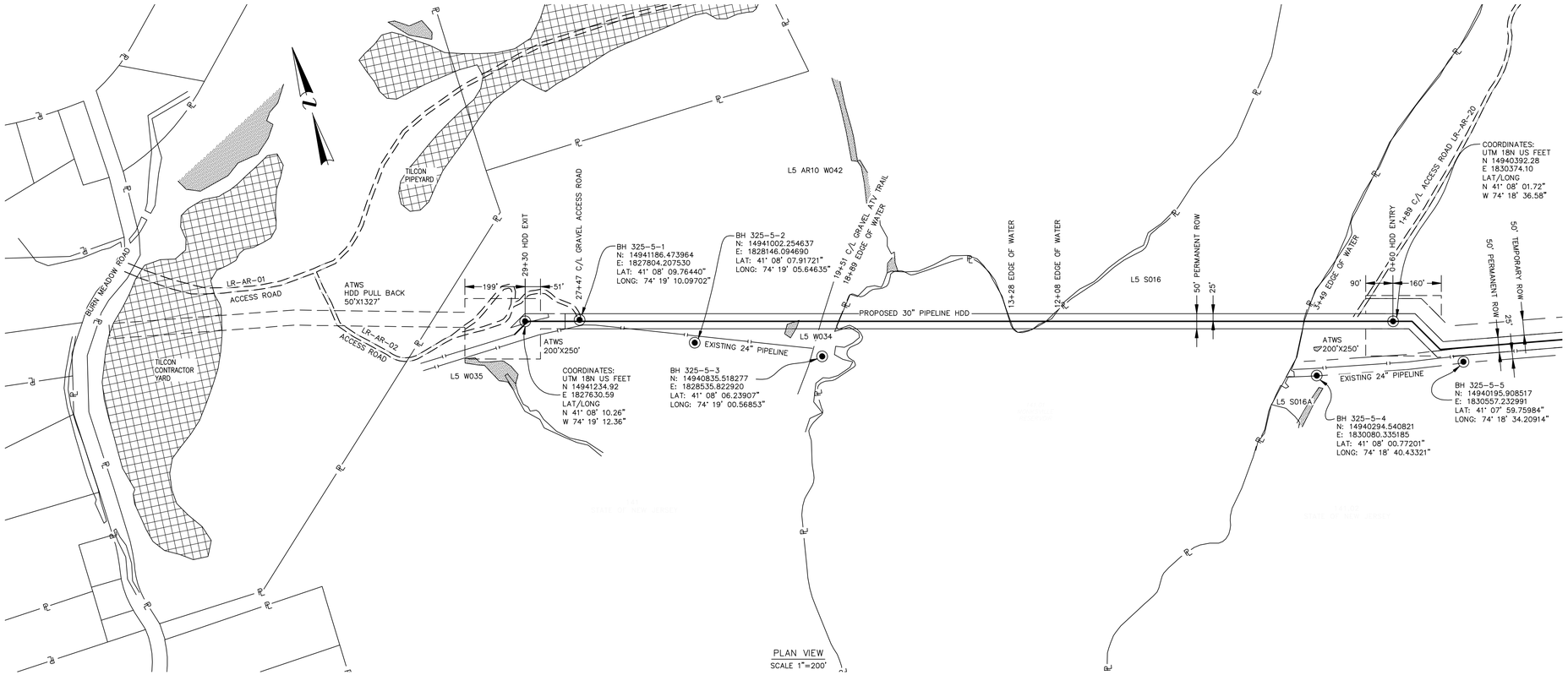
JHE: jb
51814- O -0004
File: CR-04
cc: Doug Fisher

Exhibit A

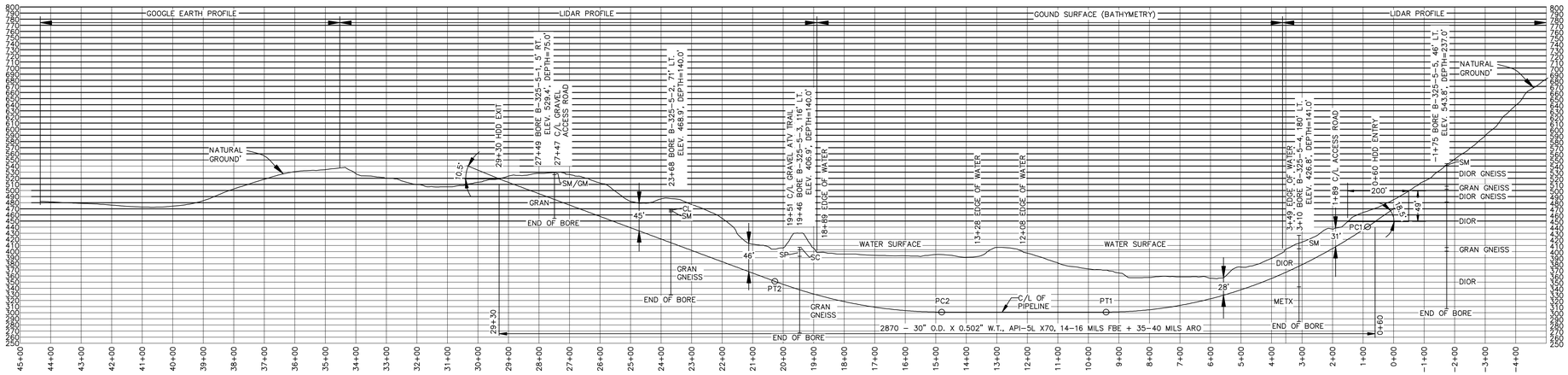
Reference drawings:

