Section 3 - Appendix 9

Environmental Construction Plan
New Hampshire

This Appendix was formatted in its entirety as part of the Final FERC 7(c) Application, filed on November 20, 2015 (PF-14-22-000), Environmental Reports, Volume II; therefore, attachment references and page numbers contained within this document are not consistent with this permit application.

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Tennessee Gas Pipeline
Company, L.L.C.
a Kinder Morgan company

APPENDIX M

ENVIRONMENTAL CONSTRUCTION PLAN FOR NEW HAMPSHIRE

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LIST OF ACRONYMS and ABBREVIATIONS

Acronym	Full Name
AR	access road
AASHTO	American Association of State and Highway Transportation Officials
ATV	all-terrain vehicle
ATWS	additional temporary workspace or temporary site
Bcf/d	billion cubic feet per day
BFM	Bonded Fiber Mix
BMPs	Best Management Practices
CFR	Code of Federal Regulations
Commission or FERC	Federal Energy Regulatory Commission
Contractor	construction contractor
Crossing Plan	General Trail Crossing Plan
°F	degrees Fahrenheit
ECP	Environmental Construction Plan
EI	Environmental Inspector
EIS	Environmental Impact Statement
ER	Environmental Report
FDA	U.S. Food and Drug Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC or Commission	Federal Energy Regulatory Commission
FERC Director	FERC Director of the Office of Energy Projects
FGM	Flexible Growth Medium
ft^2	square foot
HDD	horizontal directional drill
hp	horsepower
ISMP	Invasive Species Management Plan
lbs/acre	pounds per acre
LEI	Lead Environmental Inspector
Manual	New Hampshire Stormwater Manual, Volume 3 - Erosion and Sediment Controls During Construction (December 2008)
MAOP	maximum allowable operating pressure
MLV	mainline valve

Acronym	Full Name
MP	milepost
NED or Project	Northeast Energy Direct
NHDES	New Hampshire Department of Environmental Services
NPDES	National Pollutant Discharge Elimination System
NHDHR	New Hampshire Division of Historical Resources, Department of Cultural Resources
OSHA	Occupation Safety and Health Administration
PAM	polyacrylamide
permanent AR	permanent access road
PLS	pure live seed
the Plan	Tennessee's *Upland Erosion Control, Revegetation and Maintenance Plan*
the Procedures	Tennessee's *Wetland and Waterbody Construction and Mitigation Procedures*
Project	Northeast Energy Direct Project or NED Project
PSFM	Polymer Stabilized Fiber Matrix
ROW	right-of-way
Secretary	The Secretary of the Commission serves as the official portal through which the Commission records all legal filings and notices of proceedings related to Commission actions, and all official actions of the Commission.
SFHA	FEMA Special Flood Hazard Areas
SWPPP	Stormwater Pollution Control Plan
TBD	to be determined
temporary AR	temporary access road
Tennessee or TGP	Tennessee Gas Pipeline Company, L.L.C.
TWS	temporary workspace
U.S.	United States
USC	U.S. Code
USDA-NRCS	United States Department of Agriculture Natural Resources Conservation Service
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	ultraviolet

1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") has filed an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). The Environmental Report ("ER") is submitted in support of the application. Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There also will be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

1.1 ENVIRONMENTAL CONSTRUCTION PLAN OBJECTIVES

The purpose of this Environmental Construction Plan ("ECP") is to avoid, minimize and/or mitigate the potential impacts to the surrounding environment before, during, and after construction of the Project by outlining mitigation, monitoring and maintenance procedures. For example, this ECP will outline general Best Management Practices ("BMPs") that Tennessee and its Construction Contractors ("Contractors") will implement before, during, and after construction to minimize erosion of disturbed soils and transportation of sediment outside of the construction right-of-way ("ROW") and into environmentally sensitive areas (e.g., wetlands, streams). The BMPs are designed to provide minimum standards for the protection of environmentally sensitive areas while accounting for the significantly varying field conditions that will be encountered during construction of the Project.

This ECP will provide specifications for the installation, implementation, and maintenance of the BMPs while allowing for flexibility in the selection of specific BMPs based on site-specific conditions. This document will be included as part of the construction contract and will provide Contractors and Environmental Inspectors ("EI") a reference to specific environmental conditions and associated BMP plans and procedures.

In general, the objectives of the ECP will be achieved by implementing the following practices during and after construction:

- Minimize the footprint and duration of the disturbance;
- Divert runoff away from exposed soil and to stabilized areas to prevent erosion and sedimentation;
- Install temporary and permanent soil erosion control measures; and
- Implement an effective inspection and maintenance program.

The ECP incorporates as one document the following:

- Aerial Alignment Sheets (Attachment M1);
- Typical Construction Drawings (Attachment M2);
- Spill Prevention and Response Plan (Attachment M3);
- Waste Management Plan (Attachment M4);
- Horizontal Directional Drilling Contingency Plan (Attachment M5);
- Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains (Attachment M6);
- Unanticipated Discovery of Contamination Plan (Attachment M7);
- Blasting Management Plan (Attachment M8);
- Invasive Species Management Plan for New Hampshire (Attachment M9);
- Soil Protection and Subsoil Decompaction Mitigation Plan (Attachment M10);
- Organic Farm Protection Plan (Attachment M11);
- Winter Construction Plan (Attachment M12);
- General Trail Crossing Plan (Attachment M13);
- Tennessee's Upland Erosion Control, Revegetation, and Maintenance Plan ("Plan") (Attachment M14); and
- Tennessee's Wetland and Waterbody Crossing Construction and Mitigation Procedures ("Procedures") (Attachment M15).

1.2 GUIDELINES

As a FERC regulated Project, the plan and procedures utilized for this Project and as described within this document were developed utilizing guidance from the following resources:

- FERC Wetland and Waterbody Construction and Mitigation Procedures (May 2013 Version);
- FERC Upland Erosion Control, Revegetation, and Maintenance Plan (May 2013 Version);
- New Hampshire Department of Environmental Services' ("NHDES") New Hampshire Stormwater Manual, Volume 3 – Erosion and Sediment Controls During Construction (December 2008) ("Manual"); and
- NHDES's Rock Blasting and Water Quality Measures That Can Be Taken to Protect Water Quality and Mitigate Impacts (2010 version).

The ECP utilizes information and guidance from the above noted resources regarding Project construction, restoration, and monitoring for:

- Agricultural Mitigation;
- Wetland/Waterbody Construction and Mitigation;
- Erosion and Sedimentation Controls;
- Stormwater Pollution Prevention; and
- Revegetation and Post-Construction Monitoring.

Applicable regulatory agency BMPs will be adhered to during and after the construction of the Project in accordance with regulatory permits and approvals. Any deviation from the approved construction drawings, or changes in the design of the specified BMPs will be approved by the on-site EI and/or must have approval from the applicable permitting agency, if necessary to comply with permit conditions.

2.0 PROJECT DESCRIPTION

2.1 GENERAL PROJECT DESCRIPTION

The NED Project will provide new firm natural gas transportation capacity to meet the growing energy needs in the Northeast U.S., particularly in New England. The Supply Path Component, as defined below, will transport up to 1.2 billion cubic feet per day ("Bcf/d") of natural gas, and the Market Path Component, as defined below, will transport up to 1.3 Bcf/d of natural gas.[1] For the purposes of the Environmental Report ("ER"), the Project volume will be referred to as up to 1.3 Bcf/d. The proposed Project involves the following facilities:

- Approximately 41 miles of pipeline looping on Tennessee's 300 Line in Pennsylvania;
- Approximately 133 miles of new pipeline, of which 102 miles are proposed to be generally co-located with the certificated Constitution Pipeline Project ("Constitution") in Pennsylvania and New York (extending from Tennessee's existing 300 Line near Auburn, Pennsylvania to Wright, New York);
- Approximately 54 miles of pipeline generally co-located with Tennessee's existing 200 Line and an existing utility corridor in New York;
- Approximately 64 miles of pipeline generally co-located with an existing utility corridor in Massachusetts;
- Approximately 70 miles of pipeline generally co-located with an existing utility corridor in New Hampshire (extending southeast to Dracut, Massachusetts);
- Approximately 58 miles of various laterals and a pipeline loop in Massachusetts, New Hampshire, and Connecticut to serve local markets;
- Construction of nine new compressor stations and 15 new meter stations, and modifications to an existing compressor station and 14 existing meter stations throughout the Project area; and
- Construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

To the extent that it is practicable, feasible, and in compliance with existing law, Tennessee proposes to locate proposed pipeline facilities (either pipeline looping segments or co-located pipeline facilities) generally within or adjacent to its existing right-of-way ("ROW") associated with its existing 300 Line in Pennsylvania and Connecticut; its existing 200 Line in New York and Massachusetts; and existing utility (pipeline and powerline) corridors in Pennsylvania, New York, Massachusetts, and New Hampshire.

Pipeline loops are those pipeline segments which are laid parallel to, and connected to, another pipeline and used to increase capacity along existing pipeline facilities. These lines are connected to move larger volumes of gas through a single pipeline segment. Tennessee is proposing to minimize impacts by looping its own existing facilities in Pennsylvania and Connecticut.

Co-located pipelines are those that are laid parallel to another existing pipeline or linear utility. The current route of Tennessee's proposed NED Project, in large part, is located parallel and adjacent to, and, in many cases, overlaps existing utility easements (either pipeline or powerlines). This

[1] The reason for the difference in the capacity volumes of the two Project components is that Tennessee is assuming a certain amount of volumes to flow on the Market Path component facilities from sources other than the Supply Path component.

paralleling/overlapping of easements is commonly referred to as co-location. Refinement to the routing of the NED Project, including locations of permanent easement and temporary construction workspaces, has occurred as the NED Project was developed during the pre-filing process and will continue as necessary through the certificate process, incorporating information gained from field surveys and landowner and stakeholder input, including input from power companies that have existing easements in areas where Tennessee is proposing to co-locate the Project pipelines.

For areas of the NED Project pipeline alignment that are proposed to be co-located with existing powerline easements, Tennessee is proposing that the centerline of the pipeline will be installed generally five feet outside the existing powerline easement boundary. This proposed alignment is reflected in the proposed impacts of the Project discussed in the ER and in the attached powerline co-location configurations, ROW-Config_05 and 06, included in Volume II, Appendix G of the ER.

For all areas of co-location with powerline easements, Tennessee is proposing that the permanent easement be centered generally on the proposed pipeline and that 20 feet of the proposed 50-foot permanent easement overlap the existing powerline easement. Further, Tennessee is proposing that the temporary construction workspace for the Project for these areas of co-location will overlap the existing powerline easement between 30 to 60 feet. The amount of overlap of temporary construction easements and the existing powerline easements will depend ultimately on the location of the closest powerline towers and facilities, which will dictate the amount of available space on the powerline easement.

This proposed overlap of permanent easement and temporary construction workspace with existing powerline easements will reduce environmental and landowner impacts by a commensurate width outside the powerline easement. Tennessee notes that the proposed routing of the centerline of the pipeline generally five feet outside the existing powerline easement boundaries is based on information obtained from consultation with power companies or from available public information. Tennessee is engaged in discussions with the power companies regarding co-location and the proposed overlapping of NED Project permanent easements and temporary construction workspaces with that of existing powerline easements and these discussions are ongoing. Tennessee is currently conducting surveys of the powerline easements and may adjust the proposed centerline location of the pipeline and overlapping areas for the Project to reflect the results of these surveys, including appropriate mitigation for safety and operational considerations, as well as landowner and agency concerns, avoidance of sensitive environmental resources, and construction considerations. The centerline of the pipeline may be moved to within an existing powerline easement, less than five feet from the existing power line boundary, or further than five feet from the existing powerline boundary.

Tennessee is requesting issuance of a certificate order for the Project during the fourth quarter of 2016 and proposes to commence construction activities in January 2017, in anticipation of placing the Project facilities in-service by November 2018 (with the exception of the proposed pipeline looping segment in Connecticut, which will be placed in-service by November 2019), consistent with the terms and conditions of the precedent agreements executed with Project Shippers.

Tennessee's existing pipeline infrastructure consists of approximately 11,900 miles of pipeline designated as the 100, 200, 300, 400, 500, 700 and 800 Lines (or systems), based on the region they serve.[2] The

[2] The NED Project mainline pipeline and certain laterals will be designated as the "900 Line" or "900 system" once constructed and placed in-service.

proposed NED Project focuses on the existing 200 and 300 Lines. The 200 Line consists of multiple pipelines varying from 24 inches to 36 inches in diameter beginning on the suction side of Compressor Station 200 in Greenup County, Kentucky, and extending east through Ohio, Pennsylvania, New York, and Massachusetts. The 300 Line system consists generally of two pipelines (24 inches and 30 inches in diameter) beginning on the discharge side of Compressor Station 219 in Mercer County, Pennsylvania, traveling east through Pennsylvania, New Jersey, New York, Connecticut, and terminating as a 16-inch-diameter pipeline at Compressor Station 261 in Hampden County, Massachusetts.

2.1.1 Pipeline Facilities

The proposed Project mainline pipeline facilities in New Hampshire consist of approximately 70 miles of 30-inch-diameter pipeline, beginning at the Massachusetts/New Hampshire border and extending east to the Massachusetts/New Hampshire border north of Dracut, Massachusetts (as part of the Wright to Dracut Pipeline Segment). Portions of the Wright to Dracut Pipeline Segment will be located in New York, Massachusetts, and New Hampshire. The proposed mainline pipeline facilities in New Hampshire (70 miles of 30-inch-diameter pipeline) will be designed for a maximum allowable operating pressure ("MAOP") and maximum operating pressure ("MOP") of 1,460 psig.

Approximately 57 miles of this new proposed mainline pipeline (beginning at the Massachusetts/New Hampshire border) will be generally co-located with an existing utility corridor to the extent practicable, feasible, and in compliance with existing law. The first 6.45 miles of Segment I are not co-located with the utility corridor, due to a requested re-route by the Town of Winchester to avoid or minimize impacts to environmental resources including an aquifer protection area, Pulpit Falls, and a tree farm. On Segment J between MP 18.12 and 25.17 the mainline is not co-located with the utility corridor to accommodate a request to seek alternative routes by the Amherst Pipeline Task Force.

There have been two approximately 7-mile re-routes in Amherst and Richmond, New Hampshire since the July 24, 2015 draft ER filing. Both of these changes were included to accommodate alternate routing requests from local and regulatory agencies. Tennessee has adopted an additional re-route in Amherst, New Hampshire to accommodate landowner requests. This re-route, which was recently adopted, is depicted on aerial alignment sheets (Attachment M1) but is not included in the impact evaluations in this ER. Tennessee will include updated impact calculations in a subsequent filing.

The proposed Project pipeline facilities in New Hampshire also include the remaining lengths of the Fitchburg Lateral Extension and the Haverhill Lateral (described in the discussion of Massachusetts pipeline facilities). Approximately 2.04 miles of the 9.27-mile Haverhill Lateral and 5.08 miles of the 13.97-mile Fitchburg Lateral Extension will be located in New Hampshire. The remaining portions of these laterals will be located within Massachusetts. The Haverhill Lateral will have a MAOP of 800 psig and an MOP of 750 psig. The Fitchburg Lateral Extension will have a MAOP and MOP of 1,460 psig.

A summary of the individual pipeline facilities and milepost ("MP") designations within each town, county, and state for each pipeline facility are provided in Table 2.1-1.

2.1.2 Aboveground Facilities

2.1.2.1 Compressor Stations

Facilities in New Hampshire will include the addition of a new natural gas-powered compressor station. The Market Path Mid Station 4 will be located in Hillsborough County and will include two Titan 130 Turbines, ISO-rated for a total of 41,000 hp.

The Market Path Mid Station 4 facilities will include:

- Two Solar Titan 130 Turbine/compressor units. including all necessary auxiliary systems including: oil coolers, oil pumps, oil mist eliminators, air inlet ducting, air inlet silencing, air inlet filtering equipment, exhaust ducting, exhaust silencing, exhaust stack, unit control automation system, electric starting system, battery back-up system, automation communication systems and safety shutdown systems;
- Compressor/Valve Building, including concrete foundations, building steel support frames and beams, overhead crane lifting systems, ventilation systems, ventilation silencers, safety systems, alarm systems, acoustic insulation, space heaters, rollup doors, lighting systems, grounding systems, electric power distribution systems, auxiliary piping systems;
- High pressure gas unit piping systems, including pipe, weld fittings, isolation valves with remote control operators, axial flow check valves, blow-down valves, loading valves and anti-surge system control valves for the two turbine/compressor units;
- High pressure gas station yard piping systems, including pipe, weld fittings, station side valves with remote control operators, station gas pressure and temperature transmitters, over pressure protection system, station discharge check valve, station discharge check flow measurement ultra-sonic meter, station reverse flow valves with remote control operators, isolation valves with remote control operators, axial flow check valves, blow-down valves, loading valves, by-pass valves, emergency shutdown valves with remote control operators and station re-cycle system control valves;
- Auxiliary piping systems for drains, vents, compressed air, water, oil, cooling water/glycol mix, domestic gas, ESD control and supply piping;
- Filter/Separator units including gas filter elements, mist extractor, liquid level controls, liquid automatic drain valves, differential pressure transmitters, liquid level monitoring and alarm systems, purging and loading valves, isolation valves, filter access doors;
- High pressure gas discharge cooler, including electric driven fans and necessary piping systems;
- Compressor case vent and emergency shutdown silencers (one silencer for suction piping and case vent service, two silencers for discharge piping);
- Back-up generator. including generator, gas engine driver, automatic transfer switch, automatic load following load bank, coolers, start batteries, inlet silencers, exhaust silencers, unit automation and controls;
- Air compressor system, including air storage tanks, dryer system, redundant compressors, piping, valves, and system automation and safety shutdowns;
- Hydronic water heating system, including pumps, expansion tank, air separation system, heater, heater exhaust stack, heater fuel controls, heater level and temperature controls, system controls and automation;
- Auxiliary building. including overhead crane system, ventilation system, space heaters, building foundation, building lighting, power distribution system and safety systems;
- Domestic gas measurement and treating system;

- Turbine fuel gas measurement and treating system;
- MCC and Control building including UPS systems, motor control equipment, automation systems, communication systems, security systems, battery back-up systems, battery chargers, restroom, VFD equipment, power distribution systems, grounding systems, HVAC equipment, lighting, station automation equipment, emergency shutdown systems, SCADA systems;
- Remote MCC Building for gas coolers including, power distribution equipment, reduced voltage soft start starters for cooling fan motors, automation equipment, HVAC equipment, lighting
- Electric power utility interface and main power transformer;
- Incoming utility power line;
- Incoming communications lines;
- Radio communications tower;
- Overhead cable tray and pipe support structure between Auxiliary Building, the MCC/Control Building and the Compressor/Valve Building and also extending to the gas cooler and other equipment in the station yard;
- Pipeline condensate storage tank, including: relief systems and overfill protection systems;
- Pipeline mainline valve and operator and blow-off/bypass valve assembly;
- Pipeline bi-directional pig traps, including isolation valves, liquid valves, bypass valves and by-pass line;
- Station water well and pumping system;
- Station septic system and drain field for restroom facilities;
- Station security fence, station property fence;
- Station roads, parking areas and outdoor storage area;
- District Storage Yard with road and gravel area; and
- Storm water retention pond;
- District Office Building, including: offices, lighting, HVAC systems, communication systems, UPS system, restroom, conference room, office equipment and computers, security equipment.

A summary of the compressor station facilities is provided in Table 2.1-2.

2.1.2.2 Meter Stations

The new meter stations in New Hampshire will include:

- Merrimack – Hillsborough County, New Hampshire: Tennessee proposes to construct and operate a new delivery meter station to Liberty Utilities off of the Wright to Dracut Pipeline Segment. Meter station components include metering, chromatograph, in-line strainer, EGM, and communications. Heating, regulation and odorization facilities will be installed by Liberty Utilities, as required. Where practical, it is anticipated that the major station components and piping assemblies will be fabricated, assembled and housed in pre-fabricated buildings to be shipped to the site for final installation.

- 200-2 Check – Rockingham County, New Hampshire: Tennessee proposes to construct and operate a new check meter station at the interconnection of the Wright to Dracut Pipeline Segment with the existing Tennessee Concord Lateral. Meter station components include metering, regulation/flow control, heating, EGM and communications. Where practical, it is anticipated that the major station components and piping assemblies will be fabricated, assembled and housed in pre-fabricated buildings to be shipped to the site for final installation.

A summary of the meter station facilities is provided in Table 2.1-3.

Table 2.1-1
Proposed Pipeline Facilities for the Project in New Hampshire

Facility Name	Diameter (inches)	County	Township/Town	Segment[1]	Milepost		Length (miles)
					Begin	End	
Wright to Dracut Pipeline Segment	30	Cheshire	Winchester	I	0.00	4.81	4.81
Wright to Dracut Pipeline Segment	30	Cheshire	Richmond	I	4.81	11.48	6.67
Wright to Dracut Pipeline Segment	30	Cheshire	Troy	I	11.48	12.59	1.11
Wright to Dracut Pipeline Segment	30	Cheshire	Fitzwilliam	I	12.59	12.73	0.14
Wright to Dracut Pipeline Segment	30	Cheshire	Troy	I	12.73	13.13	0.40
Wright to Dracut Pipeline Segment	30	Cheshire	Fitzwilliam	I	13.13	14.13	1.00
Wright to Dracut Pipeline Segment	30	Cheshire	Troy	I	14.13	14.21	0.08
Wright to Dracut Pipeline Segment	30	Cheshire	Fitzwilliam	I	14.21	19.78	5.57
Wright to Dracut Pipeline Segment	30	Cheshire	Rindge	I	19.78	28.76	8.98
Wright to Dracut Pipeline Segment	30	Hillsborough	New Ipswich	J	0.00	6.33	6.33
Wright to Dracut Pipeline Segment	30	Hillsborough	Greenville	J	6.33	8.01	1.68
Wright to Dracut Pipeline Segment	30	Hillsborough	Mason	J	8.01	11.92	3.91
Wright to Dracut Pipeline Segment	30	Hillsborough	Milford	J	11.92	13.10	1.18
Wright to Dracut Pipeline Segment	30	Hillsborough	Brookline	J	13.10	15.83	2.73
Wright to Dracut Pipeline Segment	30	Hillsborough	Milford	J	15.83	17.75	1.92
Wright to Dracut Pipeline Segment	30	Hillsborough	Amherst	J	17.75	20.60	2.85
Wright to Dracut Pipeline Segment	30	Hillsborough	Hollis	J	20.60	20.87	0.27
Wright to Dracut Pipeline Segment	30	Hillsborough	Merrimack	J	20.87	26.19	5.32
Wright to Dracut Pipeline Segment	30	Hillsborough	Litchfield	J	26.19	28.85	2.66
Wright to Dracut Pipeline Segment	30	Rockingham	Londonderry	J	28.85	31.42	2.57
Wright to Dracut Pipeline Segment	30	Hillsborough	Hudson	J	31.42	33.89	2.47
Wright to Dracut Pipeline Segment	30	Rockingham	Windham	J	33.89	36.16	2.27
Wright to Dracut Pipeline Segment	30	Hillsborough	Pelham	J	36.16	41.69	5.53

Table 2.1-1
Proposed Pipeline Facilities for the Project in New Hampshire

Facility Name	Diameter (inches)	County	Township/Town	Segment[1]	Milepost		Length (miles)
					Begin	End	
Haverhill Lateral	20	Rockingham	Salem	P	6.95	8.99	2.04
Fitchburg Lateral Extension	12	Hillsborough	Mason	Q	0.00	5.08	5.08
						Total	**77.57**

[1] Each segment is associated with its own set of MPs beginning at MP 0.00.

Table 2.1-2
Proposed Compressor Stations for the Project in New Hampshire

Facility Name	Associated Pipeline[1]	County	Township/ Town	Segment[2]	Milepost[3]	New / Modified	New Horsepower	Area Required for Construction (acres)[4]	Area Required for Operation (acres)[5]
Market Path Mid Station 4	Wright to Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.81	New	41,000	32.61	21.12
						Total	**41,000**	**32.61**	**21.12**

[1] This column indicates the associated pipeline on which each compressor station will be located.

[2] Each segment is associated with its own set of MPs beginning at MP 0.00.

[3] For new compressor stations, the MPs provided reflect the approximate location of properties optioned by Tennessee.

[4] New compressor stations will require new permanent workspace for operation and temporary workspace during construction.

[5] Area Required for Operation = new permanent workspace required for operation. New parcels purchased for new compressor station sites will vary based on available land. Acreage for permanent driveways required for access to new compressor stations is included.

Table 2.1-3
Proposed Meter Stations for the Project in New Hampshire

Facility Name	Associated Pipeline[1]	County	Township/Town	Segment[2]	Milepost[3]	New / Modified	New Capacity (dekatherms per day)	Area Required for Construction (acres)[4]	Area Required for Operation (acres)[5]
Merrimack	Wright to Dracut Pipeline Segment	Hillsborough	Merrimack	J	25.70	New	100,000	0.78	0.78
200-2 Check	Wright to Dracut Pipeline Segment	Rockingham	Windham	J	34.45	New	500,000	1.31	0.90
							Total	**2.09**	**1.68**

1 This column indicates the associated pipeline for each meter station.

2 Each segment is associated with its own set of MPs beginning at MP 0.00.

3 MPs are provided for meter stations and refer to the nearest MPs of the meter stations' associated segment.

4 New meter stations will require new permanent workspace for operation and temporary workspace during construction.

5 Area Required for Operation = new permanent workspace required for operation. Acreage for permanent driveways required for access to new meter stations is included.

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2.1.2.3 Mainline Valves, Pig Facilities, and Cathodic Protection Facilities

For the Project, Tennessee proposes that MLVs will generally be installed and operated within the proposed permanent ROW associated with the applicable pipeline segment(s). MLV site components include valve, actuator, piping and communications equipment. Each MLV will generally consist of a 60-foot by 50-foot graveled area and will be fenced within the permanent ROW. Where practicable, Tennessee has sited appurtenant facilities close to public roads to limit the number of permanent access roads ("ARs"); however, some permanent ARs to these sites will be required. Tennessee has conducted a class study on each proposed pipeline segment and designed MLV locations that meet or exceed the federal spacing requirements.

Locations of MLVs are provided in Table 2.1-4 and included on the Aerial Alignment Sheets (Attachment M1).

Table 2.1-4
Proposed Appurtenant Aboveground Facilities for the Project in New Hampshire

Facility Name[1]	Segment[2]	Approximate Milepost[3]	County	Township/Town	Approximate Area (acres)[4,5]
MLV-I-01	I	14.92	Cheshire	Fitzwilliam	0.00
Remote Blowoff (MLV-I-01)	I	14.92	Cheshire	Fitzwilliam	0.00
MLV-I-02	I	22.01	Cheshire	Rindge	0.00
Remote Blowoff (MLV-I-02)	I	22.01	Cheshire	Rindge	0.00
PR-J-01	J	5.80	Hillsborough	New Ipswich	0.00
MLV-J-01	J	5.81	Hillsborough	New Ipswich	0.00
PL-J-01	J	5.81	Hillsborough	New Ipswich	0.00
MLV-J-02	J	19.05	Hillsborough	Amherst	0.00
Remote Blowoff (MLV-J-02)	J	19.05	Hillsborough	Amherst	0.00
MLV-J-03	J	27.01	Hillsborough	Litchfield	0.00
Remote Blowoff (MLV-J-03)	J	27.01	Hillsborough	Litchfield	0.00
MLV-J-04	J	34.45	Rockingham	Windham	0.00
Remote Blowoff (MLV-J-04)	J	34.45	Rockingham	Windham	0.00
MLV-J-05	J	39.79	Hillsborough	Pelham	0.00

Table 2.1-4
Proposed Appurtenant Aboveground Facilities for the Project in New Hampshire

Facility Name[1]	Segment[2]	Approximate Milepost[3]	County	Township/Town	Approximate Area (acres)[4,5]
Remote Blowoff (MLV-J-05)	J	39.79	Hillsborough	Pelham	0.00
MLV-Q-01	Q	0.00	Hillsborough	Mason	0.00
PL-Q-01	Q	0.00	Hillsborough	Mason	0.00
				Total	**0.00**

1 The prefixes for the facility names are defined below:
MLV – Mainline Valve
PL – Pig Launcher
PR – Pig Receiver
TB – Temporary Barrel
PB – Pig Barrel

2 Each segment is associated with its own set of MPs beginning at MP 0.00.

3 The approximate location of MLVs was determined based on a class location study utilizing digitized structures photo interpreted from aerial flights conducted in the spring of 2015.

4 All proposed appurtenant ancillary aboveground facilities, including MLVs, pig launcher/receivers and blowoffs will be constructed and operated within areas of existing or new permanent easements associated with the pipeline facilities.

5 Approximate Area impacts are additional permanent impacts not previously accounted for within the pipeline or AR impacts.

2.2 LAND REQUIREMENTS

The construction workspace (including TWS), additional temporary workspace ("ATWS"), permanent (or operational) ROW, temporary and permanent ARs, contractor yards, and aboveground facilities for the New Hampshire portion of the Project will total approximately 1,885.74 acres (Table 2.2-1). Operation of the New Hampshire portion of the Project facilities will require approximately 495.95 acres that will be maintained as permanent ROW (or fee-owned property of Tennessee for compressor station facilities). Table 2.2-1 includes a summary of all Project-related land requirements that will be affected by construction and operation of the Project facilities (pipeline facilities, new compressor and meter stations, temporary and permanent ARs, and contractor yards). The USGS topographic maps and Aerial Alignment Sheets, provided in Attachment M1, depict the location and configuration of all TWS and permanent construction workspace, and ARs and contractor yards (to the extent they have been identified) required for the Project. Typical construction workspace configurations are provided in Attachment M2, Typical Construction Drawings of this ECP.

Table 2.2-1
Summary of Land Requirements for the Project in New Hampshire

Facility	Land Affected During Construction (acres)[1]	New Permanent Easement Affected During Operation (acres)[2]	Land Affected Within TGP Existing Operational ROW (acres)
Pipeline	834.22	459.05	10.36
Additional Temporary Workspace[3]	165.93	0.00	0.00
Compressor Stations	32.61	21.12	0.00
Meter Stations	2.09	1.68	0.41
Cathodic Protection Ground Beds	20.03	13.42	0.00
Total Temporary and Permanent Access Roads	116.18	0.68	0.00
Contractor Yards	714.68	0.00	0.00
Appurtenant Facilities[4]	0.00	0.00	0.00
Total	**1,885.74**	**495.95**	**10.77**

[1] Construction workspace acreage impacts were calculated along the pipeline facilities utilizing the construction limits (which encompasses TWS and operational ROW widths). Construction workspace through wetlands and waterbodies generally has been reduced to 75 ft as required and where practicable.

Pipe Diameter (inches)	Construction ROW Width (ft)
8 – 16	75
18 – 24	90
26 – 36	100

* Exception is the Haverhill Lateral which will be constructed within a 75-foot ROW.

[2] Operational workspace acreage impacts were calculated along the pipeline facilities according to the following permanent ROW widths:

Pipe Diameter (inches)	New Permanent Easement Affected During Operation (ft)
8 – 16	30-50
18 – 24	30-50
26 – 36	50

[3] Acreages for ATWS are not included in the Land Affected During Operation pipeline acreage values.

[4] All appurtenant aboveground facilities, including MLVs and pig facilities, will be constructed and operated within areas of existing or new permanent easements associated with the pipeline facilities.

2.2.1 Pipeline Facilities

The approximate land requirements for the pipeline facilities are summarized in Table 2.2-1. The pipeline acreages are based on varying construction ROW widths to accommodate the outer diameter of the pipeline proposed for each pipeline segment. Tennessee's proposed construction ROW widths for each pipeline segment are provided in Table 2.2-2. These widths will be maintained through uplands and a reduced construction ROW width of 75 feet is proposed for areas crossing wetlands and waterbodies and has been incorporated into the pipeline workspace, except where variance requested on site-specific basis. Pipeline ROW workspace configurations and dimensions are depicted in Attachment M1, Aerial Alignment Sheets.

Table 2.2-2
Proposed Construction ROW Widths for the Project Pipeline Facilities in New Hampshire

Facility Name	Diameter (inches)	Construction ROW Width (feet)[1]	Operational ROW Width (feet)[2,3]
Wright to Dracut Pipeline Segment	30	100-120	50
Haverhill Lateral[4]	20	75	50
Fitchburg Lateral Extension	12	75	50

[1] Construction workspace acreage impacts were calculated along the pipeline facilities according to the following construction ROW widths (which encompasses TWS and the operational ROW widths described in footnote 2). Construction workspace through wetlands and waterbodies will be reduced to 75 feet as required and where practicable, as shown on the alignment sheets.

Pipe Diameter (inches)	Construction ROW Width (feet)
8 – 16	75
18 – 24	90*
26 – 36	100-120

*Exception is the Haverhill Lateral which will be constructed within a 75-foot ROW.

[2] Operational workspace acreage impacts were calculated along the pipeline facilities according to the following permanent ROW widths:

Pipe Diameter (inches)	Operational ROW Width (feet)
8 – 16	50
18 – 24	50
26 – 36	50

[3] This includes 25 ft of existing Tennessee ROW in areas where the proposed pipeline is looped with an existing Tennessee pipeline.

[4] Due to encroachments and development near the Haverhill Lateral, construction will be conducted within a 75 ft construction ROW instead of the 90 ft proposed construction ROW width for pipelines with diameters of 18"-24".

2.2.2 Aboveground and Appurtenant Facilities

The land requirements for the aboveground facilities are summarized in Table 2.2-3.

Table 2.2-3
Land Requirements for the Project Aboveground and Appurtenant Facilities in New Hampshire

Facility Name[1]	Facility Type	Associated Pipeline	County	Township/Town	Segment[2]	Milepost	New / Modified	Area Required for Construction (acres)[3]	Area Required for Operation (acres)[4]
MLV-I-01	Mainline Valve	Wright to Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.92	New	0.00	0.00
Remote Blowoff (MLV-I-01)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.92	New	0.00	0.00
MLV-I-02	Mainline Valve	Wright to Dracut Pipeline Segment	Cheshire	Rindge	I	22.01	New	0.00	0.00
Remote Blowoff (MLV-I-02)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Cheshire	Rindge	I	22.01	New	0.00	0.00
PR-J-01	Pig Receiver	Wright to Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.80	New	0.00	0.00
MLV-J-01	Mainline Valve	Wright to Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.81	New	0.00	0.00
PL-J-01	Pig Launcher	Wright to Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.81	New	0.00	0.00
Market Path Mid Station 4	Compressor Station	Wright to Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.81	New	32.61	21.12
MLV-J-02	Mainline Valve	Wright to Dracut Pipeline Segment	Hillsborough	Amherst	J	19.05	New	0.00	0.00
Remote Blowoff (MLV-J-02)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Hillsborough	Amherst	J	19.05	New	0.00	0.00
Merrimack	Meter Station	Wright to Dracut Pipeline Segment	Hillsborough	Merrimack	J	25.70	New	0.78	0.78
MLV-J-03	Mainline Valve	Wright to Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.01	New	0.00	0.00
Remote Blowoff (MLV-J-03)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.01	New	0.00	0.00
MLV-J-04	Mainline Valve	Wright to Dracut Pipeline Segment	Rockingham	Windham	J	34.45	New	0.00	0.00
Remote Blowoff (MLV-J-04)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Rockingham	Windham	J	34.45	New	0.00	0.00
200-2 Check	Meter Station	Wright to Dracut Pipeline Segment	Rockingham	Windham	J	34.45	New	1.31	0.90
MLV-J-05	Mainline Valve	Wright to Dracut Pipeline Segment	Hillsborough	Pelham	J	39.79	New	0.00	0.00
Remote Blowoff (MLV-J-05)	MLV Remote Blowoff	Wright to Dracut Pipeline Segment	Hillsborough	Pelham	J	39.79	New	0.00	0.00
MLV-Q-01	Mainline Valve	Fitchburg Lateral Extension	Hillsborough	Mason	Q	0.00	New	0.00	0.00
PL-Q-01	Pig Launcher	Fitchburg Lateral Extension	Hillsborough	Mason	Q	0.00	New	0.00	0.00
							Total	**34.70**	**22.80**

[1] The prefixes for the facility names are defined below:
MLV - Mainline Valve
PL - Pig Launcher
PR - Pig Receiver
TB – Temporary Barrel
TB – Pig Barrel

[2] Each segment is associated with its own set of MPs beginning at MP 0.00.

[3] New compressor and meter stations will require new permanent workspace for operation and temporary workspace during construction. All proposed appurtenant ancillary aboveground facilities, including MLVs, pig facilities and blowoffs will be constructed and operated within areas of existing or new permanent easements associated with the pipeline facilities. No additional temporary or permanent impacts are anticipated for the construction of MLVs, pig facilities and blowoffs that are not already being accounted for in the pipeline facility impacts.

[4] Area Required for Operation = new permanent workspace required for operation. All proposed appurtenant ancillary aboveground facilities, including MLVs, pig facilities and blowoffs will be operated within areas of existing or new permanent easements associated with the pipeline facilities. No additional temporary or permanent impacts are anticipated for the operation of MLVs, pig facilities and blowoffs that are not already being accounted for in the pipeline facility impacts. Permanent impacts for driveways to new compressor and meter stations are included in acreage provided for those facilities.

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2.2.3 Access Roads

Construction access to the Project areas and ancillary facilities will be by way of the construction ROW and existing and new public and private roads. Tennessee anticipates utilizing temporary and permanent ARs during the construction of each portion of the Project with permanent ARs to be used during operation of the Project. Where public road access is unavailable, Tennessee will identify private ARs. Locations of ARs proposed for the Project are provided in Resource Report 8 of this ER. Locations of ARs proposed for the Project are provided in Table 2.2-4. Locations of proposed temporary ARs identified are depicted on USGS topographic maps (Volume II, Appendix E of the ER) and Aerial Alignment Sheets provided in Attachment M1.

Where possible, Tennessee has proposed to use existing roads as ARs for the Project; if no existing road is available for use, Tennessee has sited new ARs away from sensitive resources to the extent practicable. Temporary soil erosion and sediment control measures will be installed along the proposed ARs in accordance with this ECP.

Construction impacts associated with proposed ARs are included in Table 2.2-4.

2.2.4 Contractor Yards

Tennessee has identified locations to be utilized for contractor yards for the Project. These areas will be used for equipment, pipe, and material storage and staging, as well as temporary field offices and pipe preparation/field assembly areas. Contractor yards proposed represent locations that were utilized for prior Tennessee projects and additional areas identified by Tennessee. Acreages associated with the contractor yards are included in the overall land requirements for the Project, as detailed in Table 2.2-1, and locations of proposed contractor yards are provided in Table 2.2-5. Tennessee continues to evaluate locations of proposed contractor yards for the Project in consultation with appropriate regulatory agencies, landowners, and other stakeholders. Tennessee notes that certain contractor yards included in this ER will be excluded from the Project scope due to environmental and land use constraints, and impacts associated with these contractor yards will be removed in a supplemental filing.

Contractor yards that are proposed to be used for the Project include those located in previously disturbed areas such as open fields, sand and gravel pits, parking lots and industrial facilities. Although certain wetland impacts for these previously disturbed areas are included in Resource Report 2 of the ER, Tennessee will select contractor yard sites considering these environmental impacts identified during environmental field surveys and obtain the appropriate regulatory permits prior to utilizing these sites.

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Table 2.2-4
Access Roads Associated with Pipeline Facilities in New Hampshire

Facility Name	County	Access Road ID[1,2]	Segment	Nearest Milepost[3]	Modification Required	Road Type[4]	Existing Land Use[5]	Justification[6]	Length (ft)	Area Affected During Construction (acres)
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0001	I	1.30	Yes	Dirt	RD, UF	N/A	2,587	1.19
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0002	I	2.75	Yes	Dirt	UF	N/A	828	0.38
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0003	I	3.30	Yes	Dirt	OL/ROW, RD, UF, WB/OW, PFO	N/A	6,995	3.24
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0200	I	4.03	Yes	Dirt	OL/ROW, RD, RE, UF, WB/OW	N/A	15,345	7.15
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0400	I	5.71	Yes	Dirt	OL/ROW, UF	N/A	5,278	2.42
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0500	I	7.67	Yes	Dirt	OL/ROW, RD, UF, WB/OW, PSS, PEM, WETLAND	N/A	5,343	3.69
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0600	I	9.34	Yes	Dirt	UF, WB/OW, OL/ROW, PEM, PSS, WETLAND, RD	N/A	20,555	13.77
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0601	I	14.34	No	Dirt	CI, OL/ROW	N/A	114	0.08
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0700	I	15.27	Yes	Dirt	OL/ROW, UF, PSS, PEM	N/A	1,291	0.90
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0800	I	15.69	Yes	Dirt/Gravel	CI, OL/ROW, RD, UF	N/A	3,714	2.54
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-0900	I	16.93	Yes	Dirt/Gravel	RD, RE, UF	N/A	887	0.61
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1000	I	18.12	Yes	Dirt	OL/ROW, RE, UF	N/A	910	0.63
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1100	I	18.90	Yes	Dirt/Gravel	OL/ROW, RE, UF, PEM	N/A	867	0.60
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1101	I	21.21	Yes	Gravel	OL/ROW, RD, RE, UF, WB/OW	N/A	6,419	3.21
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1400	I	22.40	Yes	Paved/Gravel	AG, OL/ROW, RD, RE, UF	N/A	1,788	1.23
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1401	I	22.98	Yes	Paved/Dirt	CI, OL/ROW, RD, UF	N/A	1,108	0.80
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1500	I	23.15	Yes	Dirt	OL/ROW, WB/OW, PFO, PSS, PEM, WETLAND	N/A	2,913	1.99
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1600	I	23.79	Yes	Dirt	OL/ROW, WB/OW, PFO, PSS, PEM	N/A	1,157	0.79
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1700	I	24.20	Yes	Dirt	OL/ROW, UF, WB/OW, PSS, PEM	N/A	2,127	1.45
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1800	I	24.62	Yes	Dirt	OL/ROW, RD, UF, WB/OW, PEM, PSS, WETLAND	N/A	1,907	1.37

Table 2.2-4
Access Roads Associated with Pipeline Facilities in New Hampshire

Facility Name	County	Access Road ID[1,2]	Segment	Nearest Milepost[3]	Modification Required	Road Type[4]	Existing Land Use[5]	Justification[6]	Length (ft)	Area Affected During Construction (acres)
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-1900	I	25.19	Yes	Dirt	OL/ROW, RD, UF, WB/OW, PEM, PSS, WETLAND	N/A	3,032	2.09
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-2000	I	26.03	Yes	Dirt	OL/ROW, UF, PEM, WETLAND	N/A	3,010	2.04
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-2100	I	26.74	Yes	Dirt	CI, OL/ROW, RD, UF, PFO, PSS, WETLAND	N/A	6,543	4.49
Wright to Dracut Pipeline Segment	Cheshire	NED-TAR-I-2200	I	27.89	Yes	Dirt	OL/ROW, RD, UF	N/A	2,373	1.64
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0100	J	0.25	Yes	Dirt	OL/ROW, UF, PEM, PSS, WETLAND	N/A	5,406	3.63
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0801	J	0.25	Yes	Dirt	CI, OL/ROW, RD, UF, WB/OW, PFO	N/A	1,612	1.11
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0200	J	1.22	Yes	Dirt	OL/ROW, UF, WB/OW, PEM, PSS, WETLAND	N/A	2,557	1.73
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0300	J	1.91	Yes	Dirt	OL/ROW, RE, UF	N/A	1,936	1.33
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0301	J	2.31	Yes	Dirt	OL/ROW, UF, WB/OW, PSS, PEM	N/A	1,967	1.35
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0302	J	3.00	Yes	Dirt	OL/ROW, WB/OW, PSS, PEM	N/A	1,461	1.01
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0400	J	3.31	Yes	Dirt	OL/ROW, RD, UF	N/A	4,920	3.38
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0500	J	4.32	Yes	Dirt	OL/ROW, RD, RE, UF, PSS, PEM, WETLAND	N/A	3,694	2.53
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0600	J	6.61	Yes	Dirt/Gravel	OL/ROW, RD, UF	N/A	3,050	2.10
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0700	J	7.03	Yes	Dirt	OL/ROW, UF	N/A	1,433	0.97
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0701	J	7.64	Yes	Dirt	OL/ROW, UF	N/A	285	0.20
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0800	J	8.07	Yes	Dirt/Gravel	OL/ROW, RE, UF, PSS, WETLAND	N/A	3,905	2.72
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-0900	J	10.86	Yes	Dirt	OL/ROW, UF, WB/OW, PFO, PSS, PEM, WETLAND	N/A	5,574	3.83
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1000	J	12.03	Yes	Dirt	CI, OL/ROW, UF, WB/OW, PFO, PSS, PEM, WETLAND	N/A	12,518	8.57
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1200	J	16.60	Minor	Dirt/Gravel	OL/ROW, RD, RE	N/A	215	0.14

Table 2.2-4
Access Roads Associated with Pipeline Facilities in New Hampshire

Facility Name	County	Access Road ID[1,2]	Segment	Nearest Milepost[3]	Modification Required	Road Type[4]	Existing Land Use[5]	Justification[6]	Length (ft)	Area Affected During Construction (acres)
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1201	J	21.02	No	Paved	RD	N/A	194	0.13
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1202	J	21.17	No	Paved	CI, RD, UF	N/A	1,045	0.75
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1203	J	21.45	No	Paved	CI, OL/ROW, RD	N/A	886	0.60
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1204	J	21.50	No	Paved	CI	N/A	750	0.60
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1205	J	21.53	No	Paved	RD, PEM	N/A	539	0.38
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1206	J	24.55	No	Paved	UF	N/A	102	0.05
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-1207	J	24.71	No	Paved	OL/ROW, UF	N/A	131	0.09
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-2000	J	25.29	Yes/Minor	Dirt	OL/ROW, RE	N/A	59	0.04
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-2100	J	25.55	Minor	Paved/Gravel/Dirt	CI, OL/ROW, RD, UF	N/A	2,997	1.71
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-2200	J	26.45	Yes	Dirt	OL/ROW, WB/OW, PSS, PEM, WETLAND	N/A	1,137	0.78
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-2201	J	29.12	No	paved	OTHER	N/A	261	0.15
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-2300	J	29.16	Yes	Dirt	OL/ROW, RD, UF, WB/OW, PEM	N/A	2,024	1.39
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-2400	J	30.13	No	Paved	RD, UF	N/A	17	0.01
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-2500	J	31.00	Yes	Paved/Dirt	CI, OL/ROW, RD, UF	N/A	5,431	3.70
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-2700	J	32.57	No	Paved	OL/ROW, RD	N/A	58	0.04
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-2800	J	32.64	No	Paved	OL/ROW, RD, UF	N/A	225	0.16
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-2801	J	34.41	No	Paved	CI, OL/ROW, RD, UF, PSS, PEM	N/A	330	0.23
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-3200	J	34.87	Minor	Paved	OL/ROW, RD	N/A	243	0.17
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-3300	J	35.51	Minor	Paved/Dirt	OL/ROW, RD, RE, UF, PSS	N/A	650	0.37
Wright to Dracut Pipeline Segment	Rockingham	NED-TAR-J-3400	J	35.74	Yes	Dirt	OL/ROW, RD, RE, UF, WB/OW, WETLAND	N/A	3,940	2.71
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-3500	J	36.72	Yes	Dirt/Paved	OL/ROW, RD, RE, UF, WB/OW, PSS	N/A	1,746	1.19
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-3700	J	38.87	Yes	Dirt/Gravel	OL/ROW	N/A	753	0.52
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-3800	J	39.39	Yes	Dirt	OL/ROW, UF, PSS	N/A	3,867	2.63

Table 2.2-4
Access Roads Associated with Pipeline Facilities in New Hampshire

Facility Name	County	Access Road ID[1,2]	Segment	Nearest Milepost[3]	Modification Required	Road Type[4]	Existing Land Use[5]	Justification[6]	Length (ft)	Area Affected During Construction (acres)
Wright to Dracut Pipeline Segment	Hillsborough	NED-PAR-J-3800	J	39.76	Yes	Dirt	OL/ROW, UF, PSS	Access to MLV-J-05 (New Mainline Valve)	992	0.68
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-3900	J	40.32	Yes	Dirt	OL/ROW	N/A	559	0.37
Wright to Dracut Pipeline Segment	Hillsborough	NED-TAR-J-4000	J	40.73	Yes	Dirt/Gravel	OL/ROW, UF, PSS, PEM, WETLAND	N/A	4,768	3.29
Haverhill Lateral	Rockingham	NED-TAR-P-0700	P	8.88	No	Paved	CI, RD, UF	N/A	1,178	0.54
								Total	**182,506**	**116.18**

Table 2.2-5
Contractor Yards for the Project in New Hampshire

County	Township/Town	Yard Name[1,2]	Existing Land Use[3]	Distance from Project (miles) and Direction	Area Affected During Construction (acres)[4]
Cheshire	Winchester	NED-I-0101	OL/ROW, RD	0.06 miles S of MP 1.68 (Segment I)	6.95
Cheshire	Winchester	NED-I-0103	AG, UF, OL/ROW	0.03 miles N of MP 1.79 (Segment I)	4.01
Cheshire	Winchester	NED-I-0100	CI, OL/ROW, PSS1E	1.25 miles W of MP 3.51 (Segment I)	7.82
Cheshire	Swanzey	NED-I-0104	CI, UF, OL/ROW, RD, PUBHh	4.67 miles N of MP 6.45 (Segment I)	68.19
Cheshire	Swanzey	NED-I-0105	CI, UF, OL/ROW, RE, RD	4.69 miles N of MP 6.46 (Segment I)	6.04
Cheshire	Richmond	NED-I-0107	UF, OL/ROW, RE	0.47 miles S of MP 9.10 (Segment I)	7.77
Cheshire	Keene	NED-I-0106	AG, RD, PSS1Ed	9.10 miles N of MP 9.86 (Segment I)	6.64
Cheshire	Troy	NED-I-0200	OL/ROW, RD	2.98 miles NW of MP 14.84 (Segment I)	8.26
Cheshire	Jaffrey	NED-I-0201	AG, UF, PEM1Ad, PSS1Ed	2.93 miles NE of MP 15.92 (Segment I)	14.68
Cheshire	Jaffrey	NED-I-0102	AG, OL/ROW, RD, PFO, CI, UF	0.05 mile S of MP 27.82 (Segment I)	8.00
Cheshire	Winchester	NED-I-0202	CI, UF	3.90 miles NW of MP 27.82 (Segment I)	14.66
Cheshire	Jaffrey	NED-I-0203	CI, UF	3.92 miles NW of MP 28.16 (Segment I)	16.85
Hillsborough	New Ipswich	NED-J-0004	CI, UF, RD, PFO4/1E, PSS3E	0.58 mile N of MP 1.60 (Segment J)	36.00
Hillsborough	New Ipswich	NED-J-0001	AG	0.41 mile S of MP 3.68 (Segment J)	6.99

Table 2.2-5
Contractor Yards for the Project in New Hampshire

County	Township/Town	Yard Name[1,2]	Existing Land Use[3]	Distance from Project (miles) and Direction	Area Affected During Construction (acres)[4]
Hillsborough	New Ipswich	NED-J-0002	AG, UF	0.07 mile S of MP 3.78 (Segment J)	3.71
Hillsborough	New Ipswich	NED-J-0006	UF, OL/ROW	0.27 mile N of MP 5.35 (Segment J)	0.11
Hillsborough	New Ipswich	NED-J-0003	AG, UF, RD	0.32 mile N of MP 5.83 (Segment J)	5.14
Hillsborough	Greenville	NED-J-0005	CI, UF	1.47 miles S of MP 7.52 (Segment J)	9.61
Hillsborough	Wilton	NED-J-0100	CI, PFO1E	2.38 miles N of MP 8.18 (Segment J)	74.87
Hillsborough	Milford	NED-J-0200	CI, PEM1F, PFO1/SS1E, PUBHh, PUBHx	3.28 miles NW of MP 14.88 (Segment J)	50.26
Hillsborough	Milford	NED-J-0202	CI, UF, RE, WB/OW, PUBHh	0.99 mile N of MP 16.21 (Segment J)	10.03
Hillsborough	Milford	NED-J-0201	CI, UF, OL/ROW	0.80 mile NW of MP 16.24 (Segment J)	20.83
Hillsborough	Amherst	NED-J-0203	UF, OL/ROW, RD, PFO1/SS1E, PFO4/1E	0.17 mile S of MP 19.03 (Segment J)	101.54
Hillsborough	Amherst	NED-J-0300	OL/ROW, PSS1/EM1E	0.34 mile S of MP 19.63 (Segment J)	17.52
Hillsborough	Merrimack	NED-J-0301	UF, OL/ROW, RD	0.06 mile W of MP 24.49 (Segment J)	9.92
Hillsborough	Litchfield	NED-J-0400	AG, UF, RE, RD, PEM1/SS1E, PUBHh	0.22 mile N of MP 26.46 (Segment J)	18.70
Merrimack	Hooksett	NED-J-0401	CI, PUBHx	15.90 miles N of MP 29.79 (Segment J)	131.19
Hillsborough	Hudson	NED-J-0402	CI, RD	1.01 miles SW of MP 31.04 (Segment J)	10.04

Table 2.2-5
Contractor Yards for the Project in New Hampshire

County	Township/Town	Yard Name[1,2]	Existing Land Use[3]	Distance from Project (miles) and Direction	Area Affected During Construction (acres)[4]
Hillsborough	Pelham	NED-J-0500	AG, UF, OL/ROW, RE, RD, WB/OW, PEM1, PSS1	0.04 mile W of MP 37.31 (Segment J)	22.43
Rockingham	Salem	NED-P-0100	AG, CI, UF, RD, PEM1	0.08 mile E of MP 7.56 (Segment P)	10.85
Rockingham	Salem	NED-P-0200	CI, OL/ROW, RD, WB/OW	0.03 mile E of MP 8.22 (Segment P)	5.07
				Total	**714.68**

Source: Landuse was digitized from publically available aerial imagery.

[1] New contractor yards to be used for the NED Project are denoted as "NED-".

[2] The contractor yards listed in this table are more than required for the construction of the Project and a final list will be determined as the sites are further evaluated through field surveys.

[3] RD= Roadways/Railroads; RE= Residential; UF= Forest; CI= Commercial/Industrial; AG= Agricultural; PEM/PFO/PSS= Wetlands; OL/ROW= Open Land; WB/OW= Waterbodies; Other.

[4] Yards will be used during the construction of the proposed pipeline facilities. No operational impacts will occur at these sites.

Contractor yards that are proposed to be used for the Project include those located in previously disturbed areas such as open fields, sand and gravel pits, parking lots and industrial facilities. Although certain wetland impacts for these previously disturbed areas are included in Resource Report 2 of the final ER, Tennessee will select contractor yard sites considering these environmental impacts and obtain the appropriate regulatory permits prior to utilizing these sites.

2.2.5 Additional Temporary Workspace (ATWS)

ATWS areas typically are required at road, railroad, wetland, and waterbody crossing locations (including horizontal directional drilling ["HDDs"]) for areas requiring specialized construction techniques, including steep slopes and agricultural land. The configurations and sizes of ATWS areas will be based on site-specific conditions and vary in accordance with the construction methodology, crossing type, and other construction needs. Tennessee has identified locations and acreages of ATWS that will be required to facilitate construction. ATWS requirements are summarized in Table 2.2-1. ATWS areas are depicted on the Aerial Alignment Sheets that can be found in Attachment M1of this ECP.

Tennessee is requesting modifications from Sections II.A.1, V.B.2 and VI.B.1.a of its Procedures.

2.2.6 Non-Surveyed Areas

Surveys for the Project were initiated in July 2014 and were suspended in November 2014 due to winter weather conditions. Additional field surveys re-commenced in March 2015 and the field season is continuing as additional survey access permissions are granted through December 2015, weather permitting. Field surveys will resume in spring 2016. Field surveys have included, but are not limited to, civil survey, wetland and waterbody delineations, rare species habitat assessment and presence/absence surveys, and cultural resources surveys. Completion of field surveys will be dependent upon the finalization of the Project alignment, as well as the acquisition of survey permission on all affected parcels. This process may extend after the issuance of the certificate order, should the Project be approved by the Commission. Field survey data shown on the aerial alignment sheets included in Volume II, Attachment M1, incorporates survey data obtained through September 29, 2015. Photo-interpreted data from high resolution aerial imagery and publicly available data sources were utilized for areas where field surveys have not yet been completed.

In March 2015, Tennessee flew the Project alignment as it was routed at the time to obtain a 1,600 high-resolution aerial imagery corridor. Tennessee has used this imagery to photo-interpret the boundaries for wetlands and waterbodies, ecological communities, and rare species habitat for areas with no access. Photointerpretation provides a more accurate assessment of impacts as compared to publicly available data; however Tennessee recognizes that all resource boundaries will require field verification for the issuance of environmental permits. Since the March 2015 flight there have been route deviations so certain portions of the current Project alignment do not have high resolution aerial imagery associated with them. Tennessee has utilized publicly available data for these areas, Tennessee anticipates flying these deviations in November 2015, weather permitting.

3.0 SUPERVISION AND INSPECTION

The on-site Environmental Inspection staff will serve a vital role in implementing the ECP and ensuring that it is adhered to throughout the construction process. The inspectors may be required to make

educated decisions regarding critical issues such as choosing the appropriate BMPs for specific stream and wetland crossings, including the location and placement of BMPs and dewatering procedures.

3.1 ENVIRONMENTAL INSPECTOR (EI)

- At least one EI is required for each construction spread during construction and restoration. The number and experience of EIs assigned to each construction spread should be appropriate for the length of the construction spread and the number/significance of resources affected.
- EIs will have peer status with all other activity inspectors. The EI will correct and report compliance problems, have "stop-task" authority and make "stop-work" recommendations to the Lead EI who has overall Project "stop-work" authority for a Project spread. The EI will discuss a potential “stop-work” action with appropriate Project personnel prior to construction shutdown and will notify the Construction Inspector when a stop-work recommendation is issued.
- The EIs will have the authority to stop activities that violate the environmental conditions of the FERC’s Orders, stipulations of other environmental permits or approvals, or landowner easement agreements, and to order appropriate corrective action.

Tennessee’s Environmental Project Manager will be the primary liaison between the Project and agency representatives. The Environmental Project Manager will notify the appropriate agency in accordance with permit requirements or as required by law regarding all Project related activities, (e.g., a spill of hazardous material into a water source, requests for agency guidance, existing requirement variances).

3.2 RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

Tennessee will employ EIs who will be responsible for ensuring that Contractors implement and maintain erosion and sediment control BMPs during construction.

At a minimum, the EI(s) will be responsible for:

- Ensuring compliance with the requirements of the ECP, the environmental conditions of the certificate order, the mitigation measures proposed by the applicant (as approved and/or modified by the certificate order), other applicable environmental permits, and environmental requirements in landowner easement agreements;
- Identifying, documenting, and overseeing corrective actions, as necessary, to bring an activity into compliance;
- Verifying that the limits of authorized construction work areas and locations of ARs are properly marked before clearing and maintained throughout construction;
- Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;
- Identifying erosion/sediment control and soil stabilization needs in all areas;
- Ensuring that the location of dewatering structures and slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;
- Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats. If such deposition is

occurring, the EI will order the dewatering activity to stop and the design of the outlet structure will be modified to prevent reoccurrence;

- Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;
- Advising the Construction Manager when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing, excessive rutting, or in some cases, excessive compaction;
- Ensuring restoration of contours and topsoil;
- Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved in writing by the landowner;
- Determining the need for and ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats, and onto roads) and determining the need for additional erosion control devices;
- Inspecting and ensuring the maintenance of temporary erosion control measures at least:
  - On a daily basis in areas of active construction or equipment operation;
  - A minimum of once a week in areas with no construction or equipment operation;
  - Within 24 hours of each 0.5 inch of rainfall or greater.
- Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this timeframe will result in greater environmental impacts;
- Keeping records of compliance with the environmental conditions of the FERC Orders, and the mitigation measures proposed by Tennessee in the application submitted to the FERC, and other applicable environmental permits during active construction and restoration;
- Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase;
- Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with applicable state and federal permit requirements;
- Monitoring hydrostatic test fill and spill activities and conducting sampling of the test water;
- Working with water and wetland resource agencies to ensure the ECP is properly implemented;
- Reviewing the Contractor's pre-job inventory and location of lubricants, fuels, and other materials which could be accidentally discharged into the environment;
- Consulting with Tennessee to determine reportable spill quantities for materials on the inventory;
- Classifying each material on the pre-job inventory, including those within designated storage areas, as hazardous or non-hazardous;
- Identifying, in conjunction with the Environmental Coordinator, the approved waste transporters and disposal sites for both hazardous and non-hazardous wastes;
- Approving the Contractor's spill containment equipment and spill response procedures and impact minimization measures submitted pursuant to Attachment M3, Spill Prevention and Response Plan;
- Defining the duties and coordinating the responses of all persons involved in cleaning up a spill;
- Maintaining, with support from Tennessee, an up-to-date list of names, addresses, and phone numbers of all persons to be contacted in case of a spill (Attachment M3, Spill Prevention and Response Plan);
- Ensuring the Contractor conducts training for spill prevention and impact minimization as outlined in Attachment M3, Spill Prevention and Response Plan;

- Coordinating with Tennessee's Field Environmental Representative to determine if waste profiles exist for wastes generated during construction pursuant to Attachment M4, Waste Management Plan; and
- Coordinating with the Field Environmental Representative and Contractor to determine the type of waste and the party responsible for proper disposal, pursuant to Attachment M4, Waste Management Plan.

3.3 ENVIRONMENTAL TRAINING FOR CONSTRUCTION

As required, environmental training will be given to all company and Contractor personnel involved during construction of the Project. Construction personnel, including but not limited to, the Chief Inspector, Lead EI, EI, craft inspectors, Contractor job superintendent to loggers, welders, equipment operators, and laborers will be given environmental training. The level of training will vary depending on the type of work being performed by the personnel. Construction personnel are expected to maintain strict compliance with applicable permit conditions and approvals to protect the environment during construction. Training will be given prior to the start of construction and throughout the construction process, as needed, and will cover the following issues:

- The specifics of this ECP and the Spill Prevention and Response Plan;
- Job- or activity-specific permit requirements and conditions;
- Company policies and Project commitments;
- Cultural resource procedures and restrictions;
- Threatened and endangered species restrictions; and
- Any other pertinent information related to the job.

4.0 PRE-CONSTRUCTION PLANNING

This section states the pre-construction planning efforts that will be undertaken as part of the Project. Further details regarding the construction activities are presented in Section 5.0, Construction Activities.

4.1 CONSTRUCTION WORK AREAS

Pipeline construction workspace requirements are a function of pipe diameter; equipment size; topography; geological rock formations; location of construction, such as at road crossings or waterbody crossings; pipeline crossovers; methods of construction, such as boring or open cut construction; and existing soil conditions encountered during construction. The proposed pipeline facilities in New Hampshire include one 30-inch-diameter pipeline (Segments I and J), one 20-inch-diameter pipeline (Segment P), and one 12-inch-diameter pipeline (Segment Q). Proposed construction ROW widths are summarized in Table 2.2-2.

4.1.1 ROW and Staging Areas

Construction activities will be restricted to the ROW limits identified on the alignment sheets and approved by FERC and applicable regulatory agencies. Construction work areas required for safe construction (e.g., construction ROW, extra work space areas, contractor yards, ARs) will be identified

prior to construction. However, in limited, non-wetland areas, the construction ROW width may be expanded by up to 25 feet without approval from the FERC for the following situations (FERC 2013):

- To accommodate full width construction ROW topsoil segregation;
- To ensure safe construction where topographic conditions (e.g., steep side-slopes or soil limitations exist); and
- For truck turn-arounds where no reasonable alternative access exists in limited, non-wetland, or non-forested areas.

Use of these limited areas is subject to landowner approval and compliance with all applicable survey, permitting, mitigation, and reporting requirements. When such additional areas are used, each one will be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material will be included in the reports (FERC 2013):

- The location of each additional area by station number and reference to a previously filed alignment sheet, or updated alignment sheets showing the additional areas;
- Identification of where the Commission's records contain evidence that the additional areas were previously surveyed; and
- A statement that landowner approval has been obtained and is available in the Project files.

Prior written approval of the FERC Director of the Office of Energy Projects ("FERC Director") is required when the certificated construction ROW width is expanded by more than 25 feet (FERC 2013).

See Attachment M2, Detail Nos. 66 through 76 for typical construction ROW widths. Additional construction ROW configurations may be required at specific locations to facilitate construction including, but not limited to, steep side or vertical slopes, road crossings, crossovers, areas requiring full width topsoil segregation, existing utility crossings (e.g., electric transmission lines) and staging areas associated with wetland and waterbody crossings. These locations are shown on the Aerial Alignment Sheets, Attachment M1.

The ROW will be staked or otherwise marked in the field prior to the beginning of construction. Utility lines located within the Project ROW limits will be located and marked to prevent accidental damage during pipeline construction. A typical utility line crossing with cofferdam is outlined in Attachment M2, Detail No. 38.

4.1.2 Off ROW Disturbance

With certain exceptions, construction activities will be restricted to within the limits identified on the construction drawings. The exceptions, which are required to comply with Tennessee's Plan and Procedures, include the installation of slope breakers, installation of energy-dissipating devices, installation of dewatering structures, drain tile repair or, for safety reasons, associated with steep slope construction, all of which are approved by the FERC. The Project has been designed to minimize off ROW disturbance to the extent practicable by proposing construction workspaces (e.g., top soil storage, subsoil storage, equipment travel lanes, etc.) wide enough to adequately and safely construct the Project.

4.1.3 Access Roads

Appropriate BMPs will be utilized and maintained on ARs during construction to limit potential impacts to areas located outside of the ROW. The following practices will be implemented, where practicable, to minimize potential impacts:

- Access to the ROW during construction and restoration activities will be permitted only by the new or existing ARs identified on the construction drawings and approved by applicable regulatory agencies;
- The Contractor will maintain safe conditions at all road crossings and access points during construction and restoration (e.g., implementing a maintenance and protection of traffic plan);
- Temporary and permanent ARs will be maintained as required during construction to fill pot holes, install additional erosion and sediment control measures, and repair soft spots that may develop during heavy construction vehicle use;
- The Contractor will implement appropriate erosion and sedimentation control measures for construction/improvement of ARs;
- The Contractor will ensure that paved road surfaces utilized during construction are kept free of mud, sediment, and debris to the extent practicable;
- Construction entrances, where required by the applicable regulatory agencies, in residential or active agricultural areas will be placed on nonwoven geotextile fabric to facilitate removal after construction;
- ARs across a waterbody will use an equipment bridge (Attachment M2, Detail No. 40), cross culvert, or other approved means (i.e., temporary access ford [Attachment M2, Detail No. 39]) in accordance with Section 6.0;
- Locate ARs, where possible, so that they do not impact wetlands. All ARs that will impact wetlands will require approval from applicable regulatory agencies and will be protected with the appropriate BMPs;
- Where temporary ARs impact wetlands, unless otherwise authorized by applicable permits, equipment mats or an equivalent protective layer will be used; and
- Minimize the limit of disturbance to only that needed to construct a stable AR where permanent ARs impact wetlands. This will be accomplished by steepening tie-in slopes to the extent practicable adjacent to wetlands while still maintaining a stable slope.

4.1.4 Contractor Yards

Tennessee has identified locations proposed to be utilized for contractor yards for the Project. Acreages associated with the contractor yards are included in the overall land requirements for the Project, as detailed in Table 2.2-1. The locations of proposed contractor yards are provided in Table 2.2-5. These areas will be used for equipment, pipe, and material storage, as well as temporary field offices and pipe preparation/field assembly areas. Tennessee will advise all Contractors that they will utilize the contractor yard locations approved for the Project, and will not establish a staging or warehouse yard for this Project without Tennessee first being advised and the FERC granting permission to use the area, as well as obtaining applicable agency approvals.

If agricultural lands are utilized for contractor yards, the Contractor will strip and segregate topsoil prior to beginning construction activities. Areas used as contractor yards will be fully restored using the same scope of agricultural mitigation and restoration measures that apply to the pipeline construction ROW. At

a minimum, the Contractor will perform the following measures at contractor yards associated with agricultural land:

- Strip and segregate topsoil in agricultural lands;
- Install erosion control structures as directed by the EI, outlined in this ECP, or identified on the construction drawings, and maintain them throughout construction and restoration activities;
- Implement and comply with the Spill Prevention and Response Plan;
- Implement the Soil Protection and Subsoil Decompaction Mitigation Plan as required; and
- Restore and revegetate disturbed areas in accordance with the measures outlined in this ECP and as directed by the EI.

Other land uses associated with contractor yards will be restored to pre-construction condition in accordance with this ECP and applicable regulatory guidelines.

4.1.5 Wetland/Waterbody Crossings

The pre-construction activities include survey of topographic surface elevations, as required, as well as field identification/delineation of wetlands and waterbodies within the pipeline ROW. The survey information will be used in conjunction with pre-construction photographs taken at the proposed crossing locations to document the pre-existing conditions of the proposed crossings to ensure that existing topography and stream profiles are re-established to the extent practicable during restoration. Construction plans will be prepared in accordance with Tennessee's Plan and Procedures and other applicable regulatory standards.

Waterbody crossings will be inspected daily during active construction and weekly during inactive construction. Once restored, crossings will be monitored to ensure that the stream banks and stream channel are stable. The monitoring will continue until adjacent areas are successfully revegetated.

4.2 AGRICULTURAL AREA PLANNING

4.2.1 Drain Tile and Irrigation Systems

For agricultural land crossed by the Project, Tennessee will perform the following agricultural area planning measures:

- Attempt to locate existing drain tiles and irrigation systems;
- Contact landowners and regional authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction;
- Develop procedures for constructing through drain tile areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction;
- Identify dewatering outlets and favorable locations for the protected day lighting of gravity flow drain outlets for new interceptors or replaced drain tiles; and
- Ensure the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems in areas where drain tiles exist or are planned.

4.2.2 Grazing Deferment

Tennessee will contact farm operators during the planning phase to develop a plan to delay the pasturing of the ROW, following construction, until pasture areas are adequately revegetated. Tennessee will be responsible for maintaining the temporary fences on the ROW until the EI determines that the vegetation on the ROW is established and able to accommodate grazing. At such time, Tennessee will be responsible for the removal of the fences.

4.2.3 Agency Coordination

Tennessee will coordinate with appropriate agencies as outlined in this ECP. For agricultural lands, Tennessee will obtain recommendations from regional authorities, land management agencies, and/or County Conservation Districts regarding the identification of highly erosive soils, permanent erosion control, and revegetation specifications.

4.3 SPILL PREVENTION AND RESPONSE PLAN

Tennessee has prepared a Spill Prevention and Response Plan to assist in prevention of any spills that may occur during the Project and to respond to any spills that do occur. The Contractor will be required to become familiar with the Spill Prevention and Response Plan and its contents prior to commencing any construction-related activities. The Spill Prevention and Response Plan can be found in Attachment M3 of this ECP.

4.4 WASTE MANAGEMENT PLAN

Tennessee has prepared a Waste Management Plan to outline the methods for disposal of construction debris (e.g., timber, slash, mats, garbage, drilling fluids, excess rock, etc.) prior to beginning construction activities. Off-site disposal in other than commercially operated disposal locations is subject to compliance with applicable surveys, landowner permission, and mitigation requirements. These materials will not be permitted to be disposed of or buried within agricultural lands. The Waste Management Plan can be found in Attachment M4 of this ECP.

4.5 HORIZONTAL DIRECTION DRILLING CONTINGENCY PLAN

Tennessee has developed a HDD Contingency Plan to establish procedures for addressing potential impacts associated with an inadvertent release of drilling fluid through hydraulically induced cracks during the HDD process. The plan identifies operational procedures and responsibilities for the prevention, containment, and clean-up of drilling fluids that have ponded on the ground surface or within a waterbody in relation to an inadvertent release of drilling fluid event during HDD operations. The HDD Contingency Plan can be found in Attachment M5 of this ECP.

4.6 PLAN FOR UNANTICIPATED DISCOVERIES OF CULTURAL AND PALEONTOLOGICAL RESOURCES AND HUMAN REMAINS

In order to minimize the potential for the accidental discovery of cultural resources, Tennessee is conducting detailed archaeological reconnaissance of the proposed Project area. A Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains has been prepared for the Project to ensure that Tennessee maintains compliance with all applicable regulations concerning the

protection of cultural resources. The plan includes procedures and contact information that will be followed in the event cultural resources that have not been previously identified in the construction documents are discovered. Tennessee has coordinated with local federally recognized Native American Tribes to ascertain feedback on this plan. Tennessee has considered the suggestions made by the Tribes and has incorporated the comments in the plan where applicable. The Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains is included as Attachment M6 to this ECP.

4.7 UNANTICIPATED DISCOVERY OF CONTAMINATION PLAN

Tennessee has prepared an Unanticipated Discovery of Contamination Plan to outline practices to employ in the event of an unanticipated discovery of contamination in soil, groundwater, and sediment when excavating during construction and/or maintenance activities, as well as debris or waste materials deposited on the pipeline ROW and other Project areas. The purpose of the Unanticipated Discovery of Contamination Plan is to:

- Protect human health and worker safety;
- Prevent the spread of contamination; and
- Comply with applicable state and/or federal regulations.

The Unanticipated Discovery of Contamination Plan can be found in Attachment M7 of this ECP.

4.8 BLASTING MANAGEMENT PLAN

Tennessee has developed a Blasting Management Plan to outline the procedures and safety measures to which the Contractor will adhere to in the event that basting is required for installation of the Project facilities. This Blasting Management Plan is intended to identify blasting operations, including safety, use, storage, and transportation of explosives, that are consistent with minimum safety requirements, as defined by federal (e.g., Title 27 (Code of Federal Regulations ["CFR"] 181 - Commerce in Explosives; Title 49 CFR 177 - Carriage by Public Highway; Title 29 CFR 1926.900 et seq. Subpart U - Safety and Health Regulations for Construction - Blasting and Use of Explosives; Title 29 CFR 1910.109 - Explosives and Blasting Agents (Occupational Safety and Health Administration [OSHA]); 29 CFR 1926.900-General Provisions and Standard Nos. 901, 902, and 904-912), state, and local regulations. The Blasting Management Plan can be found in Attachment M8 of this ECP.

4.9 INVASIVE SPECIES MANAGEMENT PLAN

Tennessee is in the process of conducting field surveys to identify occurrences of invasive species within the Project ROW and has prepared a state-specific Invasive Species Management Plan ("ISMP") for all construction activities associated with the Project. This ISMP is specific to revegetation of the ROW immediately following construction of the natural gas pipeline and aboveground facilities, as well as long-term post-construction monitoring of the ROW as required by applicable federal and state agencies. The Invasive Species Management Plan can be found in Attachment M9.

4.10 SOIL PROTECTION AND SUBSOIL DECOMPACTION MITIGATION PLAN

Tennessee has developed a Soil Protection and Subsoil Decompaction Mitigation Plan that outlines the special soil protection and subsoil mitigation measures and BMPs to be employed by Tennessee during construction of the Project on agricultural and residential properties. The Soil Protection and Subsoil Decompaction Mitigation Plan can be found in Attachment M10 of this ECP.

4.11 ORGANIC FARM PROTECTION PLAN

Tennessee has developed an Organic Farm Protection Plan (to outlines the special procedures and BMPs to be employed by Tennessee during construction of the Project on identified farms that are organic certified or farms that are in active transition to become organic certified. This plan is intended to address the unique management and certification requirements of these organic farm operations. The Organic Farm Protection Plan can be found in Attachment M11 of this ECP.

4.12 WINTER CONSTRUCTION PLAN

Tennessee has prepared a Winter Construction Plan in anticipation of construction activities occurring during the winter. The plan includes special construction techniques and material handling procedures that will be required to safely construct the Project. The plan can be found in Attachment M12 of this ECP.

4.13 GENERAL TRAIL CROSSING PLAN

Tennessee has prepared a General Trail Crossing Plan ("Crossing Plan") in anticipation of the Project crossing multiple hiking trails in the State of New Hampshire. The Crossing Plan serves to establish protocols to protect recreational users during construction; avoid and minimize impacts to the trails; and to preserve their integrity and the user experience. The plan can be found in Attachment M13 of the ECP.

4.14 STORMWATER POLLUTION PREVENTION

This ECP has been prepared in compliance with the U.S. Environmental Protection Agency's ("USEPA") National Stormwater Program General Permit requirements and National Pollution Discharge Elimination System ("NPDES") requirements for stormwater discharges from construction activities. This ECP will be made available on each construction spread.

5.0 CONSTRUCTION ACTIVITIES

This section presents details regarding specific construction activities. Additional general sequencing of planning, installation, cleanup, and restoration are presented in later sections of this ECP.

5.1 GENERAL PIPELINE CONSTRUCTION SEQUENCE

Installation of the pipeline will typically proceed from one end of the construction spread to the other in an assembly line or "mainline" fashion. The spacing between the individual crews responsible for each

interdependent activity is based on anticipated rate of progress. The activities listed below are normally performed in the following sequence:

- Pre-construction planning;
- Surveying and flagging the ROW;
- Clearing the ROW;
- Installing temporary sediment barriers;
- Grading the ROW;
- Installing temporary interceptor dikes;
- Trenching/excavating the trench;
- Pipe stringing and bending;
- Welding, weld inspection, and coating of field joints;
- Trench dewatering;
- Lowering the pipe into the trench;
- Padding/backfilling the trench;
- Hydrostatic testing of pipe; and
- ROW clean-up and restoration.

5.2 APPROVED AREAS OF DISTURBANCE

Project-related ground disturbance will be limited to the construction ROW, additional workspace areas, contractor yards, borrow and disposal areas, ARs, and other areas approved in the certificate order. Project related ground disturbing activities outside these certificated areas, except those needed to comply with Tennessee's Plan and Procedures (e.g., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs, etc.) will require prior FERC Director approval and applicable agency approval(s). All construction or restoration activities outside of the certificated areas are subject to applicable survey and mitigation requirements.

As previously noted, the standard construction corridor width for the Project will be 100 feet in all upland areas. The construction ROW width may be expanded by up to 25 feet to accommodate full construction ROW topsoil segregation, bedrock spoil storage, and to ensure safe construction where topographic conditions (such as side-slopes) or soil limitations require it. The construction corridor in wetlands and waterbodies will be reduced to 75 feet, as described in Tennessee's Plan and Procedures.

5.3 DISTURBANCE ADJACENT TO IDENTIFIED CULTURAL RESOURCE SITES

Any activity that causes ground disturbance has the potential to disturb cultural sites, and sites are often not readily identifiable by the untrained eye. Tennessee is coordinating with the New Hampshire Division of Historical Resources, Department of Cultural Resources ("NHDHR") to develop avoidance plans for any required cultural sites. Identified cultural resource sites will be cordoned off, where required and in accordance with applicable avoidance plans prior to construction activities beginning, including clearing activities to reduce the possibility of accidental impacts to significant cultural resource sites that are located directly adjacent to the construction corridor.

Temporary barriers, as necessary, will be installed in accordance with applicable avoidance plans. The temporary barriers may include orange safety fences, temporary chain link fencing, temporary concrete barriers, or a combination of all three. Any avoidance measures will be outlined in the avoidance plans, approved by the NHDHR. Tennessee will adhere to the avoidance plans to determine placement and type

of avoidance measures needed. Temporary barriers will be maintained throughout construction and will be removed once construction and restoration of the workspace is complete.

To minimize unauthorized collecting of cultural resource material or vandalism to known cultural resource sites, the Contractor will inform construction crews of the requirements relating to cultural resource protection and all workers will attend mandatory training on the significance of cultural resources and the relevant federal regulations intended to protect them. Construction personnel who operate ground-disturbing equipment will receive special instruction on the types of cultural resources that may be encountered and the procedures to be followed if they encounter buried archaeological deposits or features. Construction workers and other Project personnel present in the workspace will be informed of the EI's authority to halt work if unidentified archeological resources are encountered. Personnel will be informed that they are subject to prosecution for knowingly disturbing historic or prehistoric sites or for collecting artifacts. Any violation may result in removal from the Project and/or may result in civil or criminal penalties in accordance with the Archaeological Resources Protection Act of 1979 (as amended) (U.S. Code [USC] 1979).

5.4 CLEARING

Clearing consists of the removal of vegetation and other obstructions from the ROW. Clearing will be restricted to only that portion of the ROW necessary for actual construction. Trees, brush, and other obstructions will be cleared to permit safe and efficient use of machinery and other construction equipment.

Various clearing methods may be employed, depending on tree size, contours of the land, and the ability of the ground to support clearing equipment. Trees, if suitable, may be taken off-site by the clearing Contractor and used for timber unless alternate arrangements have been made with the landowner, as specified in landowner agreements.

- Timber not designated for other uses will be disposed of by the clearing Contractor, as designated by the EI or in approved areas that were identified prior to clearing.
- Timber will not be stacked in drainage ways or left within wetlands.

Brush, scrub vegetation, and woodchips may be disposed of in one of several ways, depending on applicable restrictions and the terms of applicable permits and/or easement agreements:

Brush

- Brush will not be piled along the edge of the ROW unless requested in writing by the landowner or land managing agency.
- Tennessee does not plan to use brush piles as wildlife habitat unless requested in writing by the landowner, land managing agency or applicable regulatory agency. If required, brush piles will be a maximum of 12 feet wide and compacted to 4 feet high with breaks every 100 to 200 feet. Brush piles will not extend through wetlands or waterbodies.
- All brush will be removed from wetland and waterbody areas.
- Off-ROW stacking must be approved by the landowner and the Commission.
- Brush piles may be chipped and spread across the ROW, in accordance with the restrictions outlined in the woodchips section below.
- Brush piles will not be burned during construction.

Woodchips

- Woodchips may be spread across the ROW within upland areas, with EI approval, in a manner that does not inhibit revegetation. Woodchips left on the ROW will require fertilizer application during restoration.
- Woodchips will not be left in agricultural lands, wetlands, waterbodies, or other sensitive areas or within 50 feet of these areas.
- Woodchips will not be stockpiled in such a manner that they may be transported into a wetland or agricultural land.

Temporary BMPs will be installed as necessary, and in accordance with approved plans, to prevent erosion within the ROW immediately after soil disturbances.

The following are standard procedures that Tennessee will follow during the clearing phase of construction:

- ROW boundaries (e.g., workspace limits) and wetland boundaries will be clearly delineated prior to clearing.
- Trees to be saved will be marked (flagging, construction fencing, etc.) before clearing begins.
- The construction corridor will be cleared and graded to remove brush, trees, roots, and other obstructions such as large rocks and stumps. Non-woody vegetation may be mowed to ground level.
- Existing fences that need to be temporarily removed for access will be maintained by use of a temporary fence section. Prior to being cut, the fence will be properly braced and similar material used to construct the section. At no time will an unattended section be left open. The section will be replaced after removing construction debris with a permanent fence of the same or similar material and condition.
- Pruning may be necessary to clear the ROW. Pruning cuts will be made as follows:
  - Cuts will be cut smooth;
  - Cuts will be made immediately in front of the branch collar;
  - Large, heavy branches will be precut on the underside to prevent splitting or peeling of bark; and
  - Climbing spurs will not be used on trees that are to remain standing.
- Trees will be felled into the ROW to prevent damage to trees adjacent to the ROW.
- Trees that have fallen into waterbodies or beyond the ROW as a result of the clearing activities will be removed immediately.

5.5 RESIDENTIAL AREA CONSTRUCTION

Temporary construction impacts on residential areas could include inconvenience caused by noise and dust generated by construction equipment, personnel, and trenching of roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences; potential damage to existing septic systems or wells; and removal of aboveground structures such as fences, sheds, or trailers from the ROW. Tennessee will make every effort to ensure that construction activities minimize adverse impacts to residential properties and that restoration is prompt and thorough.

Throughout construction, traffic lanes and access to homes will be maintained, except for the brief periods essential for laying the new pipeline. For residences within 50 feet of the ROW, the Contractor will erect temporary safety fences at the edge of the construction ROW for a distance of 100 feet on either side of any residence. Tennessee may use techniques such as stovepipe and drag section construction in order to minimize the impacts of construction in residential areas on a site-specific basis. Residential and commercial structures within 50 feet of construction are shown in Table 5.5-1. Site-specific residential construction plans will be utilized for residences within 50 feet of the edge of the construction ROW.

Affected landowners will be notified at least five days before construction commences, unless more advance notice is required pursuant to a landowner agreement. In addition, Tennessee will work to accommodate any special concerns regarding ornamental shrubs, trees, or structures by developing individual landowner agreements prior to construction.

Landowners whose access to their property will be affected by roadway construction will receive pre-construction notification either in person or via phone communications from Tennessee's land agents. At a minimum, Tennessee will attempt to provide individual notification to immediately affected landowners at least five days before construction commences and will attempt to provide general public notifications as early as possible or as required under permit conditions.

Tennessee will take measures to ensure that construction activities do not prevent access to residential areas by fire and emergency vehicles. At least one lane of traffic will be kept open for emergency vehicles when constructing on or across residential streets. During any period when a road is completely cut or temporarily closed, steel plates will be available on-site to immediately cover the open area to permit travel of emergency vehicles. In residential areas, topsoil replacement (i.e., importation of topsoil) is an acceptable alternative to topsoil segregation. Separation of segregated topsoil and subsoil will be maintained throughout construction where topsoil segregation is conducted. Segregated topsoil will not be used for padding the pipe or filling sandbags. Compaction testing may be performed prior to final restoration, and appropriate soil compaction mitigation will be performed in severely compacted areas. This may include, but is not limited, to disking, rototilling, and harrowing the subsoil prior to topsoil placement.

Tennessee will use a typical pipeline construction sequence in which the pipeline installation crew is followed by a separate backfill crew to ensure that the trench is backfilled within 10 days after pipeline installation in residential areas. Tennessee will require its Contractor, by contractual agreement, to backfill trenches in residential areas as soon as practicable after the installation of the pipeline.

As necessary to minimize impacts, Tennessee will use specialized stove pipe or drag section construction in residential areas. The stove pipe construction method typically is used when the pipeline is to be installed in very close proximity to an existing structure. A description of the stove-pipe and drag-section installation techniques can be found in Sections 5.16 and 5.17 of this ECP.

Residential areas will be restored and construction debris removed as soon as practicable or within 10 days after backfilling the trench. Lawns will be raked, topsoil added as necessary, and lawns restored per agreements with landowners. Ornamental shrubs will be replaced where possible. Contractors will restore fences, mailboxes, and other structures (not in conflict with the installed pipeline) removed during construction. Sidewalks, driveways, and roads will be restored as soon as practicable.

Additionally, Tennessee is planning to test water wells within 200 feet of the construction workspace along the ROW, both before and after construction, for water quantity and quality parameters. In order

for a landowner or resident to immediately qualify for post-construction testing, they must allow Tennessee access to property on which such water wells are located to conduct a pre-construction test. Tennessee will conduct testing of all wells within the proposed area as referenced above, both pre- and post-construction, unless otherwise prohibited by the resident or landowner. Tennessee will similarly, at the request of a landowner, sample developed springs used for drinking water pre- and post-construction within the area referenced above. Water quality parameters for testing of both wells and developed springs used for drinking water will include: yield, pH, petroleum based hydrocarbons, total suspended solids, total dissolved solids, nitrates, nitrites, arsenic, iron, manganese, lead, copper, and total coliform bacteria. After restoration is complete, a Tennessee representative will contact landowners to ensure that conditions of all agreements have been met and that the landowner has been compensated for damage incurred during construction.

Table 5.5-1
Residences and Commercial Buildings Within 50 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Commercial Structure Line List Number or Residential Drawing Number	Building Type	Segment[1]	Milepost	Direction (NSEW)[2] / Distance[3] (feet)		Mitigation[4]
						Edge of Workspace	Pipeline Centerline	
Wright to Dracut Pipeline Segment	Hillsborough	TAR-J-0100	Residence Single Family	J	1.22	SE / 6	NW / 244	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	/NH WD 220.00	Residence Single Family	J	4.44	NW / 45	SE / 1194	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-005	Apartment Building	J	19.53	SW / 12	SW / 32	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-005	Apartment Building	J	19.53	SW / 15	SW / 35	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-005	Apartment Building	J	19.56	SW / 17	SW / 37	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-006	Apartment Building	J	19.62	SW / 6	SW / 21	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-006	Apartment Building	J	19.63	SW / 1	SW / 16	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-006	Apartment Building	J	19.64	SW / 3	SW / 17	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-006	Apartment Building	J	19.65	SW / 3	SW / 18	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	MK-SEG_J-RES-006	Apartment Building	J	19.67	SW / 47	SW / 62	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 356	Commercial Building	J	19.70	SW / 37	SW / 113	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 357	Commercial Building	J	19.79	SW / 32	SW / 107	See Drawings

Table 5.5-1
Residences and Commercial Buildings Within 50 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Commercial Structure Line List Number or Residential Drawing Number	Building Type	Segment[1]	Milepost	Direction (NSEW)[2] / Distance[3] (feet)		Mitigation[4]
						Edge of Workspace	Pipeline Centerline	
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 357.01	Commercial Building	J	19.88	SW / 41	SW / 116	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 220.00	Commercial Building	J	20.49	SW / 48	SW / 123	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 220.00	Commercial Building	J	21.20	SW / 30	SE / 65	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 220.00	Commercial Building	J	21.50	NE / 6	NE / 757	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 220.00	Commercial Building	J	21.50	NW / 17	NE / 641	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 439.01	Commercial Building	J	25.71	W / 0	NW / 124	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	MK-SEG_J-RES-007	Residence Single Family	J	34.45	NW / 35	SW / 104	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	NH WD 220.00	Commercial Building	J	34.45	SW / 13	SW / 918	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	MK-SEG_J-RES-007	Residence Single Family	J	34.46	SE / 8	SW / 682	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	NH WD 220.00	Commercial Building	J	34.47	SE / 19	SW / 1166	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	MK-SEG_J-RES-007	Residence Single Family	J	34.48	SE / 41	SW / 508	See Drawings

Table 5.5-1
Residences and Commercial Buildings Within 50 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Commercial Structure Line List Number or Residential Drawing Number	Building Type	Segment[1]	Milepost	Direction (NSEW)[2] / Distance[3] (feet)		Mitigation[4]
						Edge of Workspace	Pipeline Centerline	
Wright to Dracut Pipeline Segment	Rockingham	NH WD 220.00	Commercial Building	J	34.49	SE / 48	SW / 1404	See Drawings
Wright to Dracut Pipeline Segment	Rockingham	MK-SEG_J-RES-007	Residence Single Family	J	34.49	SE / 4	SW / 351	See Drawings
Wright to Dracut Pipeline Segment	Hillsborough	NH WD 624.00	Commercial Building	J	39.91	SW / 18	SW / 583	See Drawings
Haverhill Lateral	Rockingham	MA HL 79.01	Commercial Building	P	7.40	NW / 11	NW / 36	See Drawings
Haverhill Lateral	Rockingham	NED TAR-P-0700-1	Commercial Building	P	7.40	NE / 48	SE / 530	See Drawings
Haverhill Lateral	Rockingham	NED TAR-P-0700-2	Residence Single Family	P	7.40	NE / 35	SE / 1216	See Drawings
Haverhill Lateral	Rockingham	NED TAR-P-0700-3	Residence Single Family	P	7.40	NE / 37	SE / 1445	See Drawings
Haverhill Lateral	Rockingham	NED TAR-P-0700-4	Residence Single Family	P	7.41	NE / 37	SE / 1304	See Drawings
Haverhill Lateral	Rockingham	NED TAR-P-0700-5	Residence Single Family	P	7.41	NE / 39	SE / 1422	See Drawings
Haverhill Lateral	Rockingham	MA HL 79.00	Commercial Building	P	7.43	W / 0	SE / 33	See Drawings

Table 5.5-1
Residences and Commercial Buildings Within 50 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Commercial Structure Line List Number or Residential Drawing Number	Building Type	Segment[1]	Milepost	Direction (NSEW)[2] / Distance[3] (feet)		Mitigation[4]
						Edge of Workspace	Pipeline Centerline	
Haverhill Lateral	Rockingham	MA HL 81.00	Commercial Building	P	7.48	NE / 2	NW / 19	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.46	SE / 36	SE / 86	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.47	NW / 1	NW / 5	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.50	NW / 41	NW / 91	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.53	SE / 47	SE / 72	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.53	NW / 24	NW / 74	See Drawings

Table 5.5-1
Residences and Commercial Buildings Within 50 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Commercial Structure Line List Number or Residential Drawing Number	Building Type	Segment[1]	Milepost	Direction (NSEW)[2] / Distance[3] (feet)		Mitigation[4]
						Edge of Workspace	Pipeline Centerline	
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.55	SE / 1	SE / 26	See Drawings
Haverhill Lateral	Rockingham	MA HL 85.02	Residence Single Family	P	8.58	NW / 7	NW / 22	See Drawings

Source: Survey data, aerial photography interpretation

[1] Each segment is associated with its own set of mileposts beginning at MP 0.00.

[2] NSEW – "North, South, East, West"

[3] Distances are approximate and derived from aerial photography (where survey is not available). When multiple structures are on a single parcel, the closest structure to the workspace or pipeline centerline is depicted. The associated drawings depict all structures.

[4] Residential Construction Plans are provided in Volume II, Appendix P of the ER.

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Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Cheshire	Winchester	I	4.01		Well	2635	129	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Winchester	I	4.02	4.26	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Winchester	I	4.33		Well	226	191	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Richmond	I	8.78		Well	219	160	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Richmond	I	8.82		Well	129	44	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Richmond	I	8.82		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Richmond	I	9.13		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Richmond	I	9.30		Well	148	88	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	13.84		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	13.85		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.07		Well	166	131	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.48		Well	191	81	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.50		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.50		Well	91	6	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	14.70		Well	185	150	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	16.88		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	17.83		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Fitzwilliam	I	19.52		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	19.83		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	20.40		Well	109	3	Private	Yes	Land Agent Confirmed

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	20.72		Well	231	184	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	20.76		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	21.97		Well	204	134	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	22.37		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	22.59	23.41	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	23.73		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	23.79		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	23.97		Well	1503	151	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.05		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.11		Well	45	20	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.11		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.15		Well	22	0	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.55		Well	85	60	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.61		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	24.61		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	25.13		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	25.71		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	25.72		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	25.73		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	25.93		Well	UNK	UNK	Private	Yes	Land Agent Confirmed

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Cheshire	Rindge	I	27.64	28.88	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	0.92		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	1.10		Well	198	113	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	1.11		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	1.13		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	1.70		Well	150	68	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	2.29		Well	208	98	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	3.25		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.38	4.89	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.45		Well	1275	0	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.59		Well	153	84	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.60		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.60		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.75		Well	197	172	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.79		Well	199	114	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.83		Well	213	153	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.85		Well	316	188	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.88		Well	28	3	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.88		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.90		Well	245	145	Private	Yes	Public Dataset

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	4.94		Well	131	96	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.00		Well	191	91	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.02		Well	278	193	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.07		Well	33	0	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.12		Well	163	24	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.13		Well	58	8	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.20		Well	51	4	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	New Ipswich	J	5.70		Well	38	3	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.06		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.06		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.09		Well	163	28	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.10		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.49		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.51		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Mason	J	10.92		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Brookline	J	13.69	14.65	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Brookline	J	13.88	14.67	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Brookline	J	14.65	14.68	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Brookline	J	15.20		Well	158	98	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.15		Well	UNK	UNK	Private	Yes	Land Agent Confirmed

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.19		Well	UNK	UNK	Private	Yes	Land Agent Confirmed
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.45		Well	124	99	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.47		Well	233	173	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.49		Well	175	115	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.51		Well	94	69	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.59		Well	282	156	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.64		Well	355	128	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.77		Well	131	105	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.79		Well	249	164	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.82		Well	186	161	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.84		Well	264	157	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.86		Well	224	114	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.92		Well	175	150	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	16.96		Well	206	127	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	17.02		Well	156	131	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	17.04		Well	266	169	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Milford	J	17.29		Well	199	149	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Amherst	J	17.92		Well	109	59	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Amherst	J	18.26	19.47	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Amherst	J	19.77		Well	195	120	Private	Yes	Public Dataset

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	Amherst	J	20.05		Water Supply Protection Area	252	177	Public	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Amherst	J	20.31	20.60	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hollis	J	20.60	20.87	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Merrimack	J	20.87	21.19	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Merrimack	J	23.73	25.23	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Merrimack	J	24.66		Well	56	6	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Merrimack	J	26.15		Water Supply Protection Area	150	125	Public	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.71		Well	223	173	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.74		Well	207	157	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.77		Well	190	140	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.79		Well	212	162	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.83		Well	244	194	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.84		Well	231	181	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.94		Well	165	115	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	26.98		Well	106	59	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.00		Well	461	156	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.00		Well	186	161	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.89	28.38	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.97		Well	181	156	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	27.98	28.29	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	28.04		Well	135	110	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	28.06		Well	121	96	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	28.21	28.40	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Litchfield	J	28.26		Well	190	165	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.08		Well	234	174	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.09		Well	213	153	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.39		Water Supply Protection Area	772	64	Public	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.40		Well	765	69	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.82		Well	170	110	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.88		Well	149	89	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.94		Well	166	131	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	29.94		Well	134	99	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	30.09		Well	142	117	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	30.19		Well	149	104	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	30.30		Well	190	155	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	30.53		Well	218	193	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	30.82	31.42	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	31.04		Well	87	52	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	31.16	31.38	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Londonderry	J	31.38	31.79	Water Supply Protection Area	UNK	UNK	Public[5]	Yes	Public Dataset

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	32.00		Well	210	175	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	32.21		Well	223	188	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	32.56		Well	127	92	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	32.56		Well	124	89	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	32.72		Well	96	61	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	33.15		Well	159	99	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Hudson	J	33.58		Well	82	22	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	34.29		Well	168	133	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	34.29		Well	173	138	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	34.83		Well	169	109	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	34.92	35.26	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	35.08		Well	166	131	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Rockingham	Windham	J	35.89		Well	131	71	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.29		Well	245	159	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.29		Well	271	180	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.29		Well	233	143	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.38		Well	31	0	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.54		Well	660	49	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.77	37.67	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	36.90		Well	833	74	Private	Yes	Public Dataset

Table 5.5-2
Public and Private Water Supply Wells and Protection Areas Within 200 Feet of Pipeline Facilities in New Hampshire

Facility Name	County	Township/ Town	Segment[1]	Nearest Milepost[2]		Well/ Spring / Water Supply Protection Area	Distance from Centerline (feet)	Distance from Construction Work Area (feet)	Private / Public	Drinking Water (Yes / No)[3]	Notes[4]
				Begin	End						
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	38.44		Well	2	0	Private	Yes	Field Surveyed
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.04	39.32	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.24		Well	230	198	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.28		Well	120	85	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.33		Well	109	74	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.43		Well	1057	189	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	39.61	40.09	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	40.66		Well	210	164	Private	Yes	Public Dataset
Wright To Dracut Pipeline Segment	Hillsborough	Pelham	J	41.25	41.68	Water Supply Protection Area	UNK	UNK	Private	Yes	Public Dataset
Haverhill Lateral	Rockingham	Salem	P	7.40		Well	2080	48	Private	Yes	Public Dataset
Haverhill Lateral	Rockingham	Salem	P	7.41		Well	340	97	Private	Yes	Public Dataset
Haverhill Lateral	Rockingham	Salem	P	8.57		Well	124	99	Private	Yes	Land Agent Confirmed
Fitchburg Lateral Extension	Hillsborough	Mason	Q	0.61		Well	105	55	Private	Yes	Public Dataset
Fitchburg Lateral Extension	Hillsborough	Mason	Q	1.82		Well	223	157	Private	Yes	Public Dataset

Source: New Hampshire = For Wells: GRANIT; For Water Supply Protection Areas: GRANIT; Public data is supplemented by field surveys and landowner information.

[1] Each segment is associated with its own set of mileposts beginning at MP 0.00.

[2] Nearest MP is the location of the associated pipeline segment nearest to the well/spring. For water supply protection areas, a range of MPs, begin & end will be called out, corresponds to the limits of the protection area.

[3] All wells have been assumed to be for human consumption.

[4] Records noted as "Land Agent Confirmed" indicates that a well is located on the parcel, but the exact location is uncertain. The entire parcel boundary was used for determining distances from the project for "Land Agent Confirmed" wells since the exact location of the well on that property is unknown. UNK = unknown

[5] Indicates land ownership information was used to assess whether the well was public.

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5.6 AGRICULTURAL AREA CONSTRUCTION

Agricultural lands may include land used for crop or hay production. Agricultural land in the Project area is used predominantly for the production of field crops, such as hay and corn, and for livestock grazing.

Tennessee will minimize adverse impacts on agricultural land by implementing the BMPs found in this ECP. The BMPs related to agricultural lands were developed utilizing guidance provided in Tennessee's Plan and Procedures.

Tennessee will work with applicable agencies and landowners in areas of agricultural land to ensure that proper restoration of any impacted land occurs, including replacement of segregated topsoil, stone removal, and compliance with reseeding recommendations.

Within agricultural lands crossed by the Project, Tennessee will negotiate with and reimburse landowners/producers of products for damages or loss to their product as a result of the construction of the proposed Project. Tennessee will continue to identify specialty crop areas, organic farms, and drainage systems through landowner discussions and will work with landowners to avoid these features where possible. Where avoidance is not possible, Tennessee will work with landowners to properly restore affected areas and/or drainage features. Tennessee will monitor restored areas after construction and address problem areas, including drainage problems related to the pipeline construction. Some of the measures that may be employed to mitigate impacts to agricultural resources are:

- Preparing a Grazing Deferment Plan with landowners;
- Installing construction entrances at paved road crossings in agricultural areas with stone placed on top of geotextile fabric. The geotextile fabric facilitates removal of the stone during final restoration;
- Providing open trench fencing and crossings, where requested;
- Repairing subsurface drains;
- Segregating and stockpiling topsoil on cultivated lands;
- Removing stone and rock material so that the density, size, and distribution of the material is consistent with the areas surrounding the ROW;
- Performing subsoil decompaction and subsoil shattering;
- Conducting general monitoring and remediation measures to address topsoil thickness, rock content, trench settling, crop production, drainage, repair of fences, etc.;
- Conducting specific monitoring and restoration measures to include compaction testing and remedial action, where necessary, and control of soil saturations and seeps; and
- Reimbursing the landowner for crop loss (specialty or otherwise) at market price for anticipated short- and long-term impacts.

Tennessee is in the process of identifying specialty crop areas through field surveys and discussions with affected landowners. Specialty crop areas identified in the Project area to date are included in Table 5.6-1.

Table 5.6-1
Specialty Crop Lands Crossed by the Project in New Hampshire

Crop Type	County	Township/ Town	Tract Number	Segment[1]	Milepost		Approx. Acreage Impacted (acres)	
					Enter	Exit	Construction	Operation
Ginseng[2]	Cheshire[2]	Richmond[2]	NH WD 35.00[2]	I[2]	6.84[2]	6.99[2]	0.48[2]	0.07[2]
Organic Farm[2]	Cheshire[2]	Rindge[2]	NH WD 168.00[2]	I[2]	25.11[2]	25.18[2]	1.02[2]	0.41[2]
Peach Orchard	Rockingham	Londonderry	NH WD 481.01	J	29.51	29.53	0.27	0.17
Apple Orchard	Rockingham	Londonderry	NH WD 488.00	J	30.16	30.25	1.17	0.54

Source: Survey data.
[1] Each segment is associated with its own set of MPs beginning at MP 0.00.
[2] Specialty Crop land not crossed by pipeline but is crossed by construction workspace. For this instance, the MP enter/exit is where the workspace impacts the property.

5.6.1 Grading and Ditching/Lowering-in/Backfilling

Prior to initial grading, the EI will verify and record the depth of topsoil to be stripped and segregated. As applicable, full ROW topsoil stripping will be implemented, unless otherwise specified by the applicable regulatory agency, in all actively cultivated agricultural lands, which includes permanent or rotated cropland, hayfields, orchards, and vineyards. The topsoil will be replaced over the subsoil upon completion of backfilling operations and subsoil decompaction operations. The Contractor will be careful to maintain natural flow patterns by providing breaks in soil stockpiles during the excavation process. Trench breaker spacing within agricultural land will be in accordance with Section 5.27.

5.6.2 Topsoil Segregation

In agricultural land crossed by the Project, Tennessee will utilize the full ROW topsoil segregation, as required by landowner agreements, or as required by the NRCS or CCD, or as appropriate based upon site-specific conditions. The depth of topsoil removal will include the "A" horizon down to the beginning of the subsoil "B" horizon, up to 12 inches.

Topsoil material will be stripped, stockpiled, and uniformly returned to restore the original soil profile in accordance with Detail Nos. 54, 55, and 56 (Attachment M2). Where ROW construction requires cut-and-fill of the soil profile across grades, to the extent practicable, topsoil stockpiling will be located on the upslope edge of the ROW. Where topsoil cannot be separately stored on the upslope side, suitable ROW space will be provided on the downslope side to ensure the complete segregation of the topsoil from cut-and-fill material. Where topsoil segregation is conducted, Tennessee will maintain separation of salvaged topsoil and subsoil throughout construction. Segregated topsoil will not be used for padding the pipe or filling sandbags.

5.6.3 Subsoil Protection (Shallow Soils)

In agricultural soils dominated by a shallow depth to bedrock, Tennessee will mitigate the loss, or permanent damage to, the subsoil and corresponding damage to the soil profile by adhering to the measures outlined in the Soil Protection and Subsoil Decompaction Mitigation Plan (Attachment M10).

5.6.4 Drain Tiles

Agricultural drain tiles or irrigation systems identified along the proposed pipeline alignment during environmental field surveys are presented in Table 5.6-2. This table will be updated with drain tile locations identified through landowner consultations and field surveys prior to construction.

Table 5.6-2
Agricultural Drain Tiles Along the Project in New Hampshire

Facility Name	Segment	Approximate Milepost[1]	County	Township/Town	Tennessee Parcel ID
Wright to Dracut Pipeline Segment	J	16.78	Hillsborough	Milford	NH WD 318.01
Wright to Dracut Pipeline Segment	J	17.31	Hillsborough	Milford	NH WD 333.01

Table 5.6-2
Agricultural Drain Tiles Along the Project in New Hampshire

Facility Name	Segment	Approximate Milepost[1]	County	Township/Town	Tennessee Parcel ID
Wright to Dracut Pipeline Segment	J	30.46	Rockingham	Londonderry	NH WD 490.00
Wright to Dracut Pipeline Segment	J	30.75	Rockingham	Londonderry	NH WD 491.00
Wright to Dracut Pipeline Segment	J	31.84	Hillsborough	Hudson	NH WD 500.00
Wright to Dracut Pipeline Segment	J	32.07	Hillsborough	Hudson	NH WD 501.00
Wright to Dracut Pipeline Segment	J	32.34	Hillsborough	Hudson	NH WD 503.00 and 503.01
Wright to Dracut Pipeline Segment	J	32.41	Hillsborough	Hudson	NH WD 504.03
Wright to Dracut Pipeline Segment	J	32.46	Hillsborough	Hudson	NH WD 506.02
Wright to Dracut Pipeline Segment	J	32.47	Hillsborough	Hudson	NH WD 505.00
Wright to Dracut Pipeline Segment	J	32.52	Hillsborough	Hudson	NH WD 506.00
Wright to Dracut Pipeline Segment	J	32.95	Hillsborough	Hudson	NH WD 520.00
Wright to Dracut Pipeline Segment	J	33.85	Hillsborough	Hudson	NH WD 533.00 and 533.01
Wright to Dracut Pipeline Segment	J	36.90	Hillsborough	Pelham	NH WD 588.01
Wright to Dracut Pipeline Segment	J	41.36	Hillsborough	Pelham	NH WD 638.00
Haverhill Lateral	P	7.08	Rockingham	Salem	MA HL 76.02
Haverhill Lateral	P	7.42	Rockingham	Salem	MA HL 79.00
Haverhill Lateral	P	7.70	Rockingham	Salem	MA HL 82.00

Source: Tennessee land agent title review.
[1] MPs represent enter and exit for the entire parcel, exact drain tile locations to be determined through additional landowner consultation.

Drainage tiles encountered will be marked, maintained during construction, and restored to preconstruction condition or better (Attachment M2, Detail Nos. 58 and 59). The Contractor may cut through drainage tiles, except those in locations where such cutting is prohibited. Locations where tile cutting is prohibited will be marked with flagging by Tennessee and will be noted on the Construction Line List. Specific details on drain tile monitoring activities are provided in Section 11.0.

Encountered drain tiles will be referenced and flagged/staked adjacent to the trench and along the ROW edge (outer perimeter). A temporary support will be installed across the trench when required to maintain flow in the drainage system during construction. Smaller feeder drains will be capped so that flows are diverted to the primary drain on which the support system has been installed. Open ends of tile will be covered to prevent ingress of dirt, rock, or wildlife.

Tiles damaged during construction will be flagged and repaired or replaced to their original or better condition. All plastic pipes utilized to repair damaged drain tiles will conform to the American Association of State and Highway Transportation Officials ("AASHTO") M.252 specification. Filter-covered drain tiles will not be used unless the County Conservation District and/or landowner specify. Drain tiles will be permanently repaired before the pipeline trench is backfilled and within 20 days of construction completion, weather and soil conditions permitting. The drain tile marker will not be removed until the tile repairs have been inspected, approved, and accepted by the landowner/tenant.

Tennessee will ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems in areas where drain tiles exist or are planned. Other drainage-related impacts such as water seepage and ROW saturation that are created or exacerbated by the Project will be mitigated during monitoring and follow-up restoration (Section 11.0, Post Construction Activities).

Detailed records of drainage system repairs will be maintained and given upon request to the landowner and the County Conservation District offices for future reference.

5.6.5 Irrigation

Water flow in existing crop irrigation systems will be maintained unless shutoff is coordinated with the affected parties. All damage to active crop irrigation systems resulting from the Project will be repaired/returned to operating condition as soon as practicable.

5.6.6 Construction in Agricultural Areas During Wet Weather

For construction within agricultural areas during wet weather, the on-site EI will have stop-work authority in the event that wet weather conditions place topsoil mixing with subsoils at risk. The EI will be able to stop work, assess the situation, and make decisions regarding when construction will resume and what alternative measures will be implemented to protect agricultural soils. The allowable depth of rutting prior to suspension of construction will vary based upon the depth of topsoil and if topsoil was segregated prior to the agricultural area becoming saturated.

If the topsoil has been segregated prior to the area becoming saturated, construction will proceed as normal through these areas as long as the equipment can safely traverse the saturated area and erosion control measures can be properly maintained.

The maximum depth of rutting through agricultural areas where topsoil has not been segregated prior to becoming saturated will be 4-inches, regardless of the depth of topsoil. Alternative construction procedures that will be utilized in agricultural areas during an unseasonably wet construction season to prevent the risk and/or mixing of topsoil may include the following:

- The first construction procedure that will be attempted will include segregating the saturated topsoil layer and placing a sediment barrier around the pile to prevent it from mixing with the subsoil.
- If the agricultural area is too saturated to strip topsoil and the maximum allowable depth of rutting is reached, equipment mats will be used in the same manner that they are used in wetland areas. The equipment mats will provide a stable working surface for equipment and will prevent mixing of topsoil with subsoil.

5.6.7 Restoration and Revegetation

- Permanent stabilization is defined as a minimum uniform, perennial 80 percent vegetative cover with non-invasive species or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion.
- Final grading will be completed within 20 days after backfilling (10 days in residential areas), weather permitting.
- Construction debris will be removed from the ROW.
- Rutting or compaction will be repaired prior to revegetating disturbed areas.
- The ROW will be graded to pre-construction contours, except where original contours were irregular and more uniform contours may be acceptable or are in accordance with individual landowner agreements.
- The topsoil and subsoil will be tested for compaction in agricultural areas crossed by the Project. Cone penetrometers or other appropriate testing devices will be used. Tests will be conducted at intervals sufficient to determine the need for decompaction. Tests will be done on the same soil type under the same moisture conditions. Tests will be conducted in the following areas:
  - Undisturbed areas to use for comparison;
  - Soil stockpile areas;
  - The trenched zone;
  - The work area; and
  - Any traffic areas related to the Project.
- Agricultural and residential areas will be decompacted in accordance with the Soil Protection and Subsoil Decompaction Mitigation Plan, Attachment M10 of this ECP.
- Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area will be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing. As previously noted, the ROW will be restored, including rock removal, in a manner so that it is as close to preconstruction conditions as practicable.
- The ROW will be limed, fertilized, seeded, and mulched in accordance with guidance provided from applicable agency or landowner consultation.

5.7 EQUIPMENT CROSSINGS

Construction of equipment crossings (Attachment M2, Detail Nos. 28, 30, and 32) will occur during the clearing and grading process. The equipment crossings will include paved roadway crossings, waterbody crossings, and wetland crossings. Some of the protective measures that will be utilized include equipment mats laid adjacent to and across streambeds if banks are high enough, flume pipe(s) covered by clean stone fill, dam and pump crossings, or portable bridges as approved by the EI and applicable regulatory agencies. The size and number of flume pipes will be adequate to handle the maximum anticipated design flow at the time of the crossing or the average daily spring flow, whichever is greater or applicable to the time of year the crossing. Stream channels will not be permanently straightened or realigned to conform with flume pipe dimensions or for any other reasons, unless approved by the applicable agency. Stream and wetland crossings will be constructed perpendicular to the stream banks or wetland edges where practicable. Additional information regarding waterbody and wetland crossings is located in Sections 6.0 and 7.0, respectively.

5.8 CONSTRUCTION ENTRANCES

A construction entrance pad (Attachment M2, Detail No. 23) will be located at all locations where construction traffic enters or exits the ROW onto or from a public roadway or other paved surface. An entrance pad is intended to reduce off-site sedimentation by eliminating the tracking of excess soil onto paved roadways. The entrance pad serves as the designated point at which all construction traffic can access and exit the ROW. The entrance pad is typically constructed of stone or gravel placed on top of a durable geotextile fabric. The fabric facilitates the removal of the stone or gravel to more easily restore the area to its pre-construction condition. Topsoil will be stripped and segregated from the access points and roads in agricultural and residential lands prior to entrance pad installation.

Entrance pads will be installed within 48 hours from the time the grading crew moves to the location where a pad is required. The pads will be installed after the area is cleared, grubbed, and topsoil is stripped and segregated. All required entrance pads along the Project area will be installed as the construction crews progress to locations where pads are needed.

5.9 OPEN CUT ROAD CROSSINGS

Typical open cut road crossing construction workspace configuration is shown in Attachment M2, Detail No. 37. Tennessee will employ measures to ensure construction activities will have access to residential areas by fire and emergency vehicles. Steel plates will be available on-site to immediately cover the open area to permit travel of emergency vehicles. Tennessee will utilize sandbags and flume pipes as necessary to carry existing road ditches over the trench line and under construction entrances. Tennessee will restore the pavement structure in accordance with applicable agency roadway design standards.

5.10 BACKFILLING

Prior to backfilling the trench, a final inspection will be made to ensure all debris has been removed from the trench, all padding material has been installed to required depths, and that the pipe and pipe coating are undamaged. All backfill material and methods will be subject to approval by the assigned inspector.

Subsoil excavated as part of the Project and sediment removed from BMPs will be combined and used to backfill the trench. Typically, excess soil is minimal and may be used to create a crown over the trench to

counteract settling or may be spread evenly across the ROW, which will have a negligible effect of the overall grade. Where rock, gravel, or other materials are encountered of a size and shape that could cause damage to the pipe or pipe coating, either select padding material will be placed around the pipe to a thickness of 6 inches above the pipe, or a rock shield will be applied.

Multiple passes of heavy equipment will be used to compact the fill material. If a crown of soil is added over the pipeline to compensate for future settling of the soil, openings will be left in the crown to allow for lateral surface drainage.

Additional BMPs will be utilized in the event dewatering is required during pipe installation and backfilling activities. See Section 5.26 for a detailed description of trench dewatering activities.

Permanent trench breakers are intended to slow the flow of subsurface water along the trench and prevent the draining of an adjacent waterbody or wetland along the trench line. Tennessee will construct and maintain permanent trench breakers in accordance with Table 9.2-1.

Except as depicted on site-specific plans, the depth of cover for the proposed pipeline facilities, as well as the depth of cover for other, non-typical conditions, such as HDD, will be in accordance with Tennessee's minimum specifications, as set forth in Table 5.10-1. Scour analysis and the potential for external damage may increase these depths. In actively cultivated agricultural lands, Tennessee plans to install the pipeline with 48 inches of cover, except where rock prevents this depth. In these cases, Tennessee's minimum specifications for depth of cover will be used.

Table 5.10-1
Tennessee's Minimum Specifications for Depth of Cover

Location[1]	Normal Soil (inches)	Consolidated Rock (inches)
U.S. Department of Transportation ("USDOT") Pipeline and Hazardous Materials Safety Administration ("PHMSA") Class 1	36	24
USDOT PHMSA Classes 2, 3, and 4	36	24
Land in agriculture	48	24
Drainage ditches of public roads or railroad crossings	36	24
Navigable river, stream, or harbor	60	24
Minor stream crossings[2]	60	24

[1] As defined by USDOT PHMSA at 49 CFR 192.5.
Class 1: offshore areas and areas within 220 yards of a pipeline with ≤10 buildings intended for human occupancy.
Class 2: areas within 220 yards of a pipeline with >10 but <46 buildings intended for human occupancy.
Class 3: areas within 220 yards of a pipeline with >46 buildings intended for human occupancy and areas within 100 yards of either a building or a small, well defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period.
Class 4: areas within 220 yards of a pipeline where buildings with four or more stories are prevalent.

[2] Minor streams are defined by FERC as less than 10 ft wide.

5.11 BLASTING

Blasting may be necessary in areas with shallow bedrock. Before a decision is made to blast, the Contractor will investigate other rock excavation techniques including rock saws, hydraulic hoe-rams hammers, and ripper teeth. If necessary, blasting will be performed by registered blasters and monitored by blasting inspectors. The Contractor will develop site-specific blasting plans and procedures, which will include, but are not limited to: notification requirements, controls to prevent and/or minimize fly-rock, and procedures to minimize environmental impacts. The Project Blasting Management Plan can be found in Attachment M8 to this ECP. Implementation of the Blasting Management Plan during construction will be subject to approval by the applicable regulatory agency and will enhance safety and minimize damage to adjacent areas and structures. The Contractor will utilize blasting standards that will meet or exceed applicable regulatory requirements governing the use of explosives. Refer to Attachment M8, Blasting Management Plan, for a detailed description of the measures that will be employed while blasting. Areas of shallow depth to bedrock that may require blasting are described in the Plan.

5.12 CONVENTIONAL BORING

Conventional boring consists of creating a shaft/tunnel for installation of a pipe or conduit to minimize surface disturbance. This is done by first excavating a bore pit and a receiving pit. The bore pit is excavated to a depth slightly deeper than the depth of the associated trench and is graded such that the bore will follow the proposed angle of the pipe. A boring machine is then lowered to the bottom of the bore pit and uses an auger with a cutting head to tunnel to the receiving pit. The auger rotates through a bore tube, both of which are pushed forward as the hole is cut. The pipeline is then installed through the bored hole and welded to the adjacent pipeline; the bore tube is removed. The typical workspace configurations required for boring operations consists of approximately two, 50-foot by 100-foot staging areas for boring machine setup, cuttings/return settlement and storage pits, pipe storage, entrance and exit pit spoil storage, and construction equipment necessary to support the operation.

Major factors limiting the success of a boring operation include the crossing distance, subsurface soil and geologic conditions, and existing topography. Boring operations usually occur over a crossing distance of 50 to 60 feet and the maximum length a bore can achieve in ideal soil conditions typically does not exceed 400 feet. Subsurface soil and geologic conditions must be conducive to establishing and maintaining a safe bore pit excavation as well as provide stability for the boring equipment to conduct a successful bore. Loosely packed sediment, free of rock material, is preferred when conducting boring operations. The topographic conditions at a site also may limit the use of this method, as preferred locations have level or moderately convex terrain, such that the depth of the bore pit does not present constructability or safety constraints.

5.13 JACKING

Jacking is another type of boring method in which an open-ended casing is forced, or jacked, through the earth below an artery. All materials are then removed from the casing so the proposed pipeline can be installed through the casing and welded to the adjacent pipeline.

5.14 HORIZONTAL DIRECTIONAL DRILLING (HDD)

HDD is a trenchless method (Attachment M2, Detail No. 64) of installing pipelines in areas where traditional open cut excavations are not feasible due to sensitive resource areas or logistical reasons. The greatest advantage of the HDD crossing technique is the elimination of open cut trenching and equipment disturbance within sensitive resource areas. As a result, environmental impacts on sensitive resource areas are minimized. However, a greater amount of equipment staging is required for HDD than for the open cut crossing method, and typical installation of an HDD segment generally occurs at durations two to three times slower than a conventional open cut crossing.

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 entry-side equipment and operations typically will 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 typically will 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 will be required along the working side of the ROW. ATWS in the form of "false" ROW may be required to provide a straight corridor for handling pipe at HDD locations where the ROW changes direction in order to prefabricate the pipeline into one continuous section in preparation for the pull-back. Because this "false" ROW must be relatively straight to accommodate a long section of pipe before it is pulled through the annulus, a significant area of ATWS will be required outside of the standard pipeline construction workspace. Once assembled, the pipeline will be placed on pipe rollers so that it may be conveyed into the drill hole during the pull-back operation.

Risks associated with a HDD crossing technique include:

- Potential inadvertent returns of fluids during drilling operations;
- Potential hole collapse during construction or subsequent settlement of HDD locations following installation;
- Pipeline inaccessibility for visual inspection and repairs; and
- Uneven cathodic protection on the pipeline.

Uneven cathodic protection across a pipeline segment can occur due to the effects of geologic strata changes and difficulty in identifying interference with cathodic protection due to external forces. The depth of the HDD pipe, pipeline anomalies, external pipeline coating, stress corrosion cracking, and external corrosion prevent visual inspections or repairs. Therefore, the pipe utilized for HDD operations is generally thicker-walled pipe and subject to x-ray inspection following assembly, and is treated with fusion-boned epoxy coating and wrapped in rock-shield prior to installation. These measures are expected to minimize the potential for damage or corrosion occurring to the pipeline. The longer the length, the more forces are applied to the pipe and the bigger potential for failures. In addition, in lieu of visual integrity inspections, HDD pipe segments will undergo internal corrosion inspections through use of the internal inspection facilities (e.g., pig facilities) constructed as part of the Project.

The following conditions will apply to HDD:

- Drilling fluid pits will be required to contain drilling fluids during all phases of the installation at the drill entry and exit locations. The pits are required so the fluid can be recycled throughout the drilling process. The fluids and cuttings will be disposed of in an approved manner periodically during, or at the completion of, the crossing installation.
- ATWS, including pipe staging areas and storage areas for drilling mud and borehole cuttings, will be located in upland areas outside of wetlands and riparian zones wherever practicable.
- Sediment barriers will be installed on the down gradient side of upland spoil storage areas.

5.15 DIRECT PIPE®

Direct Pipe® is a trenchless method that combines advantages of the established pipeline installation methods of microtunnelling and HDD. A single continuous working operation allows the trenchless installation of pre-fabricated pipeline and the simultaneous development of the required bore hole. Earth excavation is performed with a microtunnelling machine (equipped with a cutterhead) which is navigable and uses a flushing circuit (pipes) method to transport earthen materials to the surface. Modern and proven controlled pipejacking techniques ensure accurate measurement of the current pipe position along the intended route. The axial force that is necessary for the boring process is transferred along the installed pipeline from the pipe thruster or hydraulic jacking system at entry of the cutterhead.

Direct Pipe® installations may be much shorter and shallower than HDD installations because the excavation is continuously cased, reducing the risk of hole collapse and subsequent settlement. The external fluid pressures of the excavation slurry system and bentonite lubrication system are much lower than a typical HDD, thereby reducing the relative risk of hydraulic fracture and inadvertent returns. The length limitation for the Direct Pipe® technology (for a 30-inch pipe) is approximately 900 feet due to the requirements of the hydraulic motors in the smaller diameter tunneling machines. Soils with abundant, strong, and/or abrasive boulders or other large obstructions present risk to the Direct Pipe® method.

Direct Pipe® can be more sensitive to soil conditions than HDD, as the cutterhead cannot tunnel through rocky substrate. Direct Pipe® also requires construction personnel to periodically enter the pipe to monitor and adjust settings underground. This presents additional safety risks, and requires a specialized team of individuals to always be on-site in the event that an incident occurs. While Direct Pipe® has been used overseas this trenchless installation method is relatively new to the U.S. Also, Direct Pipe® is typically used for much larger applications (42 inches and larger). The equipment associated with this method has undergone recent modification to allow for smaller diameters drills (30 inches or less) but this diameter is not common with use of the majority of Direct Pipe® applications.

Table 5.15-1 summarizes potential trenchless installation locations for the Pipeline.

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TABLE 5.15-1
Horizontal Directional Drill Crossings

Facility Name	County	Township/Town	Segment[1]	Milepost[2]		Comment	Approx. Length (feet)[3,4]
				Begin	End		
Wright to Dracut Pipeline Segment	Hillsborough	Merrimack / Litchfield	J	25.88	26.42	Crossing of Pan Am Railway, Merrimack River	2,900
						Total	**2,900**

[1] Each segment is associated with its own set of MPs beginning at MP 0.00.
[2] Begin/End MPs are at the approximate locations of HDD entry/exit pits.
[3] Lengths represent horizontal distance and are approximate and subject to field verification.
[4] The HDD on the Haverhill Lateral crosses the New Hampshire state boundary, entering into the town of Salem in Rockingham County.

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5.16 STOVE-PIPE

The stove-pipe construction method is typically used in areas where the pipeline is to be installed in very close proximity to an existing structure and an open trench will have an adverse impact, i.e. heavily congested urban areas. The technique involves installing one joint of pipe at a time in which the welding, weld inspection, and coating activities are all performed in the open trench, thereby reducing the width of the construction ROW. At the end of each day, the trench is backfilled and/or covered with steel plates or timber mats, or protected by fencing. The length of excavation performed each day will typically not exceed the amount of pipe installed.

5.17 DRAG-SECTION

The drag-section construction technique is normally preferred over the stove-pipe method. This technique involves the trenching, installation, and backfilling of a prefabricated length of pipe containing several segments, all done in one day. As in the stove-pipe method, the trench is backfilled and/or covered with steel plates or timber mats or protected by fencing at the end of each day after the pipe is lowered in, as necessary to ensure safety.

5.18 TOPSOIL SEGREGATION and STORAGE

Topsoil handling objectives are to segregate, store, and redistribute the highest quality soils suitable for re-vegetation and maintenance of surface color. The highest quality soil is defined as surface soil that contains higher amounts of organic matter as well as the natural soil seed bank.

The topsoil stripping width, depth, and storage will vary along the pipeline route depending on site-specific criteria such as: potential safety hazards; construction techniques; land use; soil characteristics; grading requirements; landowner vegetation preference; and methods for crossing wetlands, streams, canals, roads, etc.

In areas where topsoil separation is required, the Contractor will strip and segregate up to 12 inches of the topsoil layer in all areas. It will be the EIs responsibility to determine the depth of topsoil that the Contractor will strip and segregate. The topsoil depth will vary along the Project area and will generally be stripped to a depth where the topsoil color changes to the color of a distinct underlying subsoil horizon.

Topsoil stripping will consist of blade width stripping, trench and spoil side stripping, and full ROW stripping. Trench width stripping may be substituted for blade width stripping where Tennessee and the Contractor agree that there will be no substantial difference between the two similar methods. The Contractor will strip and segregate topsoil from over the trench in wetlands except from the areas where standing water or saturated soils are present.

The Contractor will strip and segregate topsoil from over the trench and from the spoil and subsoil storage areas in residential areas unless otherwise authorized in writing by the landowner. In residential areas, the Contractor may replace topsoil (i.e., import topsoil) if approved by the EI. The EI will oversee and approve all imported material as required and ensure that the Contractor adheres to the restoration and mitigation plans defined for residential construction.

The stripped and segregated topsoil will be piled separately from the trench spoil. Topsoil will not be allowed to mix with subsoil or trench spoil. The Contractor will not use topsoil to pad the pipe, for trench breakers, or for any purpose other than its original use.

Additional segregation measures to protect the topsoil include:

- Gaps will be left in topsoil piles where natural swales, drains, and ditches are present, and where livestock and farm machinery crossings are located.
- Topsoil will be piled in a manner that minimizes increases in water content.
- Topsoil will not be stripped during excessively wet (soil moisture high enough to foul blades, rut deeply or conglomerate mud on tires and tracks) and/or inordinately windy conditions (large plumes of soil particles visibly moving during stripping operations). The presence of such conditions will be decided on jointly between the EI, Tennessee, and the Contractor.
- Topsoil will not be used as padding or backfill in the trench, to fill sacks for trench breakers, or for any other use as construction material.
- Where boring methods are used for road crossings, railroad crossings, and all other areas impractical for trenching (Attachment M2, Detail No. 33), topsoil will be stored on either side of the bore hole, separate from the spoil material.
- Topsoil will be pushed away from streams, trees, and wetlands and stored on the uphill side of the disturbance away from the spoil pile, where practicable.
- Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.
- Topsoil restoration will not be conducted in frozen or wet conditions that do not allow for the even spreading of topsoil across the ROW.

The spoil may be stored on either side of the working area where grade cuts result in additional spoil. In such cases, topsoil will be stripped from the entire workspace prior to grading so that subsoil is not stored on top of topsoil.

Refer to Section 5.6.2 for more detail related to topsoil segregation in agricultural areas.

5.19 STEEP SLOPE/RUGGED TERRAIN

Portions of the Project will traverse areas containing steep side slopes and steep terrain, which will require additional erosion control measures (BMPs) and construction techniques. The Contractor must ensure that the proposed construction activities are reasonable and appropriately timed to prepare, excavate, install the pipeline, backfill, and adequately stabilize the workspace in areas of steep slopes. Limiting the amount of time that an area of steep slope is exposed and destabilized is key to avoiding issues related to erosion and sedimentation. EIs will coordinate with the Contractor and Tennessee staff to ensure that the measures detailed within this ECP are implemented and adhered to throughout the construction process. Coordination will include weekly pre-construction meetings focused on areas forecasted to be disturbed. These meetings will allow for discussion of what equipment and materials are required to be on-site and available to stabilize critical areas within timeframes specified in the ECP and Stormwater Pollution Control Plan ("SWPPP"). EIs will have the ability to issue stop work orders and require additional erosion control measures over and above what is required within Tennessee's Plan and Procedures or this ECP if conditions warrant (Section 3.0 provides further information regarding Supervision and Inspection).

5.19.1 Construction Technique

The "two-tone" construction technique will be utilized to provide safe working conditions in areas of side-slope. In the two-tone construction technique, the uphill side of the construction ROW is cut during

grading. The material removed from the cut is used to fill the downhill side of the construction ROW to provide a safe, level surface for heavy equipment to operate on. The pipeline trench is excavated along the newly graded ROW. The two-tone construction technique will require ATWS to accommodate the additional volumes of fill material generated to create a level working surface. Areas requiring additional workspace are indicated on the aerial alignment sheets. Following pipeline installation and backfill of the trench, excavated material is placed back in the cut and compacted to restore the approximate original surface contours. Any springs or seeps found in the cut will be conveyed down-slope through a Lateral Intercept Drain (Attachment M2, Detail No. 62) or gravel trench drains installed as part of the cut restoration.

In construction areas where the slope exceeds 30 percent 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 piece of equipment at the top of the slope and using a winch to manipulate the construction equipment up and down the slope.

In areas of rugged topography, ROW restoration will begin within 20 days of final pipeline installation to minimize potential erosion and sedimentation control problems.

5.19.2 Erosion Control Measures (BMPs)

Erosion control measures include:

- Perimeter sediment barriers – silt fence and straw bale barriers. Straw bale barriers must be used in conjunction with other practices that prevent or control erosion;
- Temporary and permanent slope breakers (waterbars);
- Mulching, hydromulching, and hydroseeding; and
- Erosion-control blankets.

Perimeter sediment barriers, such as silt fence and straw bales, will be installed immediately after initial disturbance of the soil. Temporary slope breakers (waterbars) that consist of mounded and compacted soil will be installed across the ROW as clearing progresses to prevent the movement of disturbed soil off the ROW prior to grubbing, grading, and trenching operations. Permanent waterbars will be installed during restoration. Following construction, seed will be applied to steep slopes, and the ROW will be mulched or covered with erosion-control fabric. Sediment barriers will be maintained as required until permanent vegetation is established.

Unless otherwise required for installation of the pipeline or worker safety, trees will be cut flush to or just below existing grade and the associated stumps will be left in place to help stabilize the steep slopes.

Areas where erosion-control fabric is installed are specified in Section 5.25.2. Erosion control fabric will be closely monitored during the previously noted erosion and sedimentation control site inspections to determine if soil is eroding under the erosion control fabric. Inspections of these areas will include, but will not be limited to, observing:

- The density of the vegetation growing along the slope;
- Observing any mounds under the matting where it would ordinarily be expected to be smooth;
- Monitoring for breaches under the fabric; and
- Vegetation growth density.

Any areas found to have erosion underneath erosion control matting will be repaired within 24 hours of being identified, including any adjacent areas that may have been damaged as a result of the erosion. The type and extent of repairs will vary based on the severity of the erosion found.

Minor and moderate erosion may be repaired utilizing the following steps:

- Temporarily remove undamaged erosion control fabric;
- Repair the eroded section of the slope by filling it with suitable fill material;
- Apply surface roughening (Attachment M2, Detail No. 1) to the repaired area to help prevent surface runoff from channelizing;
- Reinstall/repair slope breakers and/or temporary swales as required;
- Hydromulch/seed the repaired area; and
- Reinstall any undamaged erosion control matting in accordance with the manufactures specifications.

In addition to the repair measures noted above, major erosion may require a location-specific design to address the specific issue that caused the problem. Some examples of problems include groundwater seepage and large contributing drainage areas that are uncontrolled prior to the construction workspace. Some examples of the engineered repairs that may be required to prevent future erosion include permanent diversion swales with stabilized outlets, underdrain piping within the slope, and riprap revetment.

Tennessee and its Contractor will utilize a number of BMPs to help prevent rocks from rolling off the ROW during construction. The BMPs may include:

- Utilizing reinforced silt fence. The fence will be able to intercept smaller rocks from exiting the ROW due to its metal reinforcement; and/or
- The equipment operators excavating the trench line will take care when large rocks/boulders are encountered. The operators will make an indentation in the ground to cradle the large rocks and prevent them from rolling off the ROW.

Tennessee will utilize a number of methods to retrieve rocks that have rolled off of the ROW. These methods may include:

- Retrieving rocks by hand if they are small enough;
- Utilizing a winch to pull the rocks back onto the ROW; and
- If necessary, Tennessee will obtain all required approvals and variances should equipment need to be used off-ROW to retrieve rocks.

Permanent trench breakers consisting of approved materials will be installed in the trench over and around the pipe in areas of slopes with high erosion potential. Trench breakers will be used to isolate wet areas and to minimize channeling of groundwater along the trench line.

A summary of included BMPs available for steep slope construction is included in Table 5.19-1. Areas of severe erosion potential for the pipeline and aboveground facilities are listed in Tables 5.19-2 and 5.19-3, respectively. Areas of severe erosion potential based on soil series map units crossed by the project are listed in Table 5.19-4.

Table 5.19-1
Best Management Practices for Steep Slopes

BMP	ECP Location	Key Points
Vegetative Establishment	Section 10.3	Seed slopes steeper than 30 percent immediately after rough grading if final grading will not occur immediately, weather permitting. Disturbed soils will be seeded within 6 working days of final grading, weather and soil conditions permitting.
Mulching	Section 5.25	Mulch on slopes of 8 percent or steeper will be held in place with jute or equivalent netting
Hydroseeding	Section 5.25.1	Shredded paper hydromulch will not be used on slopes steeper than 5 percent. Bonded Fiber Mix ("BFM") is a viable alternative.
Maintenance of Erosion Controls	Section 5.28	Daily inspection of active sites, weekly inspection of non-active sites until final stabilization is achieved.

Table 5.19-2
Areas of Severe Erosion Potential Crossed
by the Project Pipeline Facilities in New Hampshire

Facility Name	County	Segment[1]	Milepost		Crossing Length (miles)[2]
			Begin	End	
Wright to Dracut Pipeline Segment	Cheshire	I	2.41	2.50	0.09
Wright to Dracut Pipeline Segment	Cheshire	I	2.78	3.13	0.35
Wright to Dracut Pipeline Segment	Cheshire	I	3.45	3.55	0.09
Wright to Dracut Pipeline Segment	Cheshire	I	3.73	3.85	0.12
Wright to Dracut Pipeline Segment	Cheshire	I	4.18	4.24	0.06
Wright to Dracut Pipeline Segment	Cheshire	I	4.28	4.32	0.04
Wright to Dracut Pipeline Segment	Cheshire	I	5.18	5.60	0.42
Wright to Dracut Pipeline Segment	Cheshire	I	6.54	6.62	0.08
Wright to Dracut Pipeline Segment	Cheshire	I	7.38	7.42	0.04
Wright to Dracut Pipeline Segment	Cheshire	I	8.22	8.29	0.07
Wright to Dracut Pipeline Segment	Cheshire	I	8.72	8.75	0.04

Table 5.19-2
Areas of Severe Erosion Potential Crossed by the Project Pipeline Facilities in New Hampshire

Facility Name	County	Segment[1]	Milepost		Crossing Length (miles)[2]
			Begin	End	
Wright to Dracut Pipeline Segment	Cheshire	I	9.72	9.90	0.18
Wright to Dracut Pipeline Segment	Cheshire	I	10.68	10.73	0.05
Wright to Dracut Pipeline Segment	Cheshire	I	11.24	11.26	0.01
Wright to Dracut Pipeline Segment	Cheshire	I	12.96	13.05	0.09
Wright to Dracut Pipeline Segment	Cheshire	I	19.43	19.48	0.05
Wright to Dracut Pipeline Segment	Cheshire	I	19.53	19.56	0.03
Wright to Dracut Pipeline Segment	Cheshire	I	24.03	24.09	0.05
Wright to Dracut Pipeline Segment	Cheshire	I	24.26	24.34	0.07
Wright to Dracut Pipeline Segment	Cheshire	I	24.96	25.09	0.12
Wright to Dracut Pipeline Segment	Rockingham	J	35.71	35.73	0.02
Wright to Dracut Pipeline Segment	Rockingham	J	35.76	35.83	0.07
Wright to Dracut Pipeline Segment	Rockingham	J	35.90	35.94	0.04
Wright to Dracut Pipeline Segment	Hillsborough	J	36.19	36.21	0.02
				Total	**2.27**

Source: USDA-NRCS 2014.
[1] Each segment is associated with its own set of MPs beginning at MP 0.00.
[2] Areas of soil that contain severe erosion potential. See Resource Report 7 of the ER for soil series information, including erosion potential and erosion hazard, for the soils disturbed by the Project.

Table 5.19-3
Areas of Severe Erosion Potential at Aboveground Facilities in New Hampshire

Facility Name	County	Segment	Milepost[1]
N/A	N/A	N/A	N/A

Source: USDA-NRCS 2014. - Erosion Potential and Steep Slopes (USDA-NRCS 2015).
[1] N/A - "Not Applicable." Based on current project layout, there are no aboveground or appurtenant facilities in these states which impact areas with sever erosion potential

Table 5.19-4
Severe Erosion Potential Based on Soil Series Map Units
Crossed by the Project in New Hampshire

Soil Series Map Unit	From Milepost	To Milepost	Facility	Pipeline Name	Segment	County	Erosion Potential	Capability Class	Drainage Characteristics	Wind Erodibility Group
Pipeline Facilities										
365E	2.41	2.50	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
365E	2.78	3.06	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	3.06	3.85	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
365E	4.18	4.24	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	4.28	4.32	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
365E	5.18	5.60	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	5.26	5.58	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	6.54	6.62	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	7.37	7.42	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	8.22	8.29	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5

Table 5.19-4
Severe Erosion Potential Based on Soil Series Map Units
Crossed by the Project in New Hampshire

Soil Series Map Unit	From Milepost	To Milepost	Facility	Pipeline Name	Segment	County	Erosion Potential	Capability Class	Drainage Characteristics	Wind Erodibility Group
365E	8.72	8.75	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	9.72	9.91	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	10.68	10.73	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	11.24	11.26	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	12.96	13.05	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
77E	19.43	19.48	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	5
77E	19.53	19.56	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	5
77E	24.03	24.34	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	5
365E	24.96	25.09	Pipeline	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
141E	35.73	35.74	Pipeline	Wright to Dracut Pipeline Segment	J	Rockingham	Severe	7s	Well drained	3
141E	35.78	35.95	Pipeline	Wright to Dracut Pipeline Segment	J	Rockingham	Severe	7s	Well drained	3
141E	36.20	36.44	Pipeline	Wright to Dracut Pipeline Segment	J	Rockingham	Severe	7s	Well drained	3
Access Roads										

Table 5.19-4
Severe Erosion Potential Based on Soil Series Map Units
Crossed by the Project in New Hampshire

Soil Series Map Unit	From Milepost	To Milepost	Facility	Pipeline Name	Segment	County	Erosion Potential	Capability Class	Drainage Characteristics	Wind Erodibility Group
161E	3.31	3.51	NED-TAR-I-0003	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
365E	3.51	3.52	NED-TAR-I-0003	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	4.30	4.34	NED-TAR-I-0200	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
365E	4.59	4.71	NED-TAR-I-0200	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
365E	4.88	4.94	NED-TAR-I-0200	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
365E	5.51	5.53	NED-TAR-I-0200	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
365E	5.84	6.90	NED-TAR-I-0400	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	6.72	6.75	NED-TAR-I-0400	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	8.20	8.23	NED-TAR-I-0500	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
365E	8.73	8.77	NED-TAR-I-0500	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
161E	9.75	9.91	NED-TAR-I-0600	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5

Table 5.19-4
Severe Erosion Potential Based on Soil Series Map Units
Crossed by the Project in New Hampshire

Soil Series Map Unit	From Milepost	To Milepost	Facility	Pipeline Name	Segment	County	Erosion Potential	Capability Class	Drainage Characteristics	Wind Erodibility Group
161E	10.69	10.71	NED-TAR-I-0600	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	10.72	10.74	NED-TAR-I-0600	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
161E	11.23	11.28	NED-TAR-I-0600	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	5
77E	24.04	24.05	NED-TAR-I-1600	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	5
77E	24.27	24.33	NED-TAR-I-1700	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	5
365E	25.00	25.08	NED-TAR-I-1800	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Well drained	8
141E	35.80	35.82	NED-TAR-J-3400	Wright to Dracut Pipeline Segment	J	Rockingham	Severe	7s	Well drained	3
141E	36.20	36.20	NED-TAR-J-3400	Wright to Dracut Pipeline Segment	J	Rockingham	Severe	7s	Well drained	3
Contractor Yards										
161E	6.45	6.45	NED-I-0104	Wright to Dracut Pipeline Segment	I	Cheshire	Severe	7s	Somewhat excessively drained	N/A

Source: Data set utilized for Severe Erosion Potential Based on Soil Series Map Units is, "Natural Resource Conservation Service (NRCS) - Soils (County Based) - Erosion Potential and Steep Slopes.
"N/A - "Not Applicable."

5.20 INTERIM STABILIZATION

5.20.1 General Procedures

Temporary vegetative cover will be applied where exposed soil surfaces will not be final graded within 45 days from initial disturbance. These areas will be graded and seeded using the following:

- Ryegrass (annual or perennial) at 40 pounds per acre ("lbs/acre") (approximately 1.0 lb/100 square foot ["ft^2"]) or use 1 lb/1,000 ft^2) during spring, summer, or early fall; or
- Aroostook (if available) winter rye (cereal rye) at a rate of 112 lbs/acre (2.5 lbs/1,000 ft^2)

Clean straw mulch will be applied at a rate of 2 tons/acre. No soil amendments will be used in wetland areas unless otherwise approved in writing by the appropriate land management or applicable regulatory agency. Only weed-free straw mulch, not hay mulch, will be used where mulch is needed on agricultural land.

Tennessee has prepared a Winter Construction Plan in anticipation of construction continuing through the late autumn and winter season. The Winter Construction Plan outlines methods and measures such as snow management, frozen soil handling, temporary erosion, and sediment control specific to winter construction, trench line backfilling, hydrostatic testing/dewatering measures, winter inspections and monitoring, and measures related to spring thaw that will be employed during the winter season. The Winter Construction Plan is included as Attachment M12 to this ECP.

The following procedures will be implemented along the disturbed ROW in the event that the final phases of construction occur too late in the year for restoration activities to adequately be performed:

- Install permanent slope breakers at specified intervals on all slopes, or as directed by the EI;
- Install temporary sediment barriers adjacent to stream and wetland crossings, as well as other critical areas;
- Seed and mulch the ROW and seed segregated topsoil piles; and
- Remove flumes from waterbody crossings to reestablish natural stream flow.

5.20.2 Soil Binders

There are a number of soil binders, chemical stabilizers, or soil palliatives available from various manufacturers that provide temporary stabilization. Most of these are designed to be sprayed onto the soil surface with little or no preparation. Water-soluble anionic polyacrylamide ("PAM") may be applied to a disturbed area as a temporary soil-binding agent to reduce erosion due to wind and water. This practice is recommended for areas where timely establishment of a vegetative cover is not feasible (e.g., non-germinating season), wherever soils have high clay content, or where the vegetative cover is inadequate to provide protection from erosion.

PAM Specifications

- Anionic PAM mixtures must be environmentally safe and non-toxic to fish and other aquatic species, wildlife, and plants. It also should be non-combustible.
- Cationic PAM may not be used due to its toxicity to aquatic species.

- Anionic PAM mixtures must have <0.05 percent free acrylamide monomer by weight as established by the U.S. Food and Drug Administration ("FDA") and the USEPA.
- Acute toxicity test data should be provided from each manufacturer or supplier.
- The manufacturer should provide a product expiration date for anionic PAM based upon expiration of PAM in the pure form.

Application

- Anionic PAM will be applied in accordance with the recommended methods provided by the manufacturer or supplier for the specific site conditions (e.g., slope and soil type). A record of the application, including the date of application, product type, weather conditions, method of application, and the name of the applicator, will be kept on-site.
- Application rates will not exceed the manufacturer's recommendations. Repeated applications may be made if necessary to ensure adequate coverage.
- The application method used will provide uniform coverage to the target area while avoiding drift to non-target areas, especially paved areas.
- Manufacturer's recommendations for safe storage, mixing, and use of the product will be followed.
- Use of anionic PAM will be in conjunction with the other BMPs specified in this ECP.
- Anionic PAM will not be used in place of a protective liner in a channel or in place of mulch on a seeded area. However, seed may be added to the mixture at the time of application.
- Disposal of excess material will be in accordance with manufacturer's recommendations as well as applicable laws and regulations.
- Anionic PAM will not be applied within the floodway of a receiving stream channel or within 25 feet of other waterbodies.
- Anionic PAM may be used to temporarily stabilize topsoil stockpiles. However, anionic PAM may lose its effectiveness in as little as 2 months. Therefore, it might become necessary to reapply the mixture.
- Anionic PAM is not recommended for application on surfaces of pure sand or gravels with no fines or on snow-covered surfaces.
- A visible tracer or colorant may be added to the mixture to visually track its application.

5.21 TEMPORARY SLOPE BREAKERS (WATERBARS)

Temporary slope breakers (Attachment M2, Detail No. 41) are intended to reduce runoff velocity and divert water off the construction ROW. Temporary slope breakers will be constructed of soil. Silt fence, staked hay, straw bales and sandbags will not be used to construct temporary slope breakers in upland areas, as these barriers are not intended to convey concentrated flow, only minimal sheet flow. Tennessee will install temporary slope breakers on all disturbed areas as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbodies, wetlands, or road crossings or to prevent sediment transport into wetlands or waterbodies. Slope breakers will be installed at the spacing outlined in Table 5.21-1, based on the severity of the slope.

Table 5.21-1
Temporary Slope Breakers
(Waterbars)

Slope (percent)	Spacing (feet)
5-15	300
>15-30	200
>30	100

Source: FERC 2013.

Tennessee will direct the outfall of each temporary slope breaker to a stable, well-vegetated area or construct an energy-dissipating device at the end of the slope breaker off the construction ROW. The outfall will be positioned so that it prevents sediment discharge into wetlands, waterbodies, or other sensitive resources. The temporary slope breakers will be inspected and maintained throughout construction of the Project. Slope breakers will be installed so that construction traffic can pass over them safely without damaging them. Slope breakers will be repaired at the end of the same day they were damaged.

5.22 TEMPORARY SWALES

A temporary swale (Attachment M2 – Detail Nos. 8 and 57) is a structural measure consisting of a drainage way of mostly trapezoidal cross-section with a supporting ridge on the lower side that is constructed across the slope in order to intercept and convey runoff to stable outlets at non-erosive velocities. Diversion channels are used to divert runoff from undisturbed upslope areas and convey it around areas of earth disturbance. Temporary swales may be used where:

- Runoff from higher areas has the potential for damaging properties, causing erosion, or interfering with, or preventing the establishment of, vegetation on lower areas.
- Surface and/or shallow subsurface flow is damaging sloping upland.
- The length of slopes needs to be reduced so that soil loss will be kept to a minimum.
- Diversions are only applicable below stabilized or protected areas.
- Establishment on slopes less than 15 percent has been avoided.
- Construction of diversions will be in compliance with state drainage and water laws.

5.23 GRASSED WATERWAYS

Grassed waterways consist of natural or man-made channels of parabolic or trapezoidal cross-section that is below adjacent ground level and is stabilized by suitable vegetation and an erosion control liner as needed. The flow channel is normally wide and shallow and conveys the runoff down the slope. Its purpose is to transfer runoff without causing damage by erosion. They are used where added vegetative protection and/or a protective liner is needed to control erosion resulting from concentrated runoff.

5.24 SEDIMENT BARRIERS

A sediment barrier is a temporary barrier installed across or at the toe of a slope or upslope of a wetland or waterbody to intercept and retain small amounts of sediment from disturbed or unprotected areas. Sediment barriers may consist of silt fence, straw or hay bales, a berm of approved erosion control materials (Attachment M2, Detail Nos. 16, 17, 18, 19, 43, and 49). Tennessee will utilize sediment barriers in the following situations:

- Locations where sedimentation can pollute or degrade adjacent wetland and/or watercourses;
- At the outlet of a slope breaker when vegetation is not adequate to control erosion;
- Along banks of waterbodies between the graded construction ROW and waterbody after clearing and before grading;
- Downslope of any stockpiled soil in the vicinity of waterbodies and wetlands;
- At the base of slopes adjacent to road and railroad crossings until disturbed vegetation has been re-established;
- At side slope and downslope boundaries of the construction area where run-off is not otherwise directed by a slope breaker (a.k.a. waterbar or diversion terrace);
- Within the construction ROW at boundaries between wetlands and adjacent disturbed upland areas;
- As necessary to prevent siltation of ponds, wetlands, or other waterbodies adjacent to/downslope of the construction ROW; and
- At the edge of the construction ROW as needed to contain spoil and sediment.

Sediment barriers will be inspected as outlined in Section 3.2 of this ECP. Repairs will be made within 24 hours after a problem, if any, is noted – unless more environmental impact would result. Any excess sediment, as defined in the typical construction drawings (Attachment M2) will be removed from the barrier and re-incorporated into the site. Sediment barriers will be maintained throughout construction and remain in place until permanent revegetation has been judged successful by the EI. Successful revegetation will generally include a minimum uniform perennial vegetative cover of 80 percent.

5.24.1 Silt Fence

Silt fences (Attachment M2 – Detail Nos. 11, 12, 13, 14, 47, and 48) may be used to control runoff from small disturbed areas when they are in the form of sheet flow, and the discharge is to a stable area. Only those fabric types specified for such use by the manufacturer will be used. To provide sufficient fabric for proper anchoring of the fence, standard filter fabric width will be a minimum of 30 inches; reinforced/super filter fabric width will be a minimum of 36 inches.

- The maximum slope length above any silt fence barrier will not exceed 25 feet for 2:1 slope steepness.
- Silt fence will be placed at existing level grade. Both ends of the fence will be extended at least 8 feet upslope at a 45 degree angle to the main fence alignment.
- The fence will be adequately anchored to the ground as shown on the BMP figures.
- Sediment will be removed when accumulations reach half the aboveground height of the fence.
- Silt fence will be removed and properly disposed of when the tributary area is permanently stabilized.

Tennessee will not use silt fence in areas of concentrated flows (e.g., channels, swales, erosion gullies, across pipe outfalls, as inlet protection, etc.) or in areas where rock or rocky soils prevent the full and uniform anchoring of the fence. Use in forested areas is not recommended unless tree roots can be severed during excavation of the anchor trench. Silt fence will not be installed on uncompacted fills or in extremely loose soils (e.g., sandy loam), since it may result in undermining of the fence.

5.24.2 Hay/Straw Bale Barriers

Hay/straw bale barriers (Attachment M2, Detail No. 15) may be used to control runoff from small disturbed areas provided that runoff is in the form of sheet flow. Hay/straw bales will be considered a short-term control measure on this Project because they tend to deteriorate within approximately 3 months after installation. Straw or hay bale barriers constitute a sediment control practice, not an erosion control practice and will be used in conjunction with other practices that prevent or control erosion.

- Bales will be installed in an anchoring trench.
- The maximum slope length above any hay/straw bale barrier will not exceed 25 feet for 2:1 slope steepness.
- Hay/straw bale barriers will be placed at existing level grades with ends tightly abutting the adjacent bales. The first stake of each bale will be angled toward the adjacent bale to draw the bales together. Stakes will be driven flush with the top of the bale. Both ends of the barrier will be extended at least 8 feet upslope at a 45 degree angle to the main barrier alignment.
- Compacted backfill around the bales will extend approximately 4 inches above ground level.
- Sediment will be removed when accumulations reach one-half of the aboveground height of the barrier. Damaged or deteriorated bales will be replaced immediately upon inspection.
- Any section of the hay/straw bale barrier which has been undermined or over-topped will be immediately replaced with a rock filter outlet.
- Bales will be removed when the tributary area has been permanently stabilized.

Tennessee will not use hay/straw bale barriers in areas of concentrated flows (e.g., channels, swales, erosion gullies, across pipe outfalls, etc.) as inlet protection, or in areas where they cannot be properly staked (e.g., paved areas) or in areas where rock prevents full and uniform anchoring of the bales.

5.25 MULCHING

Mulch absorbs rainfall impact, increases the rate of infiltration, reduces soil moisture loss due to evaporation, moderates soil temperatures, provides a suitable environment for germination, and protects the seedling from intense sunlight. Seeded areas will be mulched or blanketed to minimize the potential for failure to establish an adequate vegetative cover, except in wetland areas, unless otherwise approved by applicable regulatory agencies. Mulching also may be used as a temporary stabilization measure for some disturbed areas in non-germinating seasons.

- Woodchips may be used on the ROW as temporary mulch in upland areas with EI approval as long as it does not inhibit revegetation or is not placed in an agricultural area. Chips that are left on the ROW will require fertilizer application during the restoration process. Up to 1 ton/acre of woodchips may be added to mulch if areas are top-dressed with 11 lbs/acre of available nitrogen, 50 percent of which will be slow release. Woodchips will not be utilized in wetland areas.