TO-N10-300-2-5HDD Delaware River HDD
TO-N16-300-2-3HDD Monksville Reservoir HDD
TO-N10-300-2-2HDD Susquehanna River HDD

PASSAIC COUNTY, NEW JERSEY
WEST MILFORD TOWNSHIP



PLAN VIEW
SCALE 1"=200'



PROFILE VIEW
HORZ: SCALE 1"=200'
VERT: SCALE 1"=100'

COORDINATE SYSTEM:
UTM 18N
WGS 1984
US SURVEY FOOT

NOTE:
1. WATER ELEVATION 402.9'.
2. GEOTECHNICAL INFORMATION FROM GEOENGINEERS, INC. DATED: 03 JUN 2009
3. WORKSPACE IN WETLANDS SHALL INCORPORATE THE USE OF WOOD MATS.

LEGEND

- Existing Permanent Easement
- Proposed Permanent Easement
- Temporary Workspace
- Additional Temporary Workspace (ATWS)
- ℄ Proposed 30" Pipeline
- ℄ Existing 24" Pipeline
- No Survey
- ℄ Stream
- Top of Bank
- Toe of Bank
- Stone/Rock Fence
- Fence
- Edge of Woods
- Approximate Location of Orange Construction Fence
- Guard Rail
- 50' Buffer Zone
- Right Of Way
- Erosion Control Line (To be Maintained During Periods of Active Construction)
- Property Line
- Iron Rod/Pin
- Drill Hole
- Stone/Concrete Monument
- 4-Leg Steel Tower
- Single Pole Tower/Power Pole
- H-Frame Tower
- Tree
- Wetland
- (S) Sanitary Sewer Manhole
- (D) Storm Sewer Manhole
- (W) Water Well
- Fire Hydrant
- FVB Foreign Valve Box
- Guy Wire and Anchor
- Curb Inlet
- Catch Basin
- (T) Telephone Hand Hole
- (E) Electric Hand Hole
- WV Water Valve
- GV Gas Valve
- Electric Junction Box
- Sign Post

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	BY	DESCRIPTION	PROJ. ID	APPR.
A	11/09/10	SJS	ISSUED FOR REVIEW	51814	JE
B	12/11/10	SJS	ISSUED FOR FERC DRAFT	51814	WEI
C	03/11/11	SJS	ISSUED FOR FERC	51814	JE
D	08/19/11	JR	ISSUED FOR SUPPLEMENTAL	51814	JE

REVISIONS

Tennessee Gas Pipeline
an El Paso company

PROPOSED 30" HEBRON LINE
SITE SPECIFIC FOR: MONKSVILLE RESERVOIR HDD LOOP 325
PASSAIC COUNTY, NEW JERSEY

Section:	Township:	Range:	
Co./Par.:	PASSAIC	State:	NEW JERSEY
Division:	NORTHERN	Op. Area:	AGAWAM
Drafter: SJS	Date: 11/1/10	Project ID:	51814
Chk'd: RSC	Date: 11-08-10	Scale:	1" = 200'
Approved: JE	Date: 11-09-10	Filename:	
TO-N16-300-2-3HDD		Sheet: 1 of 1	D
		Type: ACAD	

PROFILE VIEW		DIRECTIONAL DRILL DATA	STA.	ELEV.
MAX. OPER. PRESS.: 1170 PSIG		ENTRY ANGLE @ 18.5°	0+60	449.0'
HDD PIPE: 30" O.D. X 0.502" W.T. GRADE: API-5L X70 DESIGN FACTOR: 0.50 FOR CROSSING PIPE		POINT OF CURVATURE (ENTRY PC1) (2,700 FT. RADIUS)	0+85	440.64'
PIPE COATING: 14-16 MILS FBE EXTERNAL COATING: 35-40 MILS ARO LENGTH OF CROSSING: 2870 L.F.		POINT OF TANGENCY (PT1) (BEGIN HORIZONTAL SECTION)	9+42	301.1'
TYPE OF PIPE JOINT: WELDED X 40' LG. LENGTH OF PIPE: 2940'		POINT OF CURVATURE (ENTRY PC2) (3,000 FT. RADIUS)	14+80	301.1'
		POINT OF TANGENCY (PT2)	20+27	351.4'
		EXIT ANGLE @ 10.5°	29+30	518.7'

NOTES	MATERIALS

REMARKS

TO-T16-300-2-69A	ALIGNMENT SHEET		
DRAWING NO.	TITLE	DRAWING NO.	TITLE

REFERENCE DRAWINGS