- Weed-free straw and hay mulch will be anchored or tackified immediately after application to prevent being windblown. Liquid mulch tackifiers will not be used within 100 feet of wetlands or waterbodies.
- A tractor-drawn implement may be used to "crimp" the straw or hay into the soil, about 3 inches. This method will be limited to slopes no steeper than 3H:1V. The machinery will be operated along the contour, parallel to the side slope. Note: Crimping of hay or straw by running over it with tracked machinery is not recommended.
- Mulch on slopes of 8 percent or steeper will be held in place with jute or equivalent netting.
- Polymeric and gum tackifiers mixed and applied according to manufacturer's recommendations may be used to tack mulch. Application will be avoided during rain and on windy days. A 24-hour curing period and a soil temperature higher than 45 degrees Fahrenheit ("°F") are typically required to tackify mulch.
- Application of the tackifier will be heaviest at the edges of seeded areas and at crests of ridges and banks to prevent loss by wind. The remainder of the area will have tackifier applied uniformly. Tackifiers may be applied after mulch is spread or sprayed into the mulch as it is being blown onto the soil. Applying straw and tackifier together is generally more effective. Syntheticor chemical tackifiers, will be used as recommended by the manufacturer to anchor mulch, provided sufficient documentation is available to show they are non-toxic to native plant and animal species.
- Liquid mulch tackifiers will not be used within 100 feet of wetlands or waterbodies.
- Lightweight plastic, fiber, or paper nets may be stapled over the mulch according to manufacturer's recommendations.
- Mulching within wetlands will be completed as required by applicable regulatory agencies, using clean straw at the rate of 2 tons/acre. No soil amendments will be used in wetland areas unless approved by the appropriate land management or applicable regulatory agency.

5.25.1 Hydroseeding/Hydromulching

Hydroseeding (or hydraulic mulch seeding, hydro-mulching, hydroseeding) is an acceptable alternative seeding/stabilizing process that utilizes a slurry mix of a combination of seed, mulch, fertilizer, tackifying agents, and/or other additives. There are a number of advantages associated with hydroseeding/hydromulching.

- Stabilization of disturbed areas can be accelerated because hydroseeding can be completed in a short period of time.
- Hydroseeding can be very effective for hillsides and sloping lawns to help with erosion control and quick planting.
- Hydroseeding generally results in high germination rates with initial grass growth in about 1 week. Fiber or wood mulch, which is generally part of the slurry mix, accelerates the growing process by maintaining moisture around the seeds, thereby increasing the rate of germination.
- Hydro-mulching promotes fast seed germination by helping to prevent erosion along a slope, which prevents seed from washing away.

The following guidelines will be followed when hydroseeding:

- Wherever seed and mulch is applied by hydroseeding methods, the seed and mulch will be applied in separate applications with the seed being applied first and the mulch sprayed on top of the seed. This is to ensure that the seed makes contact with the underlying soil. Soil preparation

will be completed prior to adding seed to the hydroseeding equipment. Running seed through the pumping system can result in excessive abrasion of the seed and reduces the percentage of pure live seed ("PLS") in the application. Therefore, all site preparation will be completed prior to the arrival of the hydroseeder.

- Shredded paper hydromulch will not be used on slopes steeper than 5 percent. Wood fiber hydromulch may be applied on steeper slopes provided a tackifier is used. The application rate for any hydromulch will be 2,000 lbs/acre at a minimum.

There also are a number of hydraulic blankets (hydro-mulches) which can be applied to a steep slope to help prevent erosion and promote quick seed germination. The hydro-mulches include Bonded Fiber Mix ("BFM"), Flexible Growth Medium ("FGM"), and Polymer Stabilized Fiber Matrix ("PSFM").

- A BFM can be an effective method of stabilizing steep slopes when used properly. BFMs make use of a cross-linked hydrocolloid tackifier to bond thermally processed wood fibers. Application rates vary according to site conditions.
  - For slopes up to 3H:1V the BFM should be applied at a rate of 3,000 lbs/acre. Steeper slopes may need as much as 4,000 lbs/acre. In any case, the manufacturer's recommendations should be followed.
  - BFMs should only be used when no rain is forecast for at least 48 hours following the application. This is to allow the tackifier sufficient time to cure properly.
  - BFM will not be applied between September 30 and April 1.
- A FGM has the added component of 0.5 inch long, crimped organic or manmade fibers which add a mechanical bond to the chemical bond provided by BFMs. This increases the blanket's resistance to both raindrop impact and erosion due to runoff. Unlike BFMs, a FGM typically does not require a curing time to be effective.
- A PSFM also can be an effective method of stabilizing steep slopes when used properly. PSFMs make use of a linear soil stabilizing tackifier that works directly on soil to maintain soil structure, maintain pore space capacity, and flocculate dislodged sediment that will significantly reduce runoff turbidity.

PSFMs can be used in re-vegetation applications and for site winterization and/or dormant seeding (fall planting for spring germination) applications. Application rates vary according to site conditions and the typical suggested application rates are outlined in Table 5.25-1.

Table 5.25-1
Typical Application Rates for PSFMs

Typical Polymer Stabilized Fiber Matrix Application Rates Maximum Rainfall of ≤ 20"							
Slope	6:1	5:1	4:1	3:1	2:1	1.5:1	1:1
Soil Stabilizer (gallons/acre)	4	5	6	7	8	9	10
Fiber (lb/acre)	1,500	1,500	1,500	1,800	2,000	2,500	3,000

Source: Earthguard 2015.

5.25.2 Erosion Control Blankets

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 re-establishment (Attachment M2, Detail Nos. 6, 7, and 31). Matting or netting will not be used in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Specific manufacturer installation instructions will be followed to ensure proper performance of the product. Erosion control matting may be utilized on the Project as follows:

- During the growing season (April 15 - September 15), matting or netting will be applied to any disturbed soil within 100 feet of lakes, streams and wetlands;
- Be applied to any areas where temporary/permanent vegetation is not germinating to assist in protecting the seed bank; and
- Matting or netting will be anchored with pegs or staples.

There are various types of erosion control blankets for various types of situations. The matting types include short-term mattings with photodegradable netting and straw fiber, extended term mattings with ultra-violet ("UV")-stable netting, bio-degradable netting, and permanent reinforcement mats.

Extended term mattings will be primarily used along steep slopes (up to 1:1), along slope breakers, along stream banks and within erosion control swales. These mattings will remain stable for up to 36 months, which will allow up to three growing seasons for vegetation to establish and permanently stabilize the slope or stream bank.

Erosion control blankets will not be used to prevent slope failures. They will be used to help temporarily stabilize the slope to allow permanent vegetation to establish. Wherever slope stability problems are anticipated or encountered, appropriate measures such as reducing steepness of slope, diverting upslope runoff, reducing soil moisture, loading the toe, or buttressing the slope will be considered. The method utilized to stabilize the slope will be determined by the EI.

5.25.3 Dust Control

Dust control measures are practices that help reduce surface and air movement of dust from disturbed soil surfaces. The Contractor will coordinate with the EI to develop a dust control plan that will be implemented throughout the construction process. There are a number of methods that may be used to control dust including, but not limited to:

- Spraying/Irrigation – The Contractor may spray the ground surface with water until it is moist.
- Vegetative Cover – In areas not expected to handle vehicle traffic, the Contractor may re-establish permanent or temporary vegetative cover as a dust control measure. The vegetative cover will be in accordance with guidance provided in this ECP.
- Mulch – The Contractor may elect to mulch an area to control dust. Mulching will be in accordance with this ECP.
- Wind Breaks – The Contractor may construct wind breaks to reduce wind velocity through the ROW. The wind breaks may be trees or shrubs left in place during site clearing or constructed barriers such as a wind fence, snow fence, tarp curtain, hay bale, crate wall, or sediment wall.
- Tillage – The Contractor may perform deep tillage in large open areas such as agricultural lands to bring soil clods to the surface to rest on top of dust.

- Stone – The Contractor will be required to install stone construction entrances at all paved road crossings to prevent sediment transport onto the pavement surface.
- Spray-on Dust Suppressant Treatments – The Contractor may utilize spray-on dust suppressant treatments to suppress dust. Utilized chemicals will be required to be biodegradable or water-soluble and are not anticipated to have a negative impact on the surrounding environment, including waterbodies and wildlife. Spray-on dust suppressant treatments will not be utilized within organic farm properties.

Other suppressants may be used as long as they have been shown to be environmentally safe and effective for their intended use. The Contractor will coordinate with the EI to determine which dust control method best accommodates their needs based on specific site and weather conditions. Tennessee will consult with applicable regulatory agencies prior to use of chemical dust suppressants.

5.26 TRENCH DEWATERING

Trench dewatering (Attachment M2, Detail No. 51) is the process of removing excess runoff and groundwater that has accumulated and is occupying the trench line to allow for the installation of the pipe and dry backfilling of the trench. The removal of any excess water within the trench line prior to backfilling is critical because it permits inspection of the bottom of the trench line and makes it easier to control the moisture content of the spoil material being placed in the trench. Controlling the moisture content of the backfill will permit heavy equipment to pass over the trench faster than waiting for saturated backfill to stabilize enough for equipment to pass without creating deep ruts over the pipe.

Trench dewatering management will be accomplished using a combination of BMPs that will be tailored to the site-specific conditions for each dewatering operation. The dewatering operation(s) may include some of the following:

- Sump pits (Attachment M2, Detail No. 50) may be utilized in conjunction with an appropriate outlet device to dewater the trench line. The pits may be placed within the trench line or adjacent to it, depending on the workspace configuration and the amount of water that is needed to be removed from the work area. The outlet device (e.g., filter bag) will provide an additional means of filtering the water. Sump pits will not be used alone where highly turbid waters are being pumped, such as typically results from active work areas. Sump pits will be located at a low point in the work area so that the water naturally drains toward the pit. The size and number of the pits required will depend upon the amount of water that must be pumped from the work area and the space available. The Contractor will work with the EI to determine the appropriate sump pit size.
- Sediment filter bags (Attachment M2, Detail No. 5) or other equivalent sediment control structures for pumped water will be used whenever water is pumped from the pipeline trench. Sediment filter bags (use only non-woven geotextile filter bags), when implemented and maintained properly, prevent the discharge of heavily silt-laden water by effectively trapping particles larger than approximately 150 microns. Filter bags will be placed in well-vegetated areas, where possible, which will provide additional water filtration upon discharge. Discharge to agricultural lands will not be conducted in active crop areas unless approved by the landowner. The pumping rate will not exceed the maximum recommended by the manufacturer. The filter bags will be changed when they become half full of sediment. Their sediment contents may be reincorporated on to the site, except in agricultural lands, or transported off-site to an approved waste disposal location. Filter bags will not be placed on slopes greater than 5 percent.

- Dewatering discharge locations will be into suitable areas that are well vegetated or other stable erosion resistant areas. They will be located such that they do not allow the water to return to the active construction workspace. The EI will assist in choosing dewatering locations and has the authority to stop work and relocate the structure if the structure is not placed correctly or is causing sedimentation.
- If the water being discharged from the filter bag appears "milky" or excessively cloudy, then sediment corrals (Attachment M2, Detail Nos. 52 and 63) may be utilized to augment filter bag use. The corral will be located a minimum of 25 feet from any wetland or waterbody unless otherwise approved by the EI and will be closely monitored to ensure proper function to prevent turbid water from entering the wetland or waterbody.
- The Contractor and EI will monitor trenches holding water and begin dewatering activities as needed so that sediment laden water is not discharged directly from the excavated trench to resources.
- Hose intakes will be elevated off of the ditch bottom.

Under no circumstances will trench water or other forms of turbid water be directly discharged onto exposed soil, into any wetland or waterbody, into known cultural resource sites, or into locations of rare/sensitive species.

5.27 TEMPORARY TRENCH BREAKERS

Temporary trench breakers (Attachment M2, Detail No. 42) are intended to slow the flow of subsurface water along the trench. Temporary trench breakers may be constructed of materials such as sand bags, foam, unexcavated portions of the ditch, subsoil earth filled bags or equivalent. Topsoil and concrete will not be used for filling trench breaker bags.

- Temporary trench breakers will be spaced as noted Table 5.27-1. At a minimum, trench breakers will be installed at the same spacing as upslope temporary slope breakers. Any modifications to the spacing noted will be made by an Engineer or similarly qualified professional. Trench breakers will be installed at the same spacing as if permanent slope breakers were required in agricultural fields and residential areas where slope breakers are not typically required.
- Temporary trench breakers will be installed at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid modifying waterbody or wetland hydrology.
- The base level of each breaker is established on the trench floor, prior to pipe-laying, to ensure control against significant water-piping and internal erosion. The bulk remainder of each trench breaker will be installed after the pipe is installed in the trench and prior to backfilling.
- If required, the top of trench breakers placed in agricultural fields will not be closer than 2 feet from the restored surface.

Oversaturation of soils behind trench breakers may be prevented by installing underdrains adjacent to and across the pipeline trench to carry excess water down slope. Underdrain installation on steep slopes will be perpendicular to contours and will include installing lateral intercept pipes across the pipeline trench and a header pipe to convey the water down slope. Installation on steep side slopes will be parallel to contours and will include installing the underdrain in undisturbed soil uphill of the pipeline. All excess water conveyed by the underdrain pipes will be discharged into riprap outlet protection (Attachment M2, Detail No. 46) and then a stable area.

Table 5.27-1
Temporary Trench Breaker Spacing

Slope (percent)	Spacing (feet)
5-15	300
>15-30	200
>30	100

Source: FERC 2013.

5.28 MAINTENANCE OF EROSION CONTROL DEVICES

Although primarily the responsibility of the EI, all inspectors and construction personnel are responsible for regularly inspecting and assessing the condition of the erosion and sediment control devices employed during construction. The EI will inspect all disturbed areas of the construction spread(s) (e.g., construction ROW, pipe storage yards, temporary contractor yards, etc.) that have not been permanently stabilized:

- On a daily basis in areas of active construction or equipment operation;
- A minimum of once a week in areas with no construction or equipment operation; and
- Within 24 hours of each 0.5 inch of rainfall or greater.

Inspections to assess the condition of the erosion and sediment control devices will be performed by Tennessee personnel until the Commission and other applicable regulatory agency determines that the entire ROW is permanently revegetated following completion of construction. All BMPs found to be deficient will be fixed within 24 hours of the inspection, with the exception of temporary slope breakers, which will be checked and repaired at the end of each day where construction traffic has disturbed them.

5.29 HYDROSTATIC TESTING

Hydrostatic testing verifies the structural integrity of the constructed pipeline segments. Integrity is tested by capping pipeline segments with test manifolds and filling the capped segments with water. The water is then pressurized to at or above the MAOP of the pipeline and held for 8 hours (4 hours for pre-tested, pre-fabricated units or short visible sections). Any significant loss of pressure indicates that a leak may have occurred and that the pipeline needs to be repaired and re-tested prior to being put into service.

The source of the water used for testing is typically taken from local streams, rivers, or potable water supply systems. Hydrostatic testing of the pipeline will be performed in multiple sections along the Project area. The sections will be selected based on the length of the section and/or elevation change of the terrain. All hydrostatic testing activities will be performed in compliance with applicable regulatory requirements. Potential sources of hydrostatic pressure test water for the Project are listed in Table 5.29-1.

Table 5.29-1
Potential Sources of Hydrostatic Pressure Test Water for the Project in New Hampshire

Potential Water Source[1]	Segment[2]	Approximate Milepost	Manifold/Discharge Location	Water Quantity (gallons)
Sandy Pond	I	8.10	8.10	368,714
South Ashuelot River	I	13.20	13.20	191,004
Bowken Pond	I	14.50	14.50	444,131
Unnamed Water Source	I	26.40	26.40	744,287
Unnamed Water Source	J	5.20	5.20	2,982,347
Souhegan River[3]	J	7.40	7.40	958,185
Merrimack River[4]	J	26.40	26.40	5,152,530
Chase Brook	J	31.40	31.40	100,000
			Total	**10,941.98**

[1] Fire hydrants may be utilized as a potential water source and are located adjacent to the project pipeline in the following Towns:

- Winchester, Cheshire County, NH
- Fitzwilliam, Cheshire County, NH
- Amherst, Hillsborough County, NH
- Merrimack, Hillsborough County, NH
- Litchfield, Hillsborough County, NH
- Windham, Hillsborough County, NH
- Salem, Rockingham County, NH

[2] Each segment is associated with its own set of MPs beginning at MP 0.00.

[3] Segment Q to be tested using the Souhegan River water source on Segment J - MP. 7.40.

[4] Segments K, L and P will be tested using the Merrimack River water source on Segment J - MP. 26.40.

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

- Withdrawing water from either state-designated Class A waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies for testing procedures will not occur unless written permission is obtained from the applicable regulatory agency.
- Inspection of all welds and hydrostatic testing of the pipeline sections will be performed before HDD installation under waterbodies or wetlands.
- Locating hydrostatic test manifolds outside of wetlands and riparian areas as practicable.
- Withdrawing from and discharging to water sources will comply with appropriate agency requirements.
- Screening the water inlet to avoid intake of fish.
- Maintaining adequate stream flow rates during withdrawal activities to protect aquatic life, provide for all existing waterbody uses, and downstream withdrawals of water by existing users.
- Anchoring the discharge pipe for safety. A hydrostatic dewatering structure is depicted in Attachment M2, Detail Nos. 77 and 78.
- Discharging test water into a suitable receiving body of water (as approved), across a well-vegetated area or filtered through a filter bag or other erosion control barrier.
- Discharging test water against a splash plate or other energy dissipating device approved by the EI to aerate, slow, and disperse the flow.

- Controlling the rate of discharge at a level that appropriately prevents flooding or erosion.

Discharging into state-designated Class A waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies will only occur if written permission from the appropriate federal, state, or local permitting agency is obtained.

6.0 WATERBODY CROSSINGS

The term "waterbody" as used in this ECP includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes. In this ECP, waterbodies are characterized into three main categories depending on the width of the waterbody, and in accordance with Tennessee's Procedures. The categories are as follows:

- A "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing.
- An "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing.
- A "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

Tennessee will utilize dry crossing techniques for the majority of the waterbodies crossed by the Project that have flowing water present at the time of crossing. The pipeline will be buried with a minimum cover of five feet over the pipe, unless it is in consolidated rock where the minimum cover depth may decrease. A summary of the waterbodies crossed by the Project can be found in Table 6.0-1.

Tennessee will work to protect and minimize potential adverse impacts to waterbodies by:

- Accelerating construction activities in waterbodies;
- Limiting clearing of vegetation between ATWS areas and the edge of the waterbody to the certificated construction ROW;
- Limiting the use of equipment operating in the waterbodies to those required to construct the crossing;
- Crossing non-essential construction equipment over an equipment bridge;
- Maintaining downstream flow rates by use of adequately sized pumps or flume pipes to protect aquatic life and prevent interruption of existing downstream uses;
- Crossing waterbodies perpendicular to the waterbody as engineering and routing conditions permit;
- Restoring the stream channel and banks to preconstruction contours;
- Removing all construction equipment and materials from within the waterbody as soon as practicable; and
- Permanently stabilizing stream banks immediately following the pipe installation.

Table 6.0-1
Summary of Waterbodies Crossed by the Project in New Hampshire

Facility Name	Perennial Stream Crossings	Intermittent Stream Crossings	Ephemeral Stream Crossings	Unknown/Other Crossings[1]	Crossing Length (feet)[2]
Wright to Dracut Pipeline Segment	54	86	3	11	3,118
Haverhill Lateral	4	2	0	1	163
Fitchburg Lateral Extension	10	10	0	0	2,048
Aboveground Facilities	0	1	0	0	N/A
Contractor Yards	4	2	0	9	N/A
Access Roads	8	5	0	0	39
				Total	**5,368**

Source: USGS 2015.
[1] Includes the following: Unknown; NF = No Flow; AP = Artificial Path; C = Connector; R = Reservoir; RUB = Riverine Unconsolidated Bottom; L = Lake
[2] N/A = Not Applicable. The Project will not cross waterbodies at aboveground facilities or contractor yards. However, number of stream crossings indicated reflects streams on the entire parcel that will be avoided through final design of the aboveground facility or contractor yard. Access to aboveground facilities that require linear crossings of streams is accounted for in the AR line item and crossing length.

6.1 CONSTRUCTION RESTRICTIONS

Tennessee has identified the in-stream construction restriction windows listed in Table 6.1-1 and will continue to consult with the New Hampshire Fish and Game Department regarding timing for in-stream work.

Where a dry-ditch crossing method is not required, Tennessee, to the extent practicable, will complete all open cut (wet) crossing pipe installation activities, including trenching and backfilling, across "minor" waterbody crossings (less than 10 feet wide) within 24 hours and "intermediate" waterbodies (10 feet to 100 feet wide) within 48 hours, unless blasting or other rock breaking measures are required. A site specific plan will be developed for "major" waterbody crossings (100 feet wide and greater).

Table 6.1-1
Construction Timing Restrictions for Fisheries Crossed by the Project in New Hampshire

State	Water and Classification	In-Stream Work Window[1]	Applicable Regulation
New Hampshire	Coldwater Fisheries	June 1 to September 30	FERC 2013

[1] Timing restrictions specific to each waterbody crossing along the Project segments are identified in Resource Report 2 of the ER.

6.2 WATERBODY SETBACKS FOR CONSTRUCTION ACTIVITIES

Where applicable, waterbody setbacks will be maintained at all times. The setback distances vary based on the type of activity being performed. Activities such as stacking cut lumber, discharging water from trenches, ATWS areas, and fueling equipment all have different setback distance requirements. All waterbody setbacks (e.g., ATWS setbacks, refueling restrictions, etc.) will be clearly marked in the field with signs and/or highly visible flagging prior to pipeline construction and will be maintained until construction-related ground disturbing activities are complete.

Tennessee and its Contractor will structure their operations in accordance with the following setback requirements adjacent to waterbodies:

- Employees handling fuels and other hazardous materials are properly trained;
- Equipment is in good operating order and inspected on a regular basis;
- Fuel trucks transporting fuel to on-site equipment will travel only on approved ARs;
- Equipment will be parked overnight and/or fueled and maintained at least 100 feet from a waterbody boundary. These activities may occur closer only if the EI determines that there is no reasonable alternative, and after Tennessee, and its contractors, have taken appropriate steps to prevent spills (including secondary containment structures) and provide for prompt cleanup in the event of a spill;
- Hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a waterbody boundary, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials only, it does not apply to normal operation or use of equipment in these areas;
- Concrete coating activities are not performed within 100 feet of a waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the EI determines that there is no reasonable alternative, and the Contractor has taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;
- ATWS areas will be located a minimum of 50 feet from the edge of a waterbody except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. A variance will be requested on a site-specific basis for all areas where a 50-foot setback is not maintained;
- Cut lumber will be stacked a minimum of 50 feet from the edge of a waterbody;
- Pumped water from trench dewatering operations will not be directly discharged into a waterbody. Pumped water will be discharged into an appropriately sized filter device (e.g., filter bag, sediment coral) located in a suitable area, as approved by the EI; and
- Any excavated material from the trench line will be placed a minimum of 10 feet from the top of the waterbody bank.

6.3 MAINTENANCE OF EROSION CONTROL DEVICES AT WATERBODY CROSSINGS

Erosion control devices will be installed immediately after initial clearing of the workspace adjacent to waterbodies and will be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or until restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in other sections of this ECP; however, the following specific measures may be implemented at waterbody crossings:

- Sediment barriers will be installed across the entire construction ROW at all waterbody crossings where necessary to prevent the flow of sediments into the waterbody. In the travel lane, these may consist of removable sediment barriers or drivable berms. Removable sediment barriers may be removed during the construction day, but will be re-installed after construction has stopped for the day or when heavy precipitation is imminent;
- Where waterbodies are adjacent to the construction ROW, sediment barriers will be installed along the edge of the construction ROW as necessary to contain spoil and sediment within the construction ROW; and
- Trench breakers will be used at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody, unless otherwise approved by the EI to allow natural flow of water into the waterbody.

As previously noted, erosion control devices, including at or adjacent to waterbodies, will be maintained in proper working condition as required by this ECP and applicable permit conditions. Inspecting and ensuring the maintenance of temporary erosion control measures will be conducted at a minimum:

- On a daily basis in areas of active construction or equipment operation;
- A minimum of once a week in areas with no construction or equipment operation; and
- Within 24 hours of each 0.5 inch of rainfall or greater.

6.4 ADDITIONAL TEMPORARY WORK SPACE AREAS

Except where noted in Tennessee's Procedures and in Table 8.1-4 in Resource Report 8 of the final ER, ATWS areas (such as staging areas and additional spoil storage areas) will be located at least 50 feet away from the edge of a waterbody, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. Tennessee will limit the size of ATWS areas to the minimum needed to construct the waterbody crossing.

6.5 SPOIL PLACEMENT/CONTROL

Spoil from minor and intermediate waterbody crossings, as well as upland spoil from major waterbody crossings, will be placed in the construction ROW at least 10 feet from the water's edge or in ATWS areas. Tennessee will attempt to maintain a minimum of 15 feet of undisturbed vegetation, including spoil pile placement, between the waterbody and the construction workspace where the workspace parallels but does not intersect a waterbody, except where maintaining this offset will result in a greater environmental impact, or is not practicable due to the configuration of the waterbody, or impacts worker safety. Sediment barriers will be used to prevent the flow of spoil or heavily silt-laden water into any waterbody. Spoil will not be stored within waterbodies, unless otherwise approved by applicable regulatory agencies on a site-specific basis.

6.6 BLASTING AND EXPLOSIVES IN WATERBODIES

Blasting may be required to excavate streambeds where bedrock is encountered at shallow depths to allow pipeline installation in accordance with federal depth requirements. The final determination on the need for blasting will be made at the time of construction by the contractor in consultation with Tennessee. In the event blasting is required, the pipeline Contractor will develop a detailed blasting plan for in-water blasting operations. This detailed in-water Blasting Management Plan will comply with applicable

requirements and permit conditions relative to in-water blasting operations. Areas along the proposed Project with shallow depth to bedrock area are summarized in Resource Report 1.

6.7 WATERBODY CROSSING PROCEDURES

Waterbody crossing procedures will be selected based upon the site-specific conditions, as well as consultation with applicable regulatory agencies. Mobilization of construction equipment, trench excavation, and backfilling will be performed in a manner that will minimize the potential for erosion and sedimentation within the waterbody. Erosion control measures will be implemented to confine water quality impacts to within the designated work areas and minimize impacts to downstream resources.

Some of the engineering design guidelines followed in developing site-specific waterbody crossings include:

- Crossings will be constructed as close to perpendicular to the axis of the waterbody channel as engineering and field conditions permit;
- Tennessee will attempt to maintain a minimum of 15 feet of undisturbed vegetation between the waterbody and the construction workspace where the pipeline parallels but does not cross a waterbody, except where maintaining this offset will result in a greater environmental impact;
- Tennessee will attempt to minimize the number of waterbody crossings where waterbodies meander or have multiple channels;
- Tennessee will maintain flow rates downstream of the crossing to protect aquatic life, and prevent the interruption of existing downstream waterbody uses; and
- Waterbody setbacks will be clearly marked in the field with signs and/or highly visible flagging through the course of construction-related activities.

Open cut crossing techniques will be applied at intermittent streams that are dry and expected to remain dry at the time of construction. Dry crossing techniques will be applied at perennial streams and all waterbodies with discernible water flow at the time of construction, except where wet crossing techniques have been approved by the applicable regulatory agencies. Wet crossing techniques will be applied at locations where the other crossing techniques were determined impractical.

6.7.1 Wet Open Cut Crossings

Consistent with the Procedures, Tennessee plans to complete construction activities within 24 hours at minor open cut stream crossings and within 48 hours at intermediate open cut crossings. A site-specific plan will be developed for all major waterbody crossings to outline the timeframe and procedures that will be followed during installation of the crossing.

Clearing

All waterbodies may be crossed once by the clearing crews if the stream is not flowing, prior to installing equipment crossings. These crews may construct temporary crossings with equipment mats or equivalent. Temporary crossings may only be used by the clearing crews. The subsequent crews will be responsible for removing the temporary equipment crossing and constructing the long-term equipment crossing.

Trenching/Lowering-in/Backfilling

Consistent with the Procedures, Tennessee plans to complete construction activities within 24 hours at minor conventional trench stream crossings and within 48 hours at intermediate conventional trench crossings, not including the time for blasting preparation and blasting, and other rock breaking measures.

Contractors will use an excavator or dragline to excavate the trench across the waterbody. Equipment used to dig the trench will work from the stream banks, equipment crossings, or by straddling the trench line where the width of the waterbody prohibits excavations solely from the banks. The depth of the trench will be sufficient to allow a minimum of five feet of cover over the pipeline below the streambed, unless in shallow bedrock, or otherwise approved.

Cleanup/Restoration

- Waterbody banks will be stabilized and temporary sediment barriers will be installed within 24 hours of completing instream construction activities.
- All waterbody banks will be returned to preconstruction contours or to a stable angle of repose as determined by the EI and approved by applicable regulatory agencies.

6.7.2 Dry Crossing Methods

Dry crossing techniques will allow the waterbody flow to be maintained at all times during construction. Continuous downstream flow will be maintained by utilizing one of the following techniques:

- Fluming the waterbody;
- Damming and pumping the flow from upstream to downstream;
- Installing a cofferdam;
- Conventional boring (Section 5.12);
- HDD under the waterbody (Section 5.14); or
- Direct Pipe® (Section 5.15).

Clearing/Grading

- Clearing crews will construct temporary equipment crossings by using equipment mats or temporary equipment bridges prior to crossing the waterbody.
- Temporary crossings will only be used by clearing crews; subsequent crews will be responsible for constructing the long-term equipment crossing and removing the temporary ones.
- Skidders and other vehicles will not drag trees or brush across waterbodies.

Trenching/Lowering-in/Backfilling

Flumed Crossing

The banks of waterbodies will be left in place as hard plugs until the pipe ready to be installed. The Contractor will install a flume pipe(s) over the trench line after blasting is complete but prior to trenching and will maintain the flume pipes until restoration is complete. The size and number of flume pipes will be determined prior to installation based on engineering calculations and will be adequate to handle the maximum anticipated flow during the time of the crossing.

Excavation equipment will work around the flume pipe while excavating the trench line. The pipeline will be threaded under the flume pipe, and the trench will be backfilled while waterbody flows are maintained through the flume pipe(s). The waterbody flow may be temporarily pumped around the crossing so the flume pipe can be removed to lower in the pipe, or the flume pipe will be completely removed in low flow conditions with no other provisions required if the topographic conditions will not permit the pipe to be threaded under the pipe. Flume pipes will be permanently removed as part of restoration.

Dam and Pump

Another method for completing a dry crossing of a waterbody is to install temporary dams at the upstream and downstream limits of the workspace and use one or more pumps to convey the water flow around the workspace. Pumping will maintain waterbody flows during in-stream activities (except blasting). The pipeline will be lowered in while the waterbody flow is pumped around the site. The stream banks will be left in place as hard plugs until the pipe is ready to be lowered.

Personnel will be present to monitor the pump(s) while in operation. If a natural sump is not available for the intake hose, an in-stream sump will be created using double bagged sandbags or sump pits as directed by the EI. All pump intake hoses will be screened and pump discharges directed through energy dissipaters (Attachment M2, Detail Nos. 53 and 60) and applicable outlet BMPs (e.g., filter bag). A spare pump(s) will be available at the site for immediate use if required by the EI to pump larger quantities of water or if the in-use pump mechanically fails. Pumps will be placed within secondary containment (e.g., concrete mixing tubs, or other containment unit) to contain any potential oil or fuel spills while the pump is in operation.

If the time between any phases of the work become more complicated than anticipated or if it is determined that the pumps cannot handle the flow within the waterbodies, the pumps will be discontinued and flumes will be installed to maintain the flow.

Cofferdam

A cofferdam is a temporary barrier that is installed around or across the workspace in waterbodies to isolate it during construction and allow for dry working conditions. Cofferdams will be used for waterbody crossings with high flow volumes that precludes the use of a flume crossing (Attachment M2 - Detail Nos. 34 and 35) or dam and pump (Attachment M2, Detail No. 29). This method will consist of installing the pipeline across the waterbody in multiple stages, typically two, using a cofferdam to divert the waterbody around the workspace in each stage. The first stage will involve installation of two-thirds of the crossing, and the second stage will consist of completing the remaining one-third of the crossing. Typical cofferdam materials include, but are not limited to, sandbags, sheet piling, timber lagging, and inflatable dams.

The typical installation procedure will consist of the following:

1. Installing turbidity curtains around the work area;
2. Installing the cofferdam;
3. Dewatering the work area and maintaining it in a dewatered state;
4. Excavating the trench;
5. Installing the pipeline and an anti-seep collar, or equivalent, near the end of the pipe installed to help prevent water from traveling along the trench and flooding the work area during stage 2;

6. Backfilling the trench and restoring the waterbody bed and banks;
7. Removing all equipment from the work area;
8. Filling the area with water from outside the cofferdam;
9. Removing the cofferdam and turbidity curtain; and
10. Follow procedures 1 through 9 to construct the remaining third of the crossing, stage 2. Stage 2 may require installation of multiple sump pits to keep the trench line dewatered while the pipe sections are welded together.

All cofferdam crossings will be designed in accordance with applicable federal and state guidelines to ensure that the cofferdam can withstand maximum anticipated waterbody flows during the time of the crossing. All dewatering operations will require silt laden water to be discharged to an appropriate dewatering device (e.g., silt bags) prior to discharge back to the waterbody.

All cofferdams that require driving materials into the waterbody bottom for support (e.g., sheet piling) will require modifications when constructing stage 2 of the cofferdam over the pipe that was installed during stage 1. Driving of the cofferdam will not be permitted within 5 feet of either side of the pipe installed during stage 1. The modification may include, but is not limited to, driving steel h-piles on either side of the pipe and constructing a barrier between them to prevent water from entering the work area. The barrier will not be allowed to be driven into the waterbody bed over the pipe. Any gaps that remain between the bottom of the barrier and the waterbody bottom will be sealed with sand bags or an equivalent material. As noted above, an anti-seep collar or equivalent will be installed during stage 1 to help prevent flooding the work area.

Open Cut

The open cut method will be utilized for all waterbodies that are dry or frozen during the time of the crossing with no discernible or anticipated flow. This method will utilize conventional construction techniques with no temporary diversion structures (e.g., flume pipes, cofferdams) required during construction of the crossing. Consistent with Tennessee's Procedures, Tennessee plans to complete construction activities within 24 hours at minor open cut stream crossings and within 48 hours at intermediate open cut crossings. A minimum cover depth of five feet will be maintained over the pipeline for all designated waterbodies crossed with the open cut method, unless in shallow bedrock, or otherwise approved.

Temporary diversion structures will be required to be available on-site in the event that an unexpected precipitation event occurs and the waterbody crossing is not complete.

Horizontal Directional Drilling

A site-specific plan will be developed for waterbodies that will be crossed using the HDD method. The site-specific plan(s) will include:

- Site-specific construction details that show the location of mud pits, pipe assembly areas, and all associated workspace areas to be disturbed or cleared for construction;
- A description of how an inadvertent release of drilling mud will be contained and cleaned up; and
- A contingency plan for each crossing will be prepared in the event the directional drill is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

The HDD Contingency Plan for inadvertent release of drilling fluids is included in Attachment M5 of this ECP.

7.0 WETLAND CROSSINGS

The term "wetland" as used in this ECP includes any area that satisfies the requirements of the current federal methodology for identifying and delineating wetlands. Wetland areas will be delineated prior to construction and are identified on the Aerial Alignment Sheets, Attachment M1. The requirements outlined below do not apply to wetlands in actively cultivated or rotated cropland. Standard agricultural upland protective measures, (e.g., workspace, topsoiling requirements, etc.) will apply to agricultural wetland areas.

Table 7.0-1 summarizes the wetland impacts associated with the Project.

7.1 GENERAL GUIDELINES

Tennessee will develop site-specific wetland crossing plans to be implemented during construction. Tennessee will protect and minimize potential adverse impacts to wetlands by:

- Ensuring that applicable construction personnel are educated on wetland construction techniques, where wetlands are located, etc.;
- Maintaining a typical workspace width of 75 feet, where possible, through wetlands. Areas of workspace greater than 75 feet through wetlands require FERC approval on a site-specific basis;
- Accelerating construction activities in and immediately adjacent to wetlands to the extent practicable to limit the activity in the wetland;
- Maintaining a 50-foot setback, where possible, between ATWS areas and the edge of the wetland. ATWS areas closer than 50 feet from wetlands require FERC approval on a site-specific basis;
- Restoring the wetland to preconstruction contours;
- Removing all construction equipment and materials from within the wetland as soon as practicable;
- Permanently stabilizing adjacent upland areas following the pipe installation;
- Inspecting the ROW periodically during and after construction and repairing any erosion control or restoration features until permanent revegetation is successful, which is a minimum of uniform, perennial 80 percent vegetative cover;
- When wetland areas are temporarily disturbed, isolate and stockpile topsoil for replacement after backfilling is completed. If temporary vegetative stabilization is necessary, apply annual ryegrass at the rate not exceeding 40 lbs/acre. Mulch using clean straw (weed free) at the rate of 2 tons/acre. Soil amendments will not be used in wetland areas unless otherwise approved by the appropriate land management or applicable regulatory agency;
- Soil amendments will not be used in wetland areas unless otherwise approved by the appropriate land management or applicable regulatory agency.

Locations that require ATWS within 50 feet of a wetland and areas of greater than 75 feet of workspace within a wetland can be found on the Aerial Alignment Sheets provided in Attachment M1.

7.1.1 Construction in Non-Saturated Wetlands

Non-saturated wetlands are defined as having no standing water or saturated soils at the time of construction (i.e., ground is stable enough for equipment to cross without rutting). Typical saturated wetland installation procedures are outlined in Attachment M2, Detail No. 27. Standard pipeline construction methods will be used in wetlands where soils are dry enough at the time of construction to support equipment. The following construction techniques will apply to non-saturated wetlands:

- Minimize vegetation clearing within the wetland.
- If utilized, equipment mats will be placed over existing vegetation in the travel lane.
- Sediment barriers will be installed where necessary across the entire construction ROW at all wetland crossings to prevent the flow of sediments into the wetland. In the travel lane, these may consist of removable sediment barriers or drivable berms. Removable sediment barriers may be removed during the construction day, but will be re-installed after construction has stopped for the day or when heavy precipitation is imminent.
- Dirt, rock, pulled stumps, or brush rip-rap will not be used to stabilize the travel lane.

Table 7.0-1
Wetland Impact Summary by Wetland Type in New Hampshire

County	Township	Palustrine Emergent (acres affected)		Palustrine Forested (acres affected)		Palustrine Scrub-Shrub (acres affected)		Other Wetland[3] (acres affected)		Township Total (acres affected)	
		Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]
Cheshire	Winchester	0.00	0.00	1.85	0.73	0.47	0.06	0.00	0.00	2.32	0.79
Cheshire	Richmond	0.47	0.00	2.07	0.71	1.10	0.10	0.21	0.00	3.85	0.81
Cheshire	Troy	0.36	0.00	0.47	0.15	1.11	0.02	0.15	0.00	2.09	0.17
Cheshire	Fitzwilliam	0.90	0.00	6.92	2.12	2.52	0.18	5.14	0.00	15.48	2.30
Cheshire	Rindge	4.71	0.00	11.20	3.98	7.46	0.68	2.14	0.00	25.51	4.66
Cheshire	Keene	0.00	0.00	0.00	0.00	2.90	0.00	0.00	0.00	2.90	0.00
Cheshire	Jaffrey	7.72	0.00	0.00	0.00	1.17	0.00	0.00	0.00	8.89	0.00
Hillsborough	New Ipswich	0.64	0.00	2.78	1.12	2.26	0.27	0.89	0.00	6.57	1.39
Hillsborough	Greenville	0.00	0.00	0.00	0.00	0.23	0.04	0.00	0.00	0.23	0.04
Hillsborough	Mason	0.52	0.00	11.64	4.36	1.59	0.11	0.49	0.00	14.24	4.47
Hillsborough	Milford	0.74	0.00	2.48	0.82	1.47	0.18	0.81	0.00	5.50	1.00
Hillsborough	Brookline	0.00	0.00	2.77	1.03	0.03	0.00	0.05	0.00	2.85	1.03
Hillsborough	Amherst	0.44	0.00	8.39	0.60	4.32	0.07	0.22	0.00	13.37	0.67
Hillsborough	Hollis	0.00	0.00	0.10	0.03	0.10	0.00	0.00	0.00	0.20	0.03
Hillsborough	Merrimack	0.05	0.00	3.21	1.27	0.76	0.11	0.00	0.00	4.02	1.38
Hillsborough	Litchfield	0.66	0.00	3.10	0.88	11.48	1.42	0.60	0.00	15.84	2.30
Hillsborough	Londonderry	0.74	0.00	2.34	1.04	1.13	0.10	0.51	0.00	4.72	1.14
Hillsborough	Hudson	1.04	0.00	1.05	0.61	2.44	0.19	0.66	0.00	5.19	0.80
Rockingham	Windham	0.56	0.00	0.43	0.13	0.83	0.08	0.08	0.00	1.90	0.21

Table 7.0-1
Wetland Impact Summary by Wetland Type in New Hampshire

County	Township	Palustrine Emergent (acres affected)		Palustrine Forested (acres affected)		Palustrine Scrub-Shrub (acres affected)		Other Wetland[3] (acres affected)		Township Total (acres affected)	
		Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]	Const.[1]	Oper.[2]
Rockingham	Pelham	5.40	0.00	2.35	0.60	4.42	0.30	0.08	0.00	12.25	0.90
Rockingham	Salem	1.34	0.00	3.78	0.67	1.07	0.05	0.22	0.00	6.41	0.72
Total		**26.29**	**0.00**	**66.93**	**20.85**	**48.86**	**3.96**	**12.25**	**0.00**	**154.33**	**24.81**

Source: The data sets utilized for wetlands is a combination of field surveyed data, photo interpreted LiDAR data, and publicly available data. Field surveyed data was used wherever there was parcel access, photo interpreted LiDAR data was used where there was no parcel access, and publicly available data was used where there was no parcel access and no photo interpreted aerial coverage. The publicly available data is from the USFWS - NWI (2014).

[1] Construction Acreage = all workspace during construction activities (TWS, ATWS, and permanent easement) that impacts wetlands. Workspace was laid out to maintain a 75 foot construction ROW through wetlands. Any construction ROW impacts greater than 75 feet are detailed in Table 2.3-12, "Areas of Greater than 75 feet of Workspace within Wetlands."

[2] Operation Acreage = 10-foot wide corridor permanently maintained in herbaceous vegetative cover through PSS wetlands, and 30-foot wide corridor permanently maintained through PFO wetlands where trees taller than 15 feet that could damage the pipeline coating will be selectively cut and removed. The permanently maintained corridors represent a change in cover type from PFO to PSS and PEM or PSS to PEM; there is no operation impact on PEM wetlands, since there is no change in pre- and post-construction wetland vegetation cover type. Operational acreage represents areas of new permanent easement and does not include overlap with TGP's existing pipelines. The existing permanent easement for TGP's existing pipelines is not included in the operational wetland impacts.

[3] Wetland type not classified by NWI as PEM, PSS, or PFO.

- Remove cut vegetation and stumps in trench line, leave stumps and associated root system in areas outside of the trench line that do not require removal to allow for safe working conditions.
- Topsoil segregation (trench and spoil pile) will be performed as long as there is sufficient topsoil present to allow for mechanical separation by equipment, except where standing water is present or the soil is saturated;
- Install trench breakers at each wetland boundary (on upland side).
- When wetland areas are temporarily disturbed, isolate and stockpile topsoil for replacement after grading is completed. If temporary vegetative stabilization is necessary, apply annual ryegrass at the rate not exceeding 40 lbs/acre. Mulch using clean straw (weed free) at the rate of 2 tons/acre.
- Soil amendments will not be used in wetland areas unless otherwise approved by the EI or applicable permitting agency.
- Soil will be decompacted where necessary using a harrow, paraplow, Paratill®, or other equipment where equipment mats are not utilized.

7.1.2 Construction in Saturated Wetlands

Saturated wetlands are defined as having standing water or highly saturated soils at the time of construction. Typical saturated wetland installation procedures are outlined in Attachment M2, Detail No. 26. The following construction techniques will apply to saturated wetlands:

- Minimize vegetation clearing and stump removal by removing only vegetation and stumps in the trench line, unless they pose a safety risk within the travel lane;
- Install a sediment barrier across the ROW and wetland boundary as necessary;
- Trees and brush will be cut at ground level by hand, with low ground pressure equipment, or with equipment that does not cause excessive rutting of topsoil or with equipment supported by equipment mats;
- Temporary roads to be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair and no impact on the wetland (i.e., use of equipment mats);
- Topsoil segregation will not be conducted in wetlands where standing water is present or soils are saturated;
- Permanent slope breakers will be installed at the base of all slopes adjacent to wetlands;
- Temporary roads will be constructed with appropriate equipment mats;
- Pipe joints may be welded outside of the wetlands and carried in and installed using the "push-pull" or "float" technique;
- Dirt, rock, pulled stumps, or brush rip-rap will not be used to stabilize the travel lane; and
- Trench breakers will be installed at each wetland boundary, on the upland side.

In areas of unconsolidated soils such as muck and till, Tennessee will utilize sediment barriers to contain those soils within the workspace. The type of sediment barrier employed will vary depending on the amount and physical properties of the material that has to be contained.

7.2 STANDARD PIPELINE CONSTRUCTION IN WETLANDS

The size of ATWS areas at wetland crossings will be minimized to the extent practicable and will be located at least 50 feet from the edge of the wetland where topographic conditions permit. Tennessee acknowledges that the Project will require certain ATWS to be located within 50 feet of waterbodies and wetlands. Tennessee has provided site-specific locations of these ATWS and justifications per the

Commission's Procedures. Locations where ATWS is required to be located within 50 feet of the edge of the wetland can be found on the Aerial Alignment Sheets provided in Attachment M1 and Table 8.1-4 in Resource Report 8. The wetlands and setbacks will be clearly marked with flagging prior to the start of construction. Spoil will be temporarily placed immediately adjacent to the trench line where topsoil has been segregated or transported to an approved upland area adjacent to the wetland for temporary storage.

Hazardous materials, chemicals, fuels, and lubricating oils will not be stored within 100 feet of a wetland or waterbody boundary, unless the location is designated for such use by an appropriate governmental authority. Concrete coating and refueling activities will not be performed within 100 feet of a wetland or waterbody boundary, unless the EI determines that there is no reasonable alternative, and the Contractor takes appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.

Aboveground facilities will not be located in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with USDOT regulations.

The standard construction procedures used to cross small wetlands will be similar to those used on upland areas. However, if the trench contains water, temporary trench breakers will be left in the trench prior to entering the wetland. This procedure will minimize silt discharges into the wetland. In addition, permanent trench breakers will be installed at the point where the trench enters and exits a wetland to ensure maintenance of existing hydrology. Backfill will be well compacted, especially at the edges of the wetland. Original topographic conditions will be restored immediately after the completion of construction.

Construction in larger wetland areas may use the "push-pull" or "float" techniques. Equipment mats will be used to provide a working surface for the movement of equipment, personnel, and materials. The trench may be excavated using a dragline or clamshell dredge. The excavated material will be stored adjacent to the trench.

The pipe will be stored and fabricated in staging areas located outside the wetland. As necessary, the pipe will be weighted to provide negative buoyancy so that the pipe sits firmly on the bottom of the trench in submerged situations. Temporary floats may be attached to the pipe to provide short-term positive buoyancy to push the pipe through the wetland over the trench. After floating the pipe into place, the floats will be removed and the pipe will be lowered to the bottom of the trench. This operation will be repeated as necessary with pre-fabricated sections of pipe welded together outside of the wetland limits and pushed into place until the wetland crossing is complete. The pipe will then be backfilled with the native spoil material that was stockpiled adjacent to the trench or temporarily stored outside of the wetland limits. The wetlands will be restored to the preconstruction contours immediately following construction. Any excess spoil material will either be removed or redistributed within the ROW in such a manner that the pre-construction surface water flow patterns are not impacted.

7.3 EQUIPMENT MATS

The EI may require equipment mats be used to prevent unnecessary damage to the soil structure in wetlands with standing water. Generally, there will be several equipment mats laid side-by-side in the construction travel area. Equipment mats will generally be placed directly over existing vegetation where grading is not required. Rock, soil material from outside the wetland, tree stumps, or brush riprap will not be used to support equipment on the construction ROW.

7.4 CLEARING

Wetland boundaries and setbacks will be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete. No rubber-tired equipment will be allowed to work in wetlands unless it will not damage the root systems or cause rutting and its use is approved by the EI. Bulldozers will not be used for clearing within wetlands. Trees and brush will be cut to ground level by hand or with hydroaxes, tree shears, or grinders.

The minimum clearing necessary to safely construct the pipeline will be completed. Equipment mats may be placed over the top of existing vegetation, including shrubs, where possible.

Stumps will be left in place, except within the trench line or unless the removal is necessary to ensure worker safety. Stumps may be ground down to a suitable height for safety reasons. Tennessee will attempt to leave the cut tree root system intact where removal is not required for construction or worker safety. All cleared debris (e.g., slash, logs, brush, woodchips, stumps, etc.) will be completely removed from the wetland and wetland buffer areas and will be disposed of in approved disposal areas or as directed by the EI. The EI will photo document areas before and after clearing activities for use in revegetation/restoration plans.

7.5 TEMPORARY SOIL REMOVAL

- Grading in inundated wetlands will be held to a minimum and generally will not be necessary due to the typically level topography and the absence of rock outcrops in such areas.
- Topsoil will be segregated over the trench line and returned as an even layer in the same horizon, except for areas with standing water or where soils are saturated.
- Erosion control measures will be installed at all wetland crossings as soon as perimeter brush clearing will allow for effective installation. Initial clearing will be limited to that which is necessary to install the proposed perimeter BMPs.
- Topographic elevations will be documented prior to soil removal activities so that disturbed areas can be restored to pre-construction contours. Unnatural (or anthropogenic) features and unstable grades will be noted by the EI prior to construction activities so they can be reestablished during restoration activities, where appropriate.
- Wetlands will be revegetated, unless standing water is present, in accordance with the following:
  - Ryegrass (annual or perennial) at 30 lbs/acre (approximately 0.7 lb/100 ft^2 or use 1 lb/1,000 ft^2) during spring, summer or early fall (up to September 30); or
  - Aroostook (if available) winter rye (cereal rye) at a rate of 100 lbs/acre (2.5 lbs/1,000 ft^2.)
- No fertilizers, lime, or mulch will be utilized in wetland areas unless approved in writing by the appropriate land management or the applicable regulatory agencies.

7.6 TRENCHING

The topsoil in wetlands will be stripped from the trench line and spoil storage area and segregated if standing water is not present or it is not saturated and its depth is sufficient to allow mechanical separation. Topsoil stripping (in non-saturated conditions) will be performed up to a depth of 12 inches or as determined by the EI. The segregated topsoil will be stockpiled separately from subsoil for later restoration of the ROW. Spoil piles will be contained with appropriate erosion control measures to prevent sediment migration off the ROW or into wetlands.

7.7 LOWERING-IN/BACKFILLING

The trench will be backfilled with subsoil first. After the subsoil has been rough graded, topsoil that was previously segregated will be replaced in an even layer over the trench. The replaced topsoil depth will be the same as the preconstruction depth. It is important to utilize only the topsoil segregated from each specific wetland because it contains seeds, rhizomes, and other plant propagules, which will aid rapid re-colonization by indigenous wetland species. Rock present in the preconstruction wetland conditions will be placed in the wetlands in the same approximate configuration (density and size) as preconstruction conditions. Pre- and post-construction photos will be taken to aid in the replacement of these features.

Permanent trench breakers will be installed at both boundaries of the wetland to prevent draining of the wetland along the pipeline trench, if warranted. The trench breakers are required to prevent water flow along the trench line which could result in undermining of the pipeline. Pipeline padding is generally not required in wetland locations because the wetland soils used to backfill the trench are generally soft and the pipe is either concrete coated or has set on weights installed to ensure negative buoyancy, which provides extra protection from the backfill material damaging the pipe coating.

7.8 MAINTENANCE OF WETLAND EROSION CONTROL DEVICES

Erosion control devices will be installed immediately after initial earth disturbance of the wetland or adjacent upland. Erosion control devices will be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion control measures or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in this ECP; however, the following specific measures will be implemented at wetland crossings:

- Sediment barriers will be installed across the entire construction ROW at all wetland crossings where necessary to prevent the flow of sediments into the wetland. In the travel lane, these may consist of removable sediment barriers or drivable berms. Sediment barriers may be removed during the construction day, but will be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent.
- Where wetlands are adjacent to the construction ROW and the ROW slopes toward the wetland, sediment barriers will be installed along the edge of the construction ROW as necessary to prevent sediment flow into the wetland.
- The trench will be dewatered (either on or off the construction ROW) in a manner that does not cause erosion and does not result in heavily silt laden water flowing into any wetland or waterbody. The dewatering structures will be removed as soon as possible after the completion of dewatering activities.

As previously noted, erosion control devices, at or adjacent to wetlands, will be maintained in properly working condition at all times. Inspecting and ensuring the maintenance of temporary erosion control measures will be conducted at a minimum:

- On a daily basis in areas of active construction or equipment operation;
- A minimum of once a week in areas with no construction or equipment operation; and
- Within 24 hours of each 0.5 inch of rainfall or greater.

8.0 SITE-SPECIFIC CONTACT INFORMATION AND NOTIFICATIONS

Contact information for appropriate regulatory agencies regarding the proposed Project is recorded in this Section. The contact information will be needed to contact applicable agencies prior to construction to ensure that all site-specific conditions are listed and implemented during all phases of the construction process.

The following information will be filed with the Secretary of the Commission ("Secretary") prior to the beginning of construction:

- A schedule identifying when trenching or blasting would occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally listed threatened or endangered species. The Project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice.

9.0 RESTORATION

9.1 RIGHT-OF-WAY CLEANUP AND PERMANENT RESTORATION

ROW cleanup and permanent restoration operations will commence immediately following backfill operations. Permanent re-establishment of final grades and drainage patterns, as well as restoration and revegetation measures, serve to minimize post-construction erosion by establishing a vegetative cover to protect the soil, and also by using structures which can divert or slow runoff and trap sediment. The Contractor will restore disturbed portions of the construction ROW and supplemental work areas, as approved by Tennessee, applicable regulatory agencies, and as agreed to in writing by the landowner.

Tennessee will complete upland final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench in all areas except residential areas, which will be completed within 10 days. The Contractor will have steel plates on-site to temporarily cover the trench in an emergency. Permanent restoration of waterbodies and wetlands will be initiated immediately after backfilling, weather permitting. Temporary erosion control measures (e.g., trench breakers, slope breakers, sediment barriers, etc.) will be maintained to prevent high velocity stormwater runoff from potentially affecting downstream sensitive resources.

Steep slopes will require specialized techniques during the restoration process (Steep Slope, Section 5.19). These slopes will be permanently stabilized as soon as possible after installation of the pipeline to prevent severe erosion and possible slope failure (e.g., landslides). Permanent stabilization will be accomplished by implementing the following BMPs:

- Install trench breakers in accordance with the spacing provided in this ECP, and adequately compact backfill between the trench breakers. The trench line preparation also may include installation of underdrain pipes within slopes that appear to be excessively wet or contain shallow depth to bedrock. The underdrain pipe will prevent the slope from becoming saturated and decrease the potential for subsidence.

- Final grading will include installation of permanent slope breakers in accordance with the spacing and specifications provided in this ECP and roughening the surface between the slope breakers to decrease surface runoff velocity.
- Slope roughening to aid in establishment of vegetative cover from seed, reduce runoff velocity, increase infiltration and to reduce erosion by providing for trapping of sediment. Slope roughening methods may include; tracking, grooving, and stair-stepping (Attachment M2 – Detail No. 1).
- Revegetation will include hydroseeding the construction workspace with specialized seed mixes, as available, and mulch tackifiers.
- Install extended-term erosion control matting along the slope and slope breakers. The type of erosion control matting will be selected based on the severity of the slope. Tennessee will not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife.
- All steep slopes will be inspected in accordance with the schedule outlined in Section 3.0 of this ECP. The EI will review these areas to ensure that erosion is not occurring underneath the matting. Any erosion noted during the inspection will be repaired within 24 hours of the inspection, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.

Tennessee has prepared a Winter Construction Plan in anticipation of construction activities occurring during the winter. The plan includes special construction techniques and material handling procedures that will be required to safely construct the Project. The Plan can be found in Attachment M12 of the ECP.

A travel lane may be temporarily left open to allow access of construction traffic if the temporary erosion control structures are installed, inspected and maintained while the access is utilized. When access is no longer required, the travel lane will be removed and the ROW restored.

Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile and only if it will not damage the pipe. In agricultural lands, rock will not be returned to the trench any higher than 24 inches below the top of the "B" horizon sub-soil surface. Tennessee will remove excess rock from at least the top 12 inches of soil in all residential areas. In general, in residential areas, stone and rock material 4 inches in diameter and larger in size will be removed and disposed. The size, density, and distribution of rock on the construction work area will be similar to adjacent areas not disturbed by construction, or as approved in writing by the landowner.

Tennessee will grade the construction ROW to restore pre-construction contours and leave the soil in the proper condition for planting. Segregated topsoil will be spread across the ROW where it was segregated from evenly and to the same approximate layer depths documented during pre-construction surveys by the EI. Where trench compaction has not been done, the ROW will be graded to pre-construction contours, as practicable, with a small crown of soil left over the trench to compensate for settling, but will not interfere with natural drainage. Openings will be left in the trench-line crown to allow for lateral surface drainage, as approved by the EI.

Construction debris and equipment will be removed from all upland, waterbody, and wetland construction work areas unless the landowner or land managing agency approves otherwise in writing. The disturbed ROW will be seeded within 6 working days of final grading, weather and soil conditions permitting.

Tennessee will remove temporary erosion control measures when replaced by permanent ones or when permanent revegetation is successful and the area is considered stabilized by the EI and applicable regulatory agencies.

9.2 PERMANENT EROSION CONTROL DEVICES

9.2.1 Trench Breakers

Trench breakers (Attachment M2, Detail No. 42) are intended to slow the flow of subsurface water along the trench and prevent the draining of an adjacent waterbody or wetland along the trench line. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Topsoil will not be used to construct trench breakers.

Tennessee will construct and maintain permanent trench breakers in areas as specified by the EI, applicable regulatory requirements or at the same spacing as and upslope of permanent slope breakers. In agricultural fields and residential areas where slope breakers are not typically required, trench breakers will be installed at the same spacing as if permanent slope breakers were required. Spacing for permanent trench breaker spacing is listed in Table 9.2-1.

At a minimum, trench breakers will be installed at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland.

Table 9.2-1
Permanent Trench Breaker Spacing

Slope (percent)	Spacing (feet)
5-15	300
>15-30	200
>30	100

Source: FERC 2013.

9.2.2 Permanent Slope Breakers (Waterbars)

Permanent slope breakers (Attachment M2, Detail No. 41) are intended to reduce runoff velocity, divert water off the construction ROW, and prevent sediment deposition into sensitive resources. Permanent slope breakers will be constructed using soil.

Permanent slope breakers will be constructed and maintained in all areas, except cultivated areas (including rotation hayfields and pastures) and lawns, using spacing recommendations obtained from Tennessee's Plan. The spacing will be as shown in Table 9.2-2 unless closer spacing is necessary to avoid excessive erosion on the construction ROW:

Table 9.2-2
Permanent Slope Breakers
(Waterbars)

Slope (percent)	Spacing (feet)
5-15	300
>15-30	200
>30	100

Source: FERC 2013.

In general, slope breakers will be constructed with a 2 percent to 8 percent slope across the ROW to convey surface flow to a stable area without causing water to pool behind the breaker. In the absence of a stable outlet area, an approved energy dissipating device will be constructed at the end of the breaker.

Slope breakers may extend slightly (approximately 4 feet) beyond the edge of the construction ROW to effectively drain water off the disturbed area. Slope breakers that extend beyond the edge of the construction ROW will be subject to compliance with applicable survey and permit requirements, and landowner easement agreements.

The EI may direct construction of permanent slope breakers to replace temporary erosion control barriers at road, waterbody and wetland crossings, as required.

At the discretion of the EI, permanent slope breakers that may alter the permanent overland flow characteristics to wetland areas may not be installed. In such case, hay or straw bales, or an approved equal, may be utilized as temporary slope breakers adjacent to wetland boundaries only until restoration is complete to ensure the wetland hydrologic characteristics remain unaltered.

9.3 WATERBODY AND WETLAND CROSSING RESTORATION

9.3.1 Waterbody Crossings

Tennessee will utilize the following criteria to restore disturbed waterbodies to as close to their pre-construction condition as practicable:

- Clean stone or native cobbles will be used for the upper one foot of trench backfill in waterbodies that contain coldwater fisheries;
- For open cut crossings, waterbody crossing banks will be stabilized and temporary sediment barriers will be installed within 24 hours of completing in-stream construction activities;
- For dry ditch crossings, streambed and bank stabilization will be completed prior to returning flow to the waterbody channel;
- All waterbody banks will be returned to preconstruction contours or to a stable angle of repose as approved by the applicable regulatory agencies;
- Application of riprap for bank stabilization will comply with applicable regulatory agency approvals. In general, Tennessee, to the extent practicable, will employ natural stream bank restoration techniques before utilizing riprap stabilization. The use of riprap will generally be

limited to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric;
- Permanent slope breakers will be installed across the construction ROW at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody; and
- Sediment barriers will be installed as outlined in other sections of this Plan and as approved or specified by the EI. As approved by the EI, earthen berms may be utilized as sediment barriers adjacent to the waterbodies.

9.3.2 Wetland Crossings

Tennessee will utilize the following criteria to restore disturbed wetland areas to as close to their pre-construction condition as practicable:

- All equipment mats, temporary timber riprap, and other construction debris will be removed following backfill of the pipeline. Once backfilling is complete, the original surface contours and flow regimes will be restored. Wetlands will be restored to their original contours, seeded and mulched as soon after backfilling as practicable with the exception of the travel portion of the ROW, which will also be restored using these procedures after the travel way is no longer required.
- For each wetland crossed, trench breakers will be installed at the base of slopes near the boundary between the wetland and adjacent upland areas and the trench bottom will be sealed as necessary to maintain the original wetland hydrology in areas where the pipeline trench may affect the groundwater hydrology.
- Permanent slope breakers will be installed across the construction ROW at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. At the discretion of the EI and the Contractor, permanent slope breakers that may alter the permanent overland flow characteristics to wetland areas may not be installed. At the discretion of the EI, hay or straw bales, or an approved equal, will be utilized as temporary slope breakers at the wetland boundaries until restoration is complete to ensure the wetland hydrology remains intact in these situations.
- Sediment barriers will be installed as outlined in other sections of this Plan and as approved or specified by the EI.

Tennessee, at a minimum, will employ the following measures to maximize the success of wetland revegetation:

- Disturbed wetland areas will be temporarily revegetated with annual ryegrass or a native perennial seed mix at a rate of 40 lbs/acre, unless standing water is present. The temporary vegetation will stabilize the area until indigenous wetland species can re-establish themselves. As required by applicable regulatory agencies, mulch will consist of clean straw (weed free) applied at a rate of 2 tons/acre.
- No fertilizers, lime or mulch will be utilized in wetland areas unless approved in writing by the appropriate land management or applicable regulatory agencies.
- If the affected wetland is within an active agricultural parcel, revegetation will be performed according to consultation with the applicable regulatory agencies or individual landowner agreements. If inclement weather limits the effectiveness of reseeding efforts, at the discretion of the EI and as allowed by applicable permits, the ROW will be mulched (with straw only) to

minimize erosion until conditions are suitable for reseeding. The temporary mulch cover will be monitored and maintained until conditions are suitable for completing restoration. No fertilizer or lime will be used in wetlands unless approved in writing by the appropriate land management or applicable regulatory agency. Permanent stabilization is defined as a minimum uniform, perennial 80 percent vegetative cover with native plant species or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion.

The following measures will be undertaken to maximize and monitor the success of revegetation during forested wetland restoration:

- Minimizing removal of stumps, to the extent practicable, while allowing for safe working conditions, stumps will be left in place within the construction ROW to re-sprout following construction and restoration;
- As indicated in Section 5.4 of this ECP, tree stumps will only be removed from the trench line, unless specifically authorized by the EI and required for construction safety;
- Following construction, ROW maintenance in wetlands will be limited to clearing 10 feet on either side of the center of the pipeline. Trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent ROW.

9.4 RESIDENTIAL AREAS

Tennessee will complete final grading, topsoil replacement, and installation of permanent erosion control structures within 10 days after backfilling the trench in residential areas. The restoration and mitigation efforts in residential areas will be completed in accordance with federal and state requirements and include site-specific residential construction plans for residences located within 50 feet of the edge of construction workspace for the pipeline.

Tennessee will, at a minimum:

- Remove construction debris immediately after backfilling;
- Lawns will be raked, topsoil added as necessary, and restored per written agreements with landowners;
- Ornamental shrubs will be replaced where possible;
- Contractors will restore fences, mailboxes, and other structures (that do not conflict with the installed pipeline) removed during construction. Sidewalks, driveways, and roads will be restored as soon as practicable;
- Tennessee will offer the landowners testing of water wells within 200 feet of the construction workspace, both before and after construction; and
- After restoration is completed, a Tennessee representative will contact landowners to ensure that conditions of all agreements have been met and that the landowner has been compensated for damage incurred during construction.

In residential areas, topsoil replacement (i.e., importation of topsoil) may be required and is an acceptable alternative to topsoil segregation.

9.5 AGRICULTURAL AREAS

Tennessee will complete final grading, topsoil replacement, installation or repair of subsurface drainage facilities prior within 20 days after backfilling the trench in agricultural areas. The restoration and mitigation efforts in agricultural areas will be completed in accordance with applicable federal and state requirements. Tennessee will work with applicable agricultural landowners to develop grazing deferment plans as part of the restoration process to ensure that the ROW restoration is successful.

9.5.1 Subsoil Decompaction

Subsoil will be de-compacted prior to replacement of segregated topsoil. Specific additional details are included in Attachment M10, Soil Protection and Subsoil Decompaction Plan, of this ECP.

9.5.2 Subsurface Drainage Systems

Typical restoration measures associated with subsurface drainage systems may include:

- Tile repairs will be designed with substantial support placed beneath the replaced section of tile to prevent sagging of the tile line in the event that settlement occurs within the trench.
- All replacements/repairs consisting of plastic pipe will conform to the AASHTO M.252 specification.
- At the time a tile is cut, the exposed ends of the drainpipe will be plugged or covered to prevent the tile from becoming clogged with dirt and debris.

10.0 REVEGETATION

10.1 GENERAL

Tennessee will be responsible for ensuring successful revegetation of soils disturbed by Project-related activities, including agricultural and residential areas. Agricultural lands will be restored to their preconstruction condition based on the vegetation surrounding the ROW. Agricultural areas will be restored in accordance with Attachment M14, Tennessee's Upland Erosion Control, Revegetation, and Maintenance Plan, of this ECP. Turf, ornamental shrubs, and specialized landscaping will be replaced in accordance with land owner agreements or the land owner will be compensated accordingly. Tennessee will utilize personnel familiar with local horticultural and turf establishment practices to conduct the restoration work.

In upland areas, Tennessee will complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench except in residential areas, which will be completed within 10 days. Permanent restoration of waterbodies and wetlands shall be initiated immediately after backfilling, weather permitting.

Permanent stabilization is defined as a minimum uniform, perennial 80 percent vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion.

In general, rough grading will occur after backfilling. The ROW will then be limed and fertilized (no fertilizer or lime will be used in wetlands or waterbodies) in accordance with landowner agreements or as

approved by applicable regulatory agencies. The lime and fertilizer will be disked or blended into the worked soil. If necessary, any excess rocks or stones will be picked up utilizing a mechanical rock rake or by hand, so that the size and density of rocks is similar to adjacent, undisturbed areas. The ROW will be final graded to ensure that all ruts or mounds of soil are smoothed out. Seed and mulch will be applied at rates specified in Tables 10.4-1 through 10.4-3. In agricultural areas, additional procedures for restoration and revegetation will be performed in accordance with those outlined in Attachment M10, Soil Protection and Subsoil Decompaction Mitigation Plan and Attachment M14, Tennessee's Upland Erosion Control, Revegetation, and Maintenance Plan.

Tennessee will pay close attention to revegetation and stabilization of steep slopes to help prevent erosion. Steep slopes will generally be hydro-seeded or hydro-mulched in accordance with Section 5.26.1 of this ECP. All slopes 1(v):3(h) and steeper will be covered with erosion control matting to help prevent erosion and allow vegetation to establish. The Contractor will be required to final grade and seed the slope prior to installing the erosion control matting.

10.2 SOIL ADDITIVES

Tennessee will work with affected landowners prior to construction to gather data relevant to the most recent preconstruction application of soil additives. Fertilizers and soil modifiers will be applied or in accordance with recommendations from the applicable regulatory agency. Site-specific fertilizer and soil pH modifiers, as required in writing by applicable regulatory agencies or landowner, will be incorporated into the top 2 inches of soil during, or as soon as practicable, after application. Soil additives and fertilizers will not be used within wetlands or waterbodies unless approved in writing by the appropriate land management or applicable regulatory agencies. Soil additives will be incorporated into agricultural areas in accordance with Attachment M14, Tennessee's Upland Erosion Control, Revegetation, and Maintenance Plan, of this ECP.

10.3 SEEDING REQUIREMENTS

Tennessee will perform seeding practices as outlined below:

- In non-agricultural areas, prepare a firm seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment. The seedbed will be scarified in areas that will be hydroseeded to facilitate lodging and germination of seed.
- Seeding will not be conducted in actively cultivated croplands unless requested in writing by the landowner. Permanent seeding, consistent with the impacted field's specific requirements, will be applied in long-term and rotation hayfields and pastures.
- Perform seeding of permanent vegetation within the recommended seeding dates noted below or as determined in the field by the EI. If seeding cannot be done within those dates, appropriate temporary erosion control measures will be used and seeding of permanent vegetation at the appropriate time within the next recommended seeding season based on ROW soil will be performed.
- Disturbed soils will be seeded within 6 working days of final grading, weather and soil conditions permitting, unless otherwise required by the applicable regulatory agency, landowner, or land management agency.
- Seeding rates will be based on PLS rate applications.
- All seed will be used within 12 months of the seed testing date as noted by the manufacturer.

- Legume seed will be treated with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).
- A seed drill equipped with a cultipacker will be the preferred seed application apparatus unless written recommendations from an applicable regulatory agency specifies otherwise.
- All broadcast or hydroseeding performed in lieu of drilling will be placed at double the recommended seeding rate. The seedbed will be firmed with a cultipacker or roller in areas where seeding is paced with the broadcast method. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover the seed after application, as approved by the EI.

Any seeding conducted after September 15 (late season ROW stabilization activities) will be considered "temporary", or as an "interim stabilization measure", as it may result in poor seed germination and high mortality. Temporary and permanent seed and mulch rates can be found in Section 10.4 of this ECP.

10.4 SEEDING AND MULCHING MIXTURES AND RATES

Temporary Revegetation

Hay, straw mulch, or other similar material will be applied to newly seeded areas to protect against erosion until the vegetation is established. Hay, straw mulch, or other similar material will be applied at a rate of at least 2 tons/acre. Mulch will not be applied in wetland areas. The seed mixes noted in Table 10.4-1 are quick germinating seeds that can be applied any time of the year. As noted in the previous section, any seeding completed after September 15 will be considered "temporary", or as an "interim stabilization measure", as it may result in poor seed germination and high mortality. Disturbed areas that are final graded between June 1 and August 1 and September 15 and March 15 (of the following year) will be seeded with the temporary seed mixes noted in Table 10.4-1 to ensure quick establishment. Locations that are seeded with temporary seed mixes will be supplemented with the appropriate permanent seed mix, as available, during the seeding date windows of March 15 to June 1 and August 1 to September 15.

Permanent Seeding and Mulching

Topsoil will be replaced prior to permanent stabilization in applicable locations along the Project ROW. Disturbed areas shall be seeded with the appropriate seed mixture, as available, as outlined in Tables 10.4-2 and 10.4-3. Hay, straw mulch, or other similar material will be applied at a rate of at least 2 tons/acre, unless otherwise required by applicable regulatory agencies. The permanent seed mixes noted in Table 10.4-3 will be applied, as available, between March 15 to June 1 and August 1 to September 15, including areas where only temporary seed mixes have been applied. As previously noted, temporary seed mixes noted in Table 10.4-1 will be applied, as available, to all disturbed areas outside of the noted permanent seed mix windows. The seed mixes noted below were developed from the new Hampshire Manual. Tennessee will evaluate all seed mixtures prior to stabilization to ensure that no invasive species are used. Any invasive species contained in a recommended seed mix will be replaced with a suitable native alternative.

Table 10.4-1
Temporary Seeding and Mulching Rates

Species	Per Acre bushels or pounds	Per 1,000 ft^2	Remarks
Winter Rye	2 bushels or 112 pounds	2.5 pounds	Best for fall seeding. Seed from August 15 to September 15 for best cover. Seed to a depth of 1 inch.
Oats	2.5 bushels or 80 pounds	2 pounds	Best for spring seeding. Seed no later than May 15 for summer protection. Seed to a depth of 1 inch.
Annual Ryegrass	40 pounds	1 pound	Grows quickly, but is of short duration. Use where appearances are important. Seed early spring and/or between August 15 and September 15. Cover the seed with no more than 0.25 inch of soil.
Perennial Ryegrass	30 pounds	0.7 pound	Good cover which is longer lasting than annual ryegrass. Seed between April 1 and June 1 and/or between August 15 and September 15. Mulching will allow seeding throughout the growing season. Seed to a depth of approximately 0.5 inch.

Source: NHDES 2008.

Table 10.4-2
Seed Mixture Selection Based on Soil Type for New Hampshire

Use	Seed Mixture (see Table 10.4-3)	Droughty	Well Drained	Moderately Well Drained	Poorly Drained
Steep cuts and fills, borrow and disposal areas	A	Fair	Good	Good	Fair
	B	Poor	Good	Fair	Fair
	C	Poor	Good	Excellent	Good
	D	Fair	Fair	Good	Excellent
	E	Fair	Excellent	Excellent	Poor
Waterways, emergency spillways, and other channels with flowing water	A	Good	Good	Good	Fair
	B	Good	Excellent	Excellent	Fair
	C	Good	Excellent	Excellent	Fair

Table 10.4-2
Seed Mixture Selection Based on Soil Type for New Hampshire

Use	Seed Mixture (see Table 10.4-3)	Droughty	Well Drained	Moderately Well Drained	Poorly Drained
Lightly used parking lots, odd areas, unused lands, and low intensity recreation sites	A B C D	Good Good Good Fair	Good Good Excellent Good	Good Fair Excellent Good	Fair Poor Fair Excellent
Play areas and athletic fields. (Topsoil is essential for good turf.)	F G	Fair Fair	Excellent Excellent	Excellent Excellent	See Note.[1] See Note.[1]
Gravel pit	Consult with USDA-NRCS.				

Source NHDES 2008.

[1] Poorly drained soils are not desirable for use as playing areas and athletic fields.

Table 10.4-3
Seed Mixtures for Permanent Vegetation for New Hampshire

Mixture	Species	Pounds Per Acre	Pounds Per 1,000 ft^2
A	Tall Fescue Creeping Red Fescue Redtop **Total**	20 20 2 **42**	0.45 0.45 0.05 **0.95**
B[3]	Tall Fescue Creeping Red Fescue Crown Vetch or Flatpea **Total**	15 10 15 - 30 **40 or 55**	0.35 0.25 0.35 - 0.75 **0.95 or 1.35**
C[3]	Tall Fescue Creeping Red Fescue Birdsfoot Trefoil **Total**	20 20 8 **48**	0.45 0.45 0.20 **1.10**

Table 10.4-3
Seed Mixtures for Permanent Vegetation for New Hampshire

Mixture	Species	Pounds Per Acre	Pounds Per 1,000 ft^2
D[3]	Birdsfoot Trefoil	10	0.25
	Redtop	5	0.10
	Reed Canarygrass[1]	15	0.35
	Total	**30**	**0.70**
E	Tall Fescue	20	0.45
	Flatpea	30	0.75
	Total	**50**	**1.20**
F	Creeping Red Fescue[2]	50	1.15
	Kentucky Bluegrass[2]	50	1.15
	Total	**100**	**2.30**
G	Tall Fescue[2]	150	3.6

Source: NHDES 2008.

[1] Reed canary grass is on the invasive species watch list due to its rapid, aggressive growth and its ability to move into wetlands and out-compete other desirable wetland plants. Caution should be used when planted near wetlands.

[2] For heavy use athletic fields, consult the University of New Hampshire Cooperative Extension Turf Specialist for current varieties and seeding rates.

[3] The University of New Hampshire Cooperative Extension recommends red clover to substitute for crown vetch or birdsfoot trefoil if they are going to be mowed to a height of 4 inches or less. Red clover (Alsike variety) should be seeded at a rate of 20 lbs/acre.

11.0 POST-CONSTRUCTION ACTIVITIES

11.1 MONITORING

Tennessee will conduct follow-up inspections of disturbed areas after the first and second growing seasons (normally months 3 to 9 and months 15 to 21 after seeding, respectively) to determine the success of revegetation in upland and agricultural areas. Monitoring in wetland areas will be completed annually until wetland revegetation is successful. Within 3 years after construction, a report will be filed with the Secretary identifying the status of the wetland revegetation efforts.

11.1.1 Agricultural Areas

In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise. Monitoring will be performed by Tennessee for not less than two seasons following the completion of initial restoration. Tennessee will continue to monitor and correct problems with topsoil replacement, soil-profile compaction, rocks, drainage and irrigation systems resulting from pipeline construction in active agricultural areas until restoration is determined successful.

Restoration will be considered successful if the ROW surface condition, including the topsoil and the horizon of the upper subsoil, is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the landowner or land managing agency), revegetation is successful, and proper drainage for agricultural land, including the mitigation of ROW water boils and saturation, has been restored. Chronic water boils or areas of field saturation influenced by pipeline trenching can be mitigated either by follow-up monitoring and installation of interceptor drain tiles or the implementation of a well-planned system of permanent sandbag trench breakers designed to handle the varieties of slope. These measures will help avoid serious hydrology issues and make the mitigation of field saturation easier to manage.

11.1.2 Upland Areas (Non-Agricultural)

Revegetation in non-agricultural areas will be considered successful if upon visual survey the density and cover of non-invasive vegetation is similar in density and cover to adjacent undisturbed lands. Revegetation efforts will be continued until revegetation is determined successful.

11.1.3 Wetland Areas

Tennessee will monitor wetland revegetation efforts annually until wetland revegetation is determined successful. Annual reports will continue to be filed until wetland revegetation is determined successful. Revegetation will be considered successful if the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent wetland areas that were not disturbed by construction. Tennessee will develop and implement, in consultation with a professional wetland ecologist and/or applicable regulatory agencies, as needed, a plan to revegetate the wetland with native wetland species if an area is not showing signs of re-establishing native wetland plant communities subsequent to the third growing season following construction. Tennessee will incorporate any wetland monitoring measures required by applicable regulatory agencies in addition to those outlined above.

11.2 ROUTINE ROW MAINTENANCE

Tennessee will be responsible for maintenance of the ROW. For the majority of its system, Tennessee maintains its easements by mechanical means (i.e., tractor with mower or brush hog). Routine upland vegetation maintenance clearing may be performed on a frequency of once every 3 years. However, to facilitate periodic surveys and emergency access, Tennessee may maintain a 10-foot corridor centered over the pipeline as needed.

As necessary, vegetation maintenance will be consistent with the following procedures:

- Vegetation cutting/trimming will be limited to a 10-foot wide area centered on the pipeline. Trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way.
- In no case will routine vegetation maintenance clearing occur between April 15 and August 1 of any year, unless otherwise approved by the applicable regulatory agencies.
- In some instances, as approved by landowners and regulatory agencies, herbicides may be applied in certain locations (typically at compressor stations or above-ground sites such as MLVs or pig facilities).
- Herbicides will not be used within 100 feet of a wetland or waterbody, except as specified by the applicable regulatory agency and approved by land-owner.

The 3-year routine vegetation maintenance clearing procedures will be consistent with the following procedures:

- In upland areas (non-agricultural), the full ROW will be maintained in an herbaceous state.
- Trees will be cut, trimmed, and/or removed from within the permanent ROW down to their stumps;
- Maintenance within agricultural lands will consist of removing all trees from the permanent ROW. In actively cultivated or specialty crop areas, Tennessee will maintain the permanent ROW in accordance with land owner and/or land management agency written agreements.
- In wetland areas, routine vegetation cutting/trimming will be limited to a 10-foot-wide area centered on the pipeline.
- Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction ROW. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent ROW.
- Routine vegetation mowing or clearing in riparian areas will not be conducted in areas that are between HDD entry and exit points.

11.3 REPORTING

Tennessee will maintain records that identify by MPs:

a) Method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;
b) Acreage treated;
c) Dates of backfilling and seeding;
d) Names of landowners requesting special seeding treatment and a description of the follow-up actions;
e) The location of any subsurface drainage repairs or improvements made during restoration; and
f) Any problem areas and how they were addressed.

Tennessee will file with the Secretary quarterly activity reports documenting the results of follow-up inspections, any problem areas, including those identified by the landowner, and corrective actions taken for at least 2 years following construction in upland and agricultural lands.

A wetland revegetation monitoring report identifying the status of the wetland revegetation efforts will be filed at the end of 3 years following construction and annually thereafter until revegetation is determined successful.

11.4 OFF-ROAD VEHICLE CONTROL

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

- Posting, as necessary, appropriate signage;
- Installing a locking gate with fencing to prevent bypassing of the gate;
- 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
- 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 will be maintained as necessary.

12.0 ECP MODIFICATIONS TO THE FERC PLAN AND PROCEDURES

This section outlines the New Hampshire-specific modifications to FERC's Plan and Procedures that are being proposed as part of the Project. Tennessee has included modifications that have been incorporated Project-wide (noted below in italics) into Tennessee's Plan and Procedures (Attachments M13 and M14, respectively).

12.1 UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

1. *Silt fence, staked hay, straw bales, and sand bags will not be used to construct temporary slope breakers in upland areas, as these barriers are not intended to convey concentrated flow, only minimal sheet flow. This provides more appropriate resource protection and supersedes the Commission's Plan (Section IV.F.1.a).*

12.2 WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

1. *Tennessee will cross streams with discernible flow at the time of construction via fluming or dam and pump, regardless of fisheries or critical habitat designation, unless otherwise approved by applicable federal and/or state regulatory agencies. This is more restrictive than the Commission's Procedure's requirements (Section V.B.6).*
2. *Areas of workspace greater than 75 feet wide within wetlands are identified in Table 2.3-12 of Resource Report 2 of the ER. Justification for including workspace greater than 75 feet within wetlands also is provided in the table per Commission's Procedure (Section VI.A.3).*
3. *Tennessee acknowledges that the Project will require certain ATWS to be located within 50 feet of waterbodies and wetlands. Tennessee has provided site-specific locations of these ATWS and justifications per the Commission's Procedures (Section V.B.2and VI.B.1.a) in Resource Report 8 of the ER.*
4. *Tennessee proposes that permanent slope breakers may not always be appropriate for installation at wetland boundaries. At the discretion of the EI, Lead Environmental Inspector ("LEI"), and Tennessee's contractor, permanent slope breakers that may alter the permanent*

overland flow characteristics, consequently altering the wetland's characteristics, will not be installed. Tennessee proposes the use of hay/straw bales as temporary slope breakers at the wetland boundaries until restoration is complete to ensure the wetland characteristics will remain intact in situations where permanent slope breakers are not used. This exception applies only to the use of a permanent slope breaker per Commission's Procedures (Section VI.C.3).

5. Tennessee proposes to restore wetlands with seed and mulch in accordance with NHDES or other applicable regulatory agencies. Seed mixes, mulching type, and application rates are in Section 10.0 of this ECP (Procedures VI.C.5).

13.0 REFERENCES

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Tennessee Gas Pipeline Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M1

AERIAL ALIGNMENT SHEETS

Included Under Separate Cover

Tennessee Gas Pipeline Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M2

TYPICAL CONSTRUCTION DRAWINGS

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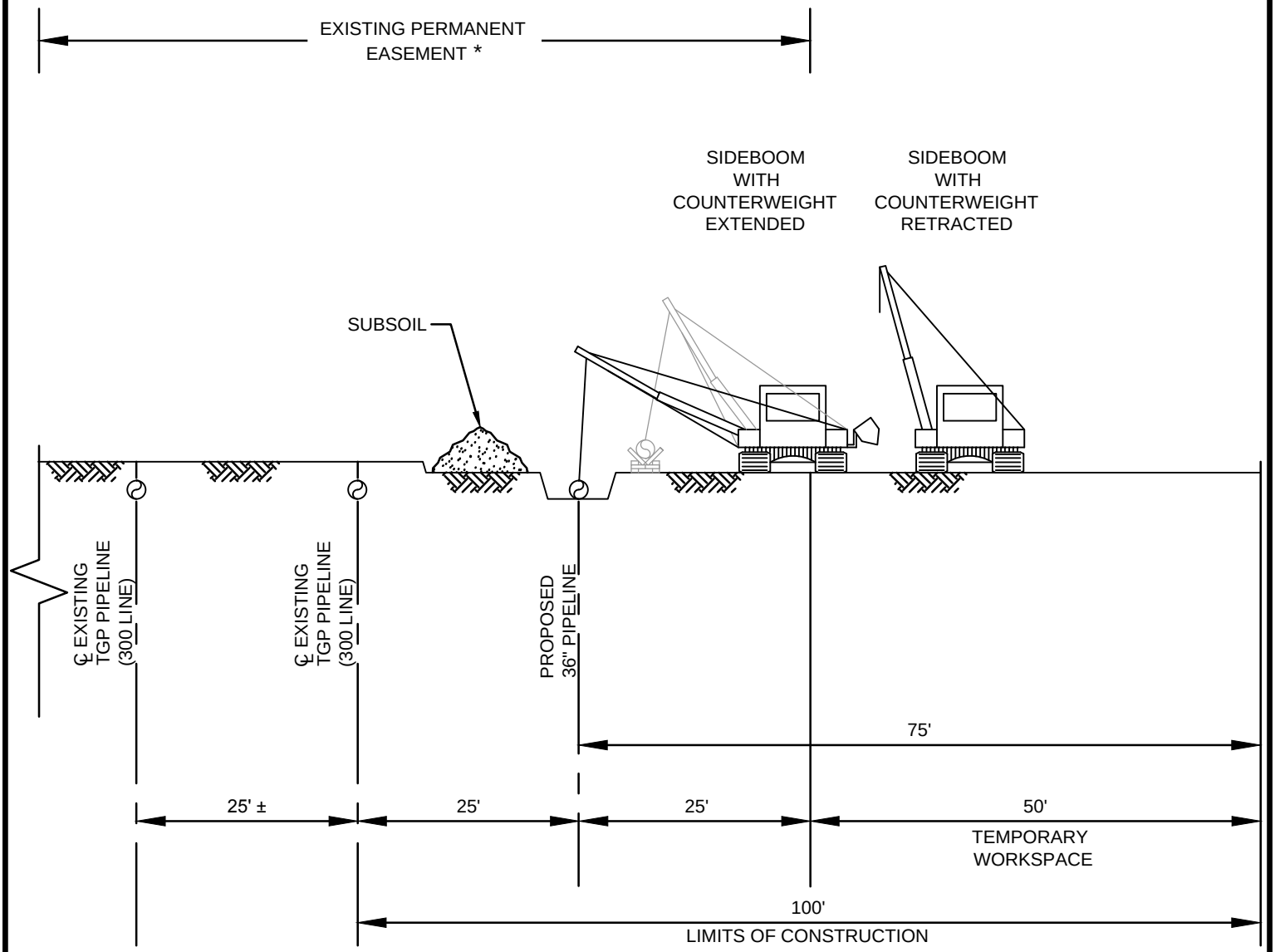

PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF EXISTING PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
3. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.
4. THE OFFSET FROM AN EXISTING TGP PIPELINE, WHERE APPLICABLE, WILL BE 25 FEET, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

* EXISTING PERMANENT EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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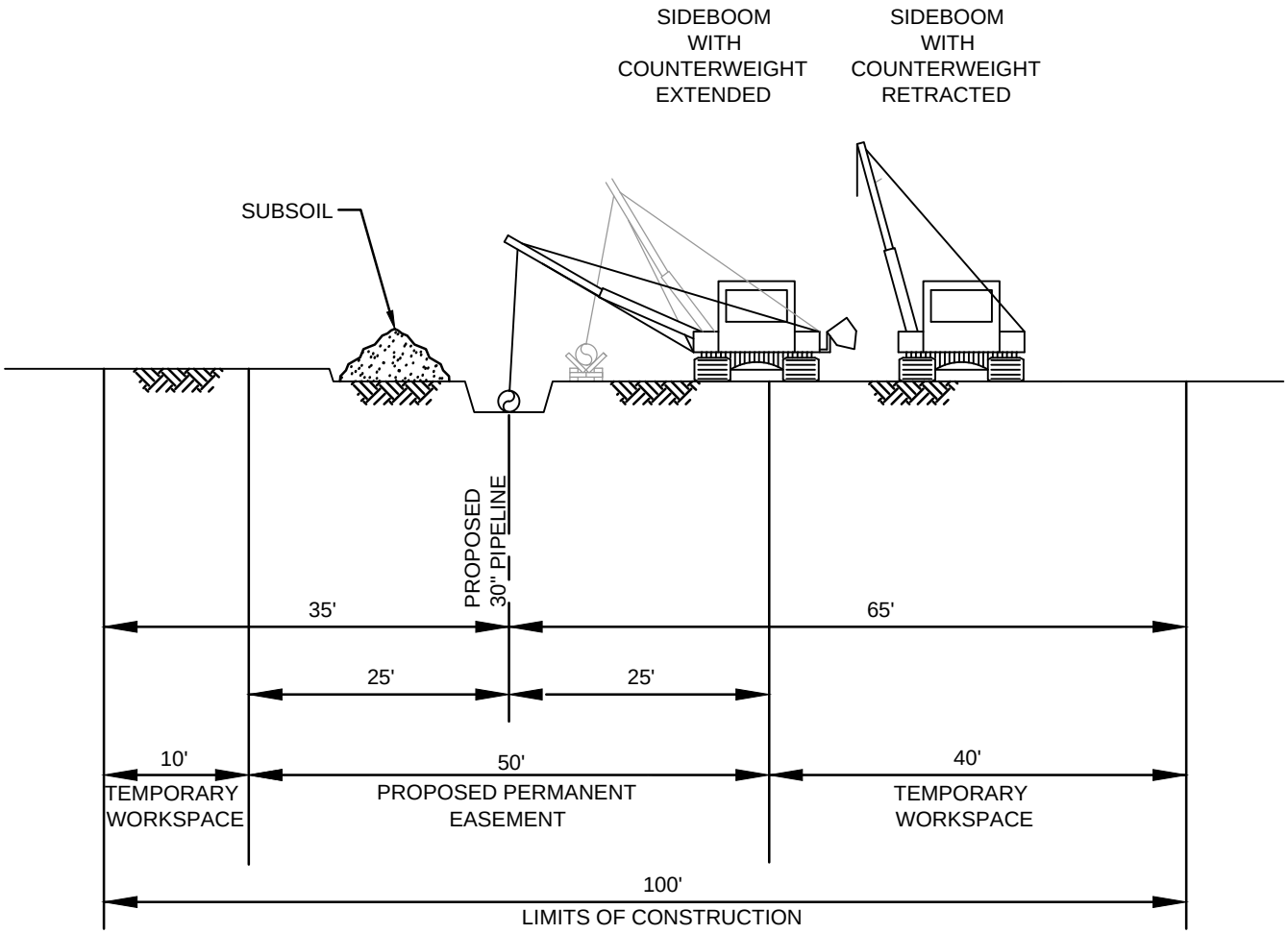
100' CORRIDOR PARALLEL TO EXISTING TGP 300 LINE

DWG. NO. ROW-CONFIG_01



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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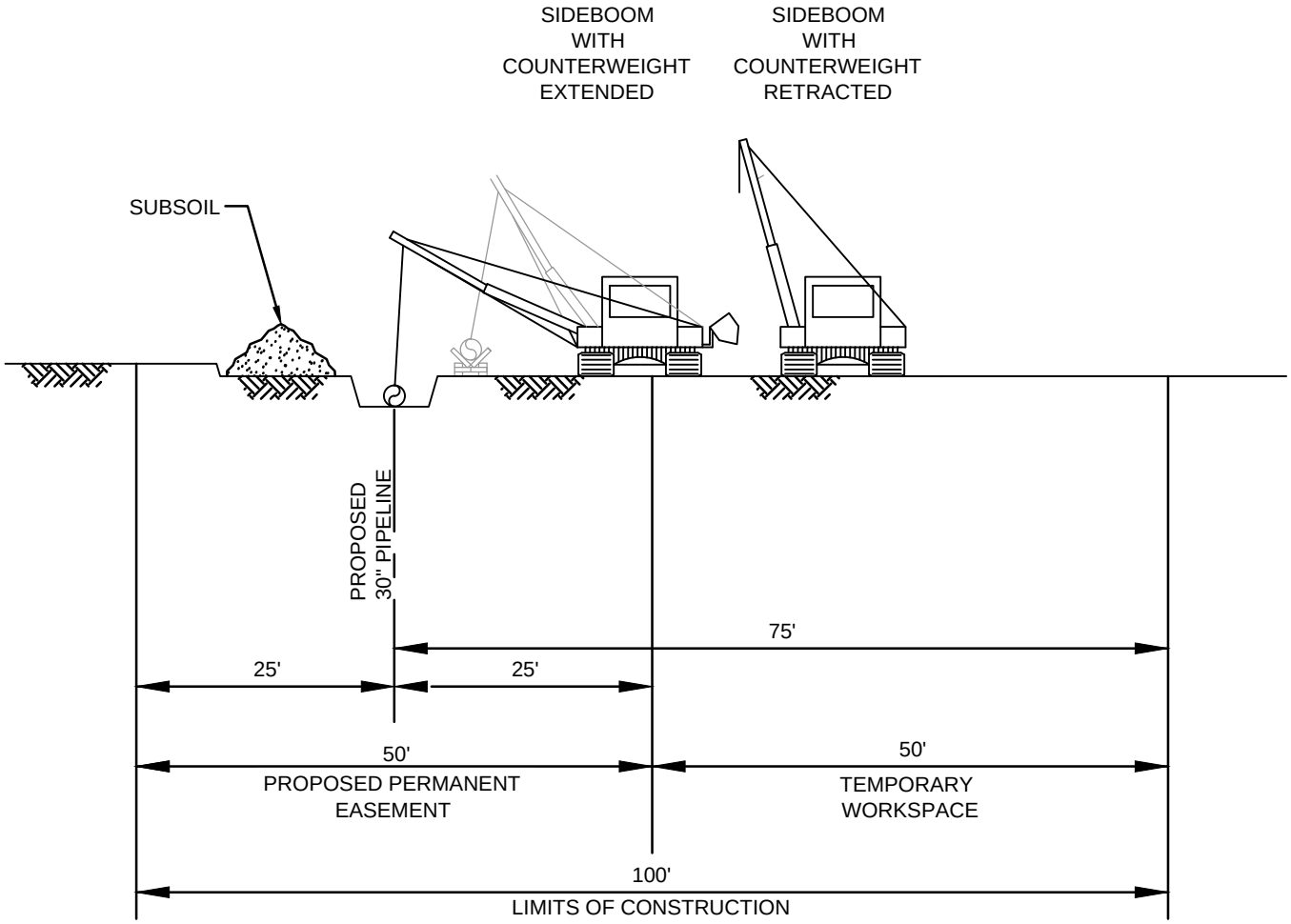
100' CORRIDOR (GREENFIELD) STANDARD

DWG. NO. ROW-CONFIG_02A



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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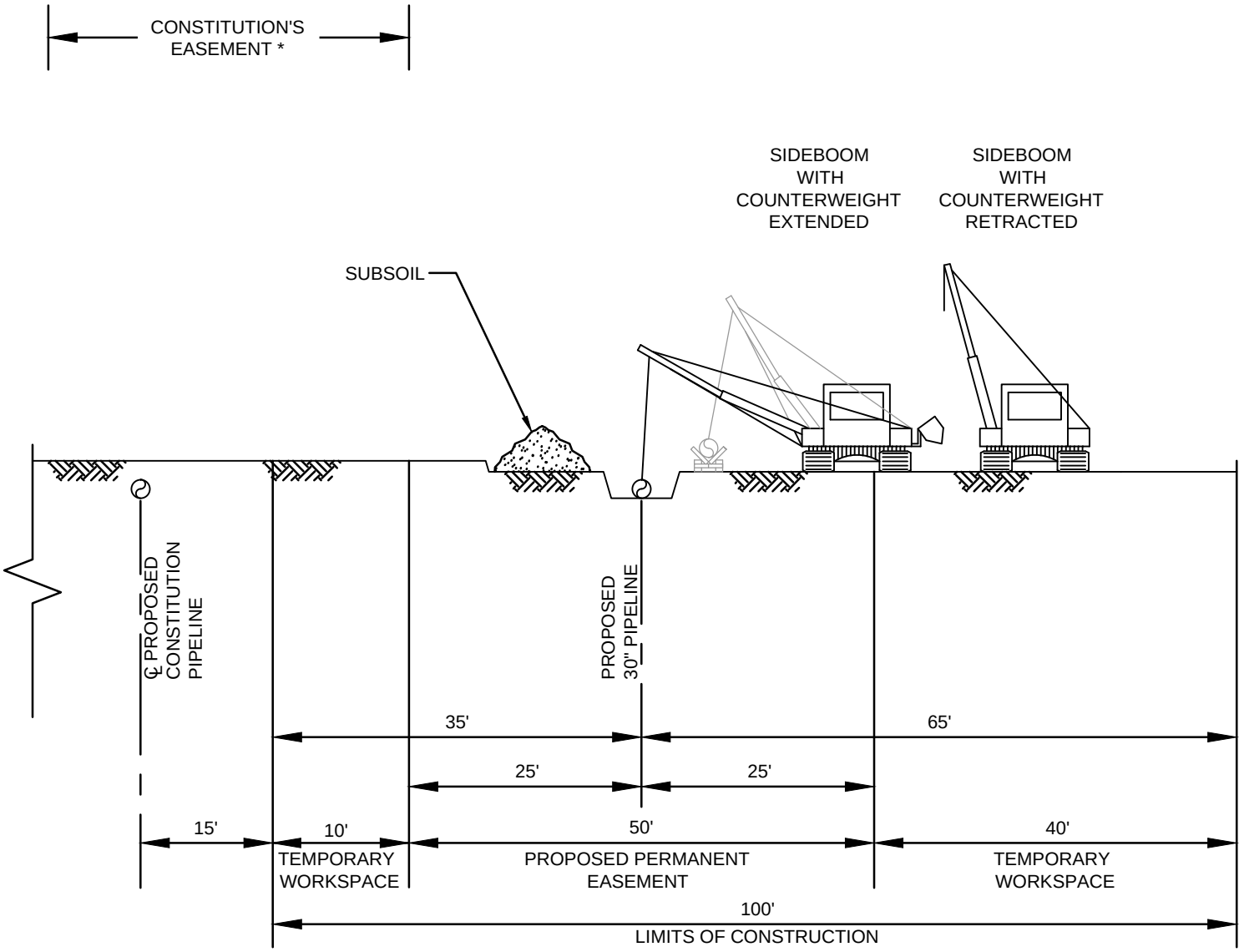
100' CORRIDOR (GREENFIELD 50/50)

DWG. NO. ROW-CONFIG_02B



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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4. THE OFFSET FROM THE PROPOSED CONSTITUTION PIPELINE, WHERE APPLICABLE, WILL BE 50 FEET, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

* CONSTITUTION'S PROPOSED PERMANENT EASEMENT IS TYPICALLY 50' WIDE CENTERED ON THE CONSTITUTION PIPELINE, BUT MAY VARY.

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100' CORRIDOR PARALLEL TO CONSTITUTION (50' OFFSET)

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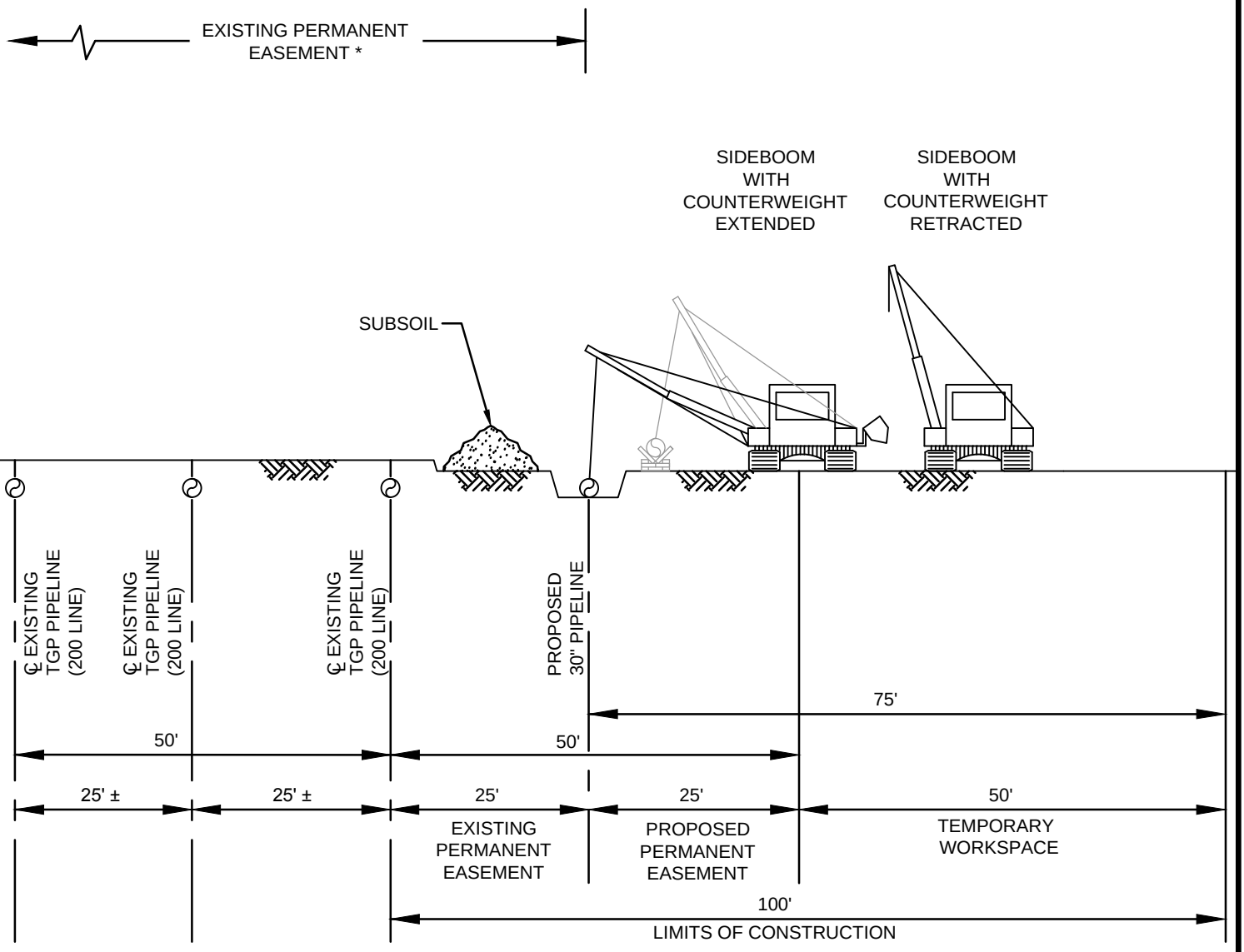

PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 25 FEET OF EXISTING PERMANENT EASEMENT, 25 FEET OF PROPOSED PERMANENT EASEMENT, AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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4. THE OFFSET FROM EXISTING PIPELINE, WHERE APPLICABLE, WILL BE 25 FEET, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

* EXISTING PERMANANT EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

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100' CORRIDOR PARALLEL TO EXISTING TGP LINE

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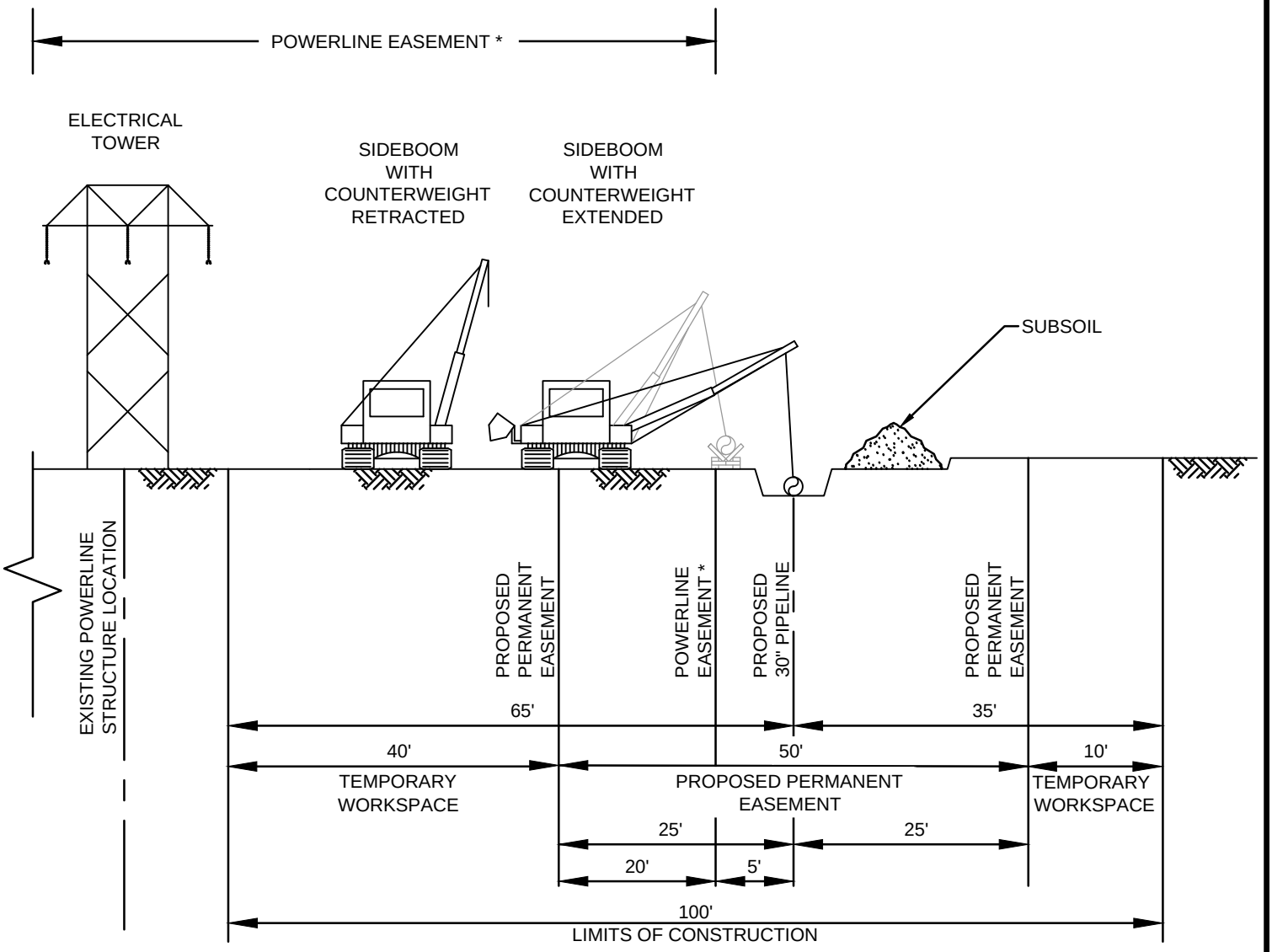

PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT (20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE'S EASEMENT) AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

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100 FT. CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 30" PROPOSED PIPELINE

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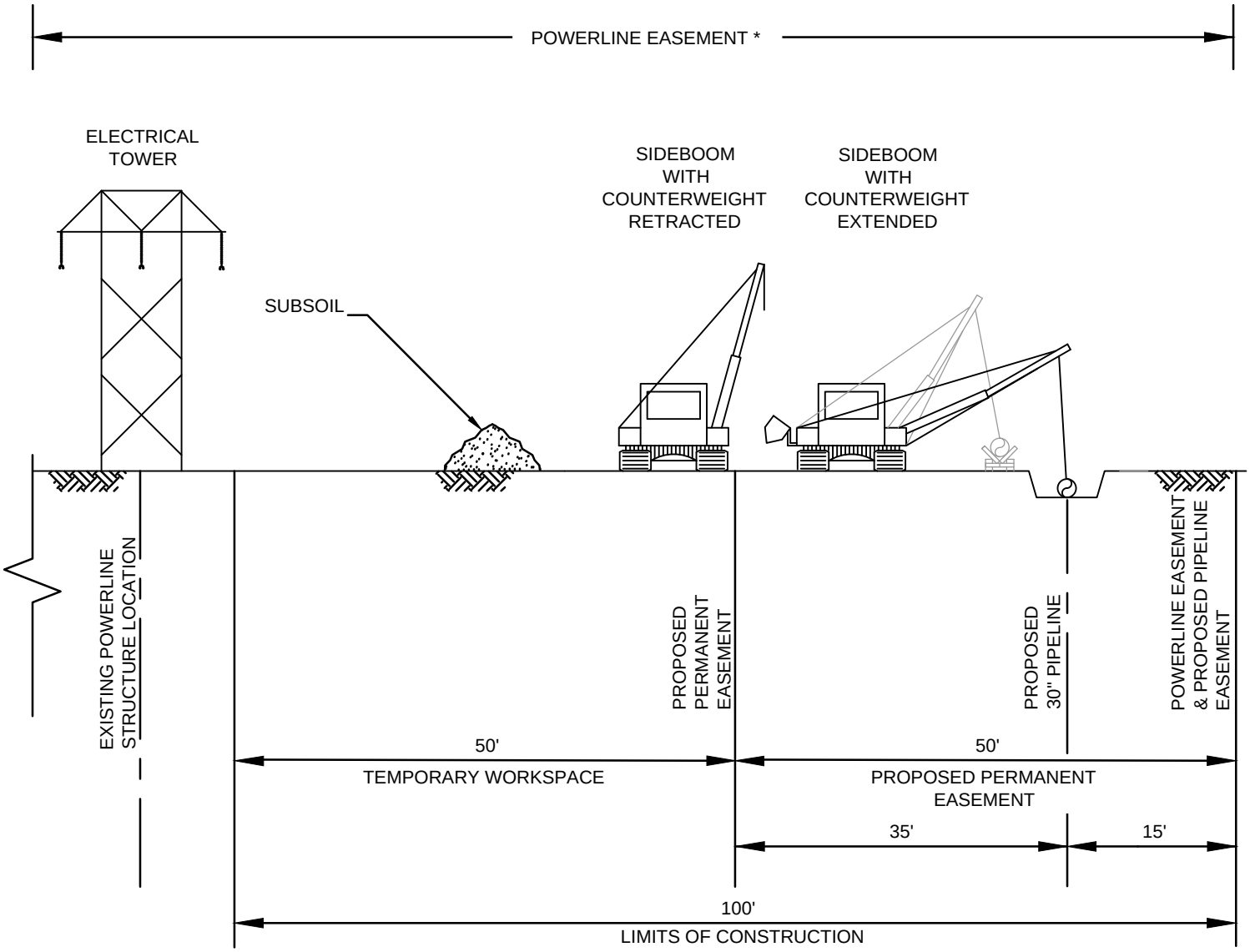

PROFILE
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NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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4. TYPICAL USED IN LOCATIONS WHERE TERRAIN, STRUCTURES OR OTHER OBSTACLES OBSTRUCT PIPELINE OUTSIDE THE EASEMENT.

* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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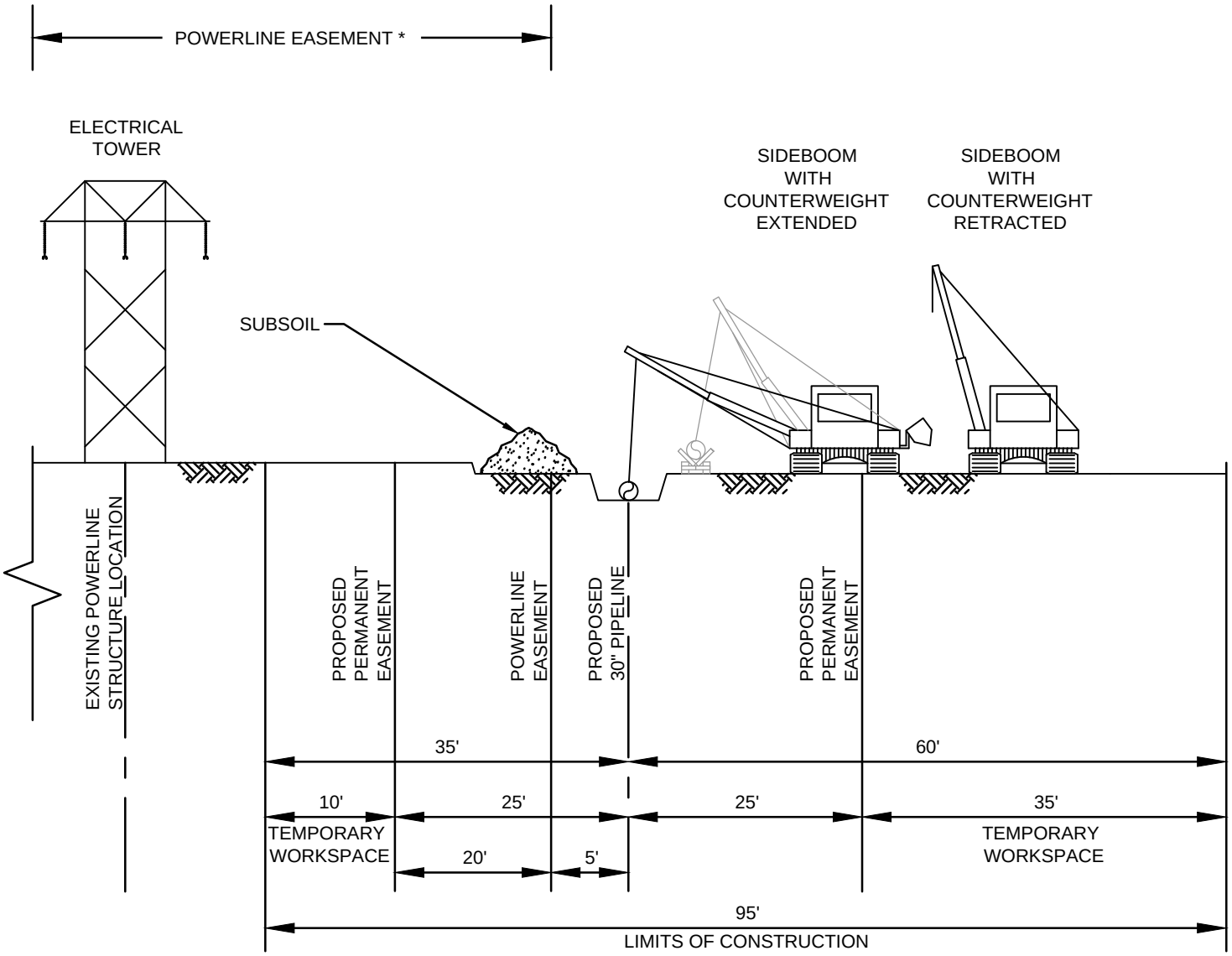
100 FT. CORRIDOR PIPELINE INSIDE POWERLINE EASEMENT FOR 30" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_05B



PROFILE
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NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 95 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT (20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE'S EASMENT) AND 45 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

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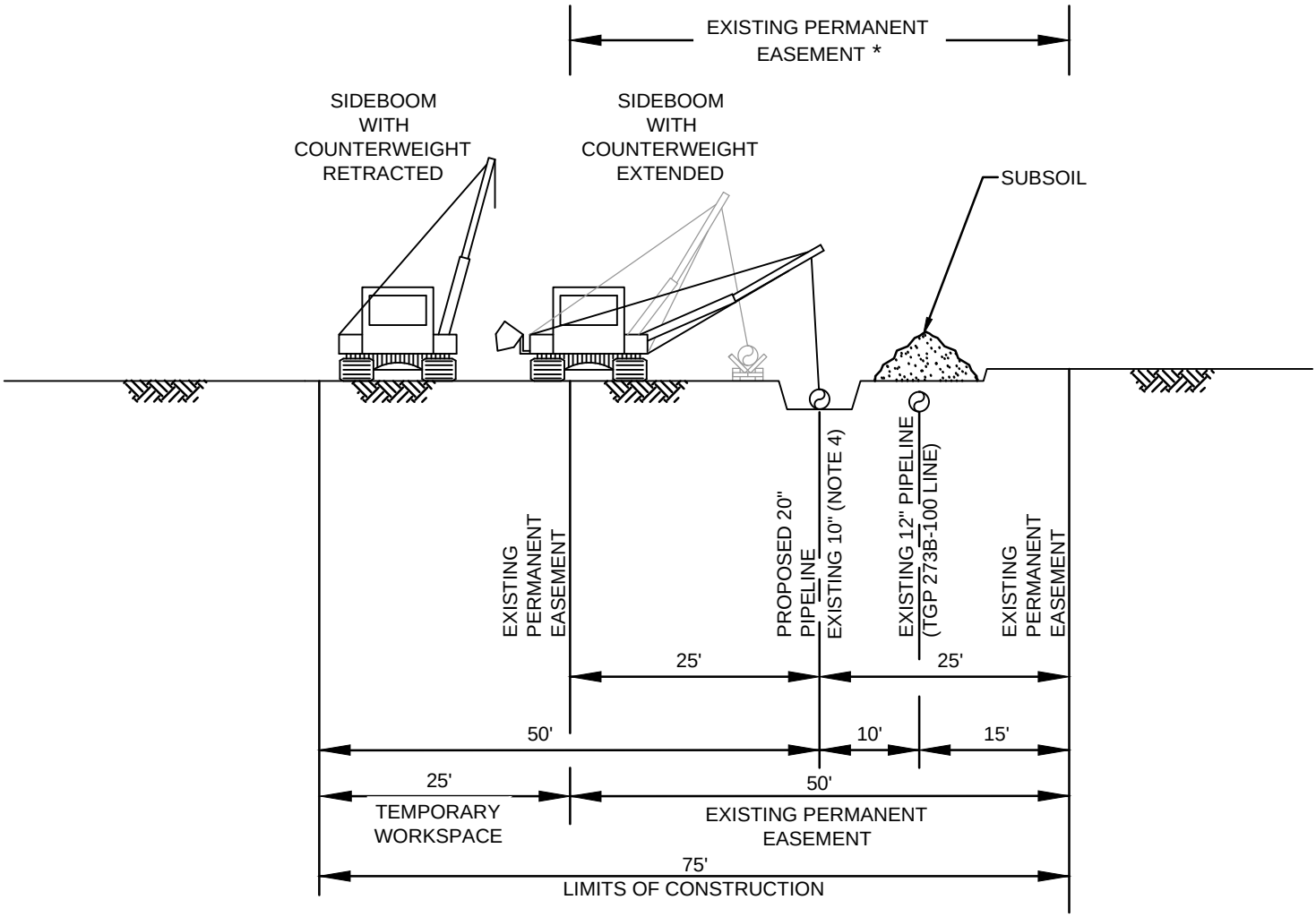
95 FT. CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 30" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_06



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF EXISTING PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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4. A PORTION OF THE EXISTING 10" TGP 270B - 300 PIPELINE WILL BE REMOVED AND REPLACED WITH A PROPOSED 20" PIPELINE.

* EXISTING PERMANENT EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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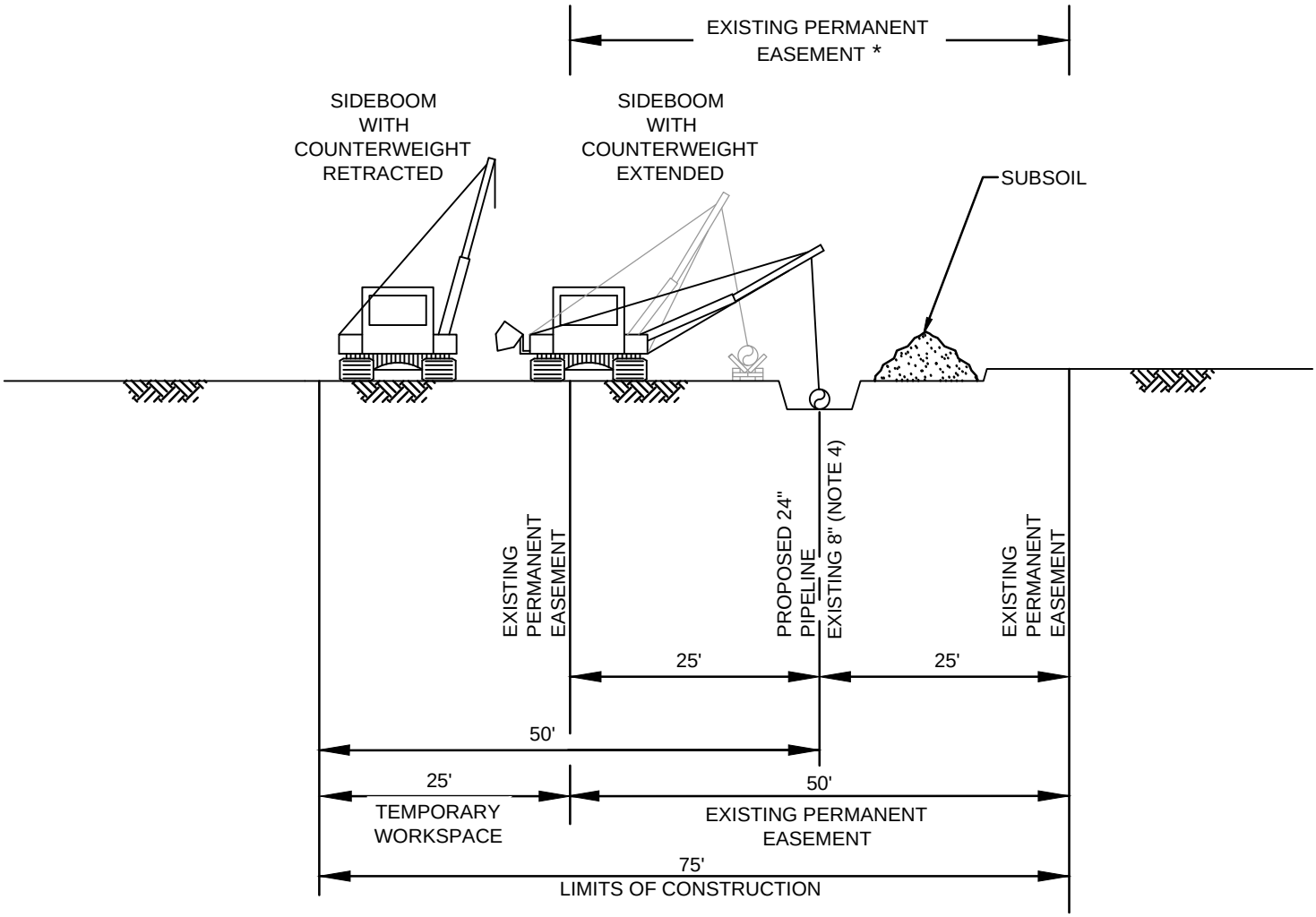
TAKE-UP & RELAY FOR SEGMENT P 20" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_07A



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF EXISTING PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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4. A PORTION OF THE EXISTING 8" TGP 270C - 1000 PIPELINE WILL BE REMOVED AND REPLACED WITH A PROPOSED 24" PIPELINE.

* EXISTING PERMANENT EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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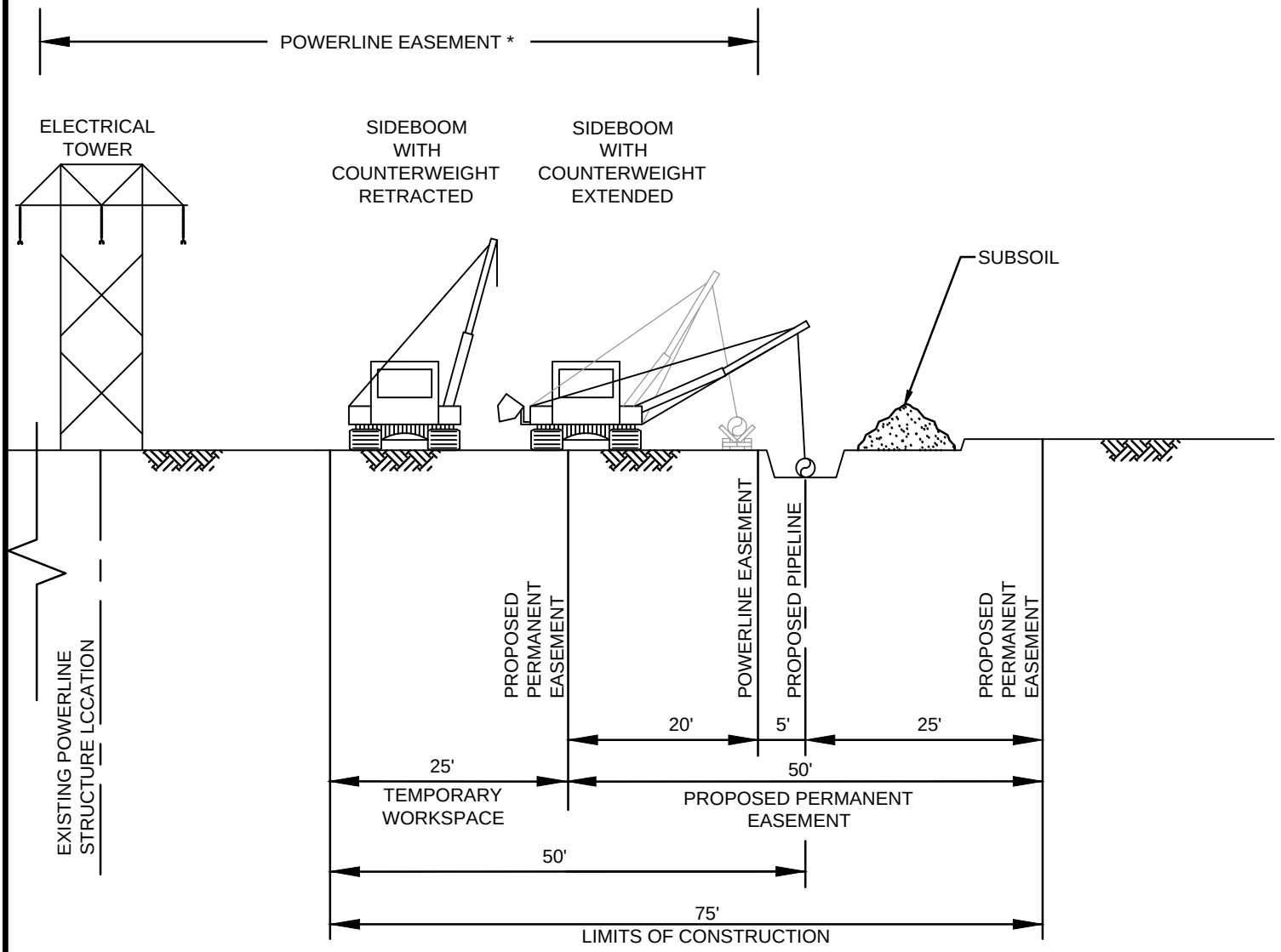
TAKE-UP & RELAY FOR SEGMENT O 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_07B



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT (20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE EASEMENT) AND 25 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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75' CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 12" PROPOSED PIPELINE

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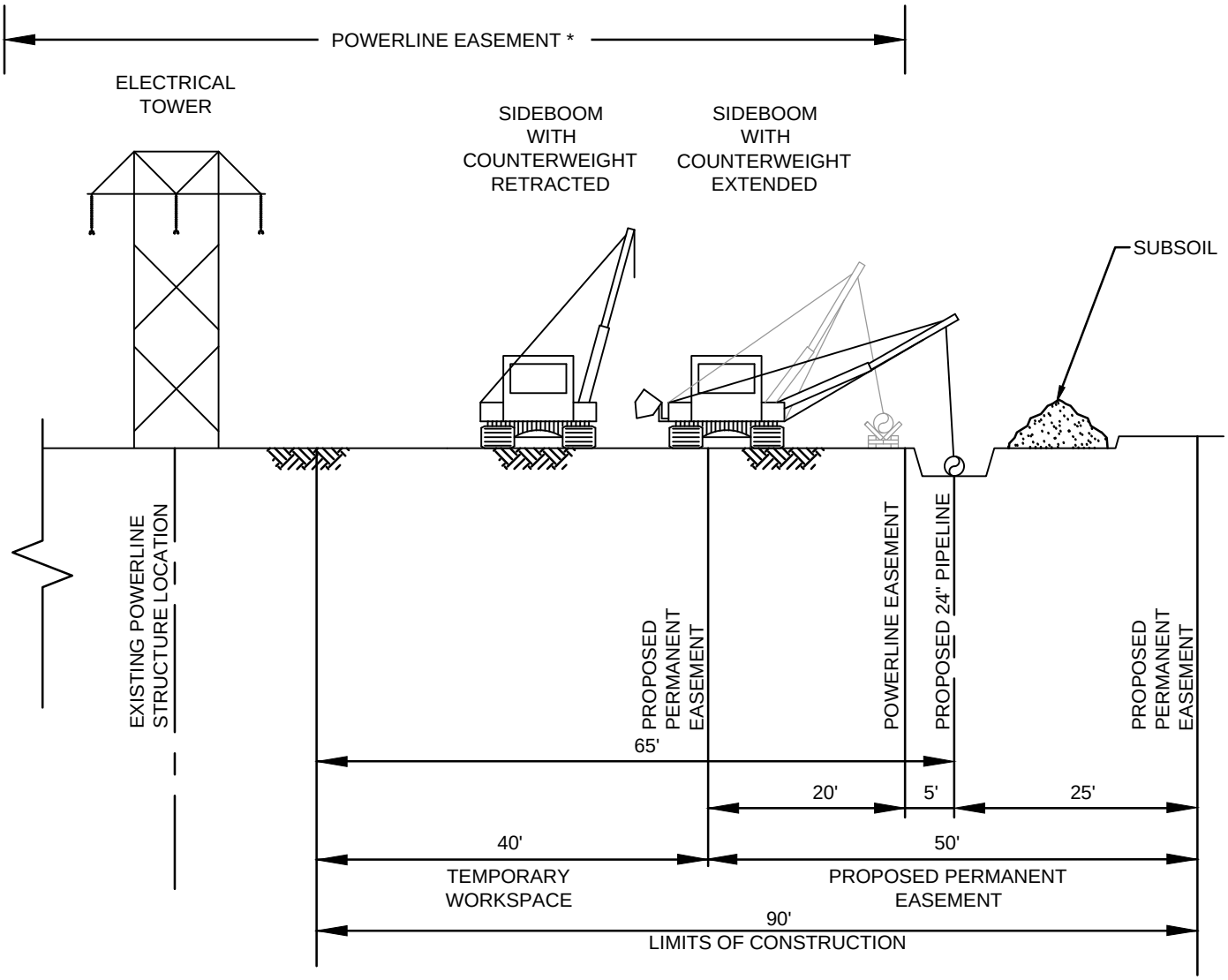

PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT(20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE EASEMENT) AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

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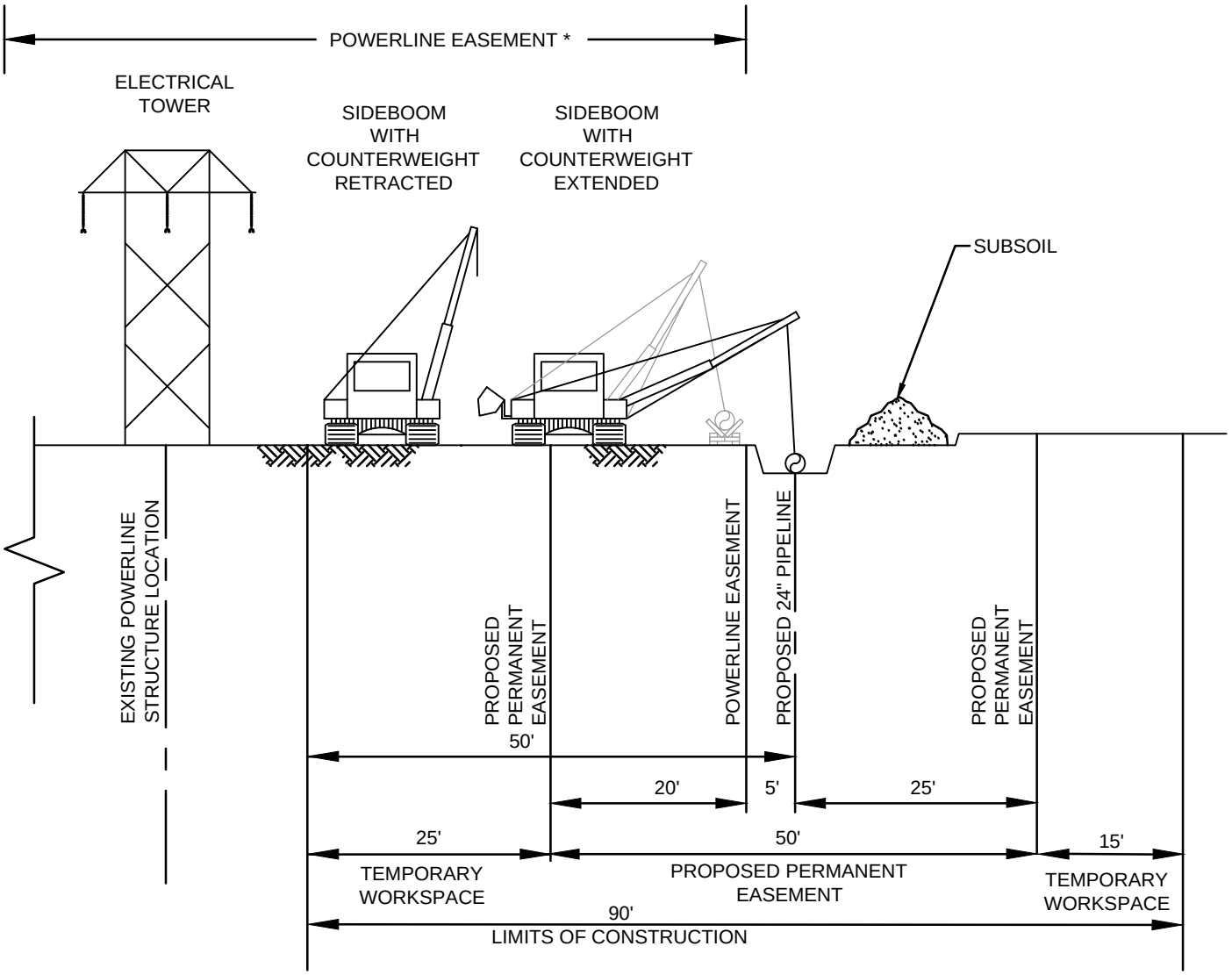
90' CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_09A



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT(20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE EASEMENT) AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
3. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.

* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

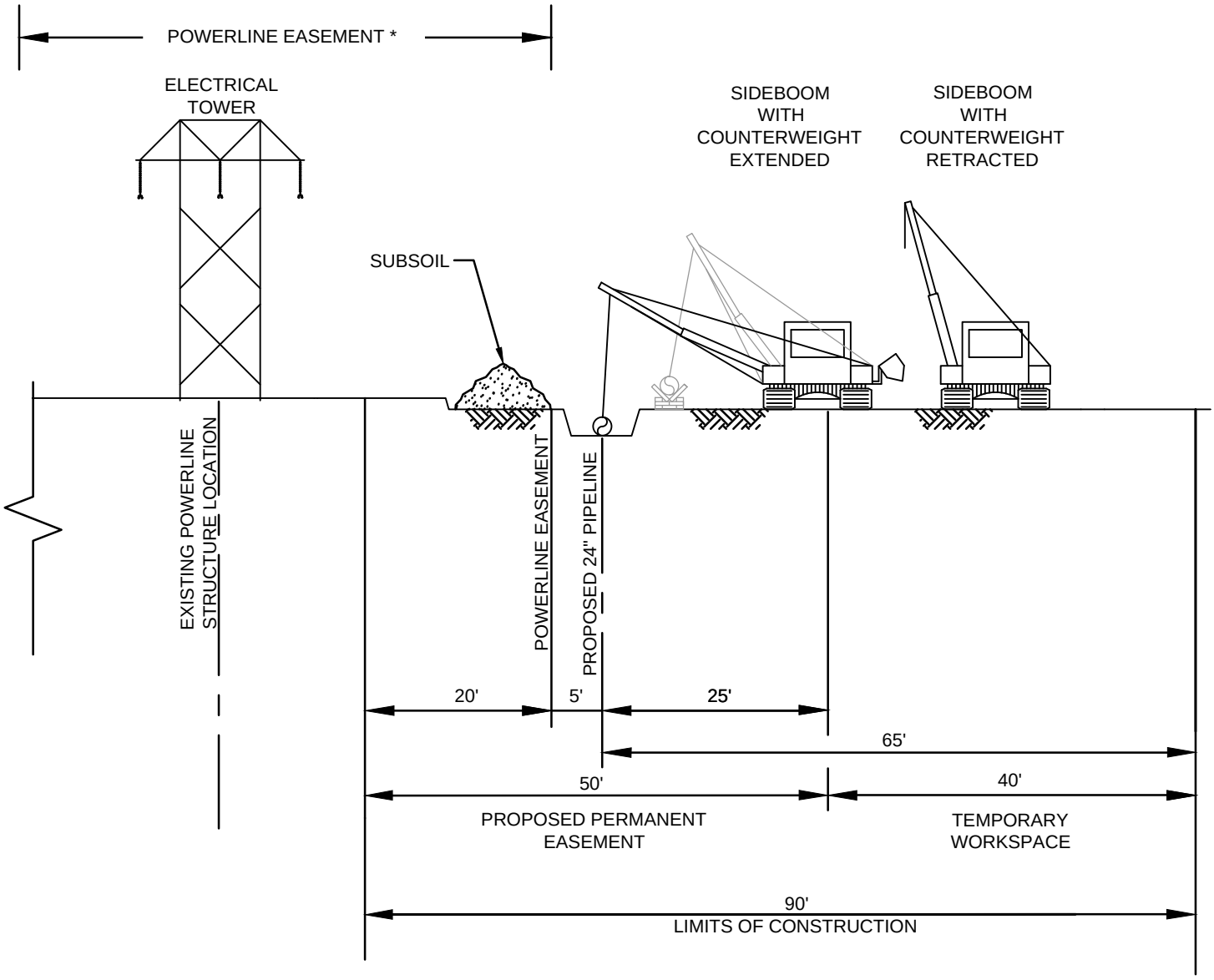
NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

REVISIONS

ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

90' CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_09B



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT (20 FEET OF THE PROPOSED PERMANENT EASEMENT BEING SHARED WITH THE POWERLINE EASEMENT) AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
3. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.

* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

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REVISIONS

ENG. RECORD		DATE
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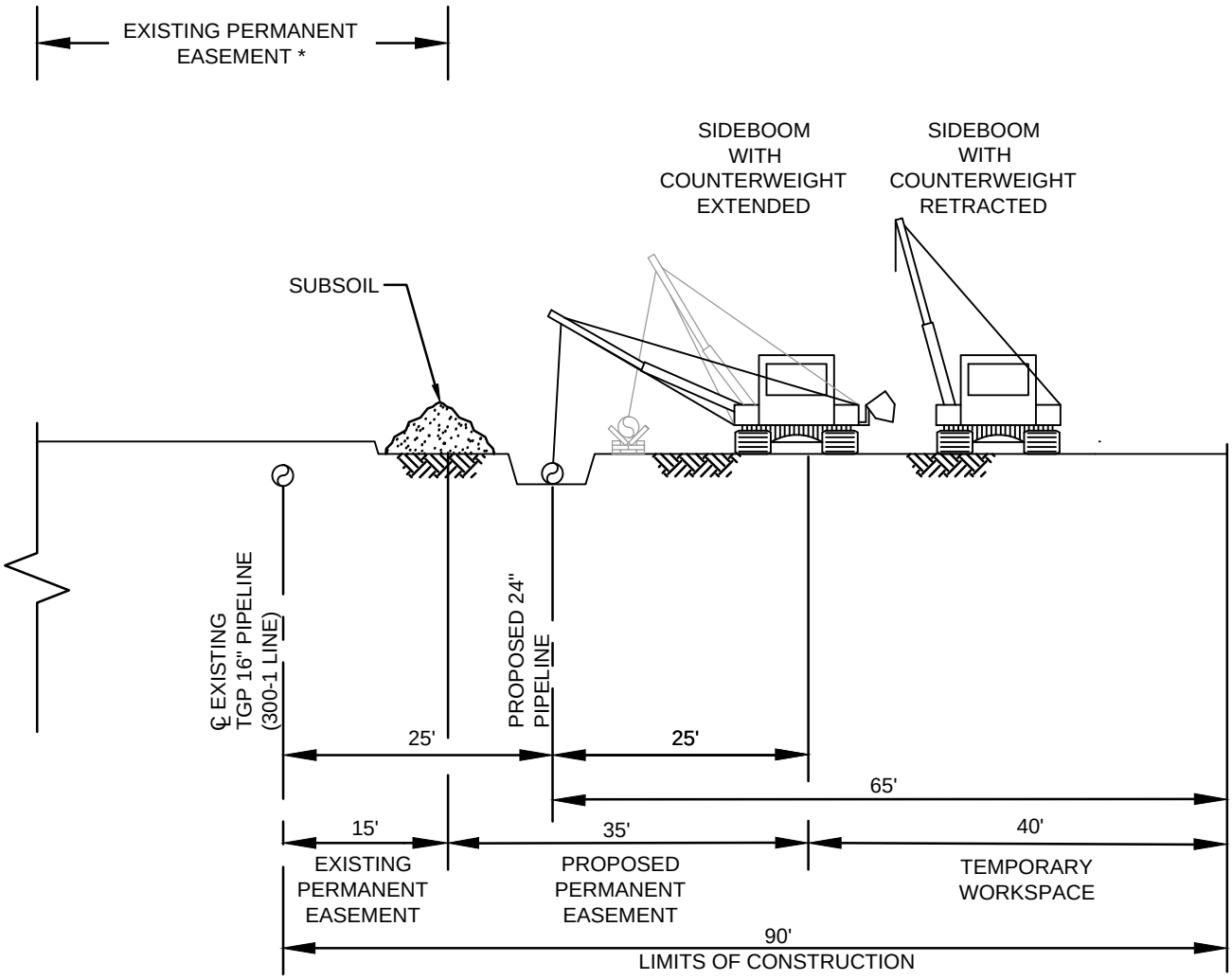
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

90' CORRIDOR PIPELINE OUTSIDE POWERLINE EASEMENT FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_9C



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF15 FEET OF EXISTING PERMANENT EASEMENT, 35 FEET OF PROPOSED PERMANENT EASEMENT, AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
3. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.
4. THE OFFSET FROM EXISTING PIPELINE, WHERE APPLICABLE, WILL BE 25 FEET, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

* EXISTING PERMANENT EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS.

NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

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DRAWN BY:	HMM	04/2015
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PROJECT APPROVAL		
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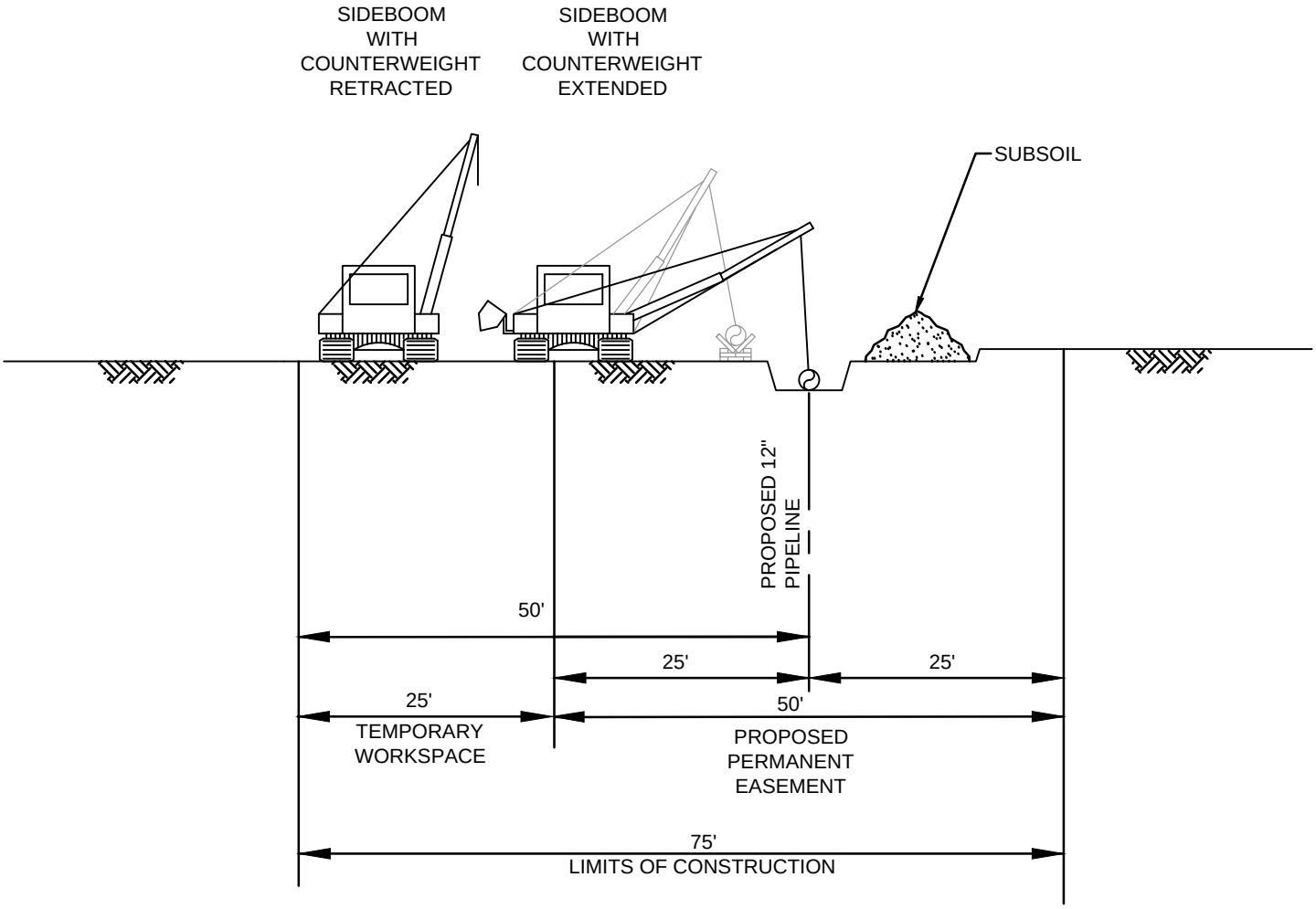
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

90' CORRIDOR PARALLEL TO 300-1 LINE FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_10



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
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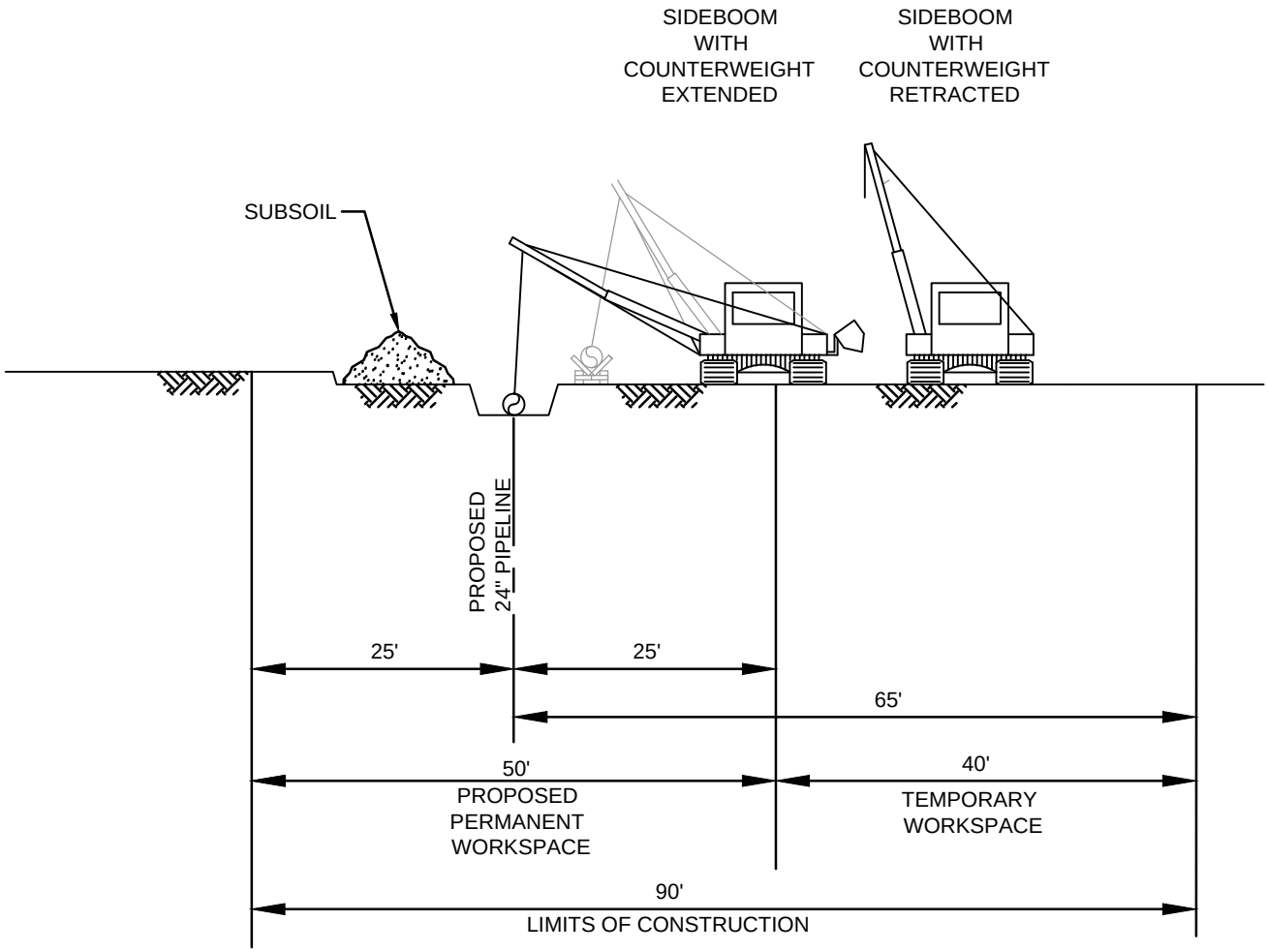
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

75' CORRIDOR (GREENFIELD) FOR PROPOSED 12" PIPELINE

DWG. NO. ROW-CONFIG_11



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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REVISIONS

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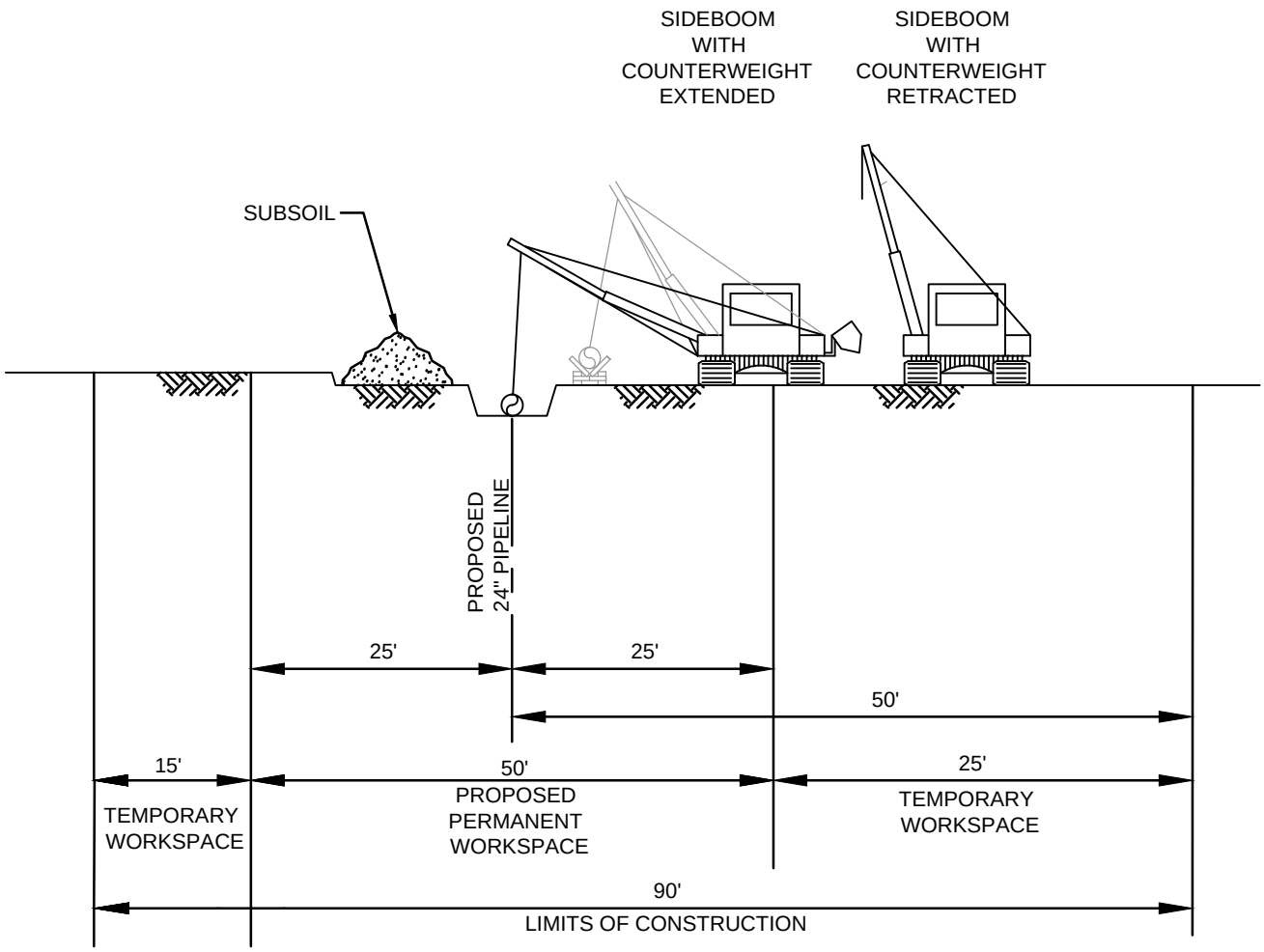
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

90' CORRIDOR (GREENFIELD 50/40) FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_12A



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 90 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 40 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
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NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

REVISIONS

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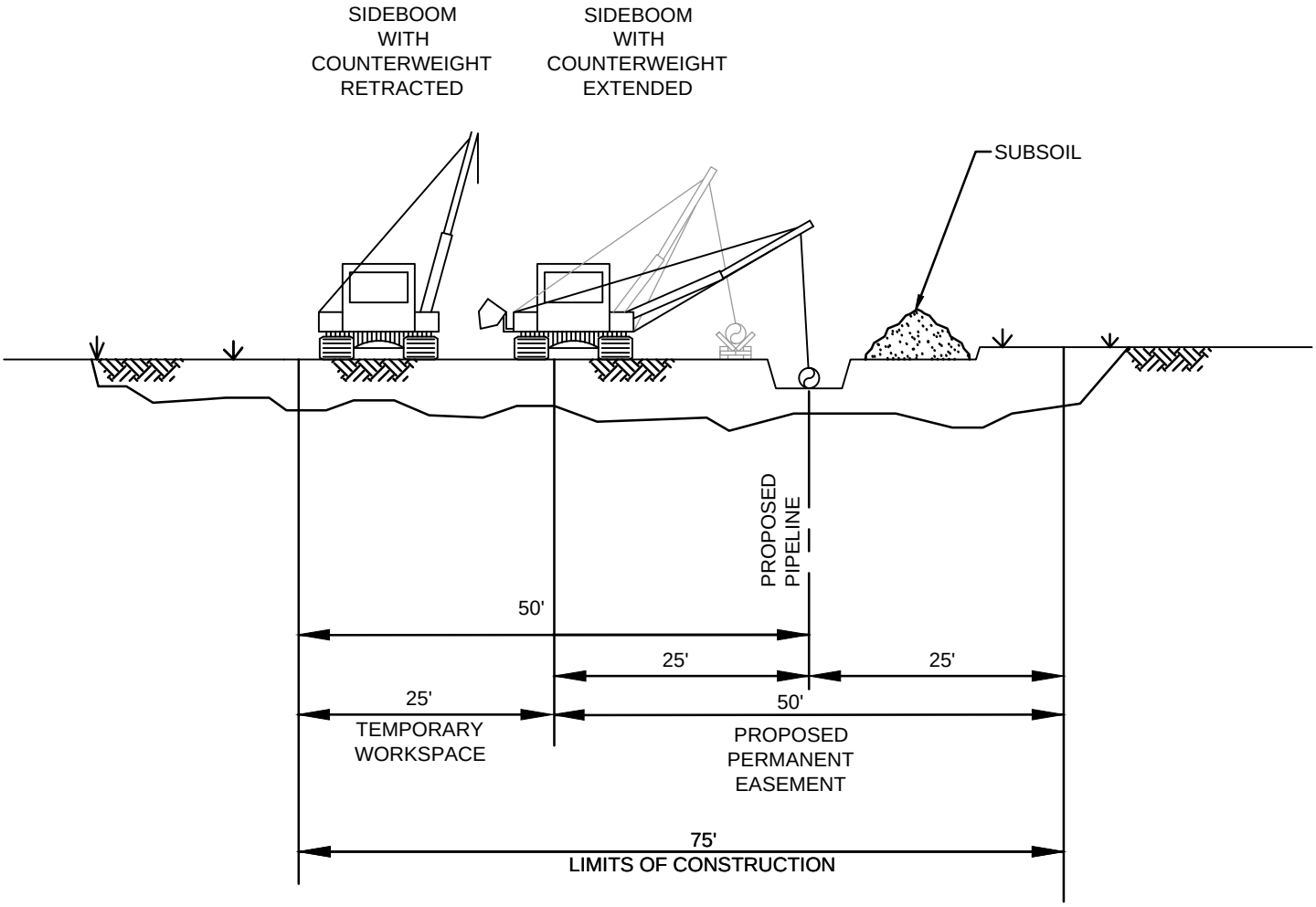
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

90' CORRIDOR (GREENFIELD) FOR 24" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_12B



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY THROUGH WETLANDS WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.

NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

REVISIONS

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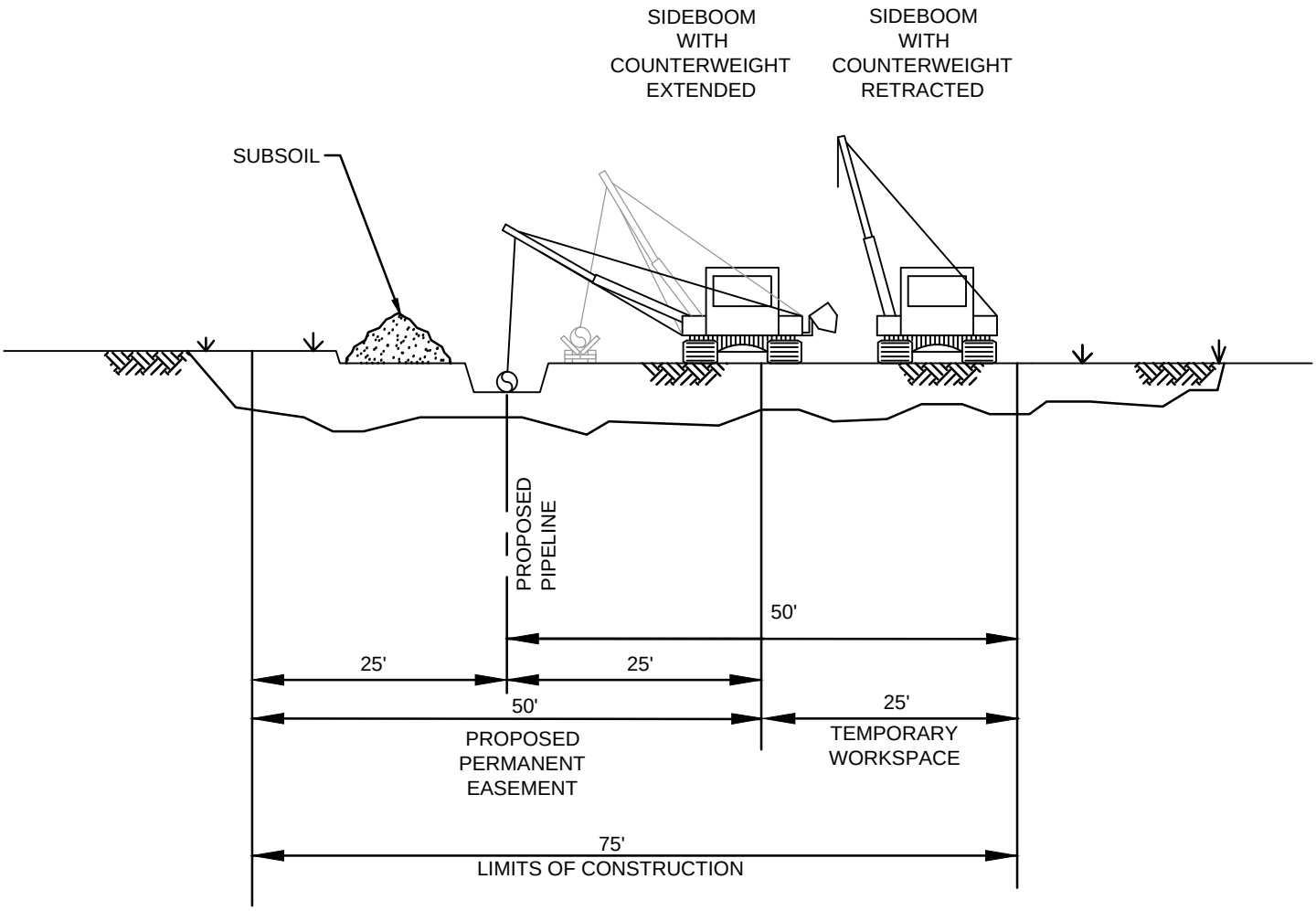
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

75' CORRIDOR (WETLANDS)

DWG. NO. ROW-CONFIG_13



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY THROUGH WETLANDS WILL TYPICALLY BE REDUCED TO 75 FEET WIDE CONSISTING OF 50 FEET OF PROPOSE PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.

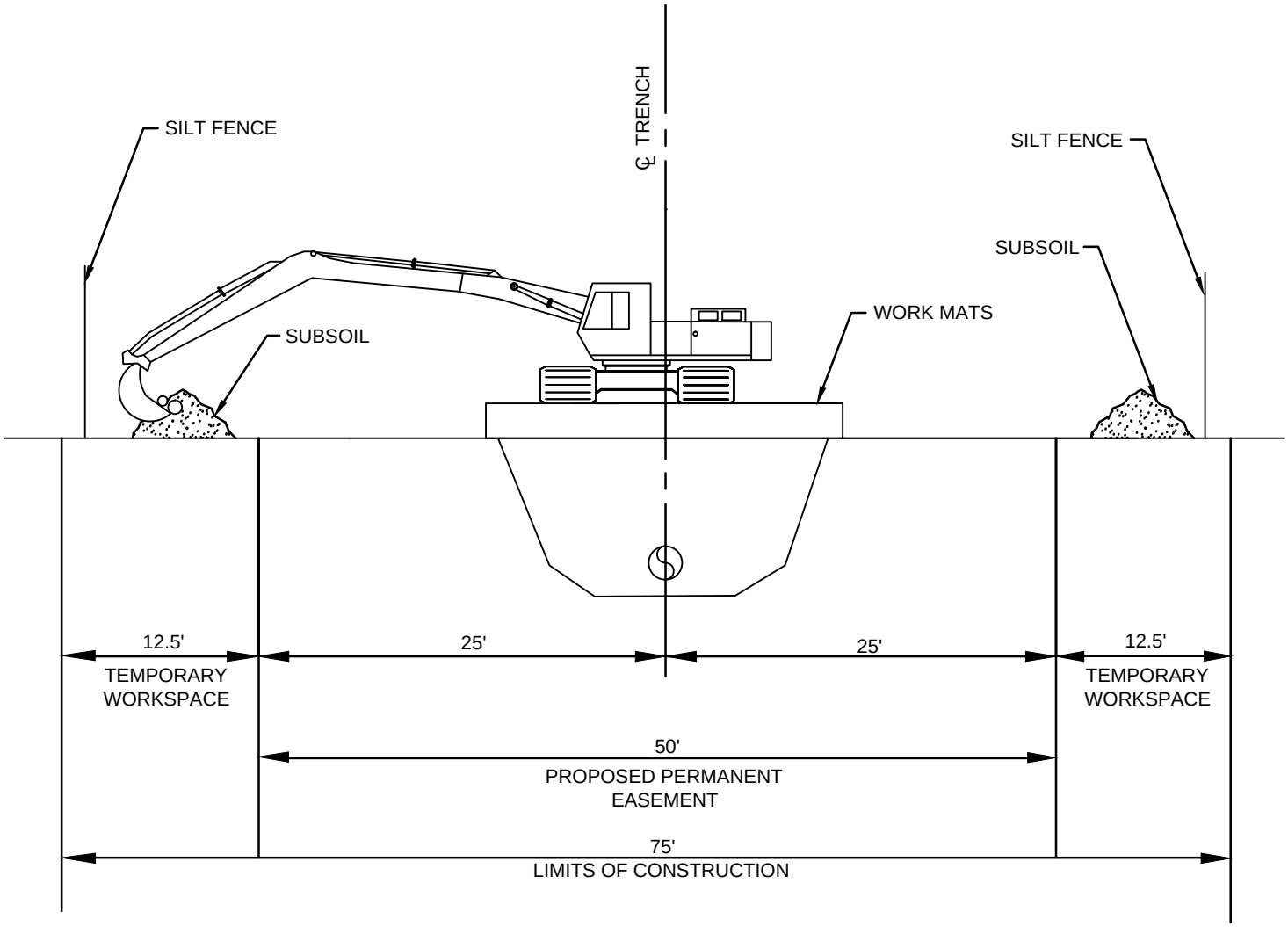
NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

REVISIONS

ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

75' CORRIDOR (WETLANDS)

DWG. NO. ROW-CONFIG_14



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY THROUGH WETLANDS WILL TYPICALLY BE REDUCED TO 75 FEET WIDE CONSISTING OF 50 FEET OF PROPOSE PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING TOPSOIL AND SPOIL PILES.

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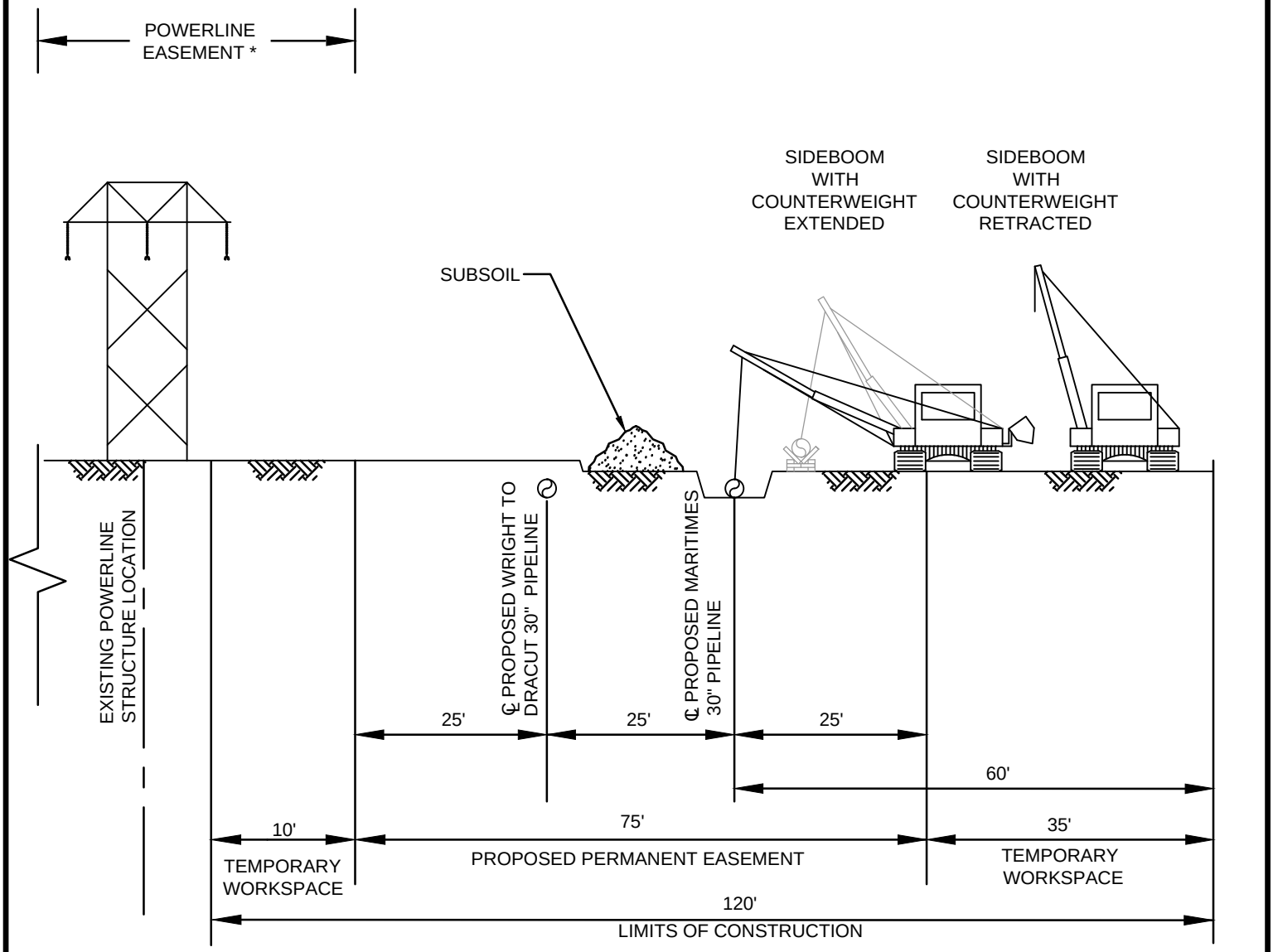
REVISIONS

ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

75' CORRIDOR PUSH/PULL WETLAND CROSSING METHOD

DWG. NO. ROW-CONFIG_15



PROFILE
(NOT TO SCALE)

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 120 FEET WIDE CONSISTING OF 75 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. ADD 25 FEET OF ATWS ON WORKING SIDE (TYPICALLY) FOR TOPSOIL STORAGE IN AGRICULTURAL FIELDS, RESIDENTIAL YARDS, AND AS PER LANDOWNER AGREEMENTS.
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* EXISTING POWERLINE EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

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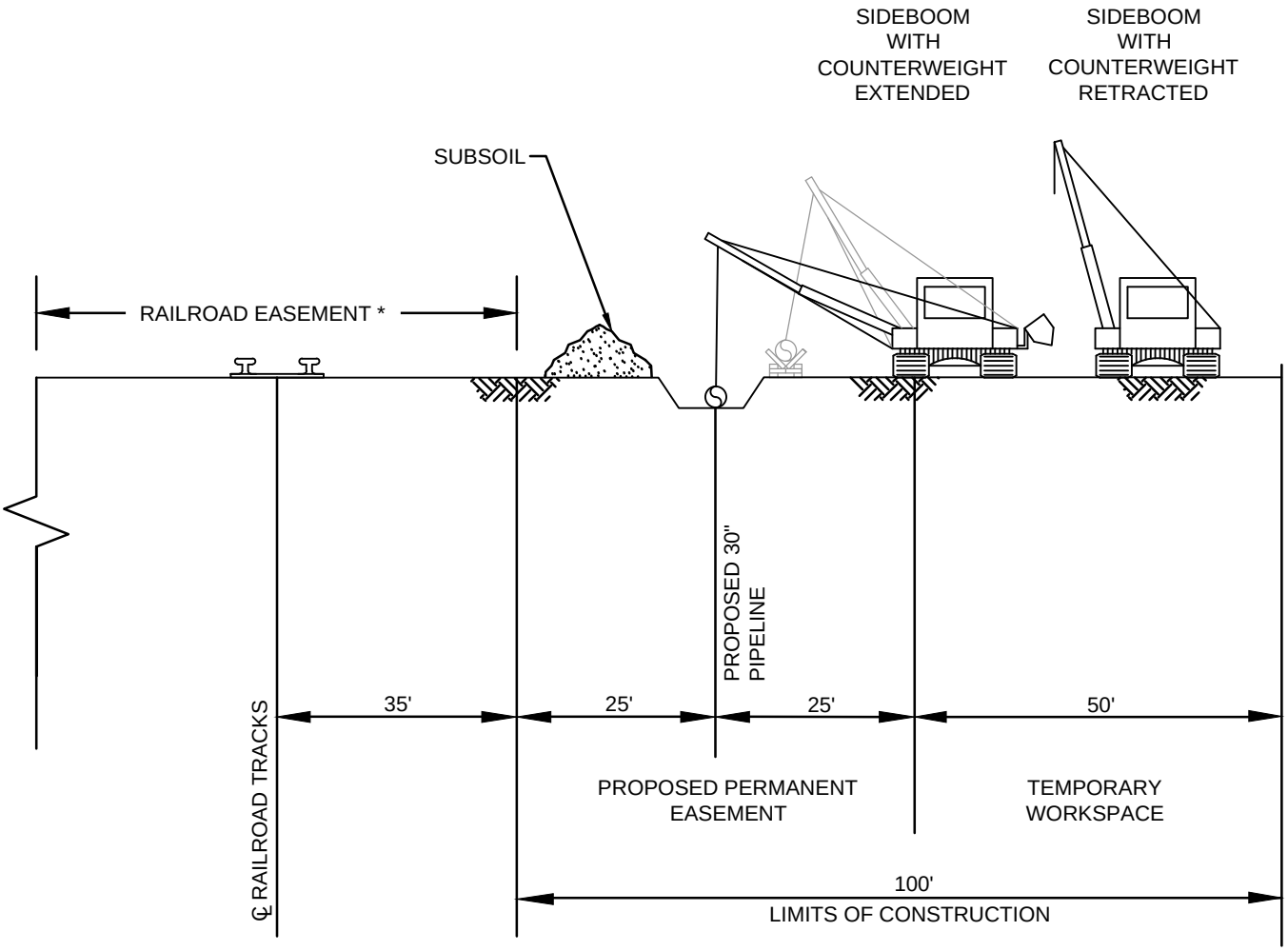
REVISIONS

ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

120' CORRIDOR SEG K & L ; PARALLEL CONSTRUCTION FOR PROPOSED 30" PIPELINES

DWG. NO. ROW-CONFIG_16



PROFILE
(NOT TO SCALE)

NOTE:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100 FEET WIDE CONSISTING OF 50 FEET OF PROPOSED PERMANENT EASEMENT AND 50 FEET OF TEMPORARY WORKSPACE. ADDITIONAL TEMPORARY WORKSPACE (ATWS) WILL BE NECESSARY AT MAJOR ROADS, RAILROADS, RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
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* EXISTING RAILROAD EASEMENT VARIES BASED ON EXISTING PROPERTY RIGHTS

NO	DATE	BY	DESCRIPTION	PROJ. ID	APPR.

REVISIONS

ENG. RECORD		DATE
DRAWN BY:	HMM	04/2015
DRAWING APPROVAL		
PROJECT APPROVAL		
SURVEY DATE:		
SCALE: N.T.S.		
PROJECT ID:		
FILE NAME:		

100' CORRIDOR PARALLEL TO EXISTING RAILROAD FOR 30" PROPOSED PIPELINE

DWG. NO. ROW-CONFIG_17

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Tennessee Gas Pipeline
Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M3

SPILL PREVENTION AND RESPONSE PLAN

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TABLE OF CONTENTS

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

2.0 PREVENTATIVE MEASURES

The Spill Prevention and Response Plan ("SPRP") provides preventative and mitigative measures to be employed by Tennessee during construction of the Project and/or operations and maintenance activities for the Project facilities. Methods listed in this plan are based on approved spill controls plans that Tennessee has used successfully in the past and are established to minimize the environmental impact associated with spills or releases at fuel, lubricant, or hazardous materials storage areas, during normal upland construction and refueling activities, and during special refueling activities within 100 feet of perennial stream banks, wetland boundaries, or within municipal watersheds. The Project's on-site Environmental Inspector ("EI") is responsible for ensuring that Tennessee's construction contractors ("Contractors") implement the measures and procedures outlined in this SPRP. The responsibilities of these inspectors are described in Tennessee's Upland and Erosion Control, Revegetation, and Maintenance Plan ("Plan", Attachment M14) and Wetland and Waterbody Construction and Mitigation Procedures ("Procedures", Attachment M15).

2.1 TRAINING

The Contractor will instruct personnel on the operation and maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, and lubricants. Personnel will also be made aware of the pollution control laws, rules, and regulations applicable to their work.

Spill prevention briefings with the construction crew will be scheduled and conducted by the Contractor to ensure adequate understanding of spill prevention measures. These briefings will highlight:

- Precautionary measures to prevent spills;
- Sources of spills, such as equipment failure or malfunction;
- Standard operating procedures in case of a spill;

- Equipment, materials, and supplies available for clean-up of a spill; and
- A list of known spill events.

A spill is an un-permitted release of product, raw materials, or chemicals outside any secondary containment and into the environment. Spills can occur as a result of leaks, accidents, or third-party incidents.

2.2 EQUIPMENT INSPECTION/MAINTENANCE

The Contractor will inspect and maintain equipment that must be fueled and/or lubricated according to a strict schedule. The Contractor will submit to Tennessee for approval written documentation of the methods used and work performed.

All containers, valves, pipelines, and hoses will be examined regularly to assess their general condition. The examination will identify any signs of deterioration that could cause a spill and signs of leaks, such as accumulated fluids. All leaks will be promptly corrected and/or repaired.

2.3 REFUELING

1. The Contractor will ensure that fuel trucks transporting fuel to on-site equipment travel only on approved access roads ("ARs"); that all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area; equipment is refueled and lubricated within the right-of-way ("ROW"), compressor station yard, meter station site, contractor yard, fee property, or other permitted area and at least 100 feet away from all waterbodies and wetlands, with the following exceptions:
   - The EI finds, in advance, that no reasonable alternative is available and the Contractor and Tennessee have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;
   - Areas such as rugged terrain or steep slopes where movement of equipment to refueling stations would cause excessive disturbance to the ROW or workspace;
   - Areas where removing equipment from a wetland for servicing would increase adverse impacts to the wetland;
   - Sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a barrier from the waterbody/wetland (i.e., road or railroad);
   - Locations where the waterbody or wetland is located adjacent to a road crossing, compressor station yard, or meter station site (from which the equipment can be serviced); and
   - Refueling of immobile equipment, including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps. Pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills.

In these areas, auxiliary fuel tanks will be used to reduce the frequency of refueling operations and in no case will refueling take place within 100 feet of any known potable water wells.

2. The Contractor will ensure that all refueling is done pursuant to the following conditions:
   - Impact minimization measures and equipment will be sufficient to prevent discharged fluids from leaving the ROW, compressor station yard, meter station site, workspace, or from reaching wetlands or waterbodies, and will be readily available for use. These will include a combination of the following:
     a. Dikes, berms, or retaining walls sufficiently impervious to contain spilled oil;
     b. Sorbent and barrier materials in quantities determined by the Contractor to be sufficient to capture the largest reasonably foreseeable spill;
     c. Drums or containers suitable for holding and transporting contaminated materials;
     d. Curbing;
     e. Culverts, gutters, or other drainage systems;
     f. Weirs, booms, or other barriers;
     g. Spill diversion or retention ponds; and
     h. Sumps and collection systems.
   - All spills will be cleaned up immediately. Containment equipment will not be used for storing contaminated material.
3. Concrete coating activities will not be performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the EI determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.
4. The Contractor will prepare, for approval by Tennessee, a list of the type, quantity, and the storage location of containment and cleanup equipment to be used during construction.

2.4 STORAGE

Storage containment areas will not have drains, unless such drains lead to a containment area or vessel where the entire spill can be recovered. The Contractor will ensure that bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils will have appropriate secondary containment systems.

2.5 PERSONNEL SUPPORT

Prior to construction, the ROW inspector or agent will identify and prepare a written inventory of water wells within 200 feet of the construction site. The Construction ROW Agent will notify the authorities of all potable water supply intakes located within 3 miles downstream of any crossings a minimum of 1 week prior to construction.

3.0 IMPACT MINIMIZATION MEASURES

Containment is the immediate priority in the case of a spill. A spill will be contained on Tennessee's property, ROW, compressor station yard, meter station site, or workspace, if possible. Clean up procedures will begin immediately after a spill is contained. In no case will containment equipment be used to store contaminated material.

Project operations will be structured in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. The Contractor will ensure the following measures are followed:

- Construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discovers of contaminate;
- Construction crew has on hand sufficient tools and material to stop leaks; and
- Names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U.S. Coast Guard and the National Response Center) that must be notified of a spill and follow the requirements of those agencies in cleaning up the spill, excavating and disposing of soils or other materials contaminated by a spill, and collecting and disposing of waste generated during spill cleanup.

Immediately report any spill or release of the following materials *regardless of location* (on-property or off-property) to the EI for notification and to the appropriate Tennessee representative as indicated below:

- Oil or petroleum products;
- Hazardous substances or hazardous wastes;
- Chemicals;
- Unplanned natural gas (flaring or venting); and
- Asbestos-containing materials ("ACMs").

If a spill enters a body of water, the Contractor will immediately take samples upstream and downstream from point of entry and refrigerate samples. If advised, additional analysis will be completed and/or additional samples will be gathered.

If the EI agrees and the Contractor determines that a spill is small enough such that the construction crew can safely handle it, the crew will use construction equipment to containerize all spilled material, contaminated soil, and sorbent material in a manner consistent with the spilled materials' characterization.

If the EI agrees and the Contractor determines that a spill cannot be adequately excavated and disposed of by the construction crew alone, the Contractor will contact waste containment specialists. The Contractor will ensure that all excavated wastes are transported to a Tennessee-approved disposal facility licensed to accept such wastes. Wastes will not be transported to a Tennessee facility (i.e., compressor station, meter station, etc.) unless the Field Environmental Coordinator approves it in writing.

The Contractor will prepare a Construction Site Spill Report form to be given to Tennessee that includes:

- The date, time, and location of the occurrence or discovery of the occurrence;
- A description or identity of the material spilled;
- An estimate of the quantity spilled;
- The circumstances that caused the spill (e.g., equipment failure);
- A list of waterbodies affected or potentially affected by the spill;
- A statement verifying whether a sheen is present;
- The size of the affected area;
- An estimate of the depth that the material has reached in water or on soil;

- A determination of whether the spill will migrate off of Tennessee's property or the ROW or workspace;
- A determination of whether the spill is under control;
- A statement verifying that clean-up has begun and a description of the methods being used to clean up the spill;
- The names of the people observing the spill (with their affiliations) and the extent of injuries, if any; and
- The Field "Report of Spill" form.

Tennessee will ensure that the Contractor's spill report is complete and forward it to the Field Environmental Coordinator. The Contractor will follow the *"Contractor's Environmental Guidelines - Waste Disposal and Spill Notification"* procedures regarding all required regulatory notifications, subject to Tennessee's prior approval, and for obtaining any necessary state and local licenses, permits, or other authorizations associated with the Project, except as otherwise provided in the scope of work. The Contractor is responsible for knowing what state and local environmental authorizations are necessary for the specific job at hand. Any above-mentioned permits, clearances, or authorizations obtained by the Contractor will be furnished to Tennessee.

The following releases require immediate (within 1 hour of discovery) notification to the National Response Center:

1. Any petroleum product released into streams, rivers, lakes, or dry washes;
2. A release that exceeds the reportable quantity ("RQ") of any Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") hazardous substances in any 24-hour period which is not fully contained;
3. A release of a hazardous substance or hazardous waste which occurs during transportation; and
4. A release of hazardous waste which contains a RQ of a hazardous substance.

The National Response Center (1-800-424-8802) will be notified immediately if spills occur above threshold levels (Clean Water Act ["CWA"], 40 Code of Federal Regulations ["CFR"] 110.10) into surface waters and/or wetlands.

4.0 SUGGESTED EQUIPMENT LIST

Section 1.3 of these Procedures states that the Contractor will prepare a list of the type, quantity, and location of storage, containment, and cleanup equipment to be used on the construction site. The list will include the Procedures and impact minimization measures to be used in response to a spill. The Contractor's choice of impact minimization measures and equipment will be tailored to meet the characteristics of the affected terrain, as well as the types and amounts of material that could potentially be spilled. The types of equipment that Tennessee expects to use to control spills at terrestrial sites and wetlands are described in the FERC's Plan.

4.1 TERRESTRIAL CONSTRUCTION

General equipment that the Contractor will use for spill containment and cleanup on terrestrial areas includes:

- Sorbents (pillows, socks, and wipe sheets) for containment and pickup of spilled liquids;
- Commercially available spill kits (or the functional equivalent thereof) that are prepackaged, self-contained spill kits containing a variety of sorbents for small to large spills;
- Structures such as gutters, culverts, and dikes for immediate spill containment;
- Shovels, backhoes, etc., for excavating contaminated materials;
- Sumps and collection systems; and
- Drums, barrels, and temporary storage bags to clean up and transport contaminated materials.

4.1.1 Fuels and Lubricating Oil Storage

The Contractor will implement special measures to prevent spills in areas where trucks carrying fuel and oil barrels are loaded. Containment equipment will be kept close to tanks and barrels to minimize spill response time, and will include absorbent pads or mats. The quantity and capabilities of the mats will be sufficient to capture the largest foreseeable spill, given ROW or workspace characteristics, crankcase and other fuel vessel capacities.

4.1.2 Routine Refueling and Maintenance

Absorbent pads and mats will be placed on the ground beneath equipment before refueling and maintenance. Equipment that will be stored on-site for routine refueling and maintenance includes small sorbent kits (or their functional equivalent).

4.1.3 Equipment Failure

Kits with the capacity of absorbing up to 5 gallons of liquid can fit beneath the operator's seat on construction equipment for use in an equipment failure.

4.2 WATERBODY AND WETLAND CROSSINGS

For each wetland and waterbody crossed, the equipment listed below will be available, in addition to that needed for terrestrial construction. This equipment will be stored close to the water or wetland to minimize response time, and will include:

- Oil containment booms and the related equipment needed for rapid deployment; and
- Equipment to remove oils from water, such as oleophilic and hydrophobic absorbent booms and mats, and/or mechanical skimmers.

Tennessee Gas Pipeline Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M4

WASTE MANAGEMENT PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

This Waste Management Plan outlines waste identification and characterization procedures that the construction contractor ("Contractor") will adhere to during Project construction.

2.0 WASTE IDENTIFICATION AND CHARACTERIZATION

2.1 IDENTIFYING WASTES

Wastes may be grouped into four categories, each requiring different forms of disposal:

- Hazardous wastes - Wastes that meet one of the criteria of ignitable, corrosive, reactive, toxic, or is specifically listed as hazardous waste by regulation. These wastes require special handling and disposal;
- Non-hazardous wastes - Wastes that do not fall into the other categories. This includes general trash;
- Special wastes - Wastes that do not meet the criteria for hazardous wastes, but may present special hazards or require special handling. Examples of special wastes are asbestos, polychlorinated biphenyls ("PCBs"), radioactive waste, and naturally occurring radioactive material ("NORM"). It is important to note that some states have their own classification of special wastes; and
- Universal wastes - To reduce the amount of hazardous waste in municipal solid waste streams, the U.S. Environmental Protection Agency ("USEPA") and many states recognize batteries, thermostats and lamps (e.g., fluorescent light bulbs) as "universal" which allows easier handling of these wastes.

2.2 WASTE CHARACTERIZATION

The Environmental Inspector ("EI") will coordinate with the Field Environmental Representative to determine if waste profiles exist for wastes generated during construction. If the classification of a waste

is unknown, the waste must be characterized using test results or knowledge of the process generating the waste to determine the proper handling requirements for that waste. The EI will coordinate with the Field Environmental Representative and Contractor to determine the type of waste and the party responsible for proper disposal. The information below is used to characterize a waste:

- Source of the waste;
- Material Safety Data Sheets ("MSDS") for materials comprising the waste;
- Laboratory results from waste testing, as applicable; and
- If no existing waste profile exists, contact the Field Environmental Representative for waste characterization and sampling instructions.

Prior to waste characterization, a number of general guidelines will be adhered to when handling or storing wastes:

- Ensure that the Contractor's Environmental Guidelines in the contract are followed;
- Ensure that the Contractor provides a list to the EI of all hazardous materials or potential contaminants that are to be used or stored on the Project site;
- DO NOT bury any waste with the exception of stumps, rocks, or boulders as approved within the Tennessee's Upland Erosion Control, Revegetation and Maintenance Plan ("Plan", Attachment M14) and the Tennessee's Wetland and Waterbody Construction and Mitigation Procedures ("Procedures", Attachment M15);
- Never mix any waste awaiting characterization with other wastes;
- Never ship any waste unless it has been characterized;
- Never ship any hazardous waste from the job site to a compressor station without prior approval from the Field Environmental Representative and compressor station;
- Ship wastes, along with the required manifests, only to Tennessee-approved facilities; and
- Never ship drums of waste to a compressor station without prior approval from the Field Environmental Representative and the compressor station.

3.0 WASTE TYPES

3.1 HAZARDOUS WASTE

Common wastes include, but are not limited to: pipeline sludge, spent pigs, sandblast abrasive (depending on type and use), paint thinner, and solvents.

The following procedures apply to the storage of waste determined to be hazardous for all classes of generators:

- Store hazardous wastes using the Department of Transportation ("DOT") approved containers, a frac tank (bulk liquid wastes); a covered steel roll-off container with a poly-liner (bulk solid wastes like contaminated soil);, or on a thick poly-liner and provide the area with a poly-liner cover and temporary containment berm (bulk solid wastes);
- When using DOT-approved containers, ensure the containers are kept closed or sealed (except when waste is being added), maintained in good condition (not damaged, leaking, or corroded),

and store compatible substances that will not react with the hazardous waste. For example, store acidic wastes in plastic or plastic-lined containers rather than steel containers;

- Label hazardous waste containers (drums, tanks, roll-off containers) with a hazardous waste label as soon as any hazardous waste is placed into the container. Use a waterproof pen to complete the following information on the label:
  - Generator name, address, and phone number;
  - Generator USEPA identification number;
  - Description of waste (contact the Field Environmental Representative to obtain a waste description);
  - The 4-digit USEPA waste code (the Field Environmental Representative will provide USEPA waste codes); and
  - Accumulation date (the date the waste was added to the container, if not from satellite storage, or the date it was brought to the waste storage area from a satellite accumulation area);
- Label waste piles with a weatherproof sign identifying the waste and the date the waste pile was started. Waste piles are to be placed on poly-liner, covered to protect them from weather, and surround with barricade tape; and
- Store hazardous waste in a designated hazardous waste storage area (or in a designated satellite accumulation area) that is covered or protected from the weather; has an impermeable floor, surrounded by curbing or use spill pallets; and is more than 50 feet away from the facility property line if ignitable or reactive hazardous waste is stored in the area.

Hazardous waste storage areas should be managed as follows:

- Identify as hazardous and non-hazardous waste appropriately;
- Arrange the containers by waste type, keeping similar hazardous wastes together;
- Separate any incompatible waste by a dike, berm, wall, or other containment device;
- Turn containers so labels may be read easily and ensure that enough isle space is left between drums to inspect for leaks and to gain access to respond to spills or fire;
- Handle waste containers carefully to prevent rupture or leaks and protect containers from extreme temperatures;
- Large quantity generators, and in some states, small quantity generators must have a contingency plan; weekly inspections of hazardous wastes; and specific training provided to personnel; and
- Hazardous waste can only be disposed of at approved facilities. Contact the Field Environmental Representative for a list of approved facilities.

3.2 NON-HAZARDOUS WASTE

Common wastes include, but are not limited, to oily rock/soil, oily rags, sandblast abrasive (depending on type and use), and general trash/garbage.

Non-hazardous waste storage areas should be managed as follows:

- Turn containers so labels may be read easily;
- Non-hazardous waste is waste that has not been found to be hazardous through testing or by generator knowledge but has special transportation and disposal requirements, which may include State permitting and approvals;

- Store non-hazardous wastes using one of the following methods:
  - In DOT-approved containers;
  - In a frac tank (bulk liquid wastes);
  - In a covered steel roll-off container with a poly-liner (e.g., bulk solid wastes like contaminated soil or used sandblasting abrasive); and
  - On a thick poly-liner and provide the area with a poly-liner cover and temporary containment berm (bulk solid wastes).
- When using DOT-approved containers, ensure the containers are:
  - Kept closed or sealed (except when waste is being added); and
  - In good condition (not damaged, leaking or corroded).
- Label non-hazardous waste containers (drums, tanks, roll-off containers) with a non-hazardous waste label identifying the contents as soon as waste is placed into the container;
- Store non-hazardous waste segregated from hazardous waste storage or satellite accumulation areas; and
- Non-hazardous waste can only be disposed of at approved facilities. Contact the Field Environmental Representative for a list of approved facilities.

Some States allow sandblast sand to be left in the ditch if sandblasting bare pipe only. Contact the Project Environmental Coordinator to verify if this type of activity may occur.

3.3 SPECIAL WASTE (ASBESTOS AND PCB)

Common wastes include, but are not limited to: asbestos or asbestos containing material ("ACM") and PCBs.

3.3.1 Asbestos/ACM

Check with the Project Environmental Coordinator to determine if there are any additional state-specific requirements that may apply. However, at a minimum:

- Store in double, six-mil thick plastic bags, or single bags in DOT-approved drums.
- When placing asbestos into waste containers:
  - Ensure that the asbestos is thoroughly wet before closing the container for the final time;
  - Gloves and other solids can be added before sealing;
  - Seal all containers by securing the drum lids or by wrapping the neck of plastic bags with duct tape;
  - Store containers in an area where the waste is secure and not easily disturbed; and
  - For accumulation containers, each item must be individually wrapped and placed in the drum.
- Mark or label the container with the following information:
  - The letters "RQ" for reportable quantity, if the waste contains 1 pound or more of friable asbestos;
  - The word "Waste";
  - The word "Asbestos" and the identification number for asbestos "NA2212";
  - The facility name and address; and
  - A warning label stating "DANGER; CONTAINS ASBESTOS FIBERS; AVOID CREATING DUST; CANCER AND LUNG DISEASE HAZARD".
- Ship asbestos waste to a Company-approved disposal facility. Contact the Field Environmental Representative for a list of approved facilities.

- Pipe coated with non-friable asbestos can be sold and transported to a scrap dealer or individual buyer. Written notification to the dealer or buyer must include a disclosure and release document that indicates that the pipe is coated with an asbestos-containing material. Tennessee has a specific document for this purpose that contains the appropriate language. Contact the Field Environmental Representative for details on transferring pipe coated with non-friable asbestos.
- When preparing sections of pipe coated with friable asbestos-containing material for transportation to a Tennessee-approved disposal facility:
  - Pipe joints must be less than 40 feet long for transportation by trailer (also verify whether or not a specific pipe length is required by the disposal company);
  - Pipe joints must be less than 20 feet long for transportation in a roll-off box;
  - Wrap ends of pipe with polyvinyl and duct tape or place in a sealed roll-off container;
  - A manifest is required for transportation to a disposal facility; and
  - Provide state environmental or health department registration, if applicable.
- Use vehicles that meet DOT requirements to transport asbestos waste. If the amount of asbestos-containing material being transported is 1,000 pounds or more, a commercial driver's license with hazardous materials endorsement is required.
- Ensure that the vehicle transporting regulated asbestos-containing material (friable) from the facility is marked with signs warning of asbestos danger while the vehicle is being loaded or unloaded. The sign should read "DANGER; ASBESTOS DUST HAZARD; CANCER AND LUNG DISEASE HAZARD; AUTHORIZED PERSONNEL ONLY".
- Inspect all containers before and after unloading/loading to ensure:
  - All drum tops are secured;
  - Duct tape has been placed around the necks of all bags and there are no punctures. Place additional bags over the outside of any punctured bags and secure the necks of the new bags with duct tape; and
  - All containers are properly labeled.
- The type of shipping papers required depends on the applicable state. A waste shipping record must be completed for each shipment. Check with the Project Environmental Coordinator to determine if there are any additional state-specific requirements that may apply.
- Ensure shipping papers are completed as follows:
  - Check the "RQ" column on the shipping paper or mark "RQ" before the shipping name if the shipment contains 1 pound or more of friable asbestos;
  - DOT shipping name is "Waste Asbestos" or, if the asbestos waste is mixed with a binder, filler, or other material, "Waste Asbestos Mixture";
  - Hazard Class Identification Number is "Class 9";
  - North American Identification Number is "NA2212"; and
  - Packing group is "PG III".
- Never dispose of asbestos-containing wastes by placing it in a container with other trash, by burying, using as fill material, or leaving in a pipe excavation ditch.
- Dispose of asbestos-containing wastes as soon as practicable at a disposal facility that is permitted to accept asbestos. Contact the Field Environmental Representative for a list of approved disposal sites for asbestos-containing wastes.

3.3.2 PCB Waste

In some states, PCB wastes are hazardous wastes and all hazardous waste requirements must be followed in addition to those listed in this Waste Management Plan. Check with the Project Environmental Coordinator to determine if there are any additional state-specific requirements that may apply.

- PCB wastes may be stored for 30 days without any special storage requirements.
- PCB wastes may be stored up to 1 year within an USEPA-defined storage area. Contact the Project Environmental Coordinator for assistance on setting up a PCB waste storage area.
- At a minimum, store liquid PCB wastes in DOT-approved containers or on pallets with containment designed to capture any drips or leaks.
- Protect storage containers or equipment from weather.
- Mark PCB wastes with the proper PCB label before placing into storage. The basic PCB label is 6"x6", white or yellow, which can be reduced as small as 2"x2".
- Mark all PCB wastes with the date the item was removed from service or the date that the waste was generated and enter this information on the PCB waste log. Mark the storage area with a sign.
- Company vehicles can only be used to transport PCB wastes from a Company location where the waste was generated to another Company location where the waste will be stored. Placards are required if transporting:
  - More than 99.4 pounds of PCB waste in containers; and
  - One or more PCB transformers with 500 parts per million ("ppm") or more PCBs.
- Check containers before and after loading to ensure that they are in good condition, are not leaking, and that all covers are secured.
- A hazardous waste manifest must accompany each shipment of PCB waste.
- Contact the Project Environmental Coordinator for a list of Tennessee-approved PCB disposal facilities. Dispose all PCB wastes at an approved facility.
- Once the PCB waste has been shipped to an approved disposal facility, the owner or operator of the disposal facility will send the manifest and acknowledgement of receipt to the generator identified on the manifest which accompanied the shipment of PCB waste within 30 days of the date the disposal facility received the waste. If an acknowledgement of receipt is not received with the manifest, the waste generators will confirm by telephone by the close of business that the disposal facility received the manifested waste and document the acknowledgement in the PCB log. The disposal facility should also send a Certificate of Disposal within 30 days of actual disposal of the waste.

3.4 UNIVERSAL WASTE

Common wastes include, but are not limited to: batteries, thermostats, and fluorescent light bulbs.

- If any universal waste is generated during construction, contact the Field Environmental Representative for storage and disposal instructions.

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ATTACHMENT M5

HORIZONTAL DIRECTIONAL DRILLING CONTINGENCY PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

Tennessee proposes to use the horizontal directional drilling ("HDD") methodology (Attachment M2 to the ECP – Detail No. 64) to install 30-inch diameter pipeline proposed as part of the Project. Tennessee is proposing to use the HDD methodology to avoid certain roadways, railroad tracks, and 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 HDD Plan 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. A list of HDD crossing in New Hampshire is included in Table 1.0-1.

TABLE 1.0-1
Horizontal Directional Drilling Crossings for the Project in New Hampshire

Facility Name	County	Township/Town	Segment[1]	Milepost[2]		Comment	Approx. Length (feet)[3,4]
				Begin	End		
Wright to Dracut Pipeline Segment	Hillsborough	Merrimack / Litchfield	J	25.88	26.42	Avoidance of Pan Am Railway, Merrimack River	2,900
						Total	**2,900**

[1] Each segment is associated with its own set of MPs beginning at MP 0.00.
[2] Begin/End MPs are at the approximate locations of HDD entry/exit pits.
[3] Lengths are approximate and subject to field verification.
[4] For exact lengths refer to the HDD site-specific drawings.

2.0 FEASIBILITY ASSESSMENT

2.1 TECHNICAL FEASIBILITY

Tennessee has not yet completed geotechnical site investigations of all proposed HDD locations. However, when completed, this effort will include performing multiple boreholes at the HDD crossing 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 will determine if the proposed crossing is geotechnically feasible.

2.2 CONTINGENCY PLANS FOR FLOODING

Tennessee recognizes the potential for localized short-term flooding events and longer term flooding events during construction, including HDD activities. 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 the site, the construction crews will wait until water levels subside 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 with Tennessee's Upland Erosion Control, Revegetation and Maintenance Plan (Attachment M14) and Tennessee's Wetland and Waterbody Construction and Mitigation Procedures (Attachment M15), construction will continue using site preparation techniques for saturated conditions and proper monitoring will continue to ensure any water does not reach a level that is unmanageable. If there is a potential that water will reach a level that will jeopardize safety and/or compliance with Tennessee's Plan and Procedures, 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 Plan and Procedures.

2.3 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. Tennessee will notify the appropriate regulatory agencies of the failed installations and provide information to determine whether a second HDD attempt has a reasonable chance to succeed. 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 (subject to any necessary approvals to move the entry and/or exit point locations) and proceed with a second attempt to install the crossing by HDD. If this second HDD attempt fails (or if Tennessee determines that a second HDD attempt does not have a reasonable chance to succeed), 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 will provide on-site inspection during the HDD process to maintain adequate daily progress reports, as-built information, and other applicable construction documentation that will describe the events leading up to an HDD failure. Tennessee will 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 will not demobilize until Tennessee has received approvals from the appropriate regulatory agencies for an alternate crossing method. The alternate crossing method will 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 HDD spread can be moved onto a site in 7 to 10 tractor-trailer loads. Workspace dimensions of 250 feet by 200 feet are typically 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 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 rig site 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 water levels do not allow for 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, Tennessee's HDD Contractor will have adequate supplies of pumps, hay bales, silt fence, and sand bags on-site.

Wheeled vehicle access to the rig site 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 the Tennessee's Plan and Procedures.

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 and may need to 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 Plan and Procedures.

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 factors like positioning of equipment and anticipated drilling fluid pumping rates. Typically, drilling fluid collection pit dimensions are 10 feet long by 10 feet wide by 5 feet deep.

3.3 ADDITIONAL TEMPORARY WORKSPACE

Additional temporary workspace ("ATWS") is typically required for the pull section fabrication portion of the HDD process. The configuration and size of ATWS areas will be based on site-specific conditions and will vary in accordance with the construction methodology, crossing type, and other construction needs. ATWS is shown on Project Aerial Alignment Sheets (Attachment M1) and the site-specific HDD plan and profile drawings, provided in the FERC Project Environmental Report ("ER").

3.4 SPOIL STORAGE AND DISPOSAL

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

3.5 DEPTH AND DIAMETER OF BORE HOLE

The depths of the proposed HDD installations will be shown on the site-specific HDD plan and profile drawings, (Volume II, Appendix O). The minimum diameter of the pre-reamed boreholes for pipeline installations is anticipated to be 12 inches greater than the diameter of the product pipe, in accordance with HDD industry standards.

3.6 WATER SOURCE

Preliminary sources of HDD pre-test segment water sources and volumes for the proposed Project are identified in Table 3.6-1. Tennessee will create a water withdrawal plan to be provided with the Implementation Plan prior to construction, which will ensure that prescribed thresholds from the applicable state agencies are not surpassed during the water withdrawal process. Tennessee will apply for the appropriate water withdrawal permits using a preliminary plan based on estimated water volume and withdrawal timing needs.

Table 3.6-1
Approximate Horizontal Directional Drill Water Usage in New Hampshire

HDD ID[1]	Potential Water Source	Segment[2]	Approximate Milepost	Water Quantity[3] (gallons)
HDD-12	Merrimack River	J	26.19	1,150,000
			Total	**1,150,000**

N/A = Not Applicable

[1] HDD IDs are identified on the HDD site-specific drawings.

Table 3.6-1
Approximate Horizontal Directional Drill Water Usage in New Hampshire

HDD ID[1]	Potential Water Source	Segment[2]	Approximate Milepost	Water Quantity[3] (gallons)

[2] Each segment is associated with its own set of MPs beginning at MP 0.00.

[3] Water Quantity is the approximate water required for executing the drill (pilot bore, reaming, swab, and pull back operations) and for buoyancy control during construction. The water quantities are conservative estimates and may vary based on site specific conditions.

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 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 ("USEPA's") characteristics of ignitability, corrosivity, reactivity, or commercial chemicals. It is also used to seal earth structures (e.g., 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 percent viscosifier by volume, with the remaining components being water and drilled spoil. The drilling fluid is non-toxic and meets National Sanitation Foundation International/American National Standards Institute ("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, ROW 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 or land farming on the construction workspace with the approval of the landowner. 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 cleanup 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 practicable. However, resources spent in an effort to maintain circulation will be weighed against the potential benefits achieved through full circulation. It will be recognized that in subsurface conditions that are not conducive to annular flow, restoration of circulation may not be practicable or possible. In such cases, environmental impacts 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 will 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; and
- Suspend drilling activities for a period of 6 to 8 hours.

Inadvertent returns are the unplanned and uncontrolled release of drilling mud to the surrounding rock and sand, which travels towards the ground surface. Inadvertent returns typically occur through rock fractures, low density soils or unconsolidated geology. 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. If inadvertent returns occur within a wetland, waterway or other sensitive areas, 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 the environment and public health and safety (Section 4.3). 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

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 to 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 detail below.

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; and
- 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; and
- 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 will 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. If the Contractor fails 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 should it 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 first reduce the pressure, if possible and commence containment of drilling mud.
- Tennessee's Field Engineer will then 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 will be contained immediately with hand placed barriers (i.e., hay bales, sand bags, silt fences, etc.) and collected using pumps, as practicable. If the amount of the surface return is not enough to allow practical collection, the affected area will be diluted with fresh water and the fluid 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 will be suspended until surface return volumes can be brought under control. If the Contractor fails 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, after notifying appropriate regulatory agencies, will determine if the return poses a threat to the environment.
- If it is determined by the EI that the return does not pose a threat to the environment, such as sensitive environmental areas, protected species or their habitat, and/or cultural or archaeological sites, 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 becomes necessary to estimate inadvertent return volumes.
- If it is determined by the EI that the return does pose a threat to the environment, such as sensitive environmental areas, protected species or their habitat, and/or cultural or archaeological sites, drilling operations will be suspended until containment measures are 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 becomes necessary to estimate inadvertent return volumes. Upon completion of the HDD installation, Tennessee will clean up the drilling fluid returns to the satisfaction of appropriate regulatory agencies and any affected parties.

4.7 NOTIFICATION

In the event of an inadvertent drilling fluid return within a waterway, Tennessee will contact the following agencies no later than 24 hours after detection: United States Army Corps of Engineers; Pennsylvania State Department of Environmental Protection; and U.S. Fish and Wildlife Service ("USFWS") will also be contacted in the event of potential impacts to federal-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.

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ATTACHMENT M6

PLAN FOR UNANTICIPATED DISCOVERIES OF CULTURAL AND PALEONTOLOGICAL RESOURCES AND HUMAN REMAINS

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ATTACHMENT 4a
Plans for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains

ATTACHMENT 4a-1: Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains – Pennsylvania

As part of the Section 106 process, a protocol must be developed and put in place for the handling of any unanticipated paleontological and/or archaeological resources that might be exposed during the implementation and construction of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). For this purpose, Tennessee Gas Pipeline Company, L.L.C ("Tennessee") and its cultural resource consultant have developed the following Unanticipated Discovery Plan ("UDP"). This plan also covers unanticipated discoveries of paleontological resources.

Historic Properties

In the event that a previously unidentified archaeological resource or item of possible historical or cultural importance is discovered during ground-disturbing activities, Tennessee will immediately notify the Federal Energy Regulatory Commission ("FERC"), the appropriate State Historic Preservation Office ("SHPO"), Tribal Historic Preservation Office ("THPO") or appropriate tribal representative, and their cultural resource consultant. Appropriate contacts organized by state and federal agency are listed in Table 4a-1.

Table 4a-1
Pennsylvania Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Eric Tomasi	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8097	eric.tomasi@ferc.gov
FERC	Paul Friedman	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8059	Paul.Friedman@ferc.gov
PA SHPO	Steve McDougal	Pennsylvania Historical and Museum Commission Bureau for Historic Preservation 400 North Street, 2nd Floor Harrisburg, PA 17120 (717) 772-0923	smcdougal@pa.gov

Table 4a-1
Pennsylvania Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
PA GS	Gale Blackmer	DCNR – Bureau of Topographic and Geologic Survey 3240 Schoolhouse Road Middletown, PA 17057-3534 (717) 702-2032	gblackmer@pa.gov
Tribal Contacts			
Stockbridge-Munsee Band of Mohican Indians	Bonney Hartley THPO	400 Broadway #718 Troy, NY, 12181 (518) 326-8870	Bonney.Hartley@mohican-nsn.gov
Oneida Nation of Wisconsin	Corina Williams THPO	P.O. Box 365 Oneida, WI 54155-0365 (920) 496-5386	cwilliam@oneidanation.org
Saint Regis Mohawk Tribe	Arnold Printup THPO	412 State Route 37 Akwesasne, NY 13655 (518) 358-2272 x163	arnold.printup@srmt-nsn.gov
Seneca Nation of Indians	Scott Abrams THPO	90 Ohio Way Salamanca, NY 14779 (716) 945-1790 x 3580	Scott.Abrams@sni.org
	Jay Toth Tribal Archaeologist		jay.toth@sni.org
Oneida Indian Nation	Jesse Bergevin Historic Resources Specialist	2037 Dream Catcher Plaza Oneida, NY13421 (315) 829-8463	jbergevin@oneida-nation.org
	Ray Halbritter Nation Representative	5218 Patrick Road Verona, NY 13478	N/A
Onondaga Nation	Tony Gonyea Faithkeeper	RR#1 Box 245 Onondaga Nation, via Nedrow, NY 13120 (315) 952-3109	onondationhispres@aol.com
Cayuga Nation	Clint Halfton, THPO	P.O. Box 803 Seneca Falls, NY 13148 (315) 568-0750	Tina Orbaker (reception) tina.orbaker@gmail.com
Eastern Shawnee Tribe of Oklahoma	Robin Dushane THPO	70500 E 128 Rd. Wyandotte, OK 74370 (918) 553-4104	rdushane@estoo.net
	Dee Gardner		dgardner@estoo.net
Delaware Nation	Nekole Alligood Director	31064 State Highway 281 Anadarko, OK 73005 (405) 247-8903	NAlligood@delawarenation.com
	Jason Ross Section 106 Program Manager		jross@delawarenation.com

Table 4a-1
Pennsylvania Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Delaware Tribe	Brice Obermeyer THPO	Delaware Tribe Historic Preservation Office Roosevelt Hall, Rm 212 1200 Commercial St. Emporia, KS 66801	bobermeyer@delawaretribe.org
	Susan Bachor (Eastern Projects Review)	Department of Anthropology Gladfelter Hall, Rm. 207 Temple University 1115 W. Polett Walk Philadelphia, PA 19122 (610) 761-7452	temple@delawaretribe.org
Seneca-Cayuga Tribe of Oklahoma	Paul Barton Historic Preservation Officer	23701 S. 655 Road Grove, OK 74344 (918) 787-7979	pbarton@sctribe.com
Shawnee Tribe	Kim Jumper THPO	29 South 69a Highway Miami, OK 74354 (918) 542-2441	Kim.jumper@shawnee-tribe.com
Tuscarora Nation	Leo Henry	Hope Road Tuscarora Nation Via Lewiston, NY 14092 (716) 601-4737	N/A
	Bryan Printup	5226 Walmore Road Lewiston, NY 14092 (716) 264-6011	bprintup@hetf.org
Tonawanda Seneca Nation	Christine Abrams Darwin Hill, Chief	7027 Meadville Road Basom, NY 14013	tonseneca@aol.com
Absentee-Shawnee Tribe of Oklahoma	Joseph Blanchard, Director of Cultural Preservation	2025 S. Gordon Cooper Drive Shawnee, OK 74801 (405) 275-4030 x 302	joseph.blanchard@astribe.com
	Carol Butler THPO Specialist		carol.butler@astribe.com
Law Enforcement and Coroner/Medical Examiner (for anticipated discoveries of human remains only)			
Bradford County Sherriff	Clinton J. Walters	Bradford County Courthouse 301 Main Street Towanda, PA 18848 (570) 265-1701	bcsheriff@bradfordco.org
Bradford County Coroner	Thomas M. Carman	129 Canton Street Troy, Pa 16947 (570) 297-0720	bccoroner@westernems.com

Table 4a-1
Pennsylvania Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Susquehanna County Sherriff	Lance M. Benedict	Susquehanna Courthouse PO Box 218 Montrose, PA 18801 (570) 278-4600	-
Susquehanna County Coroner	Anthony J. Conarton	PO Box 218 Montrose, PA 18801 (570) 278-6630	coroner58@susqco.com

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential archaeological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

The cultural resource consultant will conduct an on-site inspection of the identified archaeological discovery by the next business day. The THPO (or a designated tribal representative if a THPO has not been appointed) will be notified of the on-site inspection and provided the opportunity to send a tribal monitor to participate in the site visit. This on-site inspection will assess the nature of the archaeological discovery to determine if it represents an archaeological site and if the site is eligible for inclusion in the National Register of Historic Places ("NRHP"). The cultural resource consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. Tennessee will then consult with the FERC, the SHPO, and the THPO to determine the NRHP eligibility of the archaeological discovery. The SHPO and THPO will respond following contacts to all appropriate consulting parties.

If the cultural resource consultant determines that the archaeological discovery is not potentially significant, is an isolated find, or is completely disturbed by prior construction activities, and if the SHPO and THPO concur with this finding, the cultural resource consultant will inform Tennessee that construction may resume. The decision will be documented by the cultural resource consultant. The method of documentation will be determined at the time and, depending on the circumstances, may range from a letter report to an email.

If the cultural resource consultant determines that the archaeological discovery represents a significant archaeological site and the SHPO and THPO concur with this determination, then the cultural resource consultant will develop a plan for additional archaeological investigations and/or mitigation of the identified archaeological site. This plan may include further archaeological study or coordination with Native American groups or other interested parties. The plan will be submitted to Tennessee for their review. Tennessee will then submit this plan to the SHPO and THPO for review and concurrence. If the SHPO and/or THPO fail to comment within two business days of receiving the proposed treatment plan, Tennessee may assume concurrence and implement the plan. All proposed archaeological investigations will conform to the Secretary of Interior's (SOI's) Standards for Archeological Documentation and will be conducted by an archaeologist who meets or exceeds the SOIs Professional Qualification Standards for Archeology as published in the Federal Register ("FR") on September 29, 1983.

Construction in the area of the archaeological site will not resume until all required fieldwork and consultation/coordination tasks are completed. Upon receipt of FERC, SHPO and THPO concurrence that all required fieldwork has been completed, the cultural resource consultant will notify Tennessee that work at the location of the archaeological discovery may resume. The decision will be documented appropriately by the cultural resource consultant. The method of documentation may range from a letter report to an e-mail, depending on the circumstances. A technical report describing the work at all locations where unanticipated discoveries resulted in additional survey and/or data recovery will be prepared and submitted to Tennessee for review within one year of the completion of fieldwork. Tennessee, or an approved agent of Tennessee, will submit the reviewed technical report to the SHPO, the THPO, and the FERC.

Paleontological Resources

In the event that a previously unidentified paleontological resource of possible importance is discovered during ground-disturbing activities, Tennessee will immediately notify the FERC, the applicable state agency, and Tennessee's cultural resources consultant. Contact information for the agencies is listed in Table 4a-1. Generally, within the Project, important paleontological resources that may be found include vertebrate fossils in unconsolidated deposits, such as wetlands, bogs, alluvial deposits, or lake clays. Fossil finds are not regulated in Pennsylvania, except on state or federally owned land, but the presence of Pleistocene vertebrate fossils may signal the associated presence of archaeological materials.

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential paleontological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed by the FERC and the applicable state agency.

Tennessee's cultural resources consultant will conduct an on-site inspection of the identified discovery by the next business day. The consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. If archaeological materials are found in association with the paleontological discovery, then investigation and reporting protocols will follow the procedures outlined for historic properties.

Human Remains

Unanticipated discovery of human remains and/or funerary objects found anywhere in the Project area are of concern and must be reported. Human remains may be full burials, may be represented only by decomposing bones found in the ground in an area of darker soil, may be more recent burials with identifiable caskets or their remains, or they may be represented only by an individual bone or tooth. All discoveries must be reported and appropriately addressed. The treatment of any human remains encountered during construction of the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation ("ACHP") ("Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects" [ACHP 2007]), by the relevant state laws and guidelines ("Pennsylvania Historical and Museum Commission, Policy on the Treatment of Human Remains"), and Tribal policies, including the Haudenosaunee Tuscarora Nation's "Protocol for Handling Discovery of Human Remains" and "Policy on Human Remains" as well as the Stockbridge-Munsee Band of Mohican Indians' "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During

Planned Activities" and "Buffer Zone Policy" (Haudenosaunee Tuscarora Nation, No Date; Stockbridge Munsee Mohican 2002; Appendix 4a-A). It is imperative that all burial sites, human remains, and funerary objects be treated with dignity and respect, and that all measures are taken to protect such remains from undue harm until the area is cleared and reopened to Tennessee for the resumption of Tennessee's activities and operations. Remains should be covered and not moved or disturbed. Whenever possible, Tennessee will preserve human remains in place.

If any personnel on the construction site identifies potential human remains (including teeth, single bones, bone fragments, etc.) or indicators of potential human remains, such as gravestones or other means of marking potential grave sites, all construction work that will affect the remains' integrity or harm them will immediately stop. The remains will be left in place and will not be touched, moved, or further disturbed until assessed by all designated parties (Table 4a-1). Again, the remains will be carefully covered, and access to the area of the remains will be precluded. Per the Stockbridge-Munsee Band of Mohican Indians "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities", tobacco will be placed with the remains by a representative of the tribe (Stockbridge Munsee Mohican Tribe 2002).

Immediately upon discovery of possible human remains, Tennessee will contact the FERC, the county coroner and coroner/medical examiner, the SHPO, tribes, and Tennessee's cultural resource consultant (Table 4a-1). The coroner and law enforcement will assess the remains and make the determination of whether or not they are forensic or historical in nature. The medical examiner may also determine if the remains are Native American. A request to hold on photography, pending a determination of ethnicity, will made to the county coroner for consideration.

If the remains are determined to be non-human and no other archaeological features that require evaluation are present, then this will be conveyed to Tennessee. Tennessee will convey these findings to the FERC, the SHPO, and tribes. Upon concurrence with these findings, construction work will resume in the area of the remains.

If the remains are determined to be human and forensic in nature, the remains will come under the jurisdiction of law enforcement. The SHPO and tribes will be notified that the human remains are not historical in nature.

If the remains are determined to be human and historical in nature, the cultural resource consultant and THPO/tribal representatives will conduct a site visit to examine the human remains within 24 hours of discovery. Documentation of non-Native American remains should include photographs, a map indicating the location of the remains, and a brief written description. Upon a determination of Native American ethnicity, however, no photographs or remains or associated funerary objects will be taken. Drawings of remains determined to be of Native American ethnicity will be allowed. This information will be provided to the SHPO and the tribes within 24 hours of the site visit.

If the human remains are determined to be historical in nature but ethnicity cannot be clearly identified, an expert may be brought in to review the remains and determine affiliation. The remains will be left in situ for examination. No additional study of the remains will be authorized without first consulting with the SHPO and tribes.

In consultation with the FERC, SHPO, and coordination with the tribes and other interested parties, Tennessee and the cultural resource consultant will develop a plan for the treatment of the human remains

that are historical in nature. If the remains are determined to be Native American, the plan will be similar to the guidance provided in the Native American Graves Protection and Repatriation Act ("NAGPRA"; 43 CFR 10.5(e)) in keeping with the Unanticipated Historic Properties and Human Remains policy as presented in the FERC's "Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects" (FERC 2002). If the remains are determined to be non-Native American, the FERC and the cultural resource consultant will coordinate with the SHPO and other appropriate parties to develop a plan. The plan may include preservation in place, exhumation and reburial, scientific study, and/or cultural rituals. The plan will be completed within 15 days of the discovery. Any deviations from the plan during implementation must be approved by the consulting parties. Final decisions regarding the disposition of any human remains and any associated funerary objects, including repatriation, will be made by the FERC.

ATTACHMENT 4a-2: Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains – New York

As part of the Section 106 process, a protocol must be developed and put in place for the handling of any unanticipated archaeological resources that might be exposed during the implementation and construction of the proposed Northeast Energy Direct Project (NED Project" or "Project"). For this purpose Tennessee Gas Pipeline Company, L.L.C ("Tennessee"), and its cultural resource consultant have developed the following Unanticipated Discovery Plan ("UDP"). This plan also covers unanticipated discoveries of paleontological resources.

Historic Properties

In the event that a previously unidentified archaeological resource or item of possible historical or cultural importance is discovered during ground-disturbing activities, Tennessee will immediately notify the Federal Energy Regulatory Commission ("FERC"), the appropriate State Historic Preservation Office ("SHPO"), Tribal Historic Preservation Office ("THPO"), or appropriate tribal representative, and their cultural resource consultant. Appropriate contacts organized by state and federal agency are listed in Table 4a-2.

Table 4a-2
New York Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Eric Tomasi	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8097	eric.tomasi@ferc.gov
FERC	Paul Friedman	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8059	Paul.Friedman@ferc.gov

Table 4a-2
New York Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
NY SHPO	Philip Perazio	Division for Historic Preservation New York State Office of Parks, Recreation and Historic Preservation Peebles Island, PO Box 189, Waterford, NY 12188 (518) 237-8643 x 3276	Philip.Perazio@parks.ny.gov
NYSM Office of State Geologist	Lisa Amati	State Paleontologist, Curator of Invertebrate Paleontology and Paleobotany New York State Museum 222 Madison Ave, Albany, NY 12230 518-474-8949	lisa.amati@nysed.gov
Tribal Contacts			
Stockbridge-Munsee Band of Mohican Indians	Bonney Hartley THPO	400 Broadway #718 Troy, NY 12181 (518) 326-8870	Bonney.Hartley@mohican-nsn.gov
Saint Regis Mohawk Tribe	Arnold Printup THPO	412 State Route 37 Akwesasne, NY 13655 (518) 358-2272 x163	arnold.printup@srmt-nsn.gov
Seneca Nation of Indians	Scott Abrams THPO	90 Ohi:yo' Way Salamanca, NY 14779 (716) 945-1790 x 3580	Scott.Abrams@sni.org
	Jay Thoth Tribal Archaeologist		jay.toth@sni.org
Oneida Indian Nation	Jesse Bergevin Historic Resources Specialist	2037 Dream Catcher Plaza Oneida, NY 13421 (315) 829-8463	jbergevin@oneida-nation.org
	Ray Halbritter Nation Representative	5218 Patrick Road Verona, NY 13478	N/A
Oneida Nation of Wisconsin	Corina Williams THPO	P.O. Box 365, Oneida, WI 54155-0365 (920) 496-5386	cwilliam@oneidanation.org
Delaware Tribe of Indians	Brice Obermeyer THPO	Delaware Tribe Historic Preservation Office, Roosevelt Hall, Rm 212 1200 Commercial St. Emporia, KS 66801	bobermeyer@delawaretribe.org

Table 4a-2
New York Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
	Susan Bachor (Eastern Projects Review)	Department of Anthropology Gladfelter Hall, Rm. 207 Temple University 1115 W. Polett Walk Philadelphia, PA 19122 (610) 761-7452	temple@delawaretribe.org
Delaware Nation	Nekole Alligood Director	31064 State Highway 281 Anadarko, OK 73005 (405) 247-8903	NAlligood@delawarenation.com
	Jason Ross Section 106 Program Manager		jross@delawarenation.com
Onondaga Nation	Tony Gonyea Faithkeeper	RR#1 Box 245, Onondaga Nation, via Nedrow, NY 13120 (315) 952-3109	e-mail via Steven Thomas (stevethomas808@yahoo.com)
Shawnee Tribe	Kim Jumper THPO	29 South 69a Highway Miami, OK 74354 (918) 542-2441	kim.jumper@shawnee-tribe.com
Eastern Shawnee Tribe of Oklahoma	Robin Dushane THPO	12705 E. 705 Road Wyandotte, OK 73502 (918) 666-2435 x247	rdushane@estoo.net
	Dee Gardner Historic Preservation Representative		dgardner@estoo.net
Cayuga Nation	Clint Halfton THPO	PO Box 803 Seneca Falls, NY 13148 (315) 568-0750	e-mail via Tina Orbaker tina.orbaker@gmail.com
Seneca-Cayuga Tribe of Oklahoma	Paul Barton Historic Preservation Officer	23701 S. 655 Road Grove, OK 74344	pbarton@sctribe.com
Tonawanda Seneca Nation of New York	Christine Abrams	7027 Meadville Road Basom, NY 14013 (716) 542-4244 or (716) 542-234	tonseneca@aol.com
	Darwin Hill		
Tuscarora Nation	Leo Henry Chief	Hope Road, Tuscarora Nation Via Lewiston, NY 14092 (716) 601-4737	N/A
	Bryan Printup Section 106 Specialist	5226 Walmore Road Lewiston, NY 14092 (716) 264-6011	bprintup@hetf.org

Table 4a-2
New York Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Law Enforcement and Coroner/Medical Examiner Contacts (for unanticipated discoveries of human remains only)			
Broome County Sheriff	David E. Harder	Public Safety Facility 155 Lt. Van Winkle Drive Binghamton, NY 13905 (607) 778-1911	bcsheriff@co.broome.ny.us
Broome County Coroner	-	Broome County Dispatch (607) 788-1911	-
Chenango County Sheriff	Ernest R. Cutting	Chenango County Sheriff's Office 279 County Route 46 Norwich , NY 13815 (607) 334-2000	-
Chenango County Medical Examiner	-	24 Conkey Ave Norwich, NY 13815 (607) 336-8965	-
Delaware County Sheriff	Thomas E. Mills	280 Phoebe Ln, Suite One Delhi, NY 13753 (607) 746-2336	-
Delaware County Medical Examiner	Dr. Richard J. Ucci	13 Railroad Ave, PO Box 67 Stamford, NY 12167 (607) 432-8752	-
Schoharie County Sheriff	Anthony F. Desmond	PO Box 689, 157 Depot Ln Schoharie, NY 12157 (518) 295-8114	-
Schoharie County Coroner	-	276 Main St., PO Box 667 Schoharie, NY 12157 (518) 295-8365	-
Albany County Sheriff	Craig D. Apple Sr.	16 Eagle St. Albany, NY 12207 (518) 487-5400	-
Albany County Coroner	Harold L. Joyce	Albany County Office Building 112 State St, 7Th Floor Albany, NY 12207 (518) 445-7604	-
Rensselaer County Sheriff	Jack Mahar	4000 Main St. Troy, NY 12180 (518) 266-1900	-

Table 4a-2
New York Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Rensselaer County Medical Examiner	-	Rensselaer Medical Examiner Office County Office Building Troy, NY 12182 (518) 270-2626	-

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential archaeological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

The cultural resource consultant will conduct an on-site inspection of the identified archaeological discovery by the next business day. The THPO (or a designated tribal representative if a THPO has not been appointed) will be notified of the on-site inspection and provided the opportunity to send a tribal monitor to participate in the site visit. This on-site inspection will assess the nature of the archaeological discovery to determine if it represents an archaeological site, and if the site is eligible for inclusion in the National Register of Historic Places ("NRHP"). The cultural resource consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. Tennessee will then consult with the FERC, the SHPO, and the THPO to determine the NRHP eligibility of the archaeological discovery. The SHPO and THPO will respond following contacts to all appropriate consulting parties.

If the cultural resource consultant determines that the archaeological discovery is not potentially significant, is an isolated find, or is completely disturbed by prior construction activities, and if the SHPO and THPO concur with this finding, the cultural resource consultant will inform Tennessee that construction may resume. The decision will be documented by the cultural resource consultant. The method of documentation will be determined at the time and, depending on the circumstances, may range from a letter report to an e-mail.

If the cultural resource consultant determines that the archaeological discovery represents a significant archaeological site and the SHPO and THPO concur with this determination, then the cultural resource consultant will develop a plan for additional archaeological investigations and/or mitigation of the identified archaeological site. This plan may include further archaeological study or consultation with Native American groups or other interested parties. The plan will be submitted to Tennessee for their review. Tennessee will then submit this plan to the SHPO and THPO for review and concurrence. If the SHPO and/or THPO fail to comment within two business days of receiving the proposed treatment plan, Tennessee may assume concurrence and implement the plan. All proposed archaeological investigations will conform to the Secretary of Interior's (SOI's) Standards for Archeological Documentation and will be conducted by an archaeologist who meets or exceeds the SOI's Professional Qualification Standards for Archeology as published in the Federal Register on September 29, 1983 (*Federal Register* 48:190:44738-44739).

Construction in the area of the archaeological site will not resume until all required fieldwork and consultation and coordination tasks are completed. Upon receipt of FERC, SHPO and THPO concurrence that all required fieldwork has been completed, the cultural resource consultant will notify Tennessee that work at the location of the archaeological discovery may resume. The decision will be documented appropriately by the cultural resource consultant. The method of documentation may range from a letter report to an e-mail, depending on the circumstances. A technical report describing the work at all locations where unanticipated discoveries resulted in additional survey and/or data recovery will be prepared and submitted to Tennessee for review within one year of the completion of fieldwork. Tennessee, or an approved agent of Tennessee, will submit the reviewed technical report to the SHPO, the THPO, and the FERC.

Paleontological Resources

In the event that a previously unidentified paleontological resource of possible importance is discovered during ground-disturbing activities, Tennessee will immediately notify the FERC, the applicable state agency, and Tennessee's cultural resources consultant. Contact information for the agencies is listed in Table 4a-2. Generally, within the Project area, important paleontological resources that may be found include vertebrate fossils in unconsolidated deposits, such as wetlands, bogs, alluvial deposits, or lake clays. Fossil finds are not regulated in New York, except on state or federally owned land, but the presence of Pleistocene vertebrate fossils may signal the associated presence of archaeological materials.

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential paleontological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed by the FERC and the applicable state agency.

Tennessee's cultural resources consultant will conduct an on-site inspection of the identified discovery by the next business day. The consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. If archaeological materials are found in association with the paleontological discovery, then investigation and reporting protocols will follow the procedures outlined for historic properties.

Human Remains

Unanticipated discovery of human remains and/or funerary objects found anywhere in the Project area is of concern and must be reported. Human remains may be full burials, may be represented only by decomposing bones found in the ground in an area of darker soil, may be more recent burials with identifiable caskets or their remains, or they may be represented only by an individual bone or tooth. All discoveries must be reported and appropriately addressed. The treatment of any human remains encountered during construction of the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation ("ACHP") ("Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects", [ACHP 2007]) and by the relevant state laws and guidelines ("State Historic Preservation Office/New York State Office of Parks, Recreation and Historic Preservation Human Remains Discovery Protocol") and tribal policies, including the Haudenosaunee Tuscarora Nation's "Protocol for Handling Discovery of Human Remains" and "Policy on Human Remains" (Haudenosaunee Tuscarora Nation n.d.), and the Stockbridge-Munsee Band of Mohican Indian "Policy for Treatment and Disposition of Human Remains

and Cultural Items That May be Discovered Inadvertently During Planned Activities" and "Buffer Zone Policy" (Stockbridge Munsee Mohican 2002) (Appendix 4a-A). It is imperative that all burial sites, human remains, and funerary objects be treated with dignity and respect, and that all measures be taken to protect such remains from undue harm until the area is cleared and reopened to Tennessee for the resumption of Tennessee's activities and operations. Remains should be covered and not moved or disturbed. Whenever possible, Tennessee will preserve human remains in place.

If any personnel on the construction site identifies potential human remains (including teeth, single bones, bone fragments, etc.) or indicators of potential human remains, such as gravestones or other means of marking potential grave sites, all construction work that will affect the remains' integrity or harm them will immediately stop. Again, the remains will be left in place and will not be touched, moved, or further disturbed until assessed by all designated parties (Table 4a-2). The remains will be carefully covered, and access to the area of the remains will be precluded. Per the Stockbridge-Munsee Band of Mohican Indians "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities," tobacco will be placed with human remains by a representative of the tribe (Stockbridge Munsee Mohican Tribe 2002).

Immediately upon discovery of possible human remains, Tennessee will contact the FERC, the county police and coroner/medical examiner, the SHPO, tribes, and the cultural resource consultant immediately upon discovery of possible human remains (Table 4a-2). The coroner and law enforcement will assess the remains and make the determination of whether or not they are forensic or historical in nature. The medical examiner may also determine if the remains are Native American.

If the remains are determined to be non-human and no other archaeological features that require evaluation are present, then this will be conveyed to Tennessee. Tennessee will convey these findings to the FERC, the SHPO, and tribes. Upon concurrence with these findings, construction work will resume in the area of the remains.

If the remains are determined to be human and forensic in nature, the remains will come under the jurisdiction of law enforcement. The SHPO and tribes will be notified that the human remains are not historical in nature.

If the remains are determined to be human and historical in nature, the cultural resource consultant and THPO/tribal representatives will conduct a site visit to examine the remains within 24 hours of discovery. Documentation of the non-Native American remains should include photographs, a map indicating the location of the remains, and a brief written description. Upon a determination of Native American ethnicity, no photographs of the remains or associated funerary objects will be taken. However, drawings of remains determined to be of Native American ethnicity will be allowed. The documentation information will be provided to the SHPO and the tribes within 24 hours of the site visit. This information will be provided to the SHPO and the tribes within 24 hours of the site visit.

If the human remains are determined to be historical in nature but ethnicity cannot be clearly identified, an expert may be brought in to review the remains and determine affiliation. The remains will be left in situ for examination. No additional study of the remains will be authorized without first consulting with the SHPO and tribes.

In consultation with the FERC and SHPO and coordination with the tribes and other interested parties, Tennessee and the cultural resource consultant will develop a plan for the treatment of the remains that

are historical in nature. If the remains are determined to be Native American, the plan will be similar to the guidance provided in the Native American Graves Protection and Repatriation Act ("NAGPRA"; 43 CFR 10.5(e)). In keeping with the Unanticipated Historic Properties and Human Remains policy as presented in the FERC's "Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects" (FERC 2002). If the remains are determined to be non-Native American, the FERC and the cultural resource consultant will coordinate with the SHPO and other appropriate parties to develop a plan. The plan may include preservation in place, exhumation and reburial, scientific study, and/or cultural rituals. Any deviations from the plan during implementation must be approved by the consulting parties. Final decisions regarding the disposition of any human remains and any associated funerary objects, including repatriation, will be made by the FERC.

ATTACHMENT 4a-3: Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains – Massachusetts

As part of the Section 106 process, a protocol must be developed and put in place for the handling of any unanticipated archaeological resources that might be exposed during the implementation and construction of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). For this purpose, Tennessee Gas Pipeline Company, L.L.C ("Tennessee") and its cultural resource consultant have developed the following Unanticipated Discovery Plan ("UDP"). This plan also covers unanticipated discoveries of paleontological resources.

Historic Properties

In the event that a previously unidentified archaeological resource or item of possible historical or cultural importance is discovered during ground-disturbing activities, Tennessee will immediately notify the Federal Energy Regulatory Commission ("FERC"), the appropriate State Historic Preservation Office ("SHPO"), Tribal Historic Preservation Office ("THPO") or appropriate tribal representative, Massachusetts Commission on Indian Affairs, and their cultural resource consultant. Appropriate contacts organized by state and federal agency are listed in Table 4a-3.

Table 4a-3
Massachusetts Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Eric Tomasi	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8097	eric.tomasi@ferc.gov
FERC	Paul Friedman	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8059	Paul.Friedman@ferc.gov

Table 4a-3
Massachusetts Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
MA SHPO	Brona Simon	Massachusetts Historical Commission 220 Morrissey Boulevard Boston, MA 02125-3314 (617) 727-8470	brona.simon@sec.state.ma.us
MA Commission on Indian Affairs	John Peters	100 Cambridge Street, Suite 300 Boston, MA 02114 (617) 573-12912	john.peters@state.ma.us
MA Geological Survey	Stephen B. Mabee	Department of Geosciences 269 Morrill Science Center University of Massachusetts 611 North Pleasant Street Amherst, MA 01003-9297 (413) 545-4814	sbmabee@geo.umass.edu
Tribal Contacts			
Stockbridge-Munsee Band of Mohican Indians	Bonney Hartley THPO	400 Broadway #718 Troy, NY 12181 (518) 326-8870	Bonney.Hartley@mohican-nsn.gov
Delaware Nation	Nekole Alligood Director	31064 State Highway 281 Anadarko, OK 73005 (405) 247-8903	NAlligood@delawarenation.com
	Jason Ross Section 106 Program Manager		jross@delawarenation.com
Delaware Tribe of Indians	Brice Obermeyer THPO	Delaware Tribe Historic Preservation Office Roosevelt Hall, Rm 212 1200 Commercial St. Emporia, KS 66801	bobermeyer@delawaretribe.org
	Susan Bachor (Eastern Projects Review)	Department of Anthropology Gladfelter Hall, Rm. 207 Temple University 1115 W. Polett Walk Philadelphia, PA 19122 (610) 761-7452	temple@delawaretribe.org
Mashpee Wampanoag Indian Tribal Council, Inc.	Ramona Peters THPO	483 Great Neck Road South Mashpee, MA 02649 (508) 477-0208 (x101 Ramona Peters and x102 David Weeden)	rpeters@mwtribe.com
	David Weeden Deputy THPO		dweeden@mwtribe.com

Table 4a-3
Massachusetts Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Wampanoag Tribe of Gay Head (Aquinnah)	Bettina Washington THPO	20 Black Brook Road Aquinnah, MA 02535-9701 (508) 645-9265	bettina@wampanoagtribe.net
Narragansett Indian Tribe	John Brown THPO	Narragansett Indian Longhouse 4425D South County Trail Charlestown, RI 02813 Mr. Brown (401) 491-9459; Mr. Harris (413) 325-7691; (401) 474-5907	brwnjbb123@aol.com
	Doug Harris Deputy THPO		dhnithpo@gmail.com
Mohegan Tribe of Indians of Connecticut	James Quinn THPO	13 Crow Hill Road Uncasville, CT (860) 862-6893	jquinn@moheganmail.com
Mashantucket Pequot Tribal Nation	Marissa Turnbull THPO	Natural Resources Protection & Regulatory Affairs 550 Trolley Line Blvd. PO Box 3202 Mashantucket, CT 06338-3202 (860) 396-7570	mturnbull@mptn-nsn.gov
Shinnecock Nation	Roddy Smith	Shinnecock Nation Cultural Resource Department PO Box 5006 Southampton, NY 11969	wabush@aol.com
Law Enforcement and Coroner/Medical Examiner Contacts (for unanticipated discoveries of human remains only)			
Office of the Chief Medical Examiner	-	720 Albany Street Boston, MA 02118 (617) 267-6767	Office of the Chief Medical Examiner
Berkshire County Sheriff	Thomas N. Bowler	467 Cheshire Road Pittsfield, MA 01201 (413) 447-7117	-
Hampshire County Sheriff	Robert J. Garvey	492 Pleasant Street Northampton, MA (413) 585-0618	-
Franklin County Sheriff	Christopher Donelan	160 Elm Street Greenfield, MA 01301 (413) 774-4014	-
Middlesex County Sheriff	Peter J. Koutoujian	400 Mystic Avenue Medford, MA 02155 (781) 960-2800	-

Table 4a-3
Massachusetts Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Essex County Sheriff	Frank G. Cousins Jr.	20 Manning Ave. (Headquarters) Middleton, MA 01949 (978) 750-1900	-
Worcester County Sheriff	Lewis G. Evangelidis	5 Paul X. Tivnan Drive West Boylston, MA 01583 (508) 854-1800	-

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential archaeological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

The cultural resource consultant will conduct an on-site inspection of the identified archaeological discovery by the next business day. The THPO (or a designated tribal representative if a THPO has not been appointed) will be notified of the on-site inspection and provided the opportunity to send a tribal monitor to participate in the site visit. This on-site inspection will assess the nature of the archaeological discovery to determine if it represents an archaeological site, and if the site is eligible for inclusion in the National Register of Historic Places ("NRHP"). The cultural resource consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. Tennessee will consult with the FERC, the SHPO, and the THPO to determine the NRHP eligibility of the archaeological discovery. The SHPO and THPO will respond following contacts to all appropriate consulting parties.

If the cultural resource consultant determines that the archaeological discovery is not potentially significant, is an isolated find, or is completely disturbed by prior construction activities, and if the SHPO and THPO concur with this finding, the cultural resource consultant will inform Tennessee that construction may resume. The decision will be documented by the cultural resource consultant. The method of documentation will be determined at the time and, depending on the circumstances, may range from a letter report to an e-mail.

If the cultural resource consultant determines that the archaeological discovery represents a significant archaeological site and the SHPO and THPO concur with this determination, then the cultural resource consultant will develop a plan for additional archaeological investigations and/or mitigation of the identified archaeological site. This plan may include further archaeological study or coordination with Native American groups or other interested parties. The plan will be submitted to Tennessee for their review. Tennessee will then submit this plan to the SHPO and THPO for review and concurrence. If the SHPO and/or THPO fail to comment within two business days of receiving the proposed treatment plan, Tennessee may assume concurrence and implement the plan. All proposed archaeological investigations will conform to the SOIs Standards for Archeological Documentation and will be conducted by an archaeologist who meets or exceeds the SOIs Professional Qualification Standards for Archeology as published in the FR on September 29, 1983.

Construction in the area of the archaeological site will not resume until all required fieldwork and consultation and/or coordination tasks are completed. Upon receipt of FERC, SHPO and THPO concurrence that all required fieldwork has been completed, the cultural resource consultant will notify Tennessee that work at the location of the archaeological discovery may resume. The decision will be documented appropriately by the cultural resource consultant. The method of documentation may range from a letter report to an e-mail, depending on the circumstances. A technical report describing the work at all locations where unanticipated discoveries resulted in additional survey and/or data recovery will be prepared and submitted to Tennessee for review within one year of the completion of fieldwork. Tennessee, or an approved agent of Tennessee, will submit the reviewed technical report to the SHPO, the THPO and the FERC.

Paleontological Resources

In the event that a previously unidentified paleontological resource of possible importance is discovered during ground-disturbing activities, Tennessee will immediately notify the FERC, the appropriate State agency, and Tennessee's cultural resources consultant. Contact information for the agencies is listed in Table 4a-3. Generally, within the Project, important paleontological resources that may be found include vertebrate fossils in unconsolidated deposits, such as wetlands, bogs, alluvial deposits, or lake clays. Fossil finds are not regulated in Massachusetts, except on state or federally owned land, but the presence of Pleistocene vertebrate fossils may signal the associated presence of archaeological materials.

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential paleontological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed by the FERC and the applicable state agency.

Tennessee's cultural resources consultant will conduct an on-site inspection of the identified discovery by the next business day. The consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. If archaeological materials are found in association with the paleontological discovery, then investigation and reporting protocols will follow the procedures outlined for historic properties.

Human Remains

Unanticipated discovery of human remains and/or funerary objects found anywhere in the Project is of concern and must be reported. Human remains may be full burials, may be represented only by decomposing bones found in the ground in an area of darker soil, may be more recent burials with identifiable caskets or their remains, or they may be represented only by an individual bone or tooth. All discoveries must be reported and appropriately addressed. The treatment of any human remains encountered during construction of the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation ("ACHP") ("Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects" [ACHP 2007]) and by the relevant state laws and guidelines (Massachusetts General Laws c. 7, s. 38A; c. 38, s.6; c. 9, ss. 26A & 27C; and c. 114, s. 17, all as amended, "Know How #4, Information and Assistance from the Massachusetts Historical Commission" [MHC, n.d.], and Tribal policies, including the Stockbridge-Munsee Band of Mohican Indian's "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities" and "Buffer Zone

Policy" [Stockbridge Munsee Mohican Tribe 2002] (Appendix 4a-A). It is imperative that all burial sites, human remains, and funerary objects be treated with dignity and respect, and that all measures be taken to protect such remains from undue harm until the area is released to Tennessee for the resumption of Tennessee's activities and operations. Remains should be covered and not moved or disturbed. Whenever possible, Tennessee will preserve human remains in place.

If any personnel on the construction site identifies potential human remains (including teeth, single bones, bone fragments, etc.) or indicators of potential skeletal remains, such as gravestones or other means of marking potential grave sites, all construction work that will affect the remains' integrity or harm them will immediately stop. Again, the remains will be left in place and will not be touched, moved, or further disturbed until assessed by all designated parties (Table 4a-3). The remains will be carefully covered, and access to the area of the remains will be precluded. Per the Stockbridge-Munsee Band of Mohican Indians' "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities", tobacco will be placed with human remains by a representative of the tribe (Stockbridge Munsee Mohican Tribe 2002).

Immediately upon discovery of possible human remains, Tennessee will contact the FERC, the county police, the Office of the Chief Medical Examiner ("OCME") in Boston, the SHPO, tribes, and Tennessee's cultural resource consultant (Table 4a-3). Per Massachusetts state law, the medical examiner will assess the remains to determine if they are over 100 years old and if so, contact the State Archaeologist. A request to hold on photography, pending a determination of ethnicity, will be made to the county coroner for consideration.

If the remains are determined to be non-human and no other archaeological features that require evaluation are present, then this will be conveyed to Tennessee. Tennessee will convey these findings to the FERC, the SHPO, and tribes. Upon concurrence with these findings, construction work will resume in the area of the remains.

If the remains are determined to be human and forensic in nature, the remains will come under the jurisdiction of law enforcement. The SHPO and tribes will be notified that the human remains are not historical in nature.

If the remains are determined to be human and historical in nature, the cultural resource consultant and THPO/tribal representatives will conduct a site visit to examine the human remains within 24 hours of discovery. Documentation of non-Native American remains should include photographs, a map indicating the location of the remains, and a brief written description. Upon a determination of Native American ethnicity, no photographs of the remains or associated funerary objects will be taken without first consulting with the tribes. However, drawings of remains determined to be of Native American ethnicity will be allowed. This information will be provided to the SHPO and the tribes within 24 hours of the site visit.

The State Archaeologist will determine if the remains are Native American. The State Archaeologist will, in turn, notify the Commission on Indian Affairs, and all appropriate THPO/tribal representatives that such an evaluation is to be made. The Commission on Indian Affairs may choose to designate a representative to be present during the evaluation. If the remains are Native American, then the State Archaeologist, the Commission on Indian Affairs, THPO/tribal representative(s), and the landowner will confer to decide the disposition of the remains. If it is determined that the remains must be removed, the parties will arrange for their removal. The remains will then be delivered to the Commission on Indian

Affairs for reinterment. All appropriate THPO/tribal representatives will be notified regarding the movement of any Native American remains to the Commission on Indian Affairs.

ATTACHMENT 4a-4: Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains – New Hampshire

As part of the Section 106 process, a protocol must be developed and put in place for the handling of any unanticipated archaeological resources that might be exposed during the implementation and construction of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). For this purpose Tennessee Gas Pipeline Company, L.L.C ("Tennessee") and its cultural resource consultant have developed the following Unanticipated Discovery Plan ("UDP"). This plan also covers unanticipated discoveries of paleontological resources.

Historic Properties

In the event that a previously unidentified archaeological resource or item of possible historical or cultural importance is discovered during ground-disturbing activities, Tennessee will immediately notify the Federal Energy Regulatory Commission ("FERC"), the appropriate State Historic Preservation Office ("SHPO"), Tribal Historic Preservation Office ("THPO") or appropriate tribal representative, and their cultural resource consultant. Appropriate contacts organized by state and federal agency are listed in Table 4a-4.

Table 4a-4
New Hampshire Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Eric Tomasi	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8097	eric.tomasi@ferc.gov
FERC	Paul Friedman	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8059	Paul.Friedman@ferc.gov
NH SHPO	Edna Feighner	New Hampshire Division of Historical Resources Review and Compliance 19 Pillsbury Street Concord, NH 03301-3570 (603) 271-2813	edna.feighner@dcr.nh.gov
NH Geological Survey	Rick Chormann	State Geologist and Director New Hampshire Geological Survey PO Box 95, 29 Hazen Dr. Concord, NH 03302-0095 (603) 271-1975	frederick.chormann@des.nh.gov

Table 4a-4
New Hampshire Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Tribal Contacts			
Narragansett Indian Tribe	John Brown THPO	Narragansett Indian Longhouse 4425D South County Trail Charlestown, RI 02813 Mr. Brown (401) 491-9459; Mr. Harris (413) 325-7691; (401) 474-5907	brwnjbb123@aol.com
	Doug Harris Deputy THPO		dhnithpo@gmail.com
Stockbridge-Munsee Band of Mohican Indians	Bonney Hartley THPO	400 Broadway #718 Troy, NY 12181 (518) 326-8870	Bonney.Hartley@mohican-nsn.gov
Delaware Nation	Nekole Alligood Director	31064 State Highway 281 Anadarko, OK 73005 (405) 247-8903	NAlligood@delawarenation.com
	Jason Ross Section 106 Program Manager		jross@delawarenation.com
Delaware Tribe of Indians	Brice Obermeyer THPO	Delaware Tribe Historic Preservation Office Roosevelt Hall, Rm 212 1200 Commercial Street Emporia, KS 66801	bobermeyer@delawaretribe.org
	Susan Bachor (Eastern Projects Review)	Department of Anthropology, Gladfelter Hall, Rm. 207 Temple University 1115 W. Polett Walk Philadelphia, PA 19122 (610) 761-7452	temple@delawaretribe.org
Wampanoag Tribe of Gay Head (Aquinnah)	Bettina Washington THPO	20 Black Brook Road Aquinnah, MA 02535-9701 (508) 645-9265	bettina@wampanoagtribe.net
Mohegan Tribe of Indians of Connecticut	James Quinn THPO	13 Crow Hill Road Uncasville, CT (860) 862-6893	jquinn@moheganmail.com
Mashantucket Pequot Tribal Nation	Marissa Turnbull THPO	Natural Resources Protection & Regulatory Affairs 550 Trolley Line Blvd. PO Box 3202 Mashantucket, CT 06338-3202 (860) 396-7570	mturnbull@mptn-nsn.gov

Table 4a-4
New Hampshire Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Shinnecock Nation	Roddy Smith	Shinnecock Nation Cultural Resource Department PO Box 5006 Southampton, NY 11969	wabush@aol.com
Law Enforcement and Coroner/Medical Examiner Contacts (for unanticipated discoveries of Human Remains only)			
OCME	-	246 Pleasant Street Suite 218 Concord, NH 03301-2598 (603) 271-1235	-
Cheshire County Sheriff	Eliezer "Eli" Rivera	Cheshire County Sheriff's Office 12 Court Street Keene, NH 03431 (603) 352-4238	-
Hillsborough County Sheriff	James A. Hardy	329 Mast Road Goffstown, NH 03045 (603) 627-5610 Or 19 Temple St Nashua, NH 03060 (603) 882-1456	info@hcsonh.us
Rockingham County Sheriff	Michael W. Downing	101 North Road Brentwood, NH 03833 (603) 679-1877 (dispatch)	-

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential archaeological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

The cultural resource consultant will conduct an on-site inspection of the identified archaeological discovery by the next business day. The THPO (or a designated tribal representative if a THPO has not been appointed) will be notified of the on-site inspection and provided the opportunity to send a tribal monitor to participate in the site visit. This on-site inspection will assess the nature of the archaeological discovery to determine if it represents an archaeological site, and if the site is eligible for inclusion in the National Register of Historic Places ("NRHP"). The cultural resource consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. Tennessee will consult with the FERC, SHPO, and the THPO to

determine NRHP eligibility of the archaeological discovery. The SHPO and THPO will respond following contacts to all appropriate consulting parties.

If the cultural resource consultant determines that the archaeological discovery is not potentially significant, is an isolated find, or is completely disturbed by prior construction activities, and if the SHPO and THPO concur with this finding, the cultural resource consultant will inform Tennessee that construction may resume. The decision will be documented by the cultural resource consultant. The method of documentation will be determined at the time and, depending on the circumstances, may range from a letter report to an e-mail.

If the cultural resource consultant determines that the archaeological discovery represents a significant archaeological site and the SHPO and THPO concur with this determination, the cultural resource consultant will develop a plan for additional archaeological investigations and/or mitigation of the identified archaeological site. This plan may include further archaeological study or coordination with Native American groups or other interested parties. The plan will be submitted to Tennessee for their review. Tennessee will then submit this plan to the SHPO and THPO for review and concurrence. If the SHPO and THPO fail to comment within two business days of receiving the proposed treatment plan, Tennessee may assume concurrence and implement the plan. All proposed archaeological investigations will conform to the Secretary of Interior's (SOI's) Standards for Archeological Documentation and will be conducted by an archaeologist who meets or exceeds the SOIs Professional Qualification Standards for Archeology as published in the FR on September 29, 1983.

Construction in the area of the archaeological site will not resume until all required fieldwork and consultation and/or coordination tasks are completed. Upon receipt of FERC, SHPO and THPO concurrence that all required fieldwork has been completed, the cultural resource consultant will notify Tennessee that work at the location of the archaeological discovery may resume. The decision will be documented appropriately by the cultural resource consultant. The method of documentation may range from a letter report to an e-mail, depending on the circumstances. A technical report describing the work at all locations where unanticipated discoveries resulted in additional survey and/or data recovery will be prepared and submitted to Tennessee for review within one year of the completion of fieldwork. Tennessee, or an approved agent of Tennessee, will submit the reviewed technical report to the SHPO, the THPO, and the FERC.

Paleontological Resources

In the event that a previously unidentified paleontological resource of possible importance is discovered during ground-disturbing activities, Tennessee will immediately notify the FERC, the applicable state agency, and Tennessee's cultural resources consultant. Contact information for the agencies is listed in Table 4a-4. Generally, within the Project, important paleontological resources that may be found include vertebrate fossils in unconsolidated deposits, such as wetlands, bogs, alluvial deposits, or lake clays. Fossil finds are not regulated in New Hampshire, except on state or federally owned land, but the presence of Pleistocene vertebrate fossils may signal the associated presence of archaeological materials.

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential paleontological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

Tennessee's cultural resources consultant will conduct an on-site inspection of the identified discovery by the next business day. The consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. If archaeological materials are found in association with the paleontological discovery, then investigation and reporting protocols will follow the procedures outlined for historic properties.

Human Remains

Unanticipated discovery of human remains found anywhere in the Project is of concern and must be reported. Human remains may be full burials, may be represented only by decomposing bones found in the ground in an area of darker soil, may be more recent burials with identifiable caskets or their remains, or they may be represented only by an individual bone or tooth. All discoveries must be reported and appropriately addressed. The treatment of any human remains encountered during construction of the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation ("ACHP") ("Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects" [ACHP 2007]), by the relevant state laws and guidelines (Title XIX, Historic Preservation Section 227-c:8 a-h; "What to Do Upon Encountering Human Remains, Before or During Land-Altering Activities in New Hampshire" [NH DHR 2008]), and tribal policies (Appendix 4a-A). It is imperative that all burial sites, human remains, and funerary objects be treated with dignity and respect, and that all measures be taken to protect such remains from undue harm until the area is cleared and reopened to Tennessee for the resumption of Tennessee's activities and operations. Remains should be covered and not moved or disturbed. Whenever possible, Tennessee will preserve human remains in place.

If any personnel on the construction site identifies potential human remains (including teeth, single bones, bone fragments, etc.) or indicators of potential human remains, such as gravestones or other means of marking potential grave sites, all construction work that will affect the remains' integrity or harm them will immediately stop. Again, the remains will be left in place and will not be touched, moved, or further disturbed until assessed by all the designated parties (Table 4a-4). The remains will be carefully covered, and access to the area of the remains will be precluded. Per the Stockbridge-Munsee Band of Mohican Indians' "Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities", tobacco will be placed with human remains by a representative of the tribe (Stockbridge Munsee Mohican Tribe 2002).

Immediately upon discovery of possible human remains, Tennessee will contact FERC, the county police and coroner/medical examiner, the State Archaeologist, tribes, and the cultural resource consultant (Table 4a-4). The coroner and law enforcement will assess the remains and make the determination of whether or not they are forensic or historical in nature. A request to hold on photography, pending a determination of ethnicity, will be made to the county coroner for consideration. If the remains are determined to be historical, the medical examiner will notify the State Archaeologist, who will then take jurisdiction over the remains. Per state law, the State Archaeologist has 48 hours to make arrangements with the landowner for the protection or removal of the human remains (Title XIX, Section 227-c: 8 b). The State Archaeologist may make arrangements with the landowner for a longer period of time if it is agreed to be mutually beneficial. Once the State Archaeologist has taken jurisdiction over the remains, they will be responsible for consultation with THPO/tribal representatives and agencies, analysis, and disposition of the remains as detailed in Title XIX Section 227-c:8 c-g.

If the remains are determined to be non-human and no other archaeological features that require evaluation are present, this will be conveyed to Tennessee. Tennessee will convey these findings to the FERC, SHPO, and THPO/tribal representatives. Upon concurrence with these findings, construction work will resume in the area of the remains.

If the remains are determined to be human and forensic in nature, the remains will come under the jurisdiction of law enforcement and the medical examiner. The SHPO and THPO/tribal representatives will be notified that the remains are not archaeological.

If the remains are determined to be human and historical in nature and the State Archaeologist, in consultation with the tribes, has identified whether the remains will be preserved in place or removed, the THPO/tribal representatives and the cultural resource consultant will conduct a site visit to examine the remains. Documentation of remains should include photographs, a map indicating the location of the remains, and a brief written description. Upon a determination of Native American ethnicity, no photographs of the remains or associated funerary objects will be taken. However, drawings of remains determined to be of Native American ethnicity will be allowed. This information will be provided to the SHPO and the tribes within 48 hours of the site visit.

ATTACHMENT 4a-5: Plan for Unanticipated Discoveries of Cultural and Paleontological Resources and Human Remains – Connecticut

As part of the Section 106 process, a protocol must developed and put in place for the handling of any unanticipated archaeological resources that might be exposed during the implementation and construction of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). For this purpose Tennessee Gas Pipeline Company, L.L.C ("Tennessee") and its cultural resource consultant have developed the following Unanticipated Discovery Plan ("UDP"). This plan also covers unanticipated discoveries of paleontological resources.

Historic Properties

In the event that a previously unidentified archaeological resource or item of possible historical or cultural importance is discovered during ground-disturbing activities, Tennessee will immediately notify the Federal Energy Regulatory Commission ("FERC"), the appropriate State Historic Preservation Office ("SHPO"), Tribal Historic Preservation Office ("THPO"), or appropriate tribal representative, and their cultural resource consultant. Appropriate contacts organized by state and federal agency are listed in Table 4a-5.

Table 4a-5
Connecticut Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Eric Tomasi	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8097	eric.tomasi@ferc.gov

Table 4a-5
Connecticut Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
FERC	Paul Friedman	Federal Energy Regulatory Commission 888 First Street, N.E. Washington, DC 20426 (202) 502-8059	Paul.Friedman@ferc.gov
CT SHPO	Cathy Labadia	State Historic Preservation Office One Constitution Plaza Hartford, CT 06103 (860) 256-2764	Catherine.Labadia@ct.gov
CT Geological Survey	Margaret Thomas	Department of Energy and Environmental Protection 79 Elm Street Hartford, CT 06106 (860)424-3583	margaret.thomas@ct.gov
Tribal Contacts			
Stockbridge-Munsee Band of Mohican Indians	Bonney Hartley THPO	400 Broadway #718 Troy, NY 12181 (518) 326-8870	Bonney.Hartley@mohican-nsn.gov
Delaware Nation	Nekole Alligood Director	31064 State Highway 281 Anadarko, OK 73005 (405) 247-8903	NAlligood@delawarenation.com
	Jason Ross Section 106 Program Manager		jross@delawarenation.com
Delaware Tribe of Indians	Brice Obermeyer THPO	Delaware Tribe Historic Preservation Office Roosevelt Hall, Rm 212 1200 Commercial St. Emporia, KS 66801	bobermeyer@delawaretribe.org
	Susan Bachor (Eastern Projects Review)	Department of Anthropology, Gladfelter Hall, Rm. 207 Temple University 1115 W. Polett Walk Philadelphia, PA 19122 (610) 761-7452	temple@delawaretribe.org
Mohegan Tribe of Indians of Connecticut	James Quinn THPO	13 Crow Hill Road Uncasville, CT (860) 862-6893	jquinn@moheganmail.com

Table 4a-5
Connecticut Unanticipated Discoveries Contact Information

Agency	Contact	Address and Phone Number	Email
Mashantucket Pequot Tribal Nation	Marissa Turnbull THPO	Natural Resources Protection & Regulatory Affairs 550 Trolley Line Blvd. PO Box 3202 Mashantucket, CT 06338-3202 (860) 396-7570	mturnbull@mptn-nsn.gov
Narragansett Indian Tribe	John Brown THPO	Narragansett Indian Longhouse 4425D South County Trail Charlestown, RI 02813 (401) 491-9459; (413) 325-7691; (401) 474-5907	brwnjbb123@aol.com
	Doug Harris Deputy THPO		dhnithpo@gmail.com
Wampanoag Tribe of Gay Head (Aquinnah)	Bettina Washington THPO	20 Black Brook Road Aquinnah, MA 02535-9701 (508) 645-9265	bettina@wampanoagtribe.net
Shinnecock Nation	Roddy Smith	Shinnecock Nation Cultural Resource Department PO Box 5006 Southampton, NY 11969	wabush@aol.com
Law Enforcement and Coroner/Medical Examiner (for unanticipated discoveries of Human Remains only)			
Connecticut State Marshal Commission	-	165 Capitol Ave., Room 279 Hartford, CT 06106 (860) 713-5372	-
Office of the Chief Medical Examiner	-	11 Shuttle Road Farmington, CT 06032 (860) 679-3980	-

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential archaeological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

The cultural resource consultant will conduct an on-site inspection of the identified archaeological discovery by the next business day. The THPO will be notified of the on-site inspection and provided the opportunity to send a tribal monitor to participate in the site visit. This on-site inspection will assess the nature of the archaeological discovery to determine if it represents an archaeological site, and if the site is eligible for inclusion in the National Register of Historic Places ("NRHP"). The cultural resource consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. Tennessee will then consult

with the FERC, SHPO, and THPO to determine NRHP eligibility of the archaeological discovery. The SHPO and THPO will respond following contacts to all appropriate consulting parties.

If the cultural resource consultant determines that the archaeological discovery is not potentially significant, is an isolated find, or is completely disturbed by prior construction activities, and if the SHPO and THPO concur with this finding, the cultural resource consultant will inform Tennessee that construction may resume. The decision will be documented by the cultural resource consultant. The method of documentation will be determined at the time and, depending on the circumstances, may range from a letter report to an e-mail.

If the cultural resource consultant determines that the archaeological discovery represents a significant archaeological site and the SHPO and THPO concur with this determination, the cultural resource consultant will develop a plan for additional archaeological investigations and/or mitigation of the identified archaeological site. This plan may include further archaeological study or coordination with Native American groups or other interested parties. The plan will be submitted to Tennessee for their review. Tennessee will then submit this plan to the SHPO and THPO for review and concurrence. If the SHPO and/or THPO fail to comment within two business days of receiving the proposed treatment plan, Tennessee may assume concurrence and implement the plan. All proposed archaeological investigations will conform to the Secretary of Interior's (SOI's) Standards for Archeological Documentation and will be conducted by an archaeologist who meets or exceeds the SOIs Professional Qualification Standards for Archeology as published in the FR on September 29, 1983.

Construction in the area of the archaeological site will not resume until all required fieldwork and consultation and/or coordination tasks are completed. Upon receipt of the FERC, the SHPO, and the THPO concurrence that all required fieldwork has been completed, the cultural resource consultant will notify Tennessee that work at the location of the archaeological discovery may resume. The decision will be documented appropriately by the cultural resource consultant; the method of documentation may range from a letter report to an e-mail, depending on the circumstances. A technical report describing the work at all locations where unanticipated discoveries resulted in additional survey and/or data recovery will be prepared and submitted to Tennessee for review within one year of the completion of fieldwork. Tennessee, or an approved agent of Tennessee, will submit the reviewed technical report to the SHPO, the THPO, and the FERC.

Paleontological Resources

In the event that a previously unidentified paleontological resource of possible importance is discovered during ground-disturbing activities, Tennessee will immediately notify the FERC, the applicable state agency, and Tennessee's cultural resources consultant. Contact information for the agencies is listed in Table 4a-5. Generally, within the Project area, important paleontological resources that may be found include vertebrate fossils in unconsolidated deposits, such as wetlands, bogs, alluvial deposits, or lake clays. Fossil finds are not regulated in Connecticut, except on state or federally owned land, but the presence of Pleistocene vertebrate fossils may signal the associated presence of archaeological materials.

All construction work involving subsurface disturbance in the immediate vicinity of the resource will be halted, unless immediate cessation of construction activities will create an unsafe condition or endanger the construction crew. Specifically, work will be stopped at the location where the potential paleontological resource was found and will not resume within 100 feet (in any direction) of the find until the construction is cleared to proceed.

Tennessee's cultural resources consultant will conduct an on-site inspection of the identified discovery by the next business day. The consultant will contact Tennessee upon returning from the initial inspection with further description of the discovery and a recommendation regarding the need for future treatment. If archaeological materials are found in association with the paleontological discovery, then investigation and reporting protocols will follow the procedures outlined for historic properties.

Human Remains

Unanticipated discovery of human remains found anywhere in the Project area is of concern and must be reported. Human remains may be full burials, may be represented only by decomposing bones found in the ground in an area of darker soil, may be more recent burials with identifiable caskets or their remains, or they may be represented only by an individual bone or tooth. All discoveries must be reported and appropriately addressed. The treatment of any human remains encountered during construction of the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation ("ACHP") (Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects [ACHP 2007]) and by the relevant state laws and guidelines and tribal policies (Appendix 4a-A). It is imperative that all burial sites, human remains, and funerary objects be treated with dignity and respect, and that all measures be taken to protect such remains from undue harm until the area is cleared and reopened to Tennessee for the resumption of Tennessee's activities and operations. Remains should be covered and not moved or disturbed. Whenever possible, Tennessee will preserve human remains in place.

If any personnel on the construction site identifies potential human remains (including teeth, single bones, bone fragments, etc.) or indicators of potential human remains, such as gravestones or other means of marking potential grave sites, all construction work that will affect the remains' integrity or harm them will immediately stop. Again, the remains will be left in place and will not be touched, moved, or further disturbed until assessed by all designated parties (Table 4a-5). They will be carefully covered and access to the area of the remains will be precluded. A request to hold on photography, pending a determination of ethnicity, will be made to the county coroner for consideration.

Immediately upon discovery of possible human remains, Tennessee will contact FERC, the county police and coroner/medical examiner, the SHPO, tribes, and Tennessee's cultural resource consultant (Table 4a-5). The coroner and law enforcement will assess the remains and make the determination of whether or not they are forensic or historical in nature. The medical examiner may also determine if the remains are Native American.

If the remains are determined to be non-human and no other archaeological features that require evaluation are present, this will be conveyed to Tennessee. Tennessee will then convey these findings to the FERC, the SHPO, and tribes. Upon concurrence with these findings, construction work will resume in the area of the remains.

If the remains are determined to be human and forensic in nature, the remains will come under the jurisdiction of law enforcement. The SHPO and tribes will be notified that the remains are not archaeological.

If the remains are determined to be human and historical in nature, the cultural resource consultant and THPO/tribal representatives will conduct a site visit to examine the remains within 24 hours of discovery. Documentation of non-Native American remains should include photographs, a map indicating the

location of the remains, and a brief written description. Upon a determination of Native American ethnicity, no photographs of the remains or associated funerary objects will be taken. However, drawings of the remains are allowed. This information will be provided to the SHPO and the tribes within 24 hours of the site visit.

If the human remains are determined to be historical but ethnicity cannot be clearly identified, an expert may be brought in to review the remains and determine affiliation. The remains will be left in situ for examination. No additional study of the remains will be authorized without first consulting with the SHPO and tribes.

In consultation with the FERC and SHPO and coordination with the tribes, and other interested parties, Tennessee and the cultural resource consultant will develop a plan for the treatment of the remains. If the remains are determined to be Native American, the plan will be similar to the guidance provided in the NAGPRA (43 CFR 10.5(e)) in keeping with the Unanticipated Historic Properties and Human Remains policy as presented in the FERC's "Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects" (FERC 20021993). If the remains are determined to be non-Native, the FERC and cultural resource consultant will coordinate with the SHPO and other appropriate parties to develop a plan. The plan may include preservation in place, exhumation and reburial, scientific study, and/or cultural rituals. Any deviations from the plan during implementation must be approved by the consulting parties. Final decisions regarding the disposition of any human remains and associated funerary objects, including repatriation, will be made by the FERC.

REFERENCES

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Stockbridge-Munsee Band of Mohican Indians. No Date Policy for Treatment and Disposition of Human Remains and Cultural Items That May be Discovered Inadvertently During Planned Activities." Tribal Council Offices, Bowler, Wisconsin.

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United States Department of the Interior. 1983. Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines. *Federal Register*, Part IV, 48(2):44716-44742. [Online WWW]. Available URL: http://www.cr.nps.gov/local-law/arch_stnds_0.htm. [Accessed January 13, 2015]

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APPENDIX 4a-A

Advisory Council on Historic Preservation, Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects, Advisory Council on Historic Preservation (2007) and by the Relevant State Laws and Guidelines and Tribal Policies

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Preserving America s Heritage

ADVISORY COUNCIL ON HISTORIC PRESERVATION

POLICY STATEMENT
REGARDING
TREATMENT OF BURIAL SITES, HUMAN REMAINS AND FUNERARY OBJECTS

Preamble: This policy offers leadership in resolving how to treat burial sites, human remains, and funerary objects in a respectful and sensitive manner while acknowledging public interest in the past. As such, this policy is designed to guide federal agencies in making decisions about the identification and treatment of burial sites, human remains, and funerary objects encountered in the Section 106 process, in those instances where federal or state law **does not prescribe a course of action**.

This policy applies to all federal agencies with undertakings that are subject to review under Section 106 of the National Historic Preservation Act (NHPA; 16 U.S.C. § 470f), and its implementing regulations (36 CFR Part 800). To be considered under Section 106, the burial site must be or be a part of a historic property, meaning that it is listed, or eligible for listing, in the National Register of Historic Places.

The Advisory Council on Historic Preservation (ACHP) encourages federal agencies to apply this policy throughout the Section 106 process, including during the identification of those historic properties. In order to identify historic properties, federal agencies must assess the historic significance of burial sites and apply the National Register criteria to determine whether a property is eligible. Burial sites may have several possible areas of significance, such as those that relate to religious and cultural significance, as well as those that relate to scientific significance that can provide important information about the past. This policy does not proscribe any area of significance for burial sites and recognizes that the assessment must be completed on a case-by-case basis through consultation.

The policy is not bound by geography, ethnicity, nationality, or religious belief, but applies to the treatment of all burial sites, human remains, and funerary objects encountered in the Section 106 process, as the treatment and disposition of these sites, remains, and objects are a human rights concern shared by all.

This policy also recognizes the unique legal relationship between the federal government and tribal governments as set forth in the Constitution of the United States, treaties, statutes and court decisions, and acknowledges that, frequently, the remains encountered in Section 106 review are of significance to Indian tribes.

Section 106 requires agencies to seek agreement with consulting parties on measures to avoid, minimize, or mitigate adverse effects to historic properties. Accordingly, and consistent with Section 106, this policy does not recommend a specific outcome from the consultation process. Rather, it focuses on issues and perspectives that federal agencies ought to consider when making their Section 106 decisions. In many cases, federal agencies will be bound by other applicable federal, tribal, state, or local laws that do

prescribe a specific outcome, such as the Native American Graves Protection and Repatriation Act (NAGPRA). The federal agency must identify and follow applicable laws and implement any prescribed outcomes.

For undertakings on federal and tribal land that encounter Native American or Native Hawaiian human remains and funerary objects, NAGPRA applies. NHPA and NAGPRA are separate and distinct laws, with separate and distinct implementing regulations and categories of parties that must be consulted.[1] Compliance with one of these laws does not mean or equal compliance with the other. Implementation of this policy and its principles does not, in any way, change, modify, detract or add to NAGPRA or other applicable laws.

Principles: When burial sites, human remains, or funerary objects will be or are likely to be encountered in the course of Section 106 review, a federal agency should adhere to the following principles:

Principle 1: Participants in the Section 106 process should treat all burial sites, human remains and funerary objects with dignity and respect.

Principle 2: Only through consultation, which is the early and meaningful exchange of information, can a federal agency make an informed and defensible decision about the treatment of burial sites, human remains, and funerary objects.

Principle 3: Native Americans are descendants of original occupants of this country. Accordingly, in making decisions, federal agencies should be informed by and utilize the special expertise of Indian tribes and Native Hawaiian organizations in the documentation and treatment of their ancestors.

Principle 4: Burial sites, human remains and funerary objects should not be knowingly disturbed unless absolutely necessary, and only after the federal agency has consulted and fully considered avoidance of impact and whether it is feasible to preserve them in place.

Principle 5: When human remains or funerary objects must be disinterred, they should be removed carefully, respectfully, and in a manner developed in consultation.

Principle 6: The federal agency is ultimately responsible for making decisions regarding avoidance of impact to or treatment of burial sites, human remains, and funerary objects. In reaching its decisions, the federal agency must comply with applicable federal, tribal, state, or local laws**.**

Principle 7: Through consultation, federal agencies should develop and implement plans for the treatment of burial sites, human remains, and funerary objects that may be inadvertently discovered.

Principle 8: In cases where the disposition of human remains and funerary objects is not legally prescribed, federal agencies should proceed following a hierarchy that begins with the rights of lineal descendants, and if none, then the descendant community, which may include Indian tribes and Native Hawaiian organizations.

[1] The ACHP's publication *Consulting with Indian Tribes in the Section 106 Process* and the National Association of Tribal Historic Preservation Officers' publication *Tribal Consultation: Best Practices in Historic Preservation* provide additional guidance on this matter.

DISCUSSION:

Principle 1: Participants in the Section 106 process should treat all burial sites, human remains and funerary objects with dignity and respect.

Because the presence of human remains and funerary objects gives a historic property special importance as a burial site or cemetery, federal agencies need to consider fully the values associated with such sites. When working with human remains, the federal agency should maintain an appropriate deference for the dead and the funerary objects associated with them, and demonstrate respect for the customs and beliefs of those who may be descended from them.

Through consultation with descendants, culturally affiliated groups, descendant communities, and other parties, federal agencies should discuss and reach agreement on what constitutes respectful treatment.

Principle 2: Only through consultation, which is the early and meaningful exchange of information, can a federal agency make an informed and defensible decision about the treatment of burial sites, human remains, and funerary objects.

Consultation is the hallmark of the Section 106 process. Federal agencies must make a "reasonable and good faith" effort to identify consulting parties and begin consultation early in project planning, after the federal agency determines it has an undertaking and prior to making decisions about project design, location, or scope.

The NHPA, the ACHP's regulations, and Presidential Executive Orders set out basic steps, standards, and criteria in the consultation process, including:

- Federal agencies have an obligation to seek out all consulting parties [36 CFR § 800.2(a)(4)], including the State Historic Preservation Officer (SHPO)/Tribal Historic Preservation Officer (THPO) [36 CFR § 800.3(c)].

- Federal agencies must acknowledge the sovereign status of Indian tribes [36 CFR § 800.2(c)(2)(ii)]. Federal agencies are required to consult with Indian tribes on a government-to-government basis in recognition of the unique legal relationship between federal and tribal governments, as set forth in the Constitution of the United States, treaties, statutes, court decisions, and executive orders and memoranda.

- Consultation on a government-to-government level with Indian tribes cannot be delegated to non-federal entities, such as applicants and contractors.

- Federal agencies should solicit tribal views in a manner that is sensitive to the governmental structures of the tribes, recognizing their desire to keep certain kinds of information confidential, and that tribal lines of communication may argue for federal agencies to provide extra time for the exchange of information.

- Properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined eligible for inclusion on the National Register [16 U.S.C. § 470a(d)(6)(A)], and federal agencies must consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to such historic properties [16 U.S.C. § 470a(d)(6)(B) and 36 CFR § 800.2(c)(2)(ii)(D)].

Principle 3: Native Americans are descendants of original occupants of this country. Accordingly, in making decisions, federal agencies should be informed by and utilize the special expertise of Indian tribes and Native Hawaiian organizations in the documentation and treatment of their ancestors.

This principle reiterates existing legal requirements found in federal law, regulation and executive orders, and is consistent with positions that the ACHP has taken over the years to facilitate enfranchisement and promote broad participation in the Section 106 process. Federal agencies must consult with Indian tribes on a government-to-government basis because they are sovereign nations.

Indian tribes and Native Hawaiian organizations bring a special perspective on how a property possesses religious and cultural significance to them. Accordingly, federal agencies should utilize their expertise about, and religious and cultural connection to, burial sites, human remains, and associated funerary objects to inform decision-making in the Section 106 process.

Principle 4: Burial sites, human remains and funerary objects should not be knowingly disturbed unless absolutely necessary, and only after the federal agency has consulted and fully considered avoidance of impact and whether it is feasible to preserve them in place.

As a matter of practice, federal agencies should avoid impacting burial sites, human remains, and funerary objects as they carry out their undertakings. If impact to the burial site can be avoided, this policy does not compel federal agencies to remove human remains or funerary objects just so they can be documented.

As this policy advocates, federal agencies should always plan to avoid burial sites, human remains, and funerary objects altogether. When a federal agency determines, based on consultation with Section 106 participants, that avoidance of impact is not appropriate, the agency should minimize disturbance to such sites, remains, and objects. Accordingly, removal of human remains or funerary objects should occur only when other alternatives have been considered and rejected.

When a federal agency determines, based on consultation with Section 106 participants, that avoidance of impact is not appropriate, the agency should then consider any active steps it may take to preserve the burial site in place, perhaps through the intentional covering of the affected area, placement of markers, or granting of restrictive or other legal protections. In many cases, preservation in place may mean that, to the extent allowed by law, the locations of burial sites, human remains, and funerary objects should not be disclosed publicly. Alternatively and consistent with the Section 106 regulations [36 CFR § 800.5(a)(2)(vi)], natural deterioration of the remains may be the acceptable or preferred outcome of the consultation process.

Principle 5: When human remains or funerary objects must be disinterred, they should be removed carefully, respectfully, and in a manner developed in consultation.

When the federal agency decides that human remains or funerary objects must be disturbed, they should be removed respectfully and dealt with according to the plan developed by the federal agency in consultation. "Careful" disinterment means that those doing the work should have, or be supervised by people having, appropriate expertise in techniques for recognizing and disinterring human remains.

This policy does not endorse any specific treatment. However, federal agencies must make a reasonable and good faith effort to seek agreement through consultation before making its decision about how human remains and/or funerary objects shall be treated.

The plan for the disinterment and treatment of human remains and/or funerary objects should be negotiated by the federal agency during consultation on a case-by-case basis. However, the plan should provide for an accurate accounting of federal implementation. Depending on agreements reached through the Section 106 consultation process, disinterment may or may not include field recordation. In some instances, such recordation may be so abhorrent to consulting parties that the federal agency may decide it is inappropriate to carry it out. When dealing with Indian tribes, the federal agency must comply with its legal responsibilities regarding tribal consultation, including government-to-government and trust responsibilities, before concluding that human remains or funerary objects must be disinterred.

Principle 6: The federal agency is ultimately responsible for making decisions regarding avoidance of impact to or treatment of burial sites, human remains, and funerary objects. In reaching its decisions, the federal agency must comply with applicable federal, tribal, state, or local laws.

Federal agencies are responsible for making final decisions in the Section 106 process [36 CFR § 800.2(a)]. The consultation and documentation that are appropriate and necessary to inform and support federal agency decisions in the Section 106 process are set forth in the ACHP's regulations [36 CFR Part 800].

Other laws, however, may affect federal decision-making regarding the treatment of burial sites human remains, and funerary objects. Undertakings located on federal or tribal lands, for example, are subject to the provisions of NAGPRA and the Archaeological Resources Protection Act (ARPA). When burial sites, human remains, or funerary objects are encountered on state and private lands, federal agencies must identify and follow state law when it applies. Section 106 agreement documents should take into account the requirements of any of these applicable laws.

Principle 7: Through consultation, federal agencies should develop and implement plans for the treatment of burial sites, human remains, and funerary objects that may be inadvertently discovered.

Encountering burial sites, human remains, or funerary objects during the initial efforts to identify historic properties is not unheard of. Accordingly, the federal agency must determine the scope of the identification effort in consultation with the SHPO/THPO, Indian tribes and Native Hawaiian

organizations, and others before any archaeological testing has begun [36 CFR § 800.4(a)] to ensure the full consideration of avoidance of impact to burial sites, human remains, and funerary objects.

The ACHP's regulations provide federal agencies with the preferred option of reaching an agreement ahead of time to govern the actions to be taken when historic properties are discovered during the implementation of an undertaking. In the absence of prior planning, when the undertaking has been approved and construction has begun, the ACHP's post-review discovery provision [36 CFR § 800.13] requires the federal agency to carry out several actions:

(1) make reasonable efforts to avoid, minimize, or mitigate adverse effects to such discovered historic properties;
(2) notify consulting parties (including Indian tribes and Native Hawaiian organizations that might attach religious and cultural significance to the affected property) and the ACHP within 48 hours of the agency's proposed course of action;
(3) take into account the recommendations received; and then
(4) carry out appropriate actions.

NAGPRA prescribes a specific course of action when Native American and Native Hawaiian human remains and funerary objects are discovered on federal or tribal lands in the absence of a plan—cessation of the activity, protection of the material, notification of various parties, consultation on a course of action and its implementation, and then continuation of the activity. However, adherence to the plan under Principle 5 would cause new discoveries to be considered "intentional excavations" under NAGPRA because a plan has already been developed, and can be immediately implemented. Agencies then could avoid the otherwise mandated 30 day cessation of work for "inadvertent discoveries."

Principle 8: In cases where the disposition of human remains and funerary objects is not legally prescribed, federal agencies should proceed following a hierarchy that begins with the rights of lineal descendants, and if none, then the descendant community, which may include Indian tribes and Native Hawaiian organizations.

Under the ACHP's regulations, "descendants" are not identified as consulting parties by right. However, federal agencies shall consult with Indian tribes and Native Hawaiian organizations that attach religious and cultural significance to burial sites, human remains and associated funerary objects, and be cognizant of their expertise in, and religious and cultural connection to, them. In addition, federal agencies should recognize a biological or cultural relationship and invite that individual or community to be a consulting party [36 CFR § 800.3(f)(3)].

When federal or state law does not direct disposition of human remains or funerary objects, or when there is disagreement among claimants, the process set out in NAGPRA may be instructive. In NAGPRA, the "ownership or control" of human remains and associated funerary objects lies with the following in descending order: specific lineal descendants; then tribe on whose tribal lands the items were discovered; then tribe with the closest cultural affiliation; and then tribe aboriginally occupying the land, or with the closest "cultural relationship" to the material.

Definitions Used for the Principles

- **Burial Site**: Any natural or prepared physical location, whether originally below, on, or above the surface of the earth, into which as a part of the death rite or ceremony of a culture, individual human remains are deposited [25 U.S.C. 3001.2(1)].
- **Consultation:** The process of seeking, discussing, and considering the views of other participants, and, where feasible, seeking agreement with them regarding matters arising in the Section 106 review process [36 CFR § 800.16(f)].
- **Consulting parties:** Persons or groups the federal agency consults with during the Section 106 process. They may include the State Historic Preservation Officer; the Tribal Historic Preservation Officer; Indian tribes and Native Hawaiian organizations; representatives of local governments; applicants for federal assistance, permits, licenses, and other approvals; and/or any additional consulting parties [based on 36 CFR § 800.2(c)]. Additional consulting parties may include individuals and organizations with a demonstrated interest in the undertaking due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties [36 CFR § 800.2(c)(6)].
- **Disturbance:** Disturbance of burial sites that are listed in or eligible for listing in the National Register of Historic Places will constitute an adverse effect under Section 106. An adverse effect occurs when "an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, setting, materials, workmanship, feeling, or association" [36 CFR § 800.5(a)(1)].
- **Federal land:** Lands under a federal agency's control. Mere federal funding or permitting of a project does not turn an otherwise non-federal land into federal land (see *Abenaki Nation of Mississquoi* v. *Hughes*, 805 F. Supp. 234 (D. Vt. 1992), aff'd, 990 F. 2d 729 (2d Cir. 1993) (where the court found that a Clean Water Act permit issued by the US Army Corps of Engineers did not place the relevant land under federal "control" for NAGPRA purposes).
- **Funerary objects:** "items that, as part of the death rite or ceremony of a culture, are reasonably believed to have been placed intentionally at the time of death or later with or near individual human remains" [25 U.S.C. 3001(3)(B)].
- **Historic property:** "Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. It includes artifacts, records, and remains that are related to and located within such properties, and it includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register of Historic Places criteria" [36 CFR § 800.16(1)].
- **Human remains:** The physical remains of a human body. The term does not include remains or portions of remains that may reasonably be determined to have been freely given or naturally shed by the individual from whose body they were obtained, such as hair made into ropes or nets [see 43 CFR § 10.2(d)(1)].
- **Indian Tribe**: "An Indian tribe, band, nation, or other organized group or community, including a Native village, Regional Corporation or Village Corporation, as those terms are defined in Section 3 of the Alaska Native Claims Settlement Act [43 U.S.C. 1602], which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians" [36 CFR § 800.16(m)].
- **Native American:** Of, or relating to, a tribe, people, or culture that is indigenous to the United States [25 U.S.C. 3001 (9)]. Of, or relating to, a tribe, people, or culture indigenous to the Unites States, including Alaska and Hawaii [43 CFR 10.2(d)].

- **Native Hawaiian:** Any individual who is a descendant of the aboriginal people who, prior to 1778, occupied and exercised sovereignty in the area that now constitutes the state of Hawaii [36 CFR § 800.16(s)(2)].
- **Native Hawaiian Organization:** Any organization which serves and represents the interests of Native Hawaiians; has as a primary and stated purpose the provision of services to Native Hawaiians; and has demonstrated expertise in aspects of historic preservation that are significant to Native Hawaiians [36 CFR § 800.16(s)].
- **Policy statement:** A formal statement, endorsed by the full ACHP membership, representing the membership's collective thinking about what to consider in reaching decisions about select issues, in this case, human remains and funerary objects encountered in undertakings on federal, tribal, state, or private lands. Such statements do not have the binding force of law.
- **Preservation in place:** Taking active steps to ensure the preservation of a property.
- **Protection of Historic Properties**: Regulations [36 CFR Part 800] implementing Section 106 of the National Historic Preservation Act.
- **Section 106**: That part of the National Historic Preservation Act which establishes a federal responsibility to take into account the effects of undertakings on historic properties and to provide the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such action.
- **State Historic Preservation Officer:** The official appointed or designated pursuant to Section 101(b)(1) of NHPA to administer the state historic preservation program.
- **Tribal Historic Preservation Officer**: The official appointed by the tribe's chief governing authority or designated by a tribal ordinance or preservation program who has assumed the responsibilities of the SHPO for purposes of Section 106 compliance on tribal lands in accordance with Section 101(d)(2) of NHPA.
- **Treatment:** Under Section 106, "treatments" are measures developed and implemented through Section 106 agreement documents to avoid, minimize, or mitigate adverse effects to historic properties.

Acronyms Used for the Policy Statement
- **ACHP**: Advisory Council on Historic Preservation.
- **ARPA**: Archaeological Resources Protection Act [16 U.S.C. 470aa-mm].
- **NHPA**: National Historic Preservation Act [16 U.S.C. § 470f].
- **NAGPRA**: The Native American Graves Protection and Repatriation Act [25 U.S.C. 3001 et seq].
- **SHPO**: State Historic Preservation Officer
- **THPO**: Tribal Historic Preservation Officer

[The members of the Advisory Council on Historic Preservation unanimously adopted this policy on February 23, 2007]

APPENDIX C

PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
POLICY ON THE TREATMENT OF HUMAN REMAINS

Adopted March 10, 1993

The PHMC developed this policy to serve as a guide for persons conducting agency programs for PHMC, persons excavating for any reason on Commonwealth land, and persons excavating under a permit authorized by a state agency, other than PHMC, who discover human remains or a burial site. It serves to prevent the destruction of unmarked burials, encourage respectful treatment of all human remains, and the role of Native American groups, in compliance with NAGPRA. The policy further attempts to balance the scientific and research value of skeletal material and associated funeral objects.

This policy offers more guidance in two specific areas:

1) Deals with burial sites discovered during CRM projects, archaeological field investigations, grant funded projects, and all earth moving projects on state land. The discovery of human remains should trigger a process that encourages careful and dignified treatment and mandates the notification of appropriate parties. The issue of human remains and burial sites is not directly addressed in NAGPRA, however, the PA policy hopes to follow this legislation as closely as possible.
2) The treatment of existing collections of skeletal material, associated and unassociated funerary objects, sacred objects and objects of cultural patrimony.

Definitions

For the purposes of this policy, the following definitions should apply:
Burial site: any natural or prepared physical location below, on, or above the surface of the earth into which, as part of a death rite or ceremony of a culture, human remains have been deposited whether marked or unmarked.

Policy I – Discovery of Human Remains

This policy is activated when the discovery of human remains falls within one of three categories:

1) When human remains are uncovered, disturbed, or exposed in the course of archaeological field investigations undertaken during Commonwealth funded, permitted, or assisted projects.
2) When human remains are inadvertently discovered during earth moving activity on Commonwealth lands.
3) When human remains re discovered during state permitted activities occurring off Commonwealth land, when the permit is granted by any agency of the state government, except the PHMC.

This policy outlines the procedures to be followed if the discovery of human remains fall within category 1 or 2. It is further designed to give guidance to discoveries that fall within category 3. It will be implemented in part through PHMC archaeological guidelines, through its Grants Program, through its contract documents, and through archaeological permits granted for archaeological investigations on state lands.

1. In field situations, human remains may be encountered under two sets of circumstances – (1) during a planned archaeological investigation, or (2) during routine ground disturbance from excavations and construction, known as unexpected discovery.

Archaeological Investigations (Category 1)
Any person doing archaeological excavations through permits or grants through the PHMC must have a contingency plan for the treatment of human remains or a burial site as part of their research proposal. This plan should identify expected lineal descendants or culturally affiliated groups

- When human remains are encountered in the manner they were anticipated, the treatment plan should be activated.
- If, during the course of investigation, it appears that human remains are encountered that were unanticipated, then work at the site should stop. The coroner and the BHP should be notified of the find.

Unexpected Discoveries (Category 2 required action, Category 3 guidance)
Any person while undertaking earth moving activities occurring off Commonwealth land who becomes aware that human remains or a burial site are being disturbed shall cease all activity in the area of the site. If it appears that the remains may be of a historic or prehistoric nature, the PHMC should be notified of the find.

2. Whether human remains are encountered through archaeological investigation or through inadvertent discovery, it is the intention of this policy to allow an opportunity for consultation with groups that may be culturally affiliated with or may be lineal descendants of the deceased. This will give all parties involved an opportunity to develop a plan for the remains.

Archaeological Investigation (Category 1)
The treatment plan developed as part of the scope of work should be implemented.

Unexpected Discovery (Category 2 and 3)
The Commission has one week to notify potential lineal descendants or culturally affiliated groups.

3. Based on the above notification and following consultation, the PHMC will consider the concerns and recommendations of all parties who are able to

establish lineal descent or cultural affiliation with the individual(s) associated with the burial site.

4. Once consultation is completed, the PHMC will develop and direct a final treatment plan. This should be competed within fifteen days. The plan may recommend any of a number of treatment plans. These include:
    - Leaving the human remains *in situ* if the burial will not be disturbed and can be protected in this manner
    - Removal and immediate reburial by the appropriate culturally affiliated group or direct lineal descendant
    - Removal of the human remains and examination undertaken by a qualified osteologist to gather basic information
    - Removal and examination of the remains

5. Funerary objects and grave goods directly associated with unmarked human remains should be treated in the same manner as human remains.

State Historic Preservation Office/
New York State Office of Parks, Recreation and Historic Preservation
Human Remains Discovery Protocol
(August 2014)

In the event that human remains are encountered during construction or archaeological investigations, the New York State Historic Preservation Office (SHPO) recommends that the following protocol is implemented:

- At all times human remains must be treated with the utmost dignity and respect. Should human remains or suspected human remains be encountered, work in the general area of the discovery will stop immediately and the location will be immediately secured and protected from damage and disturbance.

- If the services of a skeletal biologist are necessary to determine if the remains are human, we recommend that this work take place on site and no bone leave the site.

- Human remains or associated artifacts will be left in place and not disturbed. No skeletal remains or materials associated with the remains will be collected or removed until appropriate consultation has taken place and a plan of action has been developed.

- The county coroner/medical examiner, local law enforcement, the SHPO, the appropriate Indian Nations, and the involved agency will be notified immediately. The coroner and local law enforcement will make the official ruling on the nature of the remains, being either forensic or archaeological.

- If human remains are determined to be Native American, the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be generated. Please note that avoidance is the preferred choice of the SHPO and the Indian Nations. The involved agency will consult SHPO and appropriate Indian Nations to develop a plan of action that is consistent with the Native American Graves Protection and Repatriation Act (NAGPRA) guidance. Photographs of Native American human remains and associated funerary objects should not be taken without consulting with the involved Indian Nations.

- If human remains are determined to be non-Native American, the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be generated. Please note that avoidance is the preferred choice of the SHPO. Consultation with the SHPO and other appropriate parties will be required to determine a plan of action.

KnowHow #4

INFORMATION AND ASSISTANCE FROM THE MASSACHUSETTS HISTORICAL COMMISSION

What to Do When Human Burials are Accidentally Uncovered

1. Why are bones sometimes found?

In Massachusetts, many unmarked graves exist without gravestones, fences, tombstones, or other surface indications of their presence. These are chiefly the graves of prehistoric and historic Indians, which may never have been marked at all; and graves which had been identified at one time in the past, but the markings are no longer visible. As a result, bones are often found during ordinary ground disturbance activities such as the construction of new homes, utilities, or roads; in the agricultural or industrial use of a site; or the excavation of sand or gravel borrow. Bones are also sometimes found eroding out of areas exposed by natural erosion, floodwater scouring, or sand dune formation.

A new law has been enacted which establishes procedures to follow when human bones are accidentally discovered.

2. Who is involved?

Private citizens, State and Local Police, Medical Examiners, State Archaeologist, and the Commission on Indian Affairs.

3. What should you do if you discover bones?

Do not touch or disturb the bones. Notify the state or local police and the regional medical examiner about the discovery and location.

4. What does the Medical Examiner do?

The Medical Examiner investigates the discovery to determine whether the bones are human, and whether they are recent or more than 100 years old. If the bones are less than 100 years old, a criminal investigation may be warranted. If the bones are more than 100 years old, the Medical Examiner then notifies the State Archaeologist, who immediately conducts an archaeological investigation of the site. Throughout these investigations, the police authorities must insure that the site is protected from further damage.

5. What does the State Archaeologist do?

The State Archaeologist investigates the site to determine the age, cultural association and identity of the burial. If the State Archaeologist determines that the burial is that of a Native American, the Commission on Indian Affairs is notified. The State Archaeologist consults with the landowner to determine whether the burial can remain undisturbed. In the case of development projects, the owner and State Archaeologist discuss whether there are prudent and feasible steps the owner can take to protect the burial. If it is impossible to avoid future harm to the burial, the State Archaeologist removes the remains.

6. What does the Commission on Indian Affairs do?

The archaeological investigation of Indian burials is monitored by the Commission on Indian Affairs to insure that the remains are treated respectfully.

> Please remember: Once bones or artifacts are removed from the site, valuable information concerning the identity and age of the human remains is lost. Therefore, it is important not to disturb the site in any way until the State Archaeologist can conduct an investigation and record the discovery.

BIBLIOGRAPHY

Massachusetts General Laws, Chapter 38, section 6; Chapter 9, sections 26A & 27C; Chapter 7, section 38A; Chapter 114, section 17; as amended by Chapter 659 of the Acts of 1983 and Chapter 386 of the Acts of 1989.

For Further Information:

Please contact the State Archaeologist at the Massachusetts Historical Commission.

William Francis Galvin
Secretary of the Commonwealth
Chairman, Massachusetts Historical Commission
Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125
Phone: (617) 727-8470 Fax: (617) 727-5128
Website: www.sec.state.ma.us/mhc

2 New Hampshire Burial Laws

In the laws of New Hampshire (the Revised Statutes Annotated, or RSA for short) there are several chapters that deal with cemeteries and human remains. Three are particularly pertinent here.

RSA 227-C:8 a-g is the set of statutes that defines the duties of the Division of Historical Resources. Among those duties are the responsibilities of the State Archaeologist to: 1) oversee the excavation and analysis of unmarked human burials discovered in the course of construction activities, 2) attempt to contact any individuals or groups with an interest in such remains, and 3) manage the disposition of these remains once they are excavated and analyzed.

RSA 289 deals with cemeteries but more important here is **RSA 290** which deals with burials and reinterments. Specifically, this statute makes it illegal, under most circumstances, to disinter a human body without a permit. Such a disinterment is a misdemeanor, but it is important to note that the *accidental* discovery of buried human remains is not a crime.

RSA 635 is a part of the NH Criminal Code enacted by the 1987 legislature. This provision sets out the circumstances under which it is permitted to alter or remove cemetery items and/or the remains they mark. Such disturbances require written permission from those with rights to the burial ground, when they can be found, or from the local governing body if owners or descendants cannot be found. This statute also prohibits the possession or sale of tombstones and other objects from cemeteries. Violation of this law is a class B felony.

Contact Information

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WHAT TO DO UPON ENCOUNTERING HUMAN REMAINS

Before or During Land-Altering Activities in New Hampshire

A guide for planners, builders, landowners, developers, and local governments

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

State of New Hampshire, Department of Cultural Resources — 603-271-3483
19 Pillsbury Street, Concord, NH 03301-3570 — 603-271-3558
TDD Access: Relay NH 1-800-735-2964 — FAX 603-271-3433
www.nh.gov/nhdhr — *preservation@dcr.nh.gov*

January 2008

1 A Statement of Principles

Historians and archaeologists often help contemporary society remember its ancestors by studying materials and objects that were never intended by their makers to be memorials. Given this, the protection of old cemeteries and graveyards is particularly important because it is a way of honoring our forbears by respecting the things they made specifically for us to remember them by.

A second guiding principle allows us to extend our concern beyond extant cemeteries from the historic period to encompass all buried human remains. That principle, supported by the weight of judicial opinion throughout the U.S., is the idea that once a place has been used for human burial, it remains a special place in perpetuity, regardless of subsequent land transfers. In sections 3 and 4 of this pamphlet we spell out specific procedures for dealing with both marked and unmarked human burials and burial places encountered during the course of ground-disturbing activities.

The goal of the DHR in formulating and publicizing these procedures is simply to ensure that there is someone to speak for every burial place in New Hampshire, public and private, historic and prehistoric. Citizens with rights to private burial grounds and descendants of those interred in them can speak for some private burial grounds, and local governments can speak for public cemeteries within their jurisdiction. The role of the DHR is nothing more than to speak for private cemeteries and Native American Indian burial places which have no other advocates. In these cases our purpose is to extend to these memorials and remains the same kind of respect that any of us would want for the remains of our own ancestors.

3 Marked Burials

If you plan a landscape alteration, you should try to locate any old burial grounds in the area you intend to alter. There are many sources of this kind of information, including USGS quadrangle maps, town histories, and two organizations: The New Hampshire Historical Society and the New Hampshire Old Graveyard Association. In addition, under a recently-enacted New Hampshire statute, towns are obligated to keep information on old gravesites. This list of sources is not exhaustive, but it is a good start.

If there are marked burials in the path of your proposed construction, the DHR would prefer that they be left undisturbed, and state law requires a 25-foot buffer zone around most cemeteries. However, marked burials may be removed legally, and this requires two sets of approvals.

First, you need to determine who holds rights to the cemetery. Rights to visit, maintain, and approve alterations to a private cemetery belong to those who established the cemetery — and to their descendants — regardless of subsequent transfers of the surrounding property. The written permission of the holders of these rights is required to move a private cemetery. If those who hold these rights are impossible to locate, then written permission is required from the local government, which will consult with the DHR.

Second, the removal of burials to another location requires a permit. Typically, a funeral director applies to the NH Department of Health and Human Services for this permit, which must be countersigned by the local health officer. The DHR has the authority to review these applications and advise the Department of Health and Human Services.

4 Unmarked Burials

In the event that land-disturbing activities uncover unmarked human remains, a second set of procedures applies.

First, excavation must be discontinued and the local police notified. The police will call in the county medical examiner who will make an investigation to determine whether the remains require a criminal investigation or an archaeological investigation.

In the latter case, the county medical examiner will notify the State Archaeologist who has, in most cases, 48 hours to arrange with the landowner for the protection or removal of the remains. The State Archaeologist oversees the removal and analysis of the remains and has the responsibility of attempting to consult with individuals who may have an interest in them, next of kin and/or appropriate Native American groups. If located, next of kin or Native American groups will have the right to determine what happens to the remains after they have been analyzed.

Finally, there are provisions for determining who will bear the costs of archaeological work necessitated by the discovery of unmarked burials. In the case of privately funded, non-commercial land-altering activities, the DHR will fund the work. For privately funded commercial land alteration, the land owner will bear the cost of archaeology. And in the case of state funded land alteration, the department funding the construction will also fund the archaeology.

4.7 Protocol for Handling Discovery of Human Remains

	Known Burials	Unidentified Burials
When to contact?	**Intentional excavation** At the earliest time in decision-making process.	**Inadvertent Discovery** Upon discovery.
Which Nation to contact?	If find is within existing Nation boundary, contact that Nation's Cultural Resource representatives. If the find is within the traditional land use area (fifty mile radius from the current nation territory, contact the closest Nation's Cultural Resource Representative. If the find is within the aboriginal territory of each nation, as shown on the attached map, contact the Nation within that territory. For finds located within fifty miles on either side of the boundary lines shown on the map, contact the Cultural Resource Representatives of both Nations.	
Who to contact?	Haudenosaunee Cultural Resource Representatives HSCBRR	Haudenosaunee Cultural Resource Representatives HSCBRR
How to contact?	Contact list is provided.	
Information Required	Brief description of the find or potential find; site map and any information on the known cultural history of the area and summary of nearby archaeological findings.	
	Nation will send a representative to review the site.	Company must hire a Native American on-site observer.
Next steps	***Non-disturbance of burials is preferred.*** If after proper consultation, the remains must be removed, we prefer to have them reburied close to their original location as possible, provided the future sanctity of the grave can be assured. ***No remains should be removed without proper cultural protocols.*** If no safe local burial ground can be offered, the Haudenosaunee will reclaim the remains for reburial at an undisclosed location. The local government /state agency/developer must pay all of the costs for such reburial. All objects associated with the original burial must be reburied as well. All of the soil in the immediate area of the burial should also be placed in the new grave.	
Time Frame	30 to 45 days	As soon as possible

Band of Mohican Indians

Stockbridge-Munsee Community
Policy for
Treatment and Disposition of Human Remains and Cultural Items
That May be Discovered Inadvertently During Planned Activities

Purpose

The purpose of this policy is to describe the procedures that will be followed by all federal agencies, in the event there is an inadvertent discovery of human remains, that are identified as Stockbridge-Munsee (Mohican).

Treatment and Disposition of Human Remains and Cultural Items

1. The federal agency shall contact the Stockbridge-Munsee President's office (715) 793-4111 or Stockbridge-Munsee Historic Preservation Office (715) 793-3970, after hours (715)304-8155, as soon as possible, but no later than three (3) days, after the discovery of Stockbridge-Munsee, Mohican remains

2. Place tobacco with the remains and funeral objects

3. Cover remains and funeral objects with a natural fiber cloth such as cotton or muslin when possible.

4. No photographs to be taken

5. The preferred treatment of inadvertently discovered human remains and cultural items is to leave human remains and cultural items in-situ and protect them from further disturbance.

6. Non-destructive "in-field" documentation of the remains and cultural items will be carried out in consultation with the Tribe, who may stipulate the appropriateness of certain methods of documentation.

7. If the remains and cultural items are left in-situ, no disposition takes place and the requirements of 43 CFR 10 Section 10.4-10.6 will have been fulfilled.

8. The specific locations of discovery shall be withheld from disclosure (with the exception of local law officials and tribal officials as described above) and protected to the fullest extent by federal law

9. If remains and funeral objects are to be removed from the site consultation will begin between the Stockbridge-Munsee Tribe and the federal agency.

Stockbridge-Munsee Community

BAND OF THE MOHICAN INDIANS

TRIBAL COUNCIL OFFICES

RESOLUTION

Date: September 17, 2002 Number: 052-02

Whereas, the Stockbridge-Munsee Community, Band of Mohican Indians, is a federally recognized Indian Tribe organized under a Constitution and By-laws approved on November 18, 1937; and

Whereas, the Tribe's duly elected governing body, the Stockbridge-Munsee Tribal Council, is empowered under the Constitution to make and enforce laws and otherwise exercise its powers consistent with the Constitution; and

Whereas, the National Historic Preservation Act, Section 106 (16 USC 470F) applies to projects and developments within the Stockbridge-Munsee Reservation and its ancestral lands, if there is any federal monies being used for the project, if project is on tribal land, if any federal permits are needed, or if on land affiliated with a federally recognized tribe, and

Whereas, known burials have been discovered within the Stockbridge-Munsee Reservation, and it is known that Section 106 applies to these burials; and

Whereas, the Repatriation Committee recommends the following: that an area of 50 feet surrounding any known burial site (a circumference of 100 feet) may not be disturbed by any phase of a project or development, nor may any part of the grounds within the defined area be disturbed in any way after completion of the project; now

Therefore Be It Resolved, that the Stockbridge-Munsee Tribal Council hereby accepts the recommendation of the Committee and adopts this resolution for the protection of burial sites now and in the future.

CERTIFICATION

I, the undersigned, as Secretary of the Stockbridge-Munsee Tribal Council, hereby certify that the Tribal Council is composed of 7 members of whom 4, constituting a quorum, were present at a meeting duly called, noticed and convened on September 17, 2002 and that the foregoing resolution was adopted by a vote of 3 for, 0 members against, and 0 members abstaining and that said resolution was not rescinded or amended in any way.

Gregory E. Miller, Vice-Chairman
Stockbridge-Munsee Tribal Council

Diane D. Mattingly, Acting Secretary
Stockbridge-Munsee Tribal Council

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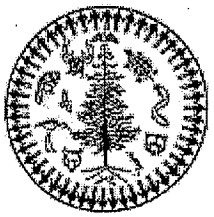

The Haudenosaunee Policies on this page are the official word of the Haudenosaunee Confederacy as promulgated by the Grand Council of Chiefs concerning cultural patrimony & repatriation.

Note:

From Kanatiyosh. The policies contain statements that are important to insure cultural sensitivity towards the Haudenosaunee. The statements are evidence of why some school projects, museums, private collections, sellers, governments, and etc., are not being culturally sensitive or respectful to the Haudenosaunee.

Haudenosaunee Policy on Human Remains

Haudenosaunee Beliefs

We have been taught that we bury our dead into the ground so that their bodies can become part of the scared Earth. We believe that we come from the Mother Earth and that the human remains that rest within the Earth are an important spiritual connection to the spirit of the Earth. The Earth is enriched by the dead as our flesh becomes part of the soil.

The souls of the dead have a path of destiny that they must follow. We refer to this as their journey after life. In this way, we feel that the dead are around us and hover over us as
we hold ceremonies or dances. We believe that the dead have power and it is dangerous to neglect the spiritual needs of the dead.

The protection of the human remains and associated graves, sacred burial sites and related objects from the graves of the Haudenosaunee are the responsibility of each generation of chiefs, clan mothers, and faithkeepers. We believe that the remains, the associated burial objects and the actual soil in which they rest is sacred. There is no acceptable excuses to justify the desecration of this sacred burial.

Violation of Our Spiritual Rights

Removing the remains from their eternal resting place is a great desecration to both the dead and the living. The disturbance, destruction, and theft of the dead is a violation of the religious and spiritual welfare of the Haudenosaunee.

As long as the human remains are disturbed, there will be spiritual consequences to our people. The desecration of the graves of our ancestors, no matter what the age of the burial, is a violation of our religious freedom.

Permits issued by the State of New York or any other local government, to allow anyone
to violate the sanctity of the graves of our ancestors can no longer be tolerated. In the past, our ancestors buried many objects along with the body with the belief that in the afterlife,
you will need all of those things that you need in this life.

All types of objects have been associated with burials, including decorated clothing, glass beads, shell beads, silver combs, tools and weapons, ceramic and metal cooking pots, wampum belts, strings of wampum, and a variety of personal items. The removal of these objects from the grave is a theft from the dead.

Violation of Our Human Rights

The remains of our dead are not "archaeological resources" that are subjects of study. They are human beings who once lived on this land. They had real lives and feelings. They had
spiritual expectations about their final resting places. To look at Native Peoples as objects rather than people is a gross violation of our human rights.

All graves and burial sites, Native or not, deserve respect. Our dead relatives deserve the basic human right to a dignified burial. We do not believe in the use of permanent headstones to mark graves of our ancestors and state law makes a difference between cemeteries and unmarked burials.

Our burial sites deserve to be considered hallowed ground, whether they are

marked or not. There has been a double standard in dealing with our people and non-Native remains. Non-Native grave sites are often afforded more protection than Native burials.

Despite the efforts of state agencies to identify Native grave locations, construction permits are issued nonetheless. Our dead deserve the same right to an eternal resting place as all other races and religions.

Violation of Our Treaty Rights

The unearthing of the remains of our ancestors from their eternal resting place is also a violation of the promises made to the Haudenosaunee under the terms of the Canandaigua
Treaty of 1794. By that treaty, the United States, including the State of New York, promised not to "disturb" the Haudenosaunee in the free use and enjoyment of their lands.

We have been on record protesting the desecration of our graves. The continual destruction of Native graves, the stealing of the Native remains and the looting of burial objects causes us serious mental, emotional, and spiritual harm.

Our people are continually upset by these events and we have been forced to adjust our spiritual traditions to accommodate outside developments. The desecration of our dead violates the mutual respect promised by the United States as they pledged a firm and permanent friendship between our peoples.

The treaty also promised to remove the cause of complaint that upsets our peace. We therefore make it clear that the desecration of the graves of our ancestors causes great harm to our people and the United States and State of New York have an obligation to protect the general welfare of our people as promised in the legally binding treaties.

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Tennessee Gas Pipeline
Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M7

UNANTICIPATED DISCOVERY OF CONTAMINATION PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

The intent of this Unanticipated Discovery of Contamination Plan ("UDC Plan") is to outline practices that will be employed in the event of an unanticipated discovery of contamination in soil, groundwater, and sediment when excavating during construction of the Project and/or operations and maintenance activities for the Project facilities, as well as debris or waste materials deposited on the pipeline right-of-way ("ROW") for Tennessee's pipeline system. The purposes of this UDC Plan are to:

- Protect human health and worker safety;
- Prevent the spread of contamination; and
- Comply with applicable state and/or federal regulations.

2.0 PRE-JOB PLANNING, REVIEW, AND ASSESSMENT

Prior to the commencement of Project construction activities or operations and maintenance activities, the Project's Chief Inspector ("CI"), Environmental Inspector ("EI"), District Manager, and/or their designee(s) will complete a review of Tennessee's pipeline ROW and aboveground facility locations where Project construction or operations and maintenance activities are planned in order to assess the potential for the presence of known or potential contamination. An assessment will be made of the likelihood of encountering contamination during any excavation activities. The scope of the review and assessment will reflect the size of the Project, Tennessee's past experience in the Project work areas, and available information from public sources and any site investigations conducted. Attached to this UDC Plan is a database listing of known hazardous waste release sites within 0.25 mile of the Project.

For the Project, the review and assessment will consist of a site reconnaissance of the proposed work areas, interviews with property owners in the proposed work areas, and a review of any publicly available information. It may also be necessary to consult with Tennessee's Field Environmental Services ("FES") Department, to conduct an environmental database search, and/or perform further investigation.

Generally, Tennessee does not anticipate that this review will identify contamination along the pipeline ROW where Project construction and/or operations and maintenance activities will occur, but may identify work areas where there is a higher potential for contamination along the pipeline ROW.

For Project construction and/or operations and maintenance activities, including any excavations at existing aboveground facility locations, there may be a higher likelihood of encountering unanticipated contamination due to the age of these facilities, as well as the use of regulated substances at these facilities.

If Tennessee determines that there is a high likelihood that the planned Project construction and operations and maintenance activities will be conducted in close proximity to, or within, known or suspected contaminated sites, the FES will be consulted by the EI.

The results of the review and assessment will be reviewed by the CI and EI prior to start of Project construction and/or operations and maintenance activities so that any identified or potentially contaminated sites and/or areas are located and available information is reviewed for potential impacts.

In the event that Tennessee determines that the planned Project construction and/or operations and maintenance activities will impact a confirmed contaminated site, the FES will work with the appropriate regulatory agency, property owner, and responsible party to ensure the Project construction and/or maintenance activities are conducted in accordance with applicable and established site requirements. Where feasible and practicable, a re-route or other modification to the Project facilities may be considered. Postponement of the Project construction and/or operations and maintenance activities may also be necessary.

If contaminated sites are identified for planned work areas of the Project, Tennessee will develop and maintain a list of the affected sites, including information on how the determination was made (i.e., database search, property owner, agency report).

3.0 UNANTICIPATED DISCOVERY RESPONSE

In the event unanticipated contaminated soil, groundwater, or other potential environmental contamination are encountered during Project construction and/or maintenance activities (e.g., malodorous soils and/or groundwater with visible staining and/or sheen), Tennessee will implement the following general procedures:

1. All Project construction and/or operations and maintenance activities in the immediate vicinity of areas where suspected contamination or unknown wastes are encountered will be halted;
2. All construction, oversight, and observing personnel will be evacuated to a road or other accessible up-wind location until the types and levels of potential contamination can be verified by qualified personnel. This assessment may include, but not be limited to: observation by a qualified health and safety professional, field screening using the appropriate air sampling devices, and/or laboratory analysis of suspect material;
3. The Project's CI, EI, and/or District Manager will be notified and they will consult with Tennessee's FES on follow-up actions;
4. Following consultation with on-site personnel, Tennessee's FES will be responsible for designating follow-up actions, including mobilizing Emergency Response personnel and

coordinating with the U.S. Environmental Protection Agency ("USEPA") and/or state and local agencies, as appropriate;

5. If an immediate or imminent threat to human health or the environment exists, the EI, CI, District Manager, and/or their designee will immediately contact the appropriate responding agency:
   - For construction of the Project, the contact numbers for fire, police, and the state environmental hotline may be found in the Environmental Contacts List for the Project; and
6. If an immediate or imminent threat to human health or the environment does **not** exist, or has been abated, a determination will be made, after consulting with all responsible parties, regarding any necessary remedial action. If Tennessee or its qualified contractor personnel are responsible for any remedial action, such actions will be limited to the Project's certificated work areas only.
   - Representative samples of the suspected contaminated media (i.e., soil, water, and waste) may need to be submitted for laboratory analysis to determine waste classification and/or agency notification requirements;
   - The Project CI, EI, District Manager, and/or their designee(s) will consult with the FES for the appropriate analyses, sampling methodology, and sampling frequency;
   - Any excavated soils or waste that are suspected of containing contamination above the appropriate clean-up standard, or otherwise regulated for disposal, will be placed on plastic sheeting and covered at the end of each work day or placed in an appropriate container to prevent the spread of any further contamination. Containers must be closed or covered and any storage areas cordoned off with orange safety fence. All containers will be clearly labeled with the name of the contents and any known hazard associated with the material identified on the container. Known hazardous wastes will be labeled with the words "Hazardous Waste" and the date the waste was placed in the container; and
   - Water or groundwater suspected of being contaminated will **not** be discharged to grade, without prior state approval. Options such as on-site storage tanks or discharge to publicly-owned treatment works may be considered. Limiting and/or diverting the flow of clean surface water away from the affected area, as well as other measures, may be implemented to minimize impacts and exposure to the Project's work areas.
7. If it is determined that Tennessee or its qualified contractor will be responsible for arranging for disposal of any affected materials (soil, water, waste), the materials will be characterized and disposed of properly and in compliance with applicable requirements at a permitted facility in a timely manner. All disposal documentation will be obtained and maintained in the Project files, with copies sent to the FES.
   - If USEPA-regulated hazardous wastes, Toxic Substance Control Act wastes, or state hazardous wastes are generated, a USEPA generator identification number will need to be obtained. The FES must be contacted to assist in either obtaining a project-specific ID number or providing an USEPA ID number for an existing facility.

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Attachment M7-A

Results of Environmental Contamination Data Base Reviews

(excerpt from FERC ER Resource Report 8, Section 8.3.6.4)

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Based on an online review of USEPA data, there is a Superfund site, the Troy Mills Landfill, located in Troy, north of the existing powerline easement (USEPA 2015c). The Troy Mills Landfill is located approximately 110 feet northwest of the Project centerline. The Project is located upgradient of the Superfund site. The site has been remediated and groundwater monitoring is occurring downgradient to evaluate monitored natural attenuation of any contamination and the Agency for Toxic Substances and Disease Registry indicates no drinking water impacts associated with the site. From information gathered as of the date of this Resource Report, no risk of encountering impacted soils or groundwater is anticipated.

The Merrimack Industrial Metals, Inc. site, a Brownfields Site on Milford Road in Merrimack, is proposed to be crossed by the Project. This site was a former metals recycling facility in operation from 1963 to 1999. Groundwater and soil contamination was identified at the site and remediation was performed; however, contaminated soils remain in place in some locations (USEPA 2015f). Tennessee is evaluating this site for potential impacts.

Correspondence concerning hazardous waste sites in New Hampshire has not yet been received from NHDES. New Hampshire's OneStop website was consulted to identify sites with spills or releases within 0.25 mile of the Project (NHDES 2015a). This information is provided in Tables M7-A-1 and M7-A-2. From information gathered as of the date of this Resource Report, there appears to be no risk of encountering impacted soils or groundwater from the identified sites during Project construction.

A Phase I ESA was conducted of the parcels associated with the proposed location of the Market Path Mid Station 4 compressor station in New Ipswich and the proposed location of Merrimack meter station in Merrimack to identify any potential contamination on the parcels. The ESAs were conducted in the spring and fall of 2015, respectively. No potential contamination issues were identified at the proposed compressor station site. Potential sources of contamination were identified at the proposed meter station site. These are anticipated to be investigated in the spring of 2016, and updated information will be provided to the Commission.

Should any hazardous materials be encountered during pipeline construction, Tennessee will dispose of and/or mitigate for any hazardous materials uncovered in accordance with applicable federal and state regulations. Additionally, Tennessee will implement its Project-specific Upland Erosion Control, Revegetation and Maintenance Plan (Attachment M14) and Wetland and Waterbody Construction and Mitigation Procedures (Attachment M15), and its Project-specific ECP for New Hampshire, Volume II, Appendix M, during construction of the Project facilities to minimize potential disturbance of contaminated media. Should surface or subsurface contamination be encountered during construction, it will be addressed and handled in accordance with this UDC Plan and federal, state, and local requirements.

References

NHDES. 2015a. [On-line WWW]. Available URL: http://www2.des.state.nh.us/DESOnestop/. [January 26, 2015].

USEPA. 2014. Wastes – Hazardous Waste – Corrective Action. [Online WWW]. Available URL: http://www.epa.gov/waste/hazard/correctiveaction/facility/index.htm. [Accessed January 21, 2015].

USEPA. 2015c. Find New England Sites. [Online WWW]. Available URL: [Accessed January 28, 2015].

USEPA. 2015d. Brownfields-Cleanups. [Online WWW]. Available URL: http://www.epa.gov/enviro/facts/topicsearch.html. [Accessed March 27, 2015].

USEPA. 2015e. Cleanups. [Online WWW]. Available URL: http://www.epa.gov/enviro/facts/topicsearch.html. [Accessed March 27, 2015].

USEPA. 2015f. EPA Waste Site Cleanup & Reuse, Merrimack Industrial Metals. [Online WWW]. Available URL: http://www3.epa.gov/region1/removal-sites/MerrimackIndustrialMetals.html. [Accessed November 5, 2015].

USEPA. 2015g. Brownfields Property Progress Profile, Merrimack Industrial Metals, Inc. [Online WWW]. Available URL: https://obipublic11.epa.gov/analytics/saw.dll?PortalPages&PortalPath=%2Fshared%2FCIMC%2F_portal%2FCIMC&Page=Profile%20Page&Action=RefreshAll&ViewState=nbakuujgv4utde7l9rdt084v4i&StateAction=samePageState. [Accessed November 5, 2015].

USEPA. 2015h. Brownfields Property Progress Profile, Traditions Village. [Online WWW]. Available URL: https://obipublic11.epa.gov/analytics/saw.dll?PortalPages&Action=Navigate&PortalPath=/shared/CIMC/_portal/CIMC&Page=Profile+Page&col1=ACRES_GRANT_EXPORT.PROPERTY_ID&val1=%22150045%22#cleanup. [Accessed November 5, 2015].

Table M7-A-1
Listings of Known Hazardous Waste Release Events Within 0.25 Mile of the Pipeline in New Hampshire

Site Name	Segment[1]	Nearest Milepost	Approximate Location		Address of Hazardous Waste Release Site			Relevant Database(s)/ Source(s)	Status and Contamination Issues	Comments
			Distance from Pipeline (feet)	Direction from Pipeline	Street	Township/ Town	County			
Troy Mills Landfill	I	13.5	110	N-NE	60 Quarry Road	Troy	Cheshire	USEPA Region I	Two acre drum disposal area. 7,692 buried drums; 29,924 gallons of flammable liquid waste; 3,099 cubic yards of sludge; and 26,244 tons of heavily contaminated soil removed in 2005. Site remedy is monitored natural attenuation, free product removal, maintenance of soil cap over drum excavation area, and intuitional controls.	Impact unlikely based on status/ location
Hannaford Bros. Co.	I	23.02	897	NE	752 Route 202	Rindge	Cheshire	New Hampshire Department of Environmental Services. OneStop EPA Brownfields Property Progress Profile	Spill: 2/27/1998. Traffic accident. No further action issued 10/15/2008.	No impact based on status/location
Traditions Village	J	5.25	1080	S	49 Skinny Cat Road	New Ipswich	Cheshire		Lead-contaminated soil. Phase II Environmental Assessment completed 10/10/12	No impact based on status/location
Wal-Mart Store #1796	J	19.82	1,103	NE	85 NH Route 101A	Amherst	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Two large truck oil filters dumped at edge of retention pond on 11/14/2007. 1 gallon of waste oil. 1 gallon of petroleum, reported 6/16/2006. Both closed.	No impact based on status/location
Bassett Bedding	J	20.00	545	SW	14 Columbia Drive	Amherst	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill of diesel fuel on 12/8/1997. CYN removed impacted soil. No further action required.	No impact based on status/location
Merrimack Valley Baptist Church	J	21.13	1,179	NW	517 Boston Post Road	Merrimack	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill: 1/6/2010. No action necessary. Closed	No impact based on status/location

Table M7-A-1
Listings of Known Hazardous Waste Release Events Within 0.25 Mile of the Pipeline in New Hampshire

Site Name	Segment[1]	Nearest Milepost	Approximate Location		Address of Hazardous Waste Release Site			Relevant Database(s)/ Source(s)	Status and Contamination Issues	Comments
			Distance from Pipeline (feet)	Direction from Pipeline	Street	Township/ Town	County			
Merrimack Industrial Metals, Inc.	J	21.22	Crosses Property	N/A	734A Milford Road	Merrimack	Hillsborough	EPA Waste Site Cleanup & Reuse; EPA Brownfields Property Progress Profile	Former metals recycling facility in operation from 1963 to 1999. Groundwater, drinking water, and soil contamination with lead, VOCs, SVOCs. Phase II Environmental Assessment started 9/26/05; Supplemental Assessment started 10/17/05 and completed 3/14/07; Phase I Environmental Site Assessment completed 5/29/2009. Remedial measures included operation of a pump and treatment system (date unknown) and stabilization and removal of impacted soil in 2019 -2010 and installation of geotextile/earthen cap over contaminated soils which that remained in place. Institutional controls are required.	Evaluating for potential impacts
Exxon Division Of Cfi 70111	J	21.89	648	SW	1 Continental Blvd	Merrimack	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Multiple Spills: 4/26/2000, 2/6/2006. Site is in the Groundwater Monitoring Program and is currently being monitored.	Evaluating for potential impacts
Anheuser Busch, Inc.	J	25.70	Crosses Property	N/A	221 Daniel Webster Highway	Merrimack	Hillsborough	New Hampshire Department of Environmental Services. OneStop	700 gallon spill of #6 fuel oil (4/18/00), regulatory action completed/closed 9/30/00.	Impact unlikely based on status
Eastern Seaboard Package Truck Spill	J	22.07	1,267	SE	650 Amherst Street	Nashua	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill: 5/21/1998. 30 gallons of diesel fuel. Closed.	No impact based on status/location
Abandon 275 Gallon AST Site	J	32.76	103	SW	Proximity Of #2 Lenny Lane	Hudson	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill: 6/21/2001 1 gallon of #2 fuel oil during abandonment of 275 gallon AST with small product in it. Closed.	Impact unlikely based on status
David Buscema Residence	J	35.13	936	SW	1104 Mammoth Road	Pelham	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill: 5/20/2010. 30 gallons of hydraulic oil after vehicle accident. Closed.	No impact based on status/location
Jeffrey Law	J	39.43	711	SW	7 Old Lawrence Road	Pelham	Hillsborough	New Hampshire Department of Environmental Services. OneStop	Spill: 12/31/1998. 50 gallons of #2 fuel oil from AST. Closed.	No impact based on status/ location

Table M7-A-1
Listings of Known Hazardous Waste Release Events Within 0.25 Mile of the Pipeline in New Hampshire

Site Name	Segment[1]	Nearest Milepost	Approximate Location		Address of Hazardous Waste Release Site			Relevant Database(s)/ Source(s)	Status and Contamination Issues	Comments
			Distance from Pipeline (feet)	Direction from Pipeline	Street	Township/ Town	County			
Pacific Moon Restaurant	P	7.44	905	NW	396 S. Broadway	Salem	Rockingham	New Hampshire Department of Environmental Services. OneStop	Spill: 1/15/1999. 50 gallons of #2 fuel oil.	No impact based on status/location
Granite State Electric Spill	P	7.46	979	SE	470 South Broadway	Salem	Rockingham	New Hampshire Department of Environmental Services. OneStop	Spill: 11/30/2001. No sources. Closed.	No impact based on status/location
Newman Ford Sales	P	7.46	979	SE	470 S Broadway	Salem	Rockingham	New Hampshire Department of Environmental Services. OneStop	Spill: 11/27/2001. 35 gallons of transformer non-PCB. Closed.	No impact based on status/location

Sources: NHDES 2015a; USEPA 2014, 2015d, 2015e, 2015f, 2015g and 2015h.

[1] Each segment is associated with its own set of MPs beginning at MP 0.00.

Table M7-A-2
Listings of Known Hazardous Waste Release Events Within 0.25 Mile of the Meter Stations and Compressor Stations in New Hampshire

Facility Name	Facility Type	Site Name	Segment[1]	Nearest Milepost	Approximate Location		Address of Hazardous Waste Release Site			Relevant Database(s)/ Source(s)	Status and Contamination Issues	Comments
					Distance from Facility (feet)	Direction from Facility	Street	Township/ Town	County			
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Sources: NHDES 2015a; USEPA 2014, 2015d, 2015e.

N/A - "Not Applicable." Indicates that no Hazardous Waste Release Sites are identified within 0.25 mile of the meter stations and compressor stations.

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Tennessee Gas Pipeline Company, L.L.C.
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ATTACHMENT M8

BLASTING MANAGEMENT PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

This Blasting Management Plan ("Plan") outlines the procedures and safety measures that the construction contractor ("Contractor") will adhere to while implementing blasting activities along the pipeline right-of-way ("ROW") during the Project. The Contractor will be required to submit a Blasting Specification Plan to Tennessee that is consistent with the provisions of this Blasting Management Plan. The Contractor's plan, when approved by Tennessee, will be incorporated into the Contractor's scope of work.

2.0 OBJECTIVE

This Plan is intended to identify blasting procedures, including safety, use, storage, and transportation of blasting materials that are consistent with minimum safety requirements as defined by applicable Federal regulations (e.g., Title 27 Code of Federal Regulations ["CFR"] 181 - Commerce in Explosives; Title 49 CFR 177 - Carriage by Public Highway; Title 29 CFR 1926.900 et seq. Sub-part U - Safety and Health Regulations for Construction – Blasting and Use of Explosives; Title 29 CFR 1910.109 – Explosives and Blasting Agents (OSHA); 29 CFR 1926.900 – General Provisions and Sections 901, 902, and 904-911), applicable state and local regulations, and Kinder Morgan Construction Specifications for Land Pipeline Construction. Additionally, this Plan is intended to address environmental aspects of blasting activities and to identify areas of concern along the proposed pipeline loop segments.

3.0 GENERAL REQUIREMENTS

Blasting operations will be conducted by or under the direct and constant supervision of personnel legally licensed and certified to perform such activities in the jurisdiction where blasting occurs. Prior to any blasting activities, the contractor will provide Tennessee with appropriate information documenting the experience, licenses, and permits associated with all blasting personnel.

Blasting-related operations, including obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material; drilling; and ground-motion monitoring, will comply with all applicable federal, state, and local regulations, permit conditions and the construction contract.

Blasting for grade or trench excavation will be used where deemed necessary by a construction expert after examination of the site and in other locations only after other reasonable means of excavation have been used and are unsuccessful in achieving the required results. Tennessee may specify locations (e.g., foreign line crossings, near structures) where consolidated rock will be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Before blasting, a site-specific Blasting Specification Plan must be submitted by the Contractor to Tennessee for approval. Tennessee will contract a third-party engineer with expertise in blasting operations to review the site-specific blasting plan. The engineer will analyze the data to determine the combined stress level of each affected pipeline and will make recommendations and/or forward approval to Tennessee before blasting may commence.

Special blasting controls will be required where dry waterbody crossings are specified. The type of blasting material, size of charges, sequence of firing, etc. will be selected to minimize shock wave stresses on aquatic life adjacent to the blasting area. In addition to the use of matting to control fly rock, where specified, the Contractor will furnish the necessary labor and equipment to employ air bubble curtains.

Tennessee will contract a third-party inspector that will be present during construction and blasting activities to monitor the Contractor and their blasting operations. Approval is required to proceed prior to each blast. Approval does not relieve the Contractor from responsibility or liability.

4.0 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the Contractor will comply with the following:

- The Contractor will obtain all required federal, state, and local permits relating to the transportation, storage, handling, loading, and detonation of blasting materials;
- The Contractor will place all necessary "One-Calls" 48 hours prior to construction where One-Call systems are in place;
- The Contractor will be responsible for the protection of all existing underground facilities;
- Before performing any work on, or accessing the ROW, the Contractor will verify to Tennessee that all property owners have been notified of the impending construction and blasting activities; and
- The Contractor will submit to the Tennessee representative its site-specific Blasting Plan for approval prior to execution of any blasting activity.

5.0 SITE-SPECIFIC BLASTING PLANS

For each area determined to require blasting, a site-specific blasting plan will be created. The Contractor's site-specific blasting plan will include, at a minimum, the following information:

- Blaster's name, company, copy of license, and statement of qualifications; seismograph company, names, equipment and sensor location;
- Site location (milepost ["MP"] and station), applicable alignment sheet number(s), and associated rock type and geological structure (solid, layered, or fractured);
- Copies of all required federal, state, and local permits;
- Methods and materials including blasting material type, product name and size, weight per unit, and density; stemming material; tamping method; blasting sequence; use of non-electrical initiation systems for all blasting operations; magazine type; and locations and security for storage of blasting materials and detonating caps;
- Site dimensions, including blasting depth, distribution, and maximum charge and weight per delay; hole depth, diameter, pattern, and number of holes per delay;
- Dates and hours of conducting blasting; distance and orientation to nearest aboveground and underground structures; schedule identifying when blasting is scheduled within each waterbody greater than 10 feet wide, or within any designated coldwater fishery; and
- Blasting procedures for:
  - Storing, handling, transporting, loading, and firing blasting materials;
  - Prevention of misfires, fly rock, fire prevention, noise, and stray current accidental-detonation;
  - Signs, flagmen, and warning signals prior to each blast;
  - Those locations where the pipeline route:
    - Parallels or crosses an electrical transmission corridor, cable or pipeline;
    - Parallels or crosses a highway or road;
    - Is within or adjacent to forested areas;
    - Approaches within 200 feet of a water well or spring; or
    - Approaches within 1,000 feet of any residence, building or occupied structure;
  - Local notification;
  - Inspections after each blast; and
  - Disposal of waste blasting material.

6.0 MONITORING

During blasting operations, Tennessee will contract a third-party blasting inspector to monitor operations in the following manner:

- The third-party blasting monitor will provide seismographic equipment to measure the peak particle velocity ("PPV") of all blasts in the vertical, horizontal, and longitudinal directions. Seismic monitoring can only be discontinued if: 1) the blasting schedule and blasting performance consistently produce PPVs at the pipeline that are lower than the maximum allowable limit; and 2) a Tennessee representative provides written authorization;

- The third-party blasting monitor will measure the PPV at the adjacent pipeline, at any water wells, potable springs, and any aboveground structures within 200 feet of the blasting; and
- The third-party blasting monitor will complete a Blasting Log Record immediately after each blast and submit a copy to a Tennessee representative.

7.0 LIMITS ON PEAK PARTICLE VELOCITY

Any proposed blast will be monitored to ensure that the PPV will not exceed the specified maximum velocities. Maximum velocities are: 4 inches per second measured adjacent to an underground pipeline and for any aboveground or underground structure.

For all aboveground facilities within 200 feet of the blasting, the third-party blasting monitor will provide additional seismograph equipment to determine the PPV at the aboveground facility. If the measured PPV at an existing pipeline or other structure exceeds the above limits, the contractor will stop blasting activities immediately and notify Tennessee. The Blasting Management Plan must be modified to reduce the PPV prior to any further blasting.

The frequency caused by the detonation of blasting charge will not drop below 25 hertz without the review and approval of the designated Tennessee Blasting Representative.

The minimum time delay between the detonation of charges will be 8 milliseconds.

All blasting activity occurring within 300 feet of high pressure pipelines will require seismological surveillance (PPV and frequency) for every blast unless otherwise agreed upon following the review of the Blasting Plan. Pipelines affected by blasting are to be leak surveyed in the affected area following the completion of the blasting operation.

Note: Limits on PPV for surface structures are based on studies which established the limits at which plaster in homes will crack. The primary purpose of the limit is to prevent damage to homes. Tennessee's designated blasting representative may increase the limit for other structures such as steel transmission line towers, as appropriate and approve higher velocities for given site-specific conditions in advance.

8.0 SAFETY

8.1 PROTECTION OF ABOVEGROUND AND UNDERGROUND STRUCTURES

Where blasting is determined to be required, Tennessee will identify any municipal water mains proposed for crossing and will consult the local water authority. Reports of identified crossings will include location by MP, owner, and status and results of contacts with the water authority.

The Contractor will exercise control to prevent damage to aboveground and underground structures, including buildings, pipelines, utilities, springs, and water wells. The Contractor will implement the following procedures:

- If blasting occurs within 200 feet of identified water well or potable springs, Tennessee will hire a third-party blasting monitor to conduct water flow performance and water quality testing before blasting. If the water well or spring is damaged, the well or spring will be repaired or otherwise restored, or the well owner will be compensated for damages. Tennessee will provide an alternative potable water supply to the landowner until repairs occur. Locations of water wells or systems within 200 feet of the construction work area are indicated on Tennessee's construction alignment sheets.
- If blasting occurs within 200 feet of any aboveground structures, the Contractor and Tennessee's third-party blasting monitor will inspect structures before and after blasting. In the unlikely event that damage occurs to the aboveground structure, the owner will be compensated.
- The Contractor will be responsible for the ultimate resolution of all damage claims resulting from blasting. Such liability is not restricted by the 200-foot inspection requirement cited above;
- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by Tennessee.
- Holes that have contained blasting materials will not be re-drilled. Holes will not be drilled where danger exists of intersecting another hole containing blasting materials.
- Blasting mats or padding will be used on all shots where necessary to prevent scattering of loose rock outside of the approved construction workspace areas and to prevent damage to nearby structures and overhead utilities.
- Blasting will not begin until occupants of nearby buildings, residences, places of business, places of public gathering, and farmers have been notified by the Contractor sufficiently in advance to protect personnel, property, and livestock. The Contractor will notify all such parties at least 48 hours prior to blasting.
- Blasting in or near environmentally sensitive areas, such as streams and wildlife areas, may include additional restrictions.
- All blasting will be subject to the following limitations:
  - Maximum PPV of 4 inches per second in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent easement;
  - Maximum drill size will be 2.5 inches unless approved by Tennessee;
  - Maximum quantity of blasting material per delay will be governed by the recorded measurements as influenced by work site conditions;
  - Blasting agents and ignition methods will be approved by Tennessee. Ammonium nitrate fuel oil and other free-flowing blasting materials and blasting agents are not acceptable and will not be used;
  - Drill holes will not be left loaded overnight; and
  - Good stemming material is to be used in all holes;
- The drilling pattern will be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. The Contractor will submit the proposed drilling pattern to Tennessee for approval prior to implementation.
- Under pipeline crossings and all other areas where drilling and blasting are required within 15 feet of existing natural gas facilities:
  - Drill holes will be reduced to a maximum of 2 inches or less in diameter;
  - The number of holes shot at one time will be limited to three unless otherwise approved by Tennessee; and
  - Appropriate delay between charges to attain desired fragmentation.

8.2 PROTECTION OF PERSONNEL

The Contractor will include in its procedures all federal, state, county, and local safety requirements for blasting. The Contractor's procedures will address, at a minimum, the following requirements:

- Only authorized, qualified, and experienced personnel will handle blasting materials.
- No blasting materials will be located where they may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat- and spark-producing devices will be prohibited in or near explosive magazines or while blasting materials are being handled, transported, or used.
- A code of blasting signals will be established, posted in conspicuous places, and utilized during blasting operations. Employee training will be conducted on the use and implementation of the code.
- The Contractor will use every reasonable precaution including, but not limited to, visual and audible warning signals, warning signs, flag person, and barricades to ensure personnel safety.
- Warning signs, with lettering a minimum of 4 inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area.
- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.
- All personnel not involved in the actual detonation will stand back at least 1,000 feet and workers involved in the actual detonation will stand back at least 650 feet from the time the blast signal is given until the "ALL CLEAR" has been sounded.
- No loaded holes will be left unattended or unprotected. No blasting materials or blasting agent will be abandoned.
- In the case of a misfire, the blaster will provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.
- The exposed areas of the blast will be matted wherever practicable. In cases where such a procedure is not deemed to be feasible, the Contractor will submit an alternative procedure for review by Tennessee. The site in question must be visited and examined by a Tennessee representative before any approval is granted.
- Tennessee may employ two-way radios for communication between vehicles and office facilities. The Contractor will advise Tennessee and other pipeline contractors of any need to cease use of such equipment during blasting activities.
- All loading and blasting activity will cease and personnel in and around the blast area will retreat to an area of safety during the approach and progress of an electrical storm irrespective of the type of blasting materials or initiation system used. T**HIS IS A MAJOR SAFETY PRECAUTION AND WILL ALWAYS BE OBSERVED**. All blasting materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.
- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using whatever techniques are called for by the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by re-shooting, drilling will be shut down and personnel evacuated to a place of safety prior to detonation.

- All transportation of blasting materials will be conducted in accordance with applicable federal, state, and local laws and regulations. Vehicles used to transport blasting materials will be in proper working condition and equipped with tight wooden or non-sparking metal floors and sides. If blasting materials are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarpaulin. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishers will be carried. The truck will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with blasting materials. There will be no smoking and no unauthorized or unnecessary personnel will be allowed in the vehicle. Competent, qualified personnel will load and unload blasting materials into or from the vehicle.
- No sparking metal tools will be used to open kegs or wooden cases of blasting materials. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame nearby while handling or using blasting materials. Blasting materials will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of blasting materials will be re-closed after use. No blasting materials will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap will not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.
- No blast will be fired without a positive signal from the person in charge. This person will ensure that all surplus blasting materials are in a safe place; all persons, vehicles, and/or boats are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist, of but not be limited to, the following:
  - Notification to nearby homeowners and local agencies if necessary;
  - Stop vehicular and/or pedestrian traffic near the blast site; and
  - Signal given by an air horn, whistle or similar device using standard warning signals.
- Only authorized and necessary personnel will be present where blasting materials are being handled or used.
- Condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus blasting materials will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No blasting materials will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.
- Should fly-rock leave the ROW even after all necessary precautions have been taken, it will be collected immediately and disposed of at approved disposal sites. This work will not be left to the cleanup crew.

8.3 PROTECTION OF THREATENED AND ENDANGERED SPECIES

- Tennessee will consult with state and federal agencies regarding areas proposed for blasting where sensitive habitats or species are known to occur. Areas identified as containing sensitive habitats or species, as directed by the appropriate agencies, will be staked and flagged. A qualified Project biologist will survey the proposed blasting zone identified by the Contractor immediately in advance of any drilling or blasting. Areas will be checked before and after blasting for the presence of sensitive species, and disturbance to species and habitats will be resolved in accordance with guidance provided by the appropriate agencies.

8.4 PROTECTION OF STREAMS

- Blasting in streams will comply with Tennessee's Upland Erosion Control, Revegetation and Maintenance Plan (Attachment M14) and Tennessee's Wetland and Waterbody Construction and Mitigation Procedures (Attachment M15). Tennessee will notify appropriate state authorities at least 48 hours before beginning trenching or blasting within a waterbody crossed by the project. Tennessee will comply with all federal and state permits issued for the project.

8.5 LIGHTNING HAZARD

- A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist by the Tennessee representative, work will discontinue at all operations and workers will be moved to secure positions away from the loaded holes. Furthermore, workers will not return to the work site until the storm has passed and the Tennessee representative has indicated it is clear to return.
- Tennessee's Contractor will have on site approved lightning detectors (model SD-2508 manufactured by Electronics Division of S.D.I. International, Model 350 manufactured by Thomas Instruments Inc., Skyscan Lightning Detector manufactured by Skyscan Technologies or equivalent) capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the ROW.

9.0 STORAGE REQUIREMENTS

- All blasting materials, blasting agents, and initiation devices will be stored in locked magazines that have been located, constructed, approved, and licensed in accordance with local, state, and federal regulations.
- The storage of blasting materials, blasting agents, and initiation devices is not permitted on the ROW and will only be stored at approved staging areas or contractor yards.
- Magazines will be dry, well-ventilated, reasonably cool (painting of the exterior with a reflective color), bullet and fire resistant, and kept clean.
- Initiation devices will not be stored in the same box, container, or magazine with other blasting materials. Blasting materials, blasting agents, or initiation devices will not be stored in wet or damp areas; near oil, gasoline, cleaning solvents; or near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools will be stored in the magazine. There will be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or blasting materials. The loading and unloading of blasting materials into or out of the magazine will be done in a business-like manner with no loitering, horseplay, or prank playing.
- Magazines will be kept locked at all times unless blasting materials are being delivered or removed by authorized personnel. Admittance will be restricted to the magazine keeper, blasting supervisor, or licensed blaster. Magazine construction will meet the requirements of Bureau of Alcohol, Tobacco and Fire Arms ("ATF") P5400.7 "Explosives Law and Regulations" and be in accordance with local, state, or federal regulations and the Blaster's Handbook.
- Accurate and current records of the blasting material inventory will be kept to ensure that oldest stocks are utilized first, to satisfy regulatory requirements and for immediate notification of any

loss or theft. Magazine records will reflect the quantity of explosions removed, the amount returned, and the net quantity used at the blasting site.

- When blasting materials are taken from the storage magazine, they will be kept in the original containers until used. Small quantities of blasting materials may be placed in day boxes, powder chests, or detonator boxes. Any blasting material not used at the blast site will be returned to the storage magazine and replaced in the original container as soon as practicable.
- Magazine locations will be in accordance with local, state, or federal regulations. Where no regulations apply, magazines will be located in accordance with the latest edition of the 175th Anniversary Edition of the Blaster's Handbook and ATF P5400-7, Explosives Law and Regulations.
- Magazines will be marked in minimum 3-inch high letters with the words "DANGER – EXPLOSIVES" prominently displayed on all sides and roof.

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Tennessee Gas Pipeline
Company, L.L.C.
a Kinder Morgan company

ATTACHMENT M9

INVASIVE SPECIES MANAGEMENT PLAN

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LIST OF ACRONYMS and ABBREVIATIONS

Acronym	Full Name
AR	access road
BMP	Best Management Practice
CFR	Code of Federal Regulations
Commission or FERC	Federal Energy Regulatory Commission
Contractor	construction contractor
°F	degrees Fahrenheit
ECP	Environmental Construction Plan
EI	Environmental Inspector
EMAP	Environmental Mobile Application for Projects
FERC or Commission	Federal Energy Regulatory Commission
ISMP	Invasive Species Management Plan
GPS	Global Positioning System
MLV	mainline valve
MP	milepost
NED or Project	Northeast Energy Direct
NHDAMF	New Hampshire Department of Agriculture, Markets and Food
the Plan	Tennessee's *Upland Erosion Control, Revegetation and Maintenance Plan*
the Procedures	Tennessee's *Wetland and Waterbody Construction and Mitigation Procedures*
Project	Northeast Energy Direct Project or NED Project
ROW	right-of-way
TBD	to be determined
Tennessee or TGP	Tennessee Gas Pipeline Company, L.L.C.
U.S.	United States
USACOE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USDA	United States Department of Agriculture

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") has filed an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). The Environmental Report ("ER") is submitted in support of the application. Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

Tennessee has prepared a state-specific New Hampshire Invasive Species Management Plan ("ISMP") for the proposed Project to minimize the spread of invasive species during construction of the natural gas pipeline and aboveground facilities located in New Hampshire. The movement of vehicles, equipment, and personnel, and the transport of materials and/or construction debris to and from areas that are inhabited by invasive species could result in the unintentional spread of these species during construction. Additionally, recently disturbed areas may provide an opportunity for the colonization and spread of invasive species. This plan will serve as a guidance document for the control of invasive plant species during construction.

2.0 EXISTING CONDITIONS

The New Hampshire portion of the Project is located within the Northeastern Highlands and Northeastern Coastal Zone Ecoregions (U.S. Environmental Protection Agency ["USEPA"] 2013). Land use mainly consists of forests, woodlands, and higher concentrations of human populations within urban and suburban development, with only some minor areas of pasture and cropland. Landforms in the region include irregular plains, and plains with high hills, but relatively low elevations ranging from 165-700 feet. The climate in these two ecoregions is characterized by moderately long and somewhat severe winters that may restrict agriculture. Snow is typically on the ground all winter. However, climates in this area typically have more than 120 days with temperatures above 50 degrees Fahrenheit ("°F") and average temperatures between 35 and 50°F (U.S. Department of Agriculture ["USDA"] 2005).

The Northeastern Highlands is a relatively sparsely populated region characterized by hills and mountains, a mostly forested land cover, nutrient-poor soils, and numerous high-gradient streams and glacial lakes. Alluvial valleys, glacial lake basins, and areas of limestone-derived soils are still farmed for dairy products, forage crops, apples, and potatoes. The western part of this ecoregion exhibits strong

annual temperature cycle, with cold winters and warm summers. Average annual temperatures range from 40 to 60°F. There is year-round precipitation, averaging from 35 to 60 in per year. The eastern portion of this ecoregion is affected by maritime air masses associated with the eastern seaboard causing precipitation to be evenly distributed throughout the year. Average annual temperatures range from 37 to 52°F. The average length of the frost-free period is about 100 days (USDA 2005).

The Project crosses multiple land use types in New Hampshire, from human-altered landscapes: residential, agricultural, commercial/industrial, transportation corridors (roadways, railroad), and utility transmission corridors, to relatively undisturbed natural landscapes, including forested uplands, open land, forested wetlands, non-forested wetlands, and waterbodies. Human-altered landscapes often create suitable conditions for establishment of the quick-germinating, fast-growing, nutrient-poor soil-loving species that typically characterize invasive plant species. Although the Project area in New Hampshire remains predominantly rural, it has had a long history of settlement since colonial times, with agriculture and timber harvesting as the predominant industries having influenced land development. Consequently, even the relatively undisturbed lands can consist of long abandoned agricultural fields and second- to third-growth woodland, which may have sufficiently altered the natural vegetation community, allowing for establishment of invasive plant species.

Tennessee has conducted an invasive plant baseline inventory, on those accessible portions of the proposed Project area, to determine the presence, location, and extent of invasive plant species at all NED facilities. Results from the baseline surveys, identifying the milepost ("MP") location, of specific species documented by field biologists is provided in Table 2.2-1.

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
Glossy Buckthorn	*Frangula alnus*	FRAL	10.80	Wright to Dracut Pipeline Segment	I	Cheshire, Richmond	1
Glossy Buckthorn	*Frangula alnus*	FRAL	16.61	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	1
Glossy Buckthorn	*Frangula alnus*	FRAL	16.67	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	1
Glossy Buckthorn	*Frangula alnus*	FRAL	16.73	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	1
Glossy Buckthorn	*Frangula alnus*	FRAL	16.79	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	1
Glossy Buckthorn	*Frangula alnus*	FRAL	16.86	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	1
Glossy Buckthorn	*Frangula alnus*	FRAL	17.06	Wright to Dracut Pipeline Segment	I	Cheshire, Fitzwilliam	90
Multiflora Rose	*Rosa multiflora*	ROMU	15.13	Wright to Dracut Pipeline Segment	J	Hillsborough, Brookline	1
Morrow's Honeysuckle	*Lonicera morrowii*	LOMO	25.67	Wright to Dracut Pipeline Segment	J	Hillsborough, Merrimack	5
Japanese Barberry	*Berberis thunbergii*	BETH	29.66	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	1

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
Oriental Bittersweet, Multiflora Rose	*Celastrus orbiculatus, Rosa multiflora*	CEOR, ROMU	30.08	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	12
Oriental Bittersweet, Japanese Barberry, Multiflora Rose	*Celastrus orbiculatus, Berberis thunbergii, Rosa multiflora*	CEOR, BETH, ROMU	30.24	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	14
Morrow's Honeysuckle	*Lonicera morrowii*	LOMO	31.40	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	3
Amur Privet	*Ligustrum obtusifolium*	LIOB	31.43	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	10
Oriental Bittersweet	*Celastrus orbiculatus*	CEOR	31.46	Wright to Dracut Pipeline Segment	J	Rockingham, Londonderry	20
Multiflora Rose	*Rosa multiflora*	ROMU	32.39	Wright to Dracut Pipeline Segment	J	Hillsborough, Hudson	1
Autumn Olive, Oriental Bittersweet, Multiflora Rose	*Elaeagnus umbellata, Celastrus orbiculatus, Rosa multiflora*	ELUM, CEOR, ROMU	32.45	Wright to Dracut Pipeline Segment	J	Hillsborough, Hudson	45

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
Oriental Bittersweet, Multiflora Rose, Japanese Barberry, Morrow's Honeysuckle	*Celastrus orbiculatus, Rosa multiflora, Berberis thunbergii, Lonicera morrowii*	CEOR, ROMU, BETH, LOMO	33.97	Wright to Dracut Pipeline Segment	J	Hillsborough, Hudson	22
European Buckthorn, Glossy Buckthorn, Oriental Bittersweet	*Rhamnus cathartica L., Frangula alnus, Celastrus orbiculatus*	RHCA, FRAL, CEOR	34.25	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	25
Glossy Buckthorn, European Buckthorn, Oriental Bittersweet	*Frangula alnus, Rhamnus cathartica L., Celastrus orbiculatus*	FRAL, RHCA, CEOR	34.34	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	9
Japanese Barberry	*Berberis thunbergii*	BETH	34.35	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	2
Glossy Buckthorn	*Frangula alnus*	FRAL	34.35	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	2
Glossy Buckthorn, European Buckthorn, Oriental Bittersweet	*Frangula alnus, Rhamnus cathartica L., Celastrus orbiculatus*	FRAL, RHCA, CEOR	34.36	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	15

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
Glossy Buckthorn, European Buckthorn, Oriental Bittersweet	*Frangula alnus, Rhamnus cathartica L., Celastrus orbiculatus*	FRAL, RHCA, CEOR	34.38	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	9
Autumn Olive	*Elaeagnus umbellata*	ELUM	34.60	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	60
Autumn Olive, Multiflora Rose, Oriental Bittersweet	*Elaeagnus umbellata, Rosa multiflora, Celastrus orbiculatus*	ELUM, ROMU, CEOR	34.67	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	55
Glossy Buckthorn	*Frangula alnus*	FRAL	34.76	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	5
Autumn Olive, Morrow's Honeysuckle, European Buckthorn, Japanese Barberry, Multiflora Rose	*Elaeagnus umbellata, Lonicera morrowii, Rhamnus cathartica L., Berberis thunbergii, Rosa multiflora*	ELUM, LOMO, RHCA, BETH, ROMU	34.77	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	11
European Buckthorn	*Rhamnus cathartica L.*	RHCA	34.98	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	1
European Buckthorn	*Rhamnus cathartica*	RHCA	34.99	Wright to Dracut	J	Rockingham,	15

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
	L.			Pipeline Segment		Windham	
Morrow's Honeysuckle, Autumn Olive, Glossy Buckthorn	*Lonicera morrowii, Elaeagnus umbellata, Frangula alnus*	LOMO, ELUM, FRAL	35.02	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	17
Japanese Barberry, European Buckthorn	*Berberis thunbergii, Rhamnus cathartica L.*	BETH, RHCA	35.36	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	5
Autumn Olive, Glossy Buckthorn	*Elaeagnus umbellata, Frangula alnus*	ELUM, FRAL	35.49	Wright to Dracut Pipeline Segment	J	Rockingham, Windham	3
Autumn Olive, European Buckthorn, Oriental Bittersweet, Tree-of-Heaven	*Elaeagnus umbellata, Rhamnus cathartica L., Celastrus orbiculatus, Ailanthus altissima*	ELUM, RHCA, CEOR, AIAL	36.34	Wright to Dracut Pipeline Segment	J	Hillsborough, Pelham	10
Glossy Buckthorn, European Buckthorn	*Frangula alnus, Rhamnus cathartica L.*	FRAL, RHCA	37.75	Wright to Dracut Pipeline Segment	J	Hillsborough, Pelham	17
Glossy Buckthorn	*Frangula alnus*	FRAL	37.76	Wright to Dracut Pipeline Segment	J	Hillsborough, Pelham	10

Table 2.2-1 Invasive Species Preliminary Occurrence by Milepost for the Project in New Hampshire

Common Name[1]	Scientific Name	USDA Code	Milepost[2]	Facility Name	Segment	County, Town	Percent Cover
Autumn Olive, Oriental Bittersweet, Glossy Buckthorn	*Elaeagnus umbellata, Celastrus orbiculatus, Frangula alnus*	ELUM, CEOR, FRAL	39.00	Wright to Dracut Pipeline Segment	J	Hillsborough, Pelham	100
Winged Burning Bush, Japanese Barberry, Glossy Buckthorn, Multiflora Rose, Oriental Bittersweet	*Euonymus alatus, Berberis thunbergii, Frangula alnus, Rosa multiflora, Celastrus orbiculatus*	EUAL, BETH, FRAL, ROMU, CEOR	41.58	Wright to Dracut Pipeline Segment	J	Hillsborough, Pelham	7

[1] Presence and location of invasive species are based on the results of the baseline inventory surveys conducted within the survey corridor from September 2014 to September 2015 (ongoing in areas where survey access becomes available).

[2] MPs for mapped species polygons and wetlands containing species are listed using the midpoint.

3.0 INVASIVE SPECIES MANAGEMENT

The following best management practices ("BMPs") will be employed to control the transport of invasive species from areas where they may currently occur along the Project route in New Hampshire. Measures, such as training personnel in the identification of invasive species; inspecting and cleaning equipment; and practices to encourage rapid stabilization, restoration, and revegetation of disturbed work areas, are incorporated to minimize adverse impacts resulting from the presence of invasive species. Tennessee's plan, outlined in the following sections, will be to implement a program to prevent the introduction or spread of invasive species resulting from construction and restoration of the Project.

Tennessee will ensure the BMPs detailed in this ISMP are implemented by construction contractors ("Contractor") during all phases of construction. Requirements of the ISMPs will be identified to Contractors during the required preconstruction environmental training. Compliance or non-compliance with these requirements will be recorded in the field by Environmental Inspectors ("EIs"), and details of the activities will be captured in the weekly construction inspection reports, which will be submitted to the FERC for review and comment.

3.1 MEASURES TO PREVENT OR CONTROL THE TRANSPORT OF INVASIVE PLANT SPECIES

Tennessee will perform the following measures to prevent or control the transport of invasive plant species:

- Prior to construction, Tennessee will provide training to educate Contractor(s) and subcontractor(s) with respect to the site-specific protocols for controlling transport of invasive plant species within or outside of the Project workspace limits.
- Locations containing invasive species will be marked with signage during construction in order to facilitate awareness.
- EIs will be employed during construction to monitor and provide oversight and implementation of this ISMP.
- When upland invasive species are cut, the slash will be removed from the site and disposed of.
- After final re-grading, the restored ROW will be seeded with a seed mix free of invasive species to restore herbaceous cover over the disturbed ROW and help prevent establishment of invasive species which can colonize at disturbed sites.
- Equipment used within wetlands will be tracked, often operating on top of construction mats. These measures will minimize the amount of soil disturbance within wetlands in which invasive species might colonize.
- To the extent practicable, the movement of soils, gravel, rock, and other fill materials infested with invasive plants to locations relatively free of invasive plants will be avoided. Soil, gravel, rock, and other fill material will come from sources on and off the site that are visibly free of invasive plants, if such sources are available.
- Revegetation of disturbed areas free of invasive species prior to construction will utilize seed and other plant materials that have been checked by EIs and certified by suppliers as noxious-weed-free.

3.2 MEASURES TO PREVENT OR CONTROL THE TRANSPORT OF INVASIVE INSECT SPECIES

Invasive insect species potentially occurring within the Project area include the emerald ash borer (*Agrilus planipennis*) and the Asian Longhorn Beetle (*Anoplophora glabripennis*). Prior to construction, Tennessee will provide training to educate Project contractor(s) and subcontractor(s) with respect to identifying these species. If these insects are found during the course of the Project, they will be reported to the New Hampshire Department of Agriculture, Markets and Food ("NHDAMF") and USDA. When conducting clearing operations, Tennessee's contractor will adhere to the NHDAMF's Firewood Exterior Quarantine (Amendment No. 2, December, 2013), as well as the USDA federal regulations pertaining to the treatment and transport of materials within quarantine locations (7 Code of Federal Regulations ["CFR"] Part 301).

3.3 MEASURES TO PREVENT OR CONTROL THE TRANSPORT OF INVASIVE AQUATIC SPECIES

3.3.1 Hydrostatic Pressure Testing

Following pipeline installation, Tennessee will hydrostatically pressure test the new pipeline system in accordance with the requirements outlined in CFR Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. Prior to testing, Tennessee will obtain applicable water withdrawal and discharge permits,.

Where possible the hydrostatic test water will be discharged to the same watershed from which it was collected. In locations where invasive aquatic species have been identified, hydrostatic test water will be discharged in level, vegetated upland areas at sufficient distances from surface waters to prevent the overland transport of any aquatic invasive species into a water feature. The rate of discharge flow will be controlled to prevent erosion.

Additional protective measures that will be implemented during hydrostatic testing operations include:

- During the filling of the pipeline, the water intake at the location where water is being taken will be screened with a 0.1-inch mesh screen (or as recommended by state agencies) to prevent entrainment of invasive vegetation.
- The intake rate/volume will be low enough to prevent impingement of aquatic species or debris on the screen.
- The intake hose and screen will be kept off the bottom of the waterbody to prevent uptake of sediment.
- No equipment will enter the waterbody, except the water withdrawal intake apparatus, which will be cleaned and dried before being used at each subsequent waterbody if applicable.

3.3.2 Waterbody Crossings

The procedures for all waterbody crossings associated with the Project will be conducted in accordance with the BMPs outlined in this New Hampshire ECP. To minimize the potential for the transport of invasive aquatic species, Tennessee will consult applicable regulatory agencies regarding the known or potential presence of invasive aquatic species. Waterbodies with known or potential

populations of invasive aquatic species will be identified to Project personnel to ensure that the proper procedures are implemented during in-stream construction activities, such that equipment and materials do not impact unaffected waterbodies within the ROW. Additional BMPs specific to minimizing the potential transport of aquatic invasive species include:

- Restricting equipment and materials to only those necessary for waterbody construction, and reviewing all materials to make certain they are visibly free of vegetation and debris prior to entering and exiting a waterbody.

3.4 GENERAL MANAGEMENT ACTIVITIES

Disturbed wetland areas within the ROW will be restored and seeded in accordance with this ECP, which incorporates guidance from New Hampshire Department of Environmental Services' ("NHDES") New Hampshire Stormwater Manual, Volume 3 - Erosion and Sediment Controls During Construction (December 2008), as well as guidance contained within Tennessee's *Upland Erosion Control, Revegetation, and Maintenance Plan* and Tennessee's *Wetland and Waterbody Construction and Mitigation Procedures*. Additionally, any supplemental fill soils or topsoil materials that need to be imported to the Project site for restoration purposes to re-establish preconstruction grades and contours will be clean, debris-free, and contaminant-free soils obtained from reputable suppliers to minimize importation of invasive plant species.

Post-construction monitoring of invasive plant species will be conducted for a period of 3 years concurrent with upland and wetland restoration success monitoring. Monitoring reports detailing the success of restoration will identify invasive plant species' locations and densities, which will be used to determine if species-specific management measures are necessary. Relative density of invasive species found on the ROW will be compared to the off ROW densities and if on ROW density is significantly greater than the adjacent off ROW plant community, then Tennessee will develop a plan to address the invasive species which may include mechanical removal, biological treatments, or if requested by the landowner or land managing agency and in accordance with regulatory requirements, spot treatment by herbicides.

4.0 SUMMARY/CONCLUSIONS

Tennessee will conduct invasive species management within the Project workspace areas in New Hampshire in a manner that is consistent with the objective of the Project. The proposed management activities outlined within this Plan are expected to prevent the inadvertent spread of existing populations of invasive species and will promote the establishment of native plant populations.

5.0 REFERENCES

U.S. Department of Agriculture (USDA). 2005. United States Department of Agriculture Description of Ecological Subregions: Sections of the Conterminous United States. [Online WWW]. Available URL: http://na.fs.fed.us/sustainability/ecomap/section_descriptions.pdf. [Accessed January 2015].

U.S. Environmental Protection Agency (USEPA). 2013. United States Environmental Protection Agency Level III and IV ecoregions of the continental United States: Corvallis, Oregon, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000. [Online WWW]. Available URL: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm. [Accessed January 2015].

Attachment M9-A

Invasive Plant Species List - New Hampshire

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Invasive Plant Species List
Tennessee Pipeline - New Hampshire

Species listed below may occur within the survey area based on known distribution records.

Common Name	Scientific Name	Source
Norway maple	*Acer platanoides*	1
Tree-of-heaven	*Ailanthus altissima*	1
Garlic mustard	*Alliaria petiolata*	1
Japanese barberry	*Berberis thunbergii*	1
European or Common barberry	*Berberis vulgaris*	1
Oriental bittersweet	*Celastrus orbiculatus*	1
Spotted knapweed	*Centaurea stoebe*	1
Black dog-strangling vine or Black swallow-wort	*Cynanchum louiseae*	1
Dog-strangling vine, Pale swallow-wort	*Cynanchum rossicum*	1
Autumn olive	*Elaeagnus umbellata*	1
Winged euonymus or Burning bush	*Euonymus alatus (Thunb.) Sieb.*	1
Japanese knotweed	*Fallopia japonica = Reynoutria japonica*	1
Glossy buckthorn	*Frangula alnus*	1
Giant hogweed	*Heracleum mantegazzianum*	1, 2
Dames rocket	*Hesperis matronalis*	1
Yellow or Water flag iris	*Iris pseudacorus*	1
Perennial or Broadleaved pepperweed	*Lepidium latifolium*	1
Border or Blunt-leaved privet	*Ligustrum obtusifolium*	1
Japanese honeysuckle	*Lonicera japonica*	1
Morrow's honeysuckle	*Lonicera morrowii*	1
Tatarian honeysuckle	*Lonicera tatarica*	1
Bell's or Showy bush honeysuckle	*Lonicera x bella*	1
Japanese stiltgrass	*Microstegium vimineum*	1

Common Name	Scientific Name	Source
Asiatic tearthumb or Mile-a-minute vine	*Persicaria perfoliata = Polygonum perfoliatum*	1
Bohemian knotweed	*Polygonum x bohemicum (J. Chrtek & Chrtkovß) Zika & Jacobson [cuspidatum x sachalinense]*	1
European or Common buckthorn	*Rhamnus cathartica L.*	1
Multiflora rose	*Rosa multiflora*	1

Sources:

[1] New Hampshire Code of Administrative Rules, Chapter Agr 3800, Table 3800.1 – New Hampshire Prohibited Invasive Species List (2004).

[2] USDA Federal Noxious Weed List.

Attachment M9-B

Invasive Species Fact Sheets - New Hampshire

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Invasive Plants in Pennsylvania

Russian and Autumn Olive

Elaeagnus angustifolia and *E. umbellata*

James H. Miller, USDA Forest Service
www.forestryimages.org

Background:

Both Russian and autumn olive were introduced into the United States in the 1800s. Prized for their silvery foliage, hardiness and plentiful berries, these shrubs were planted as ornamentals, for erosion control and wind-breaks, and in wildlife food plots.

Range:

Russian olive, native to Eurasia, can be found scattered throughout the eastern U.S. and is a problem further west. Native to east Asia, autumn olive has naturalized extensively throughout the eastern half of the United States. Autumn olive is the more common of the two species in Pennsylvania.

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
www.dcnr.state.pa.us

Description:

Russian and autumn olive are large, multi-stemmed shrubs that can reach upwards of 20 feet in height. Their most distinctive characteristic is a dusting of silvery scales covering young stems, leaves, flowers and fruit. Small yellow or white flowers become edible fruits in late summer and fall, which are red in autumn olive and orange in Russian olive.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Habitat:

Both species are found along streams, fields, roadsides, sparse woodlands, disturbed sites and open areas. Russian olive does particularly well in sandy floodplains. Neither species does well in densely forested areas.

Biology and Spread:

Both species are spread by birds and other wildlife that feed on the fruit. These shrubs grow rapidly and are able to produce fruit as early as three years of age.

Ecological Threat:

These shrubs are highly competitive against native species, shading out shorter plants. Their nitrogen-fixing capabilities may adversely affect the nitrogen cycle of native communities that depend on infertile soils. Although Russian and autumn olive provide a plentiful source of berries for birds, their fruits are actually quite low in nutrients. Ecologists have found that bird species richness is higher in riparian areas dominated by native vegetation.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

How to Control this Species:

Physical

Young seedlings can be pulled by hand when the soil is moist enough to ensure complete removal of the root system.

Small saplings can be pulled sufficiently with a weed wrench. Larger individuals can be cut at ground level or girdled.

Cutting is an initial control measure and should be followed by herbicidal treatment to prevent re-sprouting.

Chemical

Use a systemic herbicide, such as glyphosate or triclopyr.

Herbicide should be applied immediately to cut stumps to prevent regeneration. It can also be applied to girdle wounds or directly to the lower bark using the basal bark method.

Large thickets, where risk to non-target species is minimal, can be controlled by the foliar spray method.

Look-A-Likes:

Russian and autumn olive may be confused with invasive bush-honeysuckles (*Lonicera* spp.) or native deciduous hollies (*Ilex* spp.)

The Dow Gardens Archive
www.forestryimages.org

Native Alternatives:

Many native shrubs are available for re-vegetation projects. Native plants are the best option for wildlife food plots.

Jerry A. Payne, USDA ARS
www.forestryimages.org

The Dow Gardens Archive
www.forestryimages.org

References:

Global Invasive Species Database: http://www.issg.org/database/species/ecology.asp?fr=1&si=262

Plant Conservation Alliance's Alien Plant Working Group: http://www.nps.gov/plants/alien/fact/elan1.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/russian_autumn_olive.htm

Bohemian Knotweed (*Polygonum ×bohemicum (J. Chrtek & Chrtková) Zika & Jacobson [cuspidatum × sachalinense]*)

A plant profile for this species can be found at the United States Department of Agriculture website at the following link:

http://plants.usda.gov/core/profile?symbol=POBO10

Invasive Plants in Pennsylvania

Burning Bush

Euonymus alatus

Leslie J. Mehrhoff, UConn
www.forestryimages.org

Background:

Burning bush, also commonly known as winged euonymus, was introduced into the United States in 1860 for use as an ornamental shrub. Its attractive, bright red fall foliage and desirable form has made this shrub a popular ornamental and an easy go-to plant used by landscape designers. As a result, it is commonly planted along interstate highways, as hedges and in foundation plantings.

Range:

Native to northeastern Asia, winged euonymus has escaped throughout the Northeast and Midwestern United States.

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www.dcnr.state.pa.us

Description:

Burning bush is a fast-growing, deciduous shrub that may reach five to 15 feet in height. Its green stems usually have prominent, corky wings. Elliptic leaves with finely serrated margins are arranged in opposite formation and turn a brilliant purplish-red to scarlet in the fall. Flowers are small and yellowish-green, becoming fruits that split to expose four red-orange seeds in late fall.

Barry Rice, Sarracenia,
James H. Miller, USDA Forest Service
www.forestryimages.org

Habitat:

Winged euonymus quickly escapes into woodlands, mature forests and open fields. It is highly adaptable to a variety of soil types and pH levels, although it generally doesn't do well in dry areas. It is tolerant of full shade.

Biology and Spread:

This shrub is a prodigious seed producer. Many germinate where they fall, close to the mother plant, creating a dense bed of seedlings. Others are carried by birds, allowing infestations to spread rapidly.

Ecological Threat:

Winged euonymus easily outcompetes native plants with its large, dense silhouette. Lacking pests and tolerant of deep shade, this shrub can force itself into moist forested sites, creating large thickets that displace native herbs and shrubs. This displacement has negative consequences for both aquatic and terrestrial ecosystems.

Leslie J. Mehrhoff, UConn
www.forestryimages.org

How to Control this Species:

Physical

Seedlings, up to two feet tall, can be easily hand-pulled, especially when the soil is moist.

Larger plants must be dug out with a spading fork, pulled with a weed wrench, or cut. The stump must be ground out or the re-growth clipped; be sure to remove a majority of the root system.

Chemical

Glyphosate can be applied as a foliar spray or painted on cut stumps.

Look-A-Likes:

Winged euonymous may be confused with other species of euonymous, including our native strawberry bush (*Euonymus americana*). Saplings of native sweetgum (*Liquidambar styraciflua*) also have winged stems.

Karan A. Rawlins, University of Georgia
www.forestryimages.org

Native Alternatives:

A wide variety of native shrubs provide beauty and wildlife value to the landscape, including:

Dow Gardens
www.forestryimages.org

Chris Evans, River to River CWMA
www.forestryimages.org

Rob Routledge, Sault College
www.forestryimages.org

Vern Wilkins
www.forestryimages.org

James Miller & Ted Bodner, SWSS
www.forestryimages.org

References:

Center for Invasive Species and Ecosystem Health: http://www.invasive.org/browse/subinfo.cfm?sub=3023

U.S. National Park Service: http://www.nps.gov/plants/alien/pubs/midatlantic/eual.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/winged_euonymus.htm

Invasive Plants in Pennsylvania

Common Buckthorn

Rhamnus cathartica

John M. Randall, The Nature Conservancy
www.forestryimages.org

Background:

Common buckthorn was introduced into North America as an ornamental shrub in the mid 1800s. Prized for its hardiness and ability to thrive in a variety of soil and light conditions, common buckthorn was planted extensively for use in hedges, farm shelter belts and wildlife habitat. It is no longer available for purchase.

Range:

Native to Eurasia, common buckthorn can now be found throughout the Northeast and North-central regions of the United States.

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www.dcnr.state.pa.us

Description:

Common buckthorn is a dioecious shrub or small tree growing up to 22 feet high. Twigs are often tipped with a spine. Cutting the stems reveals distinctive yellow sapwood and pink to orange heartwood. The glossy, dark green leaves remain late into fall, and are broadly oval with up-curved veins and toothed margins. In spring, dense clusters of yellow-green flowers emerge from stems near the bases of leaf stalks. Small black fruits appear in fall.

Paul Wray, Iowa State University
www.forestryimages.org

Habitat:

Common buckthorn prefers light shade, but is tolerant of many conditions, including full shade. It often invades upland sites, such as open oak woodlands, tree fall gaps and woods edges. It may also be found in prairies and open fields.

Biology and Spread:

The plentiful fruit, which produce a laxative effect, are eaten by birds and small mammals, allowing for long-range dispersal. Most of the fruit falls directly beneath the parent, creating a dense understory of seedlings characteristic of buckthorn stands.

Ecological Threat:

Common buckthorn forms dense, even-aged thickets, which crowd out native shrubs and herbs and prevent woody plant regeneration. When open woodlands, savannas and prairies are invaded, fire is suppressed, changing the disturbance regimes of these ecosystems. Invasive shrubs like common buckthorn are population sinks for nesting songbirds due to higher predation rates. Common buckthorn is also an alternate host of oat crown rust, which lowers oat yield and quality.

John M. Randall, The Nature Conservancy
www.forestryimages.org

How to Control this Species:

Physical

Seedlings less than three feet tall can usually be pulled by hand. Saplings can be removed with a weed wrench, but individuals with a large base diameter are best dealt with by cutting. The resulting stump should be dug out or treated with herbicide. Girdling is also effective.

If enough fuel is present, prescribed burns have a large impact on seedlings and the current year's seeds.

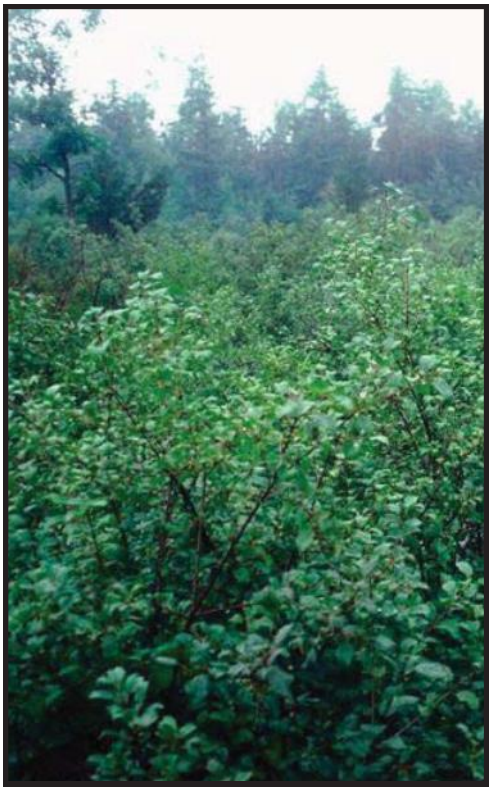
Be sure to remove and dispose of any ripened fruit from the restoration site.

Chemical

Herbicide applications may be done early in the season just after the trees have leafed out, but those conducted in the fall or early winter appear to be most effective.

Use a systemic herbicide, such as glyphosate, in order to destroy the root system.

Brush applications on recently cut stumps, in addition to the basal bark method, often achieve good results.



John M. Randall, The Nature Conservancy
www.forestryimages.org

Look-A-Likes:

Common buckthorn may be confused with native buckthorns (*Rhamnus* spp.) and cherries (*Prunus* spp.).

Rob Routledge, Sault College
www.forestryimages.org

References:

Plant Conservation Alliance's Alien Plant Working Group:
http://www.nps.gov/plants/alien/fact/rhca1.htm

University of Minnesota:
http://conservancy.umn.edu/bitstream/60097/1/6.5.Gale.pdf

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/common_glossy_buckthorn.htm

Invasive Plants in Pennsylvania

Dame's Rocket

Hesperis matronalis

Richard Old, XID Services, Inc.
www.forestryimages.org

Background:

Dame's rocket was introduced as a garden plant during the Colonial period. It is still available in horticulture, especially as a common component of "wildflower" seed mixes, which can partly be blamed for its success. This plant is now so abundant that many mistakenly believe it is a native wildflower.

Range:

Native to Eurasia, dame's rocket can now be found across the United States, except in the extreme southern regions.

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www.dcnr.state.pa.us

Description:

Dame's rocket is a showy short-lived perennial. First-year plants develop into low rosettes that remain green all winter. Flowering plants, which may reach three feet in height, have erect stems with pointed, alternately arranged leaves. The four-petaled flowers range in color from purple to pink to white. Each flower develops into a thin, wiry seedpod that splits lengthwise to release tiny seeds.

Richard Old, XID Services, Inc.
www.forestryimages.org

Habitat:

This plant grows in moist woodlands, woodland edges, roadsides, thickets, disturbed sites and open ground. It prefers partial sun and moist, non-acidic soil.

Biology and Spread:

Reproduction is only by seed. Dame's rocket is a prolific bloomer and produces large quantities of seed from May to July. The seeds are scattered when the dehiscent fruits open. They are eaten and dispersed by ground-foraging birds and stick to tires, shoes and clothing.

Ecological Threat:

The extent of its impact on native vegetation and its patterns of spread are not well documented. Often forming dense monocultures, it may compete with native plants for water, light and nutrients.

Leslie J. Mehrhoff, University of Connecticut
www.forestryimages.org

How to Control this Species:

Physical

Hand-pulling or digging out plants can be effective techniques for small infestations.

If plants are pulled while in flower and left on the ground, seedpods will continue to ripen. It is best if they are bagged or burned.

Where there is sufficient leaf litter, burning has been found to be an effective control method.

Chemical

For large infestations, a foliar application of an herbicide, such as glyphosate or triclopyr, can be effective.

This is best done in very early spring or late fall to avoid damaging native vegetation. Rosettes stay green all winter.

Leslie J. Mehrhoff, University of Connecticut
www.forestryimages.org

Native Alternatives:

Dame's rocket is easily replaced by showier natives such as our phloxes (*Phlox* sp.), obedient plant (*Physostegia virginiana*) and blazing star (*Liatris spicata*).

Stefan Bloodworth
www.wildflower.org

Look-A-Likes:

Dame's rocket resembles money plant (*Lunaria annua*), a common exotic garden escape, as well as our native phlox species.

Albert F. W. Vick
www.wildflower.org

References:

Center for Invasive Species and Ecosystem Health: http://www.invasive.org/browse/subinfo.cfm?sub=5702

Forest Invasive Plants Resource Center: http://na.fs.fed.us/spfo/invasiveplants/factsheets/pdf/dames-rocket.pdf

Wisconsin Department of Natural Resources: http://dnr.wi.gov/invasives/fact/dames_rocket.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/Dames_rocket.htm

Invasive Plants in Pennsylvania

Garlic Mustard

Alliaria petiolata

Chris Evans, River to River CWMA
www.forestryimages.org

Background:

Garlic mustard was likely introduced into the United States by early European settlers for culinary or medicinal purposes. It was first recorded in Long Island, New York in 1868.

Chris Evans, River to River CWMA
www.forestryimages.org

Range:

Native to Europe, garlic mustard now ranges from eastern Canada, south to Georgia and as far west as Oregon.

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DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
www.dcnr.state.pa.us

Description:

Garlic mustard is a cool season biennial herb with triangular to heart-shaped leaves. Leaves give off an odor of garlic when crushed. First-year plants appear as a rosette of leaves that remain green through winter, maturing the following spring. Button-like clusters of white flowers give way to erect, slender pods by May. Dead stalks of dry, brown seedpods hold viable seed throughout the summer.

Chris Evans, River to River CWMA
www.forestryimages.org

Habitat:

This invasive is frequently found in moist, shaded soil of river floodplains, forests, edges and openings, especially in disturbed areas. Garlic mustard is associated with calcareous soils and does not tolerate high acidity.

Biology and Spread:

Garlic mustard plants develop rapidly, each individual producing thousands of seeds that scatter nearby. Because white-tailed deer find garlic mustard distasteful, they further its expansion by eliminating native competition, as well as by exposing the soil and seedbed through trampling.

Ecological Threat:

Highly shade-tolerant, garlic mustard is capable of invading high-quality, mature forests. To the detriment of spring ephemeral wildflowers, garlic mustard quickly forms monocultures by monopolizing resources. Its allelopathic compounds inhibit seed germination of other species.

Toothwort (*Dentaria* sp.), the host plant of the rare West Virginia white butterfly (*Pieris virginiensis*), is one of the spring ephemerals outcompeted by garlic mustard. The butterfly is drawn to lay its eggs on garlic mustard, a fatal mistake for its offspring. Garlic mustard may also disrupt the mutualistic relationship between native trees and mycorrhizal fungi.

How to Control this Species:

Physical

Because garlic mustard seeds can remain viable in the soil for five years or more, effective management is a long-term commitment. The goal of management is to prevent further seed production and to nip pioneering colonies in the bud.

For small infestations, hand-pulling is extremely effective. Larger infestations may be controlled by cutting. This should be done when the plant is in flower. All plant material should be removed from the site following treatment, since seeds can still develop on cut stems.

Chemical

For heavy infestations, where the risk to non-target species is minimal, the systemic herbicide glyphosate may be useful.

Herbicide can be applied at any time of the year, including winter (to kill overwintering rosettes) as long as the temperature remains above 50° Fahrenheit, and rain is not expected for at least 8 hours.

Chemical control is best done in late fall when most native plants are dormant.

Prevention

Infestations may be prevented by monitoring and removing pioneering plants. Disturbances, such as foot traffic, overgrazing and erosion, should be minimized.

A regular burning regime in fire-adapted oak woodlands can also prevent infestations.

Dave Cappaert, Michigan State University
www.forestryimages.org

Look-A-Likes:

Many native white-flowered plants occur alongside garlic mustard, and may be mistaken for it. These include tooth-worts, sweet cicely (*Osmorhiza claytonia*) and early saxifrage (*Saxifraga virginica*).

Wendy VanDyk Evans
www.forestryimages.org

References:

Center for Invasive Species and Ecosystem Health:
http://www.invasive.org/browse/subinfo.cfm?sub=3005

Plant Conservation Alliance's Alien Plant Working Group:
http://www.nps.gov/plants/alien/fact/alpe1.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers:
http://www.dcnr.state.pa.us/forestry/invasivetutorial/garlic_mustard.htm

Invasive Plants in Pennsylvania

Giant Hogweed

Heracleum mantegazzianum

Terry English, USDA APHIS PPQ
www.forestryimages.org

Background:

Giant hogweed, an enormous member of the carrot family *Apiaceae*, was brought to the United States as an ornamental and as a source for the anise-scented spice golpar, which is used in Iranian cooking. It is now designated as a federal noxious weed.

Range:

This plant is native to central and southwest Asia, but has been introduced into Europe and North America. In the United States, it can be found primarily in the Northeast, Great Lakes and Northwest regions.

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www.dcnr.state.pa.us

Description:

Giant hogweed is an incredibly tall biennial or perennial herb, growing up to 20 feet in height. Its stout stems are hollow with purple splotches and course bristles. Deeply incised compound leaves with stiff hairs can grow up to five feet in width. The large umbrella-shaped flower heads have numerous small white flowers, which develop into flattened, oval-shaped fruit.

Robert Vidéki, Doronicum Kft.
www.forestryimages.org

Habitat:

Giant hogweed can be found along railroads, roadsides, rights-of-ways, vacant lots, streams, rivers, waste areas and fallow fields, particularly in disturbed soils.

Biology and Spread:

Over 100,000 seeds are produced annually by each plant. These seeds can be spread by animals, surface runoff of rain, or by wind. Prolific seed production, combined with a rapid growth rate, results in dense colonies.

Ecological Threat:

Because of its size and rapid growth, giant hogweed is an aggressive competitor capable of displacing native plants. It dies back during the winter months, leaving bare ground open to erosion on riverbanks and steep slopes. The sap of giant hogweed makes human skin sensitive to ultraviolet light, resulting in severe burns and blisters. Contact with the eyes can cause permanent blindness.

Donna R. Ellis, University of Connecticut
www.forestryimages.org

How to Control this Species:

Physical

Individual plants can be dug up, making sure to remove the entire root system.

Repeated mowing or cutting can eventually starve the plant of energy. This practice needs to be performed numerous times during a growing season.

Extreme care should be taken when undertaking these methods. Protective clothing and eye protection are a good idea.

Chemical

Foliar treatments with glyphosate or triclopyr have been effective. Glyphosate is considered the best choice, and should be applied in spring or early summer when plants are actively growing. A follow-up application in mid-summer may be necessary. Glyphosate is nonselective and may kill desirable plants, including grasses.

Biocontrol

Cattle and pigs are apparently not affected by the sap and eat giant hogweed without harm.

If You See This Plant:

Giant hogweed is on the Pennsylvania Noxious Weed Control List. It is illegal to sell, plant or transport this species. If you believe that you have found a new population of this plant, please contact Melissa Bravo, PA Dept. of Agriculture, at 717-787-7204.

Robert Vidéki, Doronicum Kft. www.forestryimages.org

Look-A-Likes:

Some of our larger native members of the carrot family, such as cow parsnip (*Heracleum maximum*) and purple-stemmed angelica (*Angelica atropurpurea*), may be confused with giant hogweed.

William M. Ciesla, Forest Health Mgmt. Intl. www.forestryimages.org

References:

New York Sea Grant: http://www.dec.ny.gov/docs/lands_forests_pdf/ghfactnyseagrant.pdf

St. Lawrence-Eastern Lake Ontario PRISM of New York State: http://www.sleloinvasives.org/about-invasives/target-species/giant-hogweed/

USDA Forest Service: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/giant-hogweed.pdf

For More Information:

DCNR Invasive Species Site: *http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm*

Invasive Plants in Pennsylvania

Glossy Buckthorn

Frangula alnus

Gil Wojciech, PFRI
www.forestryimages.org

Background:

Glossy buckthorn was first introduced into the United States in the mid 1800s as an ornamental. It has been used for hedges and wildlife habitat. A variety of cultivars are still sold in some nurseries.

Range:

Native to Eurasia, glossy buckthorn has invaded the Northeast and North-central regions of the United States.

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Description:

Glossy buckthorn is a shrub or small tree growing to a height of 10 to 25 feet. The bark is gray or brown with closely spaced, white lenticels. The simple, alternate leaves are papery and dark green with a shiny upper surface and a dull, hairy or smooth lower surface. Pale yellow flowers emerge in small clusters from the leaf axils throughout the growing season. The round fruit is red to dark purple.

John M. Randall, The Nature Conservancy
www.forestryimages.org

Habitat:

This invasive can be found in a wide variety of habitats, including nutrient-poor soils, full sun and dense shade. It is particularly a problem in wetlands such as swamps, bogs, fens and wet meadows.

Biology and Spread:

Glossy buckthorn spreads by seed, recruiting birds that eat its prolific berries. Seeds may also be spread by water since fresh fruit can float for over two weeks. Dispersal may be significant in areas that receive frequent and extensive fall and winter flooding.

Ecological Threat:

Glossy buckthorn is particularly aggressive in wet areas, rapidly producing a dense shade that eliminates native plants. It also engages in species-specific allelopathy, changing the structure of native plant communities.

Leslie J. Mehrhoff, U. of Connecticut,
www.forestryimages.org

How to Control this Species:

Physical

Seedlings less than three feet tall can usually be pulled by hand. Saplings can be removed with a weed wrench, but individuals with a large base diameter are best dealt with by cutting. The resulting stump should be dug out or treated with herbicide. Girdling is also effective.

If enough fuel is present, prescribed burns have a large impact on seedlings and the current year's seeds.

Be sure to remove and dispose of any ripened fruit from the restoration site.

Chemical

Herbicide applications may be done early in the season just after the trees have leafed out, but those conducted in the fall or early winter appear to be most effective.

Use a systemic herbicide, such as glyphosate, in order to destroy the root system.

Brush applications on recently cut stumps, in addition to the basal bark method, often achieve good results.

Native Alternatives

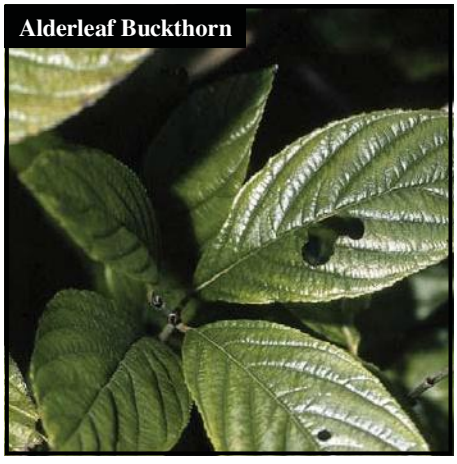
Many low-growing native trees and shrubs are available:

Steven Katovich, USDA Forest Service
www.forestryimages.org

Vern Wilkins
www.forestryimages.org

Look-A-Likes:

Glossy buckthorn may be confused with native buckthorns (*Rhamnus* spp.) and cherries (*Prunus* spp.).



Robert H. Mohlenbrock, USDA NRCS
www.plants.usda.gov

References:

Global Invasive Species Database: http://www.issg.org/database/species/ecology.asp?fr=1&si=810&sts=

Harvard University: http://harvardforest2.fas.harvard.edu/asp/hf/symposium/showsymposium.html?id=748&year=2009

USDA Forest Service: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/glossy-buckthorn.pdf

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/common_glossy_buckthorn.htm

Invasive Plants in Pennsylvania

Japanese and European Barberry

Berberis thunbergii and *B. vulgaris*

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Background:

Japanese barberry was introduced into the United States as an ornamental plant in 1875. It was promoted as a substitute for European barberry, the latter which was found to be a host for the black stem grain rust. European barberry was originally planted by settlers for hedge-rows, dye and jam-making. Japanese barberry is still widely planted for landscaping and hedges.

Range:

Japanese and European barberry, native to Japan and Europe respectively, can now be found throughout the northern half of the U.S., particularly the Northeast.

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www.dcnr.state.pa.us

Description:

Both species are dense, spiny shrubs with oval leaves, which are serrate in European barberry and often red-tinged in Japanese barberry. The spines of European barberry are three-pronged. In mid-spring to early summer, drooping clusters of pale yellow flowers develop, turning into bright red berries.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Habitat:

Barberry is shade tolerant, drought resistant and adaptable to a variety of wooded habitats, wetlands and disturbed areas. Japanese barberry is a more pressing problem than its European relative.

Biology and Spread:

Barberry produces a large number of seeds that have a high germination rate. Seeds are dispersed by birds and small mammals, which feed on the berries. Barberry can spread vegetatively by rooting from branches touching the ground.

Ecological Threat:

Barberry forms dense stands in natural habitats including forests, open woodlands, wetlands and meadows. Once established, it displaces native plants and reduces wildlife habitat and forage, increasing pressure on natives by white-tailed deer. It has been found to alter the pH and biological activity of soil. Barberry is also a human health hazard, not only because it has sharp spines, but also because it acts as a nursery for deer ticks, which can transmit Lyme disease.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

How to Control this Species:

Physical

Barberry is easy to identify in spring because it is one of the first shrubs to leaf out.

Using thick gloves, small plants can be pulled by hand, while larger plants should be dug up. Be sure to remove the entire root system and to bag and dispose of any plant material, including fallen fruits.

Mowing or cutting is not advisable except to make removal easier.

This plant is sensitive to fire; prescribed burns and weed torches are good options.

Chemical

Systemic herbicides, such as glyphosate and triclopyr, are effective in managing barberry.

Herbicide can be applied as a basal bark or cut stump application. Late summer during fruiting may be the best time to apply herbicide, but early spring applications may avoid non-target impacts.

Large thickets of barberry can be controlled with foliar spray applications. Triclopyr only targets broadleaf species, but glyphosate is non-selective.

Look-A-Likes:

American barberry (*Berberis canadensis*), an uncommon plant of open hillside slopes thought to be extirpated from Pennsylvania, could be mistaken for an invasive barberry.

Will Cook, Duke University
www.duke.edu

Native Alternatives:

Many attractive native shrubs are available for purchase:

Julie Makin
www.wildflower.org

Sally & Andy Wasowski
www.wildflower.org

James H. Miller & Ted Bodner, SWSS
www.forestryimages.org

References:

Global Invasive Species Database: http://www.issg.org/database/species/ecology.asp?si=592&fr=1&sts=

Wisconsin Department of Natural Resources: http://dnr.wi.gov/invasives/fact/barberry.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/japanese_euro_barberry.htm

Invasive Plants in Pennsylvania

Japanese and Giant Knotweed

Fallopia japonica Sieb. & Zucc. and
Fallopia sachalinensis F. Schmidt ex Maxim.

Photo: Leslie Mehrhoff, U. of Connecticut, www.forestryimages.org

Background:

Both species of knotweed were introduced into North America for ornamental use and for forage and erosion control in the late 1800s.

Range:

Both Japanese and giant knotweed come from Japan. They can be found throughout much of the United States and Canada, as well as Europe.

Habitat:

These plants are found at sites with varying combinations of sun, moist soil and human disturbance, such as stream and river banks, wet meadows, roadsides, railroad and utility rights-of-way, vacant lots and waste places.

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Description:

Both are annual, herbaceous perennials with erect, hollow stems that are light green, smooth, jointed and swollen at the nodes (resembling bamboo).

Early in the season, new shoots can grow three to four inches per day. Knotweed grows three to 12 feet tall. The two species are known to hybridize, so ID can sometimes be difficult. The shape of the leaf base is the best characteristic—Japanese knotweed leaves are squared-off, giant knotweed's are heart-shaped.

The plant's greenish white flowers are functionally unisexual, grow approximately four inches in length and appear from August to October. The fruits are papery and contain a three-sided shiny, brown seed.

Photo: Leslie Mehrhoff, U. of Connecticut, www.forestryimages.org

Biology and Spread:

Knotweeds spread primarily by rhizomes. The rhizomes can be dispersed by natural causes, such as flooding and erosion, and also by man-made disturbances to the soil. Cut or broken stems will also root if left on moist soil or put directly into water. It produces only small amounts of viable seed that are dispersed mainly by gravity, wind and water.

Photo: Tom Heutte, USDA FS, www.invasive.org

Ecological Threat:

Knotweeds are capable of quickly forming dense stands where they can crowd out native vegetation. Thickets can clog small waterways and displace streamside vegetation, increasing bank erosion and lowering the quality of riparian habitat for fish and wildlife. Once established, these stands are very difficult to eradicate.

How to Control this Species:

The key to successful knotweed management is controlling the rhizomes.

Manual and Mechanical

Mechanical methods alone are largely ineffective. It may be possible to grub or pull single plants if they are not well established and soil conditions allow for complete rhizome removal. Small portions of the rhizome system not removed have the potential to resprout.

The herbaceous stems of knotweed can be cut or mowed quite easily. Cutting alone will not control the plant but when performed after June 1 will significantly reduce the height of the regrowth.

Chemical

Several herbicides, such as glyphosate, are effective in controlling this species. If the plants grow in a wetland, be sure to use an aquatic approved herbicide. Check label directions and state requirements.

Foliar herbicide applications made after July 1 and before the first killing frost are most effective at injuring the rhizomes. During this time of year carbohydrates produced in the leaves are moved to the rhizomes for growth and storage. Foliar applied herbicides move through the plant with the carbohydrates.

References:

USDA Forest Service Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants

Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/japanese_knotweed.htm

For More Information:

Plant Invaders of Mid-Atlantic Natural Areas, National Park Service: http://www.nps.gov/plants/alien/pubs/midatlantic/midatlantic.pdf

Invasive Plants Field and Reference Guide, U.S. Forest Service: http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

Native Alternatives:

Once knotweed is removed, you must plant other vegetation to prevent re-establishment of knotweed. The following are useful native plants:

Shrubs - winterberry holly (*Ilex verticillata*), spicebush (*Lindera benzoin*), buttonbush (*Cephalanthus occidentalis*), silky willow (*Salix sericea*), pussy willow (*Salix discolor*)

Photo: John Byrd, Mississippi State U., www.forestryimages.org

Herbaceous species - wild-rye (*Elymus villosus*), big bluestem (*Andropogon gerardii*), switch grass (*Panicum virgatum*), wingstem (*Verbesina alternifolia*), joe-pye-weed (*Eupatorium fistulosum*)

Photo: Jessica Sprajcar, DCNR

Invasive Plants in Pennsylvania

Japanese and European Barberry

Berberis thunbergii and *B. vulgaris*

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Background:

Japanese barberry was introduced into the United States as an ornamental plant in 1875. It was promoted as a substitute for European barberry, the latter which was found to be a host for the black stem grain rust. European barberry was originally planted by settlers for hedge-rows, dye and jam-making. Japanese barberry is still widely planted for landscaping and hedges.

Range:

Japanese and European barberry, native to Japan and Europe respectively, can now be found throughout the northern half of the U.S., particularly the Northeast.

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www.dcnr.state.pa.us

Description:

Both species are dense, spiny shrubs with oval leaves, which are serrate in European barberry and often red-tinged in Japanese barberry. The spines of European barberry are three-pronged. In mid-spring to early summer, drooping clusters of pale yellow flowers develop, turning into bright red berries.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Habitat:

Barberry is shade tolerant, drought resistant and adaptable to a variety of wooded habitats, wetlands and disturbed areas. Japanese barberry is a more pressing problem than its European relative.

Biology and Spread:

Barberry produces a large number of seeds that have a high germination rate. Seeds are dispersed by birds and small mammals, which feed on the berries. Barberry can spread vegetatively by rooting from branches touching the ground.

Ecological Threat:

Barberry forms dense stands in natural habitats including forests, open woodlands, wetlands and meadows. Once established, it displaces native plants and reduces wildlife habitat and forage, increasing pressure on natives by white-tailed deer. It has been found to alter the pH and biological activity of soil. Barberry is also a human health hazard, not only because it has sharp spines, but also because it acts as a nursery for deer ticks, which can transmit Lyme disease.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

How to Control this Species:

Physical

Barberry is easy to identify in spring because it is one of the first shrubs to leaf out.

Using thick gloves, small plants can be pulled by hand, while larger plants should be dug up. Be sure to remove the entire root system and to bag and dispose of any plant material, including fallen fruits.

Mowing or cutting is not advisable except to make removal easier.

This plant is sensitive to fire; prescribed burns and weed torches are good options.

Chemical

Systemic herbicides, such as glyphosate and triclopyr, are effective in managing barberry.

Herbicide can be applied as a basal bark or cut stump application. Late summer during fruiting may be the best time to apply herbicide, but early spring applications may avoid non-target impacts.

Large thickets of barberry can be controlled with foliar spray applications. Triclopyr only targets broadleaf species, but glyphosate is non-selective.

Look-A-Likes:

American barberry (*Berberis canadensis*), an uncommon plant of open hillside slopes thought to be extirpated from Pennsylvania, could be mistaken for an invasive barberry.

Will Cook, Duke University
www.duke.edu

Native Alternatives:

Many attractive native shrubs are available for purchase:

Julie Makin
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www.wildflower.org

James H. Miller & Ted Bodner, SWSS
www.forestryimages.org

References:

Global Invasive Species Database: http://www.issg.org/database/species/ecology.asp?si=592&fr=1&sts=

Wisconsin Department of Natural Resources: http://dnr.wi.gov/invasives/fact/barberry.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/japanese_euro_barberry.htm

Invasive Plants in Pennsylvania

Japanese Stilt Grass

Microstegium vimineum

James H. Miller, USDA Forest Service
www.forestryimages.org

Background:

Japanese stilt grass was first documented in Tennessee in 1919. Its introduction into the United States was accidental, likely a result of its use as a packing material for porcelain.

Range:

Native to Asia, this successful invasive has colonized most of the eastern United States, as far west as Texas.

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Description:

Japanese stilt grass is an annual that typically grows one to three feet in height. Despite its branching, sprawling, mat-like manner, it resembles a small, delicate bamboo. Leaves are narrow and lance-shaped with a distinctive, pale, silvery stripe of reflective hairs on the upper surface. Flower spikes appear in September.

James H. Miller & Ted Bodner, SWSS
www.forestryimages.org

Habitat:

Japanese stilt grass occurs in a variety of habitats, including moist ground of open woods, floodplain forests, wetlands, uplands, fields, thickets, roadsides, and ditches. It readily invades areas subject to regular disturbance. Stilt grass appears to prefer moist, acidic to neutral soils that are high in nitrogen.

Biology and Spread:

Stilt grass reproduces exclusively by seed. One plant may produce 100 to 1,000 seeds that typically fall close to the parent plant. Seeds may be carried by water during heavy rains or move about in contaminated hay, soil or mud stuck in footwear. Stilt grass seeds remain viable in the soil for five or more years and germinate readily.

Ecological Threat:

When Japanese stilt grass invades a site, it can quickly crowd out native plant species. Invasions can also change soil nutrient cycling processes, inhibit tree survival and growth, and reduce light availability. After it dies back in late fall, it forms a thick layer of smothering thatch that is slow to decompose. Because stilt grass is relatively unpalatable, it may encourage heavier deer browsing on native plant species.

Chris Evans, River to River CWMA
www.forestryimages.org

How to Control this Species:

Physical

Japanese stilt grass is quite shallow-rooted and can be easily pulled by hand, especially when the soil is moist. Pulling is easiest in late summer when plants are mature. Stilt grass can also be mowed. Follow up monitoring and treatment will be necessary for years.

Hand pulling and mowing should be done in late summer when the plants are just about to flower. Performing these activities earlier in the summer months encourages flowering and early seed dispersal.

Chemical

For extensive infestations, a systemic herbicide can be used quite effectively. Using an herbicide leaves the plants and soil in place, minimizing the likelihood of additional germination of stilt grass seed.

Grass-specific herbicides, such as quizalofop, limit damage to native plants.

Be careful when treating stilt grass in wetland sites. Make sure you use an herbicide suitable for wetlands.

Chris Evans, River to River CWMA
www.forestryimages.org

Look-A-Likes:

The native perennial Virginia cutgrass (*Leersia virginica*) is quite similar. Japanese stilt grass may also be confused with some smartweeds (*Persicaria* sp.).

Leslie Mehrhoff, U. of Connecticut
www.discoverlife.org

References:

Plant Conservation Alliance's Alien Plant Working Group: http://www.nps.gov/plants/alien/fact/mivi1.htm

Purdue University Cooperative Extension Service: http://www.btny.purdue.edu/weedscience/2011/Microstegium-01.pdf

Wisconsin Department of Natural Resources: http://dnr.wi.gov/invasives/fact/japanstgrass.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/Japanese_stiltgrass.htm

Invasive Plants in Pennsylvania

Mile-a-Minute

Persicaria perfoliata

Photo: Leslie Mehrhoff, U. of Connecticut, www.invasive.org

Background:

Also known as devil's tear-thumb, mile-a-minute has been introduced into the U.S. from the Philippines several times between the late 1800s and the 1930s. It arrived in Pennsylvania in contaminated nursery stock in York.

Range:

A native of eastern Asia, this vine is not yet widespread in the U.S. but is very common is the southern two-thirds of Pennsylvania, as well as parts of WV, VA, MD, DE, NJ, NY, CT, MA, RI and NH.

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Description:

This is an herbaceous, annual vine with delicate, highly branched stems that are covered by small, curved spines. The alternate leaves are triangular, light green, one to three inches wide and barbed on the underside. Round leaf-like structures called ocreae surround the stem. It is from there that the inconspicuous flowers and fruits arise. From mid-July though the first frost, green fruits appear, turning a metallic blue color as the season goes on.

Photo: Jessica Sprajcar, DCNR

Habitat:

This plant readily colonizes disturbed areas along forest edges, wetlands, stream banks and roadsides. It needs regular sunlight to thrive and prefers high soil moisture.

Biology and Spread:

Its fast growth is one way that the plant spreads, but its seeds are the primary means. Birds and other wildlife eat the fruits and spread the seeds in their droppings. Seeds are also buoyant for up to nine days in water and can be spread by streams and floods.

Ecological Threat:

Because this plant can grow up to six inches a day, it can quickly smother native vegetation and climb into the tree canopy where it restricts light availability to plants below. It can be a pest plant on tree farms and for horticultural crops where the soil is not regularly tilled.

Photo: Leslie Mehrhoff, U. of Connecticut, www.invasive.org

How to Control this Species:

Manual and Mechanical
Hand-pulling of vines is possible, especially when the soil is wet, but be sure to wear thick gloves. Removal should be done prior to fruit formation. Repeated mowing will prevent the plant from flowering and thus reduce or eliminate fruit and seed production. Monitor the site for several years to ensure no seeds germinate.

Chemical
A systemic herbicide like glyphosate will work on mile-a-mine, especially when used with a surfactant that will help to penetrate the leaves' waxy coating. Apply the herbicide in the summer, before fruits appear.

Biocontrol
A weevil, *Rhinocominus latipes*, is being used on various test plots in Pennsylvania and elsewhere to control mile-a-minute. These small insects feed on the leaves and bore into the stems. While they will not completely eliminate the plant they help keep it in check and reduce fruit production.

Rhinocominus latipes

Photo: NJ Dept. of Agriculture

Look-a-Likes:

There are several other vines with triangular-shaped leaves that may be confused with mile-a-minute, including halbard-leaved tearthumb (*Polygonum arifolium*), climbing false buckwheat (*Polygonum scandens*), wild morning glory (*Ipomoeae pupurea*) and hedge bindweed (*Calystegia sepium*). The presence of spines and ocreae will let you know that it is indeed mile-a-minute.

Photo: Theodore Webster, USDA, www.forestryimages.org

References:

Center for Invasive Species and Ecosystem Health: http://www.invasive.org/browse/subinfo.cfm?sub=3065

Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/mile_a_minute.htm

University of Delaware, College of Agriculture & Natural Resources, Biological Control of Mile-a-Minute Weed: http://ag.udel.edu/enwc/research/biocontrol/mileaminute.htm

Massachusetts Introduced Pests Outreach Project: http://massnrc.org/pests/mamreport.aspx

For More Information:

Plant Invaders of Mid-Atlantic Natural Areas, National Park Service: http://www.nps.gov/plants/alien/pubs/midatlantic/midatlantic.pdf

Invasive Plants Field and Reference Guide, U.S. Forest Service: http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

Invasive Plants in Pennsylvania

Multiflora Rose

Rosa multiflora

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Background:

Multiflora rose was introduced into the United States as ornamental rootstock from Japan in 1866. Beginning in the 1930s, the U.S. Soil Conservation Service promoted it for use in erosion control and livestock fencing. It was also encouraged in wildlife plantings and as a crash barrier along highways. Recognition of its tenacious and unstoppable growth habitat came too late, and it is now considered a noxious weed in many states.

Range:

Native to Asia, multiflora rose now occurs throughout most of the United States, especially the eastern half.

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Description:

Multiflora rose is a dense, thorny shrub, reaching up to 15 feet in height, with arching canes (stems) that are capable of rambling up trees. Its leaves are pinnately compound, divided into seven to nine leaflets, and finely serrate. Clusters of fragrant white to pink flowers appear in May or June. Small bright red hips (fruit) develop during the summer and remain on the plant through winter.

James H. Miller, USDA Forest Service
www.forestryimages.org

Habitat:

This invasive shrub has a wide tolerance for various soil, moisture and light conditions. It can be found in dense woods, along stream banks and roadsides, and in open fields and prairies.

Biology and Spread:

It is estimated that a single plant may produce a million seeds per year, which may remain viable in the soil for up to 20 years. The hips are readily eaten by birds, which are the primary seed dispersers. New plants can also be formed by rooting from the tips of canes touching the ground.

Ecological Threat:

Multiflora rose forms impenetrable thickets that exclude native plant species. This shrub grows very prolifically in riparian areas, where its inedible leaf litter can change the composition of the aquatic macroinvertebrate community. Its occasional habitat of climbing can weigh down trees, making them susceptible to breakage.

James H. Miller, USDA Forest Service
www.forestryimages.org

How to Control this Species:

Physical

Frequent cutting or mowing, three to six times per growing season, for two to four years, is effective in achieving high mortality. Be careful—the strong thorns have been known to puncture rubber tires.

Scattered populations may be eliminated by complete removal of the plants. Be sure to remove all root material because this shrub readily re-sprouts.

In areas where multiflora rose is detected early, prescribed fire may limit its establishment.

Chemical

Application of herbicides, such as glyphosate or triclopyr, on freshly cut stems is an effective control method since it destroys the root system and prevents re-sprouting. This may be done during the dormant period, which reduces the likelihood of damaging desirable species.

A foliar spray of fosamine can be used from July through September, but die-back will not be apparent until the following summer. Fosamine will only affect woody species.

Biological

Biological control is currently under investigation. Rose-rosette disease, a native viral pathogen, is spread by a mite, and is slowly spreading eastward from the west. The European rose chalcid, a seed-infesting wasp, promises to reduce seed viability. Unfortunately, both of these measures have the potential to impact native rose species.

Leslie J. Mehrhoff, U. of Connecticut
www.forestryimages.org

Look-A-Likes:

Multiflora rose could easily be confused with other rose species (both native and non-native), especially when not in bloom. This is a concern, since some native species are of conservation interest.

Catherine Herms, Ohio State University
www.forestryimages.org

References:

Plant Conservation Alliance's Alien Plant Working Group:
http://www.nps.gov/plants/alien/fact/romu1.htm

Wisconsin Department of Natural Resources:
http://dnr.wi.gov/invasives/fact/rose.htm

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers:
http://www.dcnr.state.pa.us/forestry/invasivetutorial/Multiflora_rose.htm

Invasive Plants in Pennsylvania

Norway Maple

Acer platanoides

Photo: Leslie Mehrhoff, U. of Connecticut, www.forestryimages.org

Background:

Norway maple was originally introduced into North America by John Bartram of Philadelphia, who received seedlings from London in 1756. Bartram began offering this plant to nurseries and Norway maple subsequently became a popular tree for city plantings. This species is naturalized throughout the state, but is more common in the southern half.

Range:

Norway maple is the most widespread maple in Europe where it occurs from Norway and Sweden to Turkey and northern Iran. Norway maples are widely planted in the U.S., from the Canadian border south to the Carolinas.

Description:

Norway maple is a large, deciduous tree with a broad, rounded crown. It can readily be distinguished from other maples because the leaves and twigs ooze milky sap when cut or torn; however, this may be difficult to detect late in the season. This species grows up to 65 feet in height with up to a seven foot trunk diameter. Norway maple leaves are dark green and are about six inches wide and five inches long, with five to seven lobes. The bark is smooth and gray-brown, twigs are stout, brown with green buds with over-lapping bud scales (*see photo on right*).

Photo: Paul Wray, Iowa State U., www.forestryimages.org

Habitat:

Norway maple is usually planted in urban and suburban settings but commonly invades deciduous forests adjacent to suburban areas.

Biology and Spread:

Norway maple reproduces by seed, which each tree produces in large amounts. The winged fruits are spread by the wind. The seeds germinate readily, even in dense shade, and grow quickly when young.

Photo: John Randall, The Nature Conservancy, www.forestryimages.com

Ecological Threat:

This species is a frequent invader of urban and suburban forests. Its extreme shade tolerance allows it to penetrate deep within an intact forest canopy. Recent research has shown that forests invaded by Norway maple have less wildflower diversity compared with forests dominated by native Sugar maple (*Acer saccharum*).

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How to Control this Species:

Manual and Mechanical

Norway maple seedlings are easy to pull when the soil is moist. For larger plants, dig them out, making sure to get all the roots. Cut down large trees and grind out the stump, or clip off re-growth. Girdle the tree by cutting through the bark and growing layer (cambium) all around the trunk. Girdling is most effective in spring.

Chemical

Norway maple can be controlled effectively by using an herbicide such as glyphosate or triclopyr. Trees up to four inches in diameter can be controlled by applying triclopyr mixed with a horticultural oil to the bark, a foot from the base of the trunk. This can be done in early spring or from June 1 to September 30. The cut stump method may also be used—cut the tree and immediately apply the herbicide around the outer ring of the stump.

Look-A-Likes:

Norway maple is similar to the native sugar maple. However, Norway maple can be readily distinguished from other maples because the leaves and twigs ooze milky sap when cut or torn. It is the only maple in our region with that characteristic.

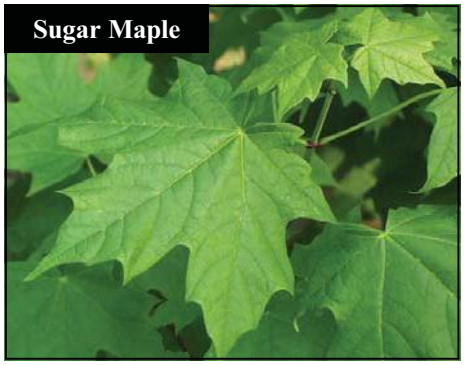

Photo: Paul Wray, Iowa State U., www.forestryimages.org

Native Alternatives:

There are many native trees that make great alternatives. Sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), American basswood (*Tilia americana*), red oak (*Quercus rubra*), white ash (*Fraxinus americana*) and tuliptree (*Liriodendron tulipifera*) are just a few examples.

Photo: Bill Cook, Michigan State U., www.forestryimages.org

References:

Center for Invasive Species and Ecosystem Health: http://www.invasive.org/browse/subinfo.cfm?sub=3002

U.S. Forest Service Weed of the Week: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/norway-maple.pdf

Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/norway_maple_M_C.htm

For More Information:

Plant Invaders of Mid-Atlantic Natural Areas: http://www.invasive.org/eastern/midatlantic/acpl.html

Invasive Plants Field and Reference Guide, U.S. Forest Service: http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

Invasive Plants in Pennsylvania

Oriental Bittersweet

Celastrus orbiculatus Thunb.

Photo: Jessica Sprajcar, DCNR

Background:

Also known as round-leaved and Asiatic bittersweet, this vine was introduced from China into the U.S. around 1860 as an ornamental.

Range:

Oriental bittersweet can be found throughout New England and the Mid-Atlantic states, down to Louisiana and up through the Midwest as far north as Wisconsin. It is not known to occur further west than that.

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Description:

Oriental bittersweet is a deciduous, climbing, woody vine that can grow up to 60 feet in length. Vines can grow up to four inches in diameter. The alternate, elliptical leaves are light green in color, finely toothed and two to five inches in length. Fruits are round and yellow, splitting to reveal bright red berries through the fall and winter months.

Photo: Leslie Mehrhoff, U. of Connecticut, www.invasive.org

Habitat:

Commonly found on old home sites, in fields and forest edges, and along roadsides and train tracks. While it prefers open, sunny sites it can tolerate shade.

Biology and Spread:

Birds and other wildlife readily consume the large number of berries, spreading seeds far and wide. Humans also spread the seed through the use of bittersweet vines and berries for craft projects. The plant also spreads vegetatively through rhizomes and root suckers.

Ecological Threat:

This vine is able to girdle and kill trees or break their branches off from the weight of the vines. When it grows into the canopy it can shade out natives. Oriental bittersweet has also been shown to hybridize with the American bittersweet, leading to a loss of genetic identity.

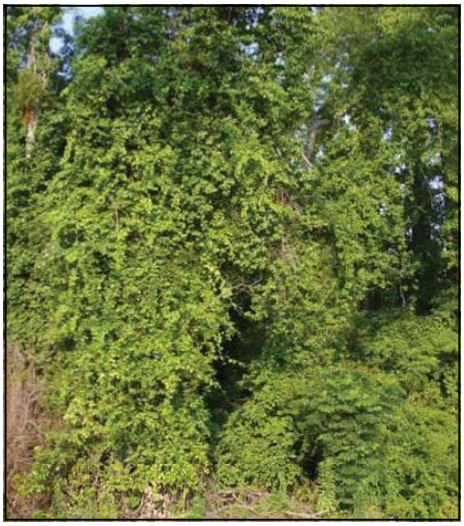

Photo: Nancy Loewenstein, Auburn U., www.invasive.org

How to Control this Species:

Manual and Mechanical

Because the seeds of bittersweet are so numerous and can remain viable in the soil for several years, all control efforts will require multiple years to be effective.

Small populations, especially of vines not high up in canopy, can be pulled by hand or dug out prior to fruiting. If fruits are present, all material should be bagged and disposed of.

Vines in trees can be cut close to the ground. The vines will re-sprout, however, unless and herbicide is immediately applied to the cut stump.

Weekly mowing will prevent the vines from fruiting, but less frequent mowing will promote root sprouts.

Chemical

Because Oriental bittersweet looks so much like the native American bittersweet, be absolutely sure you have properly identified the species before doing any control work.

Systemic herbicides like glyphosate and triclopyr can successfully manage bittersweet. It is most effective when stems are cut or mowed and the herbicide is applied to the cut area immediately.

For cut stump applications, a two percent solution of glyphosate and water can be applied as long as the air temperature is above 40 degrees F. A 25 percent solution of triclopyr and water can be applied when the air temperature is above 60 degrees F.

For foliar application, a two percent solution of glyphosate or triclopyr and water, plus a 0.5 percent non-ionic surfactant, can be sprayed on the leaves when the air temperature is above 65 degrees F.

References:

Center for Invasive Species and Ecosystem Health:
http://www.invasive.org/browse/subinfo.cfm?sub=3012

Invasive Exotic Plant Tutorial for Natural Lands Managers:
http://www.dcnr.state.pa.us/forestry/invasivetutorial/Oriental_bittersweet.htm

For More Information:

Plant Invaders of Mid-Atlantic Natural Areas, National Park Service:
http://www.nps.gov/plants/alien/pubs/midatlantic/midatlantic.pdf

Invasive Plants Field and Reference Guide, U.S. Forest Service:
http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

Look-A-Likes:

Oriental bittersweet closely resembles the native American bittersweet (*Celastrus scandens*), but American bittersweet has flowers and fruits at the ends of its branches, rather than in the axils of the leaves, like the Oriental variety.

Photo: Chris Evans, River to River CWMA, www.forestryimages.org

Invasive Plants in Pennsylvania

Pale and Black Swallow-worts

Cynanchum louiseae and *C. rossicum* (previously *Vincetoxicum spps.*)

Photo: Leslie Mehrhoff, www.invasive.org

Background:

Swallow-worts were likely introduced for ornamental purposes into New York, Massachusetts and Illinois. Records of occurrences include Pennsylvania in 1927. Indications of naturalized populations include records of collections from roadsides and natural areas in New York State in the 1800s and 1900s.

Range:

Originally from Europe and Eurasia, it is now established in CT, IN, MA, MI, MO, NH, NJ, NY, PA and WI.

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Description:

Black and pale swallow-worts are perennial, twining herbaceous vines, three to six feet high. The leaves are opposite, oval shaped with pointed tips. Pale swallow-wort leaves are 2.5 to 4.5 inches long and the flowers are star shaped with reddish colored petals each twice as long as wide, born in clusters. Black swallow-wort has darker green leaves three to four inches long, dark purple flowers with the five pointed petals nearly triangular, about as long as wide. Plants tend to grow in clumps of several to many stems, forming extensive patches.

Habitat:

Swallow-worts prefer lime-stone based soils, are drought tolerant and will thrive in a wide range of soil, moisture and light conditions, with the exception of extremely wet soils. Populations growing under dense wooded canopy may have inadequate resources to produce flowers or seeds. Swallow-wort dies back to the ground every winter. Its root crown fragments support dormant buds that readily sprout if not destroyed.

Biology and Spread:

The fruits are slender tapered pods, often paired, two to three inches long by about ¼ inch wide, that turn from green to light brown as they mature. When ripe, the fruits open along a seam and release flattened seeds equipped with a downy parachute that aids in wind dispersal (*see photo on right*). In contrast to its invasive relative the black swallow-wort (*C. louiseae*), pale swallow-wort does not have rhizomes.


Photo: Leslie Merhoff

Ecological Threat:

Related to milkweeds, swallow-worts are extremely toxic to livestock and monarch butterfly larvae, which are sometimes fooled into laying their eggs on this plant. Pale swallow-wort can form extensive patches that crowd out native plant species and have various impacts on native wildlife. In some instances, old-field habitats occupied by goldenrods and grasses are replaced almost exclusively by swallow-wort, disrupting natural succession and completely altering the physical structure of those habitats.

How to Control this Species:

To prevent seed dispersal, mechanical removal of the pods must be completed before they open. Hand pulling roots is labor intensive and rarely successful since the stem base is brittle.

Herbicides should be applied when plants are actively growing, after flowering has begun. DO NOT SPRAY TOO SOON. Avoid the temptation to spray the plants as soon as they emerge in May.

Only when the plants flower will they be large enough to receive enough spray on the exposed leaf surface to deliver a killing dose to the roots. Plants sprayed before pods form will probably not produce a viable seed crop that season.

Systemic herbicides do not cause a "burn down" of plants like contact herbicides do. Within one to two weeks the plants will look sick. There may be dead tissue spots on most leaves, with many yellowing leaves.

Do not waste herbicide, money or effort by spraying plants twice. Sick plants cannot effectively absorb the herbicide through the leaf surface or move the herbicide to the roots. Swallow-wort control may take a few years and it is important not to use more herbicide than is necessary.

Photo: Leslie Mehrhoff, www.invasive.org

Look-A-Likes:

There are many native species of *Cynanchum*, including honeyvine (*Cynanchum laeve*) which occurs throughout the eastern U.S. and could be confused with pale swallow-wort. Honeyvine has white flowers, and its leaves have a distinct heart-shaped base.

Photo: Leslie Merhoff, www.invsive.org

References:

DiTommaso, A., Lawlor, F. M. and Darbyshire, S. J. 2005. The Biology of Invasive Alien Plants in Canada

Cynanchum rossicum (Kleopow) Borhidi [= *Vincetoxicum rossicum* (Kleopow) Barbar.] and *Cynanchum louiseae* (L.) Kartesz & Gandhi [= *Vincetoxicum nigrum* (L.) Moench]. Can. J. Plant Sci. 85: 243–263

Swearingen, J. 2009. WeedUS Database of Plants Invading Natural Areas in the United States: Pale Swallow-wort (*Cynanchum rossicum*) http://www.invasive.org/weedus/subject.html?sub=4260

Weeds Gone Wild: Alien Plant Invaders of Natural Areas: www.nps.gov/plants/alien

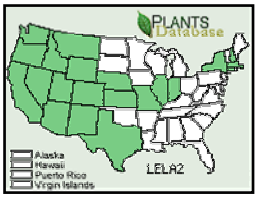
Perennial Pepperweed *Lepidium latifolium* L.

Common Names: tall whitetop, giant whiteweed, perennial peppergrass, slender perennial peppercress, broadleaf or broadleaved pepperweed, ironweed and other names

Native Origin: southeastern Europe and southwestern Asia

Description: A herbaceous perennial in the Mustard family (Brassicaceae). Plants are multiple stemmed and grow in stiffly erect masses 3 to 8 feet tall. Leaves are lanceolate, bright green to gray green, and entire or toothed. Basal leaves are stalked, up to 1 foot long and 3 inches wide and have serrate margins. Leaf size decreases up the stem. Flowering occurs from early summer to fall. Abundant small white 4-petaled flowers are borne in dense clusters near the stem tips. The fruits are small, flattened pods about 1/10th inch long, each containing 2 seeds (1 per chamber). Fruits remain on the plant, dropping irregularly throughout the winter. The base of the stem is semi-woody. The creeping roots enlarge at the soil line, forming a woody crown. The plant mainly propagates clonally from its brittle rhizome-like roots that grow to a length of up to 6 feet.

Habitat: Perennial pepperweed occurs in riparian (stream) areas, coastal wetlands, marshes, roadsides, railways, ditches, hay meadows, pastures, cropland, and waste places.



Distribution: It occurs in a few states along the eastern seaboard, in several Midwestern states, and in all far western states. Infestations have been reported in coastal, intermountain and mountainous areas in New England, all the states west of the Rocky Mountains. It also occurs in Canada and Mexico.

Ecological Impacts: Perennial pepperweed a highly invasive plant that alters the ecosystem it grows in. It can invade a wide range of habitats including riparian areas, wetlands, marshes, and floodplains. It adapts readily to natural and disturbed wetlands. It may occur as spotty, scattered populations, or as large, dense, nearly monospecific stands. These dense stands have potential to displace native plants and animals, threatened and endangered species, decrease plant diversity, and reduce nesting frequency of waterfowl in or near wetlands.

Control and Management: Deep-seated rootstocks make pepperweed difficult to control.

- **Manual**- Physical and mechanical control methods such as mowing and disking are unlikely to control perennial pepperweed because new plants quickly regenerate from roots and root crowns. Very small patches can be controlled by hand removal if the process is repeated often for several years and plants are not allowed to mature.
- **Chemical**- Foliar application methods have been effective (Telar®- a selective herbicide or a glyphosate such as Roundup® - nonselective herbicide)

Natural Enemies- Several general herbivorous insects are feed on perennial pepperweed (e.g. *Lygus* spp) and a white rust *(Albugo sp.)* infects large numbers of flowers and limits seed production, but do not prevent the clonal expansion of the creeping root system.

References: www.fs.fed.us/database/feis/plants/forb/leplat/all.html, http://plants.usda.gov www.nps.gov/plants/alien/fact/lela1.htm,
ELEMENT STEWARDSHIP ABSTRACT-http://tncweeds.ucdavis.edu/esadocs/documnts/lepilat.html

Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. WOW 08-14-05
Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants

Invasive Plants in Pennsylvania

Privets

(Japanese, Border, Chinese and Common)

Ligustrum japonicum, L. obtusifolium, L. sinense and *L. vulgare*

Photo: Troy Evans, www.bugwood.org

Background:

These four species of privets were originally imported for use in landscaping around 1860. They are still often used in hedges and landscaping.

Range:

The various privets are originally from Japan, China and Europe. They have spread through the eastern United States, from New Hampshire and Michigan in the north to Florida and Texas in the south.

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Description:

Privets are deciduous or semi-evergreen shrubs that often form dense thickets. They have opposite or whorled stems that are brown to gray with slightly rough bark. Privets produce white flowers from April to June, which are followed by green drupes from July to March. These fruit gradually ripen to a dark purple or black color in the winter. It is often difficult to differentiate between the four privets to the species level, particularly when they are not flowering.

Photo: Rebekah Wallace, U. of Georgia, www.invasive.org

Habitat:

Privets are often found in bottom-land forests, fence-rows, fields and rights-of-way. They seem to prefer disturbed areas with rich soil.

Biology and Spread:

Privets mainly spread to new areas via their seeds. Often-times, these are distributed by birds, which have eaten the fruit. Once introduced to an area, privet can regenerate from root and stump sprouts, making it difficult to eradicate.

Ecological Threat:

Privets can form dense thickets, which reduce light and moisture availability for native shrubs and wild-flowers. This decreases plant diversity and impacts the animals which depend on them for food and shelter.

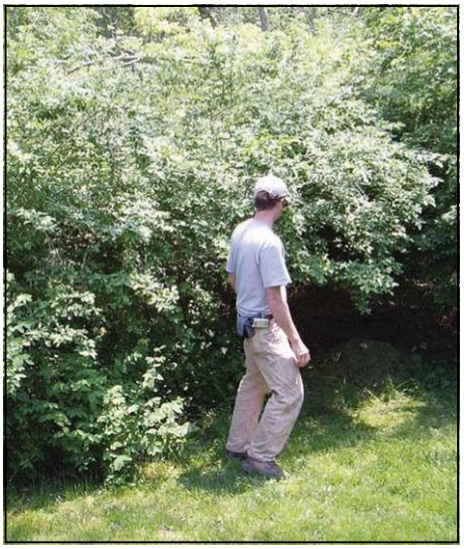

Photo: Leslie Mehrhoff, U. of Connecticut, www.invasive.org

How to Control this Species:

Once established in an area, privet can be difficult to control or remove.

With smaller populations, hand removal can be used. However, fragments of root that are left behind in the ground can re-sprout.

Larger areas can also be treated with herbicides such as glyphosate. Herbicide can be applied to the leaves, or painted on cut stems or stumps. Once the herbicide is applied, disturbances to the privet should be avoided for approximately one year, in order for the herbicide to travel through the privet's root systems.

No biological controls are currently known for privet. Studies show that controlled burning does not appear to have a lasting effect on privet populations, so it is not recommended as a control option.

Look-A-Likes:

There are a large variety of shrub-sized, berry-producing, deciduous alternatives to privets for landscaping purposes. These include species such as spicebush (*Lindera benzoin*), dogwoods (*Cornus* spp.) and chokeberry (*Aronia* spp.). These species will all provide food and cover for wildlife.

Photo: Jessica Sprajcar, DCNR

Photo: Chris Vans, River to River CWMA, www.forestryimages.org

Photo: Richard Webb, www.forestryimages.org

References:

USDA Plant Guide:
http://plants.usda.gov/plantguide/pdf/pg_lisi.pdf

University of Connecticut Plant Database:
http://www.hort.uconn.edu/plants/index.htm

Center for Invasive Species and Ecosystem Health: www.invasive.org

For More Information:

Plant Invaders of Mid-Atlantic Natural Areas, National Park Service:
http://www.nps.gov/plants/alien/pubs/midatlantic/midatlantic.pdf

Invasive Plants Field and Reference Guide, U.S. Forest Service:
http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

Invasive Plants in Pennsylvania

Shrub Honeysuckles

(Amur, Morrow's, Bells, Standish, and Tartarian)

Lonicera maackii, L. morrowii, L. x bella, L. standishii, and *L. tatarica*

Chuck Bargeron, University of Georgia, www.bugwood.org

Background:

Shrub or bush honeysuckles were introduced to North America for use in landscaping, erosion control and wildlife cover. Unfortunately, these plants then spread throughout much of the country.

Range:

The nonnative bush honeysuckles are native to eastern Asia, Europe and Japan. Currently, they can be found in a variety of habitats from the Great Plains to southern New England, and south to Tennessee.

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Description:

Nonnative bush honeysuckles grow to heights of six to 20 feet. Their stems are thornless with a hollow brown pith. Their leaves are opposite and egg-shaped. Their flowers, which bloom from May to June, are fragrant, tubular and less than an inch long. They range in color from white to yellow to pink to red. The berries are small and red or yellow.

Leslie J. Merhoff, University of Connecticut, www.bugwood.org

Habitat:

Nonnative bush honeysuckles are relatively shade-intolerant, and often occur in disturbed woods or edges, roadsides and abandoned fields where more light is available. Morrow's and Bell's honeysuckles are capable of invading bogs, fens, lakeshores and sandplains.

Biology and Spread:

Nonnative bush honeysuckles produce large numbers of small fruits, particularly when growing in open sunlight. These are eaten by birds, which then spread the seeds in their droppings. Once a population establishes, vegetative sprouting continues the spread of these plants.

Ecological Threat:

These invasive species compete with native plants for sunlight, moisture and pollinators. And while birds eat the fruit, it is poorer in fats and nutrients than fruits from native plants, so the birds do not get enough nutrients to help sustain long flights during migrations.

Leslie J. Merhoff, University of Connecticut, www.bugwood.org

How to Control this Species:

The two main methods of controlling nonnative bush honeysuckles are mechanical and chemical. Smaller populations can be removed by hand, making sure to include the roots. Larger populations should be cut to ground level at least once per year, in either early spring or late fall.

Glyphosate can be sprayed onto the leaves, or could also be applied to cut stems in order to kill the root system.

No biological controls are known that would target solely nonnative bush honeysuckle species. In open areas, prescribed fire may help to eradicate this species. In order to optimize this approach, however, the burn should be conducted prior to late summer in order to prevent seed dispersal.

Look-A-Likes:

Native bush honeysuckles exist throughout North America. The natives generally have solid stems, as opposed to the hollow pith of the invasive ones. Be very cautious when buying so-called "native" honeysuckles from a nursery or online.

Native Alternatives:

There are a large variety of shrub-sized, berry-producing, deciduous alternatives for landscaping purposes. These include species such as spicebush (*Lindera benzoin*), dogwoods (*Cornus* spp.) and chokeberry (*Aronia* spp.). These species will all provide food and cover for wildlife.

Photo: Jessica Sprajcar, DCNR

Photo: Chris Vans, River to River CWMA, www.forestryimages.org

Photo: Richard Webb, www.forestryimages.org

References:

Invasive Exotic Plant Tutorial for Natural Lands Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/bush_honeysuckles.htm

University of Wisconsin, Invasive Plants of Wisconsin: http://www.uwgb.edu/biodiversity/herbarium/invasive_species/lonxbe01.htm

Plant Conservation Alliance's Least Wanted List: http://www.nps.gov/plants/alien/fact/loni1.htm

University of Connecticut Plant Database: http://www.hort.uconn.edu/plants/index.html

Robert W. Freckmannn Herbarium: http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=LONTAT

Fact Sheet: Spotted Knapweed

Spotted Knapweed

Centaurea stoebe L. *ssp. micranthos* (Gugler) Hayek
Sunflower family (Asteraceae)

NATIVE RANGE

Central Europe, east to central Russia, Caucasia, and western Siberia

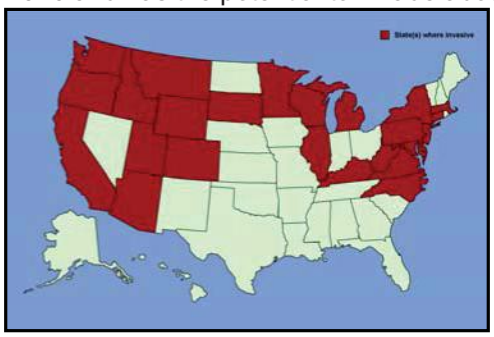
DESCRIPTION

Spotted knapweed, previously known as *Centaurea biebersteinii*, is a biennial or short-lived perennial. Its name is derived from the spots formed by black margins on the flower bract tips. Spotted knapweed typically forms a basal rosette of leaves in its first year and flowers in subsequent years. Rosette leaves are approximately 8 inches long by 2 inches wide, borne on short stalks, and deeply lobed once or twice on both sides of the center vein, with lobes oblong and wider toward the tip. The taproot is stout and deep. Flowering stems are erect, 8 to 50 inches tall, branched above the middle, and sparsely to densely hairy. Stem leaves alternate along the stem, are unstalked, and may be slightly lobed, or linear and unlobed. Leaf size decreases towards the tip of the stem.

Flowers are purple to pink, rarely white, with 25 to 35 flowers per head. Plants bloom from June to October, and flower heads usually remain on the plant. Flower heads are oblong or oval shaped, ¼ inch wide and ½ inch across, and are single or borne in clusters of two or three at the branch ends. Leaf like bracts surrounding the base of the flower head are oval and yellow green, becoming brown near the base. The margins of these bracts have a soft spine like fringe, with the center spine being shorter than the lateral spines. The brown, oval seeds are 1/16 to 1/8 inch long, with pale longitudinal lines and a short fringe on one end.

ECOLOGICAL THREAT

Spotted knapweed infests a variety of natural and semi-natural habitats including barrens, fields, forests, prairies, meadows, pastures, and rangelands. It outcompetes native plant species, reduces native plant and animal biodiversity, and decreases forage production for livestock and wildlife. Spotted knapweed may degrade soil and water resources by increasing erosion, surface runoff, and stream sedimentation. It has increased at an estimated rate of 27% per year since 1920 and has the potential to invade about half of all the rangeland (35 million acres) in Montana alone.



DISTRIBUTION IN THE UNITED STATES

Spotted knapweed is a widely distributed species reported to occur throughout Canada and in every state in the U.S. except Alaska, Georgia, Mississippi, Oklahoma and Texas. It has been designated as a noxious weed in Arizona, California, Colorado, Idaho, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

It has been identified as invasive in natural areas by eighteen organizations in twenty-six states (Arizona, California, Colorado, Connecticut, Delaware, Kentucky, Idaho, Illinois, Massachusetts, Maryland, Michigan, Minnesota, Montana, North Carolina, New Jersey, New York, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Washington, Wisconsin, West Virginia, and Wyoming). Fifteen national parks also identify spotted knapweed as an invasive plant and a threat to natural habitats.

HABITAT IN THE UNITED STATES

Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving 8 to 80 inches of rain annually. Spotted knapweed prefers well-drained, light-textured soils that receive summer rainfall, including open forests dominated by ponderosa pine and Douglas fir, and prairie habitats dominated by Idaho fescue, bluebunch

wheatgrass, and needle-and-thread grass. Disturbance allows for rapid establishment and spread; however, spotted knapweed is capable of invading well managed rangelands. Spotted knapweed does not compete well with vigorously growing grass in moist areas. In seasonally dry areas, spotted knapweed's taproot allows it to access water from deep in the soil, beyond the reach of more shallowly rooted species.

BACKGROUND

Spotted knapweed was introduced to North America from Eurasia as a contaminant in alfalfa and possibly clover seed, and through discarded soil used as ship ballast. It was first recorded in Victoria, British Columbia in 1883 and spread further in domestic alfalfa seeds and hay before it was recognized as a serious problem.

BIOLOGY & SPREAD

Spotted knapweed plants in North America generally live 3 to 7 years but can live up to nine years or longer. Plants regrow from buds on the root crown. Reproduction is by seed, and plants are capable of producing 500- 4,000 seeds per square foot per year. About 90% of the seeds are viable at the time of dispersal, and they can remain viable in the soil for 5-8 years. Most seeds are dispersed near the parent plant but can be transported by people, wildlife, livestock, vehicles, and in soil, crop seed, and contaminated hay. Gravel pits, soil stockpiles, powerlines, grain elevators, railroad and equipment yards are important seed distribution points.

MANAGEMENT OPTIONS

The most cost effective management strategy for spotted knapweed is to prevent its spread to non-infested areas. Spread by seed can be minimized by avoiding travel through infested areas; by cleaning footwear, clothing, backpacks, and other items after hiking through infested areas; by not grazing livestock when ripe seeds are present in the flower heads; and by using weed free hay.

Manual and Mechanical

Small infestations of spotted knapweed can be controlled by persistent hand-pulling done prior to seed set. Gloves should be worn because of the possibility of skin irritation. Because spotted knapweed can regrow from the base, care must be taken to remove the entire crown and taproot.

Biological

A variety of natural enemies are used as biological control agents for large infestations of spotted knapweed. Most biocontrol techniques use insect larvae to damage the root, stem, leaf, or flower. Two species of seed head flies, *Urophora affinis* and *U. quadrifasciata*, are well-established on spotted knapweed. The larvae of these species reduce seed production by as much as 50% by feeding on spotted knapweed seed heads and causing the plant to form galls. Three moth species (*Agapeta zoegana*, *Pelochrista medullana*, and *Pterolonche inspersa*) and a weevil (*Cyphocleonus achates*) that feed on spotted knapweed roots have also been released.

The collective stress on the plant caused by these insects reduces seed production and may lead to reduced competitiveness. Biological control agents may be more effective when combined with other control methods such as herbicides, grazing, and revegetation with desirable, competitive plants.

Chemical

Control of spotted knapweed infestations using three chemical herbicides (2,4-D, clopyralid, and picloram) has been reported but is problematic. Existing plants can be killed with 2,4-D but it needs to be reapplied yearly to control new plants germinating from seed stored in the soil. Picloram is a more persistent herbicide and has controlled knapweed for three to five years when applied at 0.25 lb/acre at any stage of plant growth; or with clopyralid (0.24 lb/acre) or clopyralid (0.2 lb/acre) plus 2,4-D (1 lb./acre) applied during bolt or bud growth stage. In the absence of desirable native grasses, longevity of control may be increased by revegetating with competitive grasses and forbs. Picloram may pose a risk of groundwater contamination where soils are permeable, particularly where the water table is shallow.

Other

Long-term grazing by sheep and goats has been found to control spotted knapweed. Burning, cultivation, and fertilization typically are not effective on spotted knapweed unless combined with other methods of control.

USE PESTICIDES WISELY: Always read the entire pesticide label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact your state department of agriculture for any additional pesticide use requirements, restrictions or recommendations.

NOTICE: mention of pesticide products on this page does not constitute endorsement of any material.

CONTACTS

For more information on the management of spotted knapweed, please contact:

- Michael Carpinelli, USDA-ARS, Burns, OR (541-573-8911, michael.carpinelli at oregonstate.edu)
- Steve Dewey's Weed Web (http://www.ext.usu.edu/ag/weeds/index.htm)
- Peter Rice, Montana Noxious Weed Trust (http://invader.dbs.umt.edu/)

OTHER LINKS

- http://www.invasive.org/species/subject.cfm?sub=3013
- http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=45

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PHOTOGRAPHS

Washington State Noxious Weed Control Board

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Invasive Plants in Pennsylvania

Tree of Heaven

Ailanthus altissima

Photo: Jessica Sprajcar, DCNR

Background:

Also known as Chinese sumac, stinking sumac and tree of hell, this tree is native to China. It was brought to Philadelphia in 1784 by an amateur gardener. By 1840 it was commonly available from nurseries. Ailanthus is the subject of the well known book, "A Tree Grows in Brooklyn," by Betty Smith.

Range:

Tree of heaven is very common in the northeast and Midwest, through parts of the southeast, southwest and west coast.

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Description:

This rapidly growing tree can reach a height of 80 feet, with up to a six-foot diameter trunk. Leaves are pinnately compound with 10 to 41 leaflets with smooth leaf margins. When crushed, the leaves and other plant parts have a rancid smell like cat urine or burnt peanut butter.

Photo: Chuck Bargeron, U. Of Georgia, www.invasive.org

Flowering occurs in early summer, when large clusters of yellowish flowers develop above the leaves, Fruit produced on the female trees are tan to reddish, single winged, papery seeds, called samaras. They may remain on the tree throughout late fall.

Habitat:

Ailanthus is extremely tolerant of poor soils and will even grow through cracks in pavement. Trees are not shade tolerant. They will quickly colonize forest edges, fields and roadsides.

Biology and Spread:

Tree of heaven spreads by hundreds of thousands of seeds per tree and through vegetative sprouting. A cut or injured ailanthus tree may send up dozens of root suckers and resprouts, creating large clonal colonies.

Ecological Threat:

This tree produces chemicals in its roots that prevent the establishment of other plant species nearby. Its fast growth limits habitat for other species. Its root system may be extensive and has been known to cause damage to sewer lines and building foundations.

Photo: Leslie Mehrhoff, U. of Connecticut, www.invasive.org

Look-A-Likes:

The native trees most likely to be confused with ailanthus are the sumacs (*Rhus* spp.). One way to tell them apart is the small glands on the underside of ailanthus leaves (*see photo below*). Staghorn sumac leaves do not have this gland, but have toothed leaf margins, while ailanthus' leaf edges are smooth. Sumac fruits are fuzzy and red.

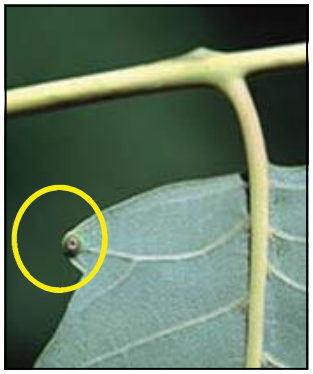

Photo: James Miller, USDA Forest Service, www.invasive.org

Young ailanthus may also be confused with black walnut (*Juglans nigra*) because of the compound leaves and shield-shaped leaf scars. However, the flowers, seeds and smell of ailanthus should give it away.

Photo: John Cardina, The Ohio State University, www.forestryimages.org

How to Control this Species:

Elimination of this species is difficult and time consuming, due to its abundant seed, high germination rate, and frequent root sprouts.

Manual and Mechanical

While young seedlings could be pulled or dug up, the chance of getting all root fragments is difficult and can lead to re-sprouts. Seedlings can be confused with root suckers, which would be nearly impossible to remove effectively by hand.

Cutting is not recommended, as the trees will send up large numbers of root sprouts and suckers, creating a bigger problem than before.

Chemical

The most effective way to treat ailanthus is with herbicides. Foliar application of triclopyr or glyphosate, mixed with water and a non-ionic surfactant, is effective on smaller trees when applied between June and late August.

For larger trees, application of triclopyr or glyphosate with the basal bark, hack and squirt, injection or cut stump method should work effectively. Application rates may vary—see the references below for more specific information.

Follow-up monitoring and treatment are very important. Regardless of the control method used, treated areas should be checked one or more times a year.

References:

Plant Conservation Alliance's Least Wanted List:
http://www.nps.gov/plants/alien/fact/aial1.htm

Center for Invasive Species and Ecosystem Health:
http://www.invasive.org/browse/subinfo.cfm?sub=3003

Virginia Cooperative Extension:
http://pubs.ext.vt.edu/420/420-322/420-322_pdf.pdf

For More Information:

Penn State University Vegetation Management Publications:
http://horticulture.psu.edu/research/labs/vegetative-management/publications

Invasive Plants in Pennsylvania

Yellow Flag Iris

Iris pseudacorus L.

Photo: Nancy Loewenstein, Auburn University, www.invasive.org

Background:

This showy flower was originally used as an ornamental wetland plant, but was also promoted for erosion control and to remove metals and nutrients from sewage treatment plant effluent.

Range:

Originally from Europe, western Asia and northern Africa, this plant is now reported throughout the east, Midwest, south and west coast of the U.S.

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Description:

An herbaceous perennial that grows to a height of three to four feet. The leaves grow to a length of one to three feet and are green with a grayish-blue tint. Flowers are usually yellow, although they may also be cream-colored.

Habitat:

This plant can survive a wide range of conditions, from fresh to brackish water and even low oxygen habitats. Wetlands, stream banks, ponds and ditches are places you may see this plant. Yellow iris tolerates high soil acidity and needs high levels of nitrogen for optimum growth.

Map courtesy of http://plants.usda.gov

Biology and Spread:

Each fruit capsule contains roughly 120 seeds (*top image*) that are buoyant and can float long distances in water. The plant can also spread vegetatively through pieces of its rhizome/roots (*bottom image*).

Photo: Steve Hurst, USDA, www.invasive.org

Photo: Leslie Mehrhoff, U. of Connecticut, ww.invasive.org

Ecological Threat:

Widely planted as a pond ornamental in the past, this plant has escaped cultivation. It can form dense colonies in fresh or brackish water, altering habitat and displacing native plant and animal species. All parts of the plant are poisonous.

Photo: Jessica Sprajcar, DCNR

How to Control this Species:

Manual

Be careful when removing by hand: resin from the leaves and roots of this plant can cause skin irritation.

At a minimum, remove seed pods and flowers to help slow this plant's spread.

Small infestations can be dug up but the entire rhizome system must be removed or the plants will return. Limit soil disturbance as much as possible.

Chemical

For most large-scale infestations, some form of herbicide will be needed. Several readily available herbicides can be effectively used to treat this plant, including a glyphosate that is labeled for use in wetland habitats.

Because of the extensive root system, multiple applications of herbicide over multiple years will probably be needed for eradication.

Always follow all of the herbicide label's instructions and state requirements.

Native Alternatives:

These plants are native to the northeast and don't have invasive tendencies.

Blue flag iris, *Iris versicolor*

Photo: Judy Slater, www.forestryimages.org

Swamp rose mallow, *Hibiscus moscheutos*

Photo: North Carolina DOT

Blue vervain, *Verbena hastata*

Photo: Jessica Sprajcar, DCNR

References:

USDA Forest Service, Forest Health Staff: Weed of the Week: http://www.na.fs.fed.us/fhp/invasive_plants

Oregon State University Extension Service: http://extension.oregonstate.edu/gardening/node/1008

Photo: Nancy Loewenstein, Auburn University, www.invasive.org

For More Information:

DCNR Invasive Species Site: http://www.dcnr.state.pa.us/conservationscience/invasivespecies/index.htm

Plant Invaders of Mid-Atlantic Natural Areas, National Park Service: http://www.nps.gov/plants/alien/pubs/midatlantic/midatlantic.pdf

Invasive Plants Field and Reference Guide, U.S. Forest Service: http://na.fs.fed.us/pubs/misc/ip/ip_field_guide.pdf

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ATTACHMENT M10

SOIL PROTECTION AND SUBSOIL DECOMPACTION MITIGATION PLAN

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TABLE OF CONTENTS

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

The Soil Protection and Subsoil Decompaction Mitigation Plan ("SPSDM Plan") outlines the special soil protection and subsoil mitigation measures and best management practices ("BMPs") to be employed by Tennessee during construction of the Project on agricultural and residential properties. The Project's on-site Environmental Inspector ("EI") is responsible for ensuring that Tennessee's construction contractor ("Contractor") implements the measures and procedures outlined in this SPSDM Plan. The responsibilities of these inspectors are described in Tennessee's Upland Erosion Control, Revegetation and Maintenance Plan (Attachment M14) and Tennessee's Wetland and Waterbody Construction and Mitigation Procedures (Attachment M15).

2.0 OVERVIEW OF PROCEDURES

This section provides and overview of the soil protection and subsoil mitigation measures and BMPs to be employed by Tennessee during construction of the Project on agricultural and residential properties.

2.1 AGENCY COORDINATION

During Project planning, construction, restoration, and monitoring; agency coordination will be conducted to allow for effective communication and to properly prepare and implement this SPSDM Plan for the mitigation of adverse impacts to soils. Tennessee's agency coordination will include:

- Continue to coordinate with the appropriate agencies regarding:
  - Drain tile and irrigation systems;
  - Grazing deferment; and
  - Soils.
- Obtain written recommendations from the County Conservation District ("CCD") regarding erosion control and revegetation specifications, both temporary and permanent:

- Incorporate recommendations from these or other applicable regulatory agencies for erosion control and revegetation specifications into New Hampshire's Environmental Construction Plan ("ECP"); and

2.2 TOPSOIL SEGREGATION

- Topsoil segregation will be performed in all agricultural and residential[1] areas, including:
  - Annually cultivated or rotated agricultural lands or developed improved pasture lands;
  - Hayfields; and
  - Land enrolled in U.S. Department of Agriculture ("USDA") Conservation Reserve Program ("CRP") and maintained for return to tillable use, and other areas at the landowners request.
- Tennessee will prevent mixing of topsoil with subsoil in agricultural lands by removing and segregating topsoil from the full work area to a maximum depth of 12 inches, as determined by the EI.
- In deep agricultural soils (more than 12 inches of topsoil), Tennessee will segregate the topsoil to a minimum depth of 12 inches.
- Segregate topsoil from over the trench on stream banks and wetlands (unless they are saturated or inundated) to facilitate re-stabilization at stream crossings.

2.3 DRAIN TILES

All drainage tiles encountered will be marked, maintained during construction, and restored or replaced to existing or better condition upon completion of construction, in consultation with landowner. Tiles will be referenced and flagged with stakes located adjacent to the trench and the temporary construction right-of-way ("ROW") edges (outer perimeter).

Additional details regarding drain tile maintenance, repair, and replacement are provided in Sections 4.0 and 5.0 of New Hampshire's ECP. All drain tile replacement pipes that consist of plastic will conform to the AASHTO M.242 specification.

2.4 SOIL COMPACTION MITIGATION

Subsoil compaction of agricultural lands, and severely compacted residential areas, will be relieved in two phases. First, the subsoil will be deep-ripped at times of appropriately low soil moisture, with uplifted stone removal, using standard rock-picking equipment, prior to replacement of the segregated topsoil. Following topsoil replacement, a second phase of decompaction will occur that utilizes Paratill® deep sub-soiling and supplemental excess stone removal from the ROW, including from the topsoil storage area.

[1] In residential areas, topsoil replacement (i.e., importation of topsoil) is an acceptable alternative to topsoil segregation.

3.0 DETAILED PROCEDURES

3.1 TOPSOIL SEGREGATION

- Use topsoil segregation methods in the following areas:
  - Residential;
  - Annually cultivated or rotated agricultural lands;
  - Hayfields, improved pastures[2]; and
  - Other areas at the landowners' request.
- Prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or the trench and subsoil storage area and limit excavating, spoil stockpiling, and traffic/equipment to only the area stripped of topsoil. Note: Less than the full available width of construction ROW may be used if the topsoil and subsoil are segregated and all traffic/equipment and subsoil storage are able to fit within the area stripped of topsoil.
- Stockpile both the spoil and topsoil in a manner that prevents pooling of water behind the soil piles (i.e., prevents excessive saturation of the soil). This will be accomplished by leaving a gap between soil piles to allow water travel around the piles and across the ROW.
- In deep agricultural soils (more than 12 inches of topsoil) segregate the topsoil to a minimum depth of 12 inches. In soils with less than 12 inches of topsoil the entire topsoil layer and 1 to 2 inches of friable subsoil will be segregated.
- At stream crossings, only segregate topsoil from the pipe trench on stream banks to facilitate re-stabilization. The remainder of the actual bank will not be disturbed. Agricultural topsoil stripping will proceed out to the field's fringe, near, but not beyond, the edge of the stream's riparian strip.

3.2 SOIL COMPACTION MITIGATION: TWO PHASES

3.2.1 First Phase: Deep-ripping the Exposed Subsoil

The Contractor will deep-rip the exposed construction surface subsoil with deep tillage devices such as a heavy duty ripping chisel or ripping chisel-plow (e.g., V-frame or straight-frame ripper; or a heavy duty Paratill®) in all agricultural sections of the ROW where topsoil is stripped.

The subsoil will be thoroughly deep-ripped and rock picked prior to the replacement of segregated topsoil. The subsoil will be deep-ripped to a depth of 18 to 22 inches.

Note: Due to the spacing between ripping legs (approximately 24 to 30 inches) a series of staggered, overlapping "parallel rips" will be employed to help ensure thorough breakup of the compacted mass of subsoil material. "Kittering" or a broad "S" series of cross rips will immediately follow for sites where the former "parallel" technique is inadequate for breakup of larger chunks into smaller clods.

[2] Improved pastures: land of generally tillable quality, used predominantly for grazing but largely open (i.e., free of trees, brush, and boulders).

- All stones 4 inches in diameter or greater that are brought to the surface during the decompaction process will be removed from the subsoil area.
- The segregated topsoil will be uniformly replaced, preferably using a light to moderate weight, Low ground pressure ("LGP") wide-track bulldozer.
- All of the first phase deep-ripping and rock picking activities, as well as topsoil replacement and second phase decompaction activities, will be conducted only during periods of relatively low soil moisture (i.e., not in a state of plastic consistency), as verified by the Atterberg field test, to ensure the desired mitigation and prevent additional soil profile compaction. Additional technical details are provided in the Soil Moisture (Workability) section.
- Once the deep-ripping phase begins, further use of the ROW by any construction traffic will be limited.

3.2.2 Second Phase: Following Topsoil Replacement

A Paratill®, or equivalent machinery, that contains a deep angled-leg subsoiler, will be used within the ROW so the soil profile will be loosened to a depth of 20 to 22 inches to achieve the necessary shattering of the subsoil. Paratill®, and equivalent machinery, is designed such that it will not mix topsoil and subsoil during decompaction.

- Deep soil profile shattering, by Paratill® or other approved deep tillage implement, includes the entire width of the temporary construction ROW (i.e., all areas where topsoil was stripped and replaced plus the area where the topsoil berm was stored).
- Deep soil profile shattering tools with angled legs include the 3 to 5 leg Paratill®.
- Alternative deep sub-soiling tools include, but are not limited to, the straight leg Unverferth Zone Builder® with 5 legs or 3 leg parabolic shanks for narrower ROWs or limited horsepower ("hp") tractors, and a heavy duty subsoiler (either straight frame or V-frame). Manufacturers' include, but are not limited to, John Deere® and Brillion®.
- As noted for deep-ripping, at least 40 hp of pull should be available per leg of implement for full depth effectiveness.
- If subsequent construction and restoration activities result in further compaction, additional deep subsoiling of the agricultural soil profile will be performed as needed.

3.3 SUBSOIL PROTECTION (SHALLOW DEPTH TO BEDROCK)

Construction through agricultural soils dominated by a shallow depth to bedrock can result in a significant loss of, or permanent damage to, the subsoil and corresponding damage to the soil profile. The structure and thickness of the thin layer of remaining subsoil over bedrock can be adversely impacted as a result of grading, construction traffic, and trench excavation, as well as backfilling involving bedrock material. The actual need for subsoil protection, as well as the method to be used will be based on site-specific factors including depth to bedrock and the thickness of the subsoil. The measures that will be utilized to help to minimize subsoil damage include:

- Stripping and separately stockpiling the "B" horizon of the ROW up to a depth of 12 inches or to the top of the bedrock, whichever is shallower; or stripping and separately stockpiling the "B" horizon from the full top width of the trench and spoil pile zone;
- Removing excavated bedrock materials from the site at the time of excavation; and
- Backfilling the work trench with imported subsoil material that is approved by the landowner.

3.4 TRENCH CROWNING AND MITIGATION OF TRENCH SETTLING

Ripped or blasted bedrock or concentrated volumes of excavated stone or rock material may be used for trench backfill, prior to trench crowning, in areas of cropland including rotation hayland, permanent hayland, and improved pastureland. However, rock will not be installed closer than 24 inches in mesic soils nor 30 inches in frigid soils from the exposed working construction surface of the ROW. Excess rock not utilized as trench backfill will be hauled away or stock-piled as approved in writing by the landowner.

The remaining backfill materials will consist of suitable subsoil over the rock fill material. Trench crowning will occur during the backfill operation of the construction phase, using subsoil materials over the trench to allow for trench settling. The segregated topsoil will be spread over the entire impacted ROW after the initial ripping of the exposed subsoil and rock cleanup activities have been completed. Imported topsoil will be used to fill depressions in areas where trench settling occurs after initial topsoil spreading. Topsoil from the ROW or adjacent agricultural land will not be used to backfill depressions. Imported topsoil will be used to fill each area where trench settling occurs after the segregated topsoil has been used. Attempts will be made to identify sources of topsoil free of weeds, including soliciting input from landowners of potential sources.

Note: If construction backfilling occurs between early autumn through winter, agricultural restoration will not be initiated until relatively drier soil conditions are present in late spring or early summer. The majority of the trench settling will have occurred by mid-spring, giving the opportunity to compensate for trench settling using surplus, on-site subsoil material immediately before restoration.

3.5 SOIL MOISTURE (WORKABILITY) DURING RESTORATION, COMPACTION TESTING DURING MONITORING AND REMEDIAL ACTION

3.5.1 Soil Moisture

Check the soils for not exceeding friable, workable, moisture content using the following procedures during restoration activities (Atterberg field test for plastic soil consistency):

Exposed construction surface subsoil:

- Take a sample with a soil auger at a depth of 16 inches; and
- Roll the soil (Worm Method) to a diameter of approximately 1/8 inch diameter, and if the soil remains intact, in increments beyond 3/8 inch long, the soil is too wet (or “plastic”). If it breaks (crumbles) apart into 3/8 inch or shorter sections, the moisture content is correct (workable for deep-ripping).

Topsoil stockpile (berm):

- Take samples from vicinity of the berms’ lower outside and inside slopes, 9 inches deep, and from the berms’ inner core (at least 24 inches inside of the berm);

- Administer the same test (worm method) for each individual sample of topsoil material. If all sample tests are acceptable (friable), topsoil replacement may proceed as long as favorable soil conditions remain; and
- If the topsoil is too wet, break open the topsoil stockpile (berm) and rough spread the soil partially across the ROW, allow it to air dry, and then conduct re-tests until it is friable.

3.5.2 Compaction Testing during the Post Restoration Monitoring and Maintenance

Once the moisture of the restored soil profile on the affected ROW is at or near equilibrium with the adjacent off ROW land, soil profile compaction testing will be conducted by Tennessee using an appropriate soil penetrometer or other soil compaction-measuring device in the early spring following the year of initial restoration.

3.5.3 Cone-type Soil Penetrometer

A 0.75-inch-diameter cone, or similar cone-type soil compaction measuring tool, capable of withstanding applications of at least 400 pounds per square inch, gauge ("psig") will be used. When the readings inside the ROW are less than, equal with, or no more than 20 percent greater than the subsoil density readings outside the ROW, the subsoil decompaction/shattering restoration is satisfactory.

3.5.4 Test for Soil Compaction

Readings will be taken at every 3-inch vertical interval from surface to 21 inches, or to the point of resistance (300 psig), through the topsoil and subsoil, across the Project ROW in agricultural and residential areas. These cross-section tests will be conducted at ROW inter-spacing (not to exceed 200 feet) sufficient to determine the need for remedial measures. Tests will be done on the same soil type under the similar moisture conditions and should include the following areas:

- Temporary stockpile areas;
- The trenched zone;
- Soil from undisturbed areas;
- The work area; and
- Any traffic areas related to the Project.

There will be five to eight soil density tests taken from within a 30-inch circle at a sampling site. The single highest and single lowest mechanical samples of the complete soil profile, per test site, will be discounted as anomalies and will not be used in the calculations. The remaining test samples, which are to be recorded in 3-inch increments, are used to calculate the soil profile's average density per 3-inch increment.

The soil profile compaction test results from within the ROW will be compared with those of the adjacent, off-ROW portion of the affected agricultural land to determine the level of decompaction needed. Additional deep shattering will be performed as required based on the soil density profile tests. All deep shattering will be performed in the same manner and under the same conditions as previously noted in this SPSDM Plan.

3.6 GENERAL MONITORING AND REMEDIATION

General ROW conditions to be monitored include topsoil thickness, relative content of rock and large stones, trench settling, crop production, drainage, repair of severed fences, etc. Impacts will be identified through on-site monitoring of all agricultural areas along the ROW and through contact with respective farmland operators, the New Hampshire Department of Agriculture, Markets and Food and CCDs.

Topsoil deficiency and trench settling will be mitigated with imported topsoil that is consistent with the quality of topsoil on the affected site. Excessive amounts of rock and oversized stone material will be determined by a visual inspection of the ROW and periodic probes of the trench area. Results will be compared to portions of the same field located outside of the ROW. Included in the determination of relative rock and large stone content is the ROW's condition subsequent to farm plowing/tillage and the relative concentration of such materials within the ROW as compared to off the ROW.

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Tennessee Gas Pipeline Company, L.L.C.
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ATTACHMENT M11

ORGANIC FARM PROTECTION PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

The Organic Farm Protection Plan ("OFPP") outlines the special procedures and best management practices ("BMPs") to be employed by Tennessee during construction of the Project on identified farms that are organic certified or farms that are in active transition to become organic certified. This OFPP is intended to address the unique management and certification requirements of these organic farm operations. These special procedures may be implemented and used in conjunction with other plans, procedures, and BMPs Tennessee has specified for use on the Project, as applicable.

The provisions of this OFPP will apply to certified organic agricultural land for which the landowner or tenant has provided Tennessee proof of certification for organic farming within the affected property. Tennessee recognizes that certified organic agricultural land is a unique feature on the landscape and will treat this land with the same level of care as other sensitive environmental features.

DEFINITIONS

Terms used in this OFPP have been defined by the National Organic Program Standards ("NOPS"), Federal Regulations (7 Code of Federal Regulations "[CFR"] Part 205), and have the meanings indicated below.

The Act refers to the Organic Foods Production Act of 1990, as amended (7 United States Code ["USC"] 6501 et seq.).

Certifying agent is defined as any entity accredited as a certifying agent for the purpose of certifying a production or handling operation as a certified production or handling operation (7 CFR Part 205.2).

Decertified or decertification is the loss of organic certification (7 CFR Part 205.2).

Organic certified refers to any agricultural product that is sold, labeled, or represented as "100 percent organic," "organic," or "made with organic (ingredients or food group[s])" and must be:

- Produced in accordance with the requirements specified in Section 205.101 or Subsections 205.202 through 205.207 or Subsections 205.236 through 205.240 and all other applicable requirements of Part 205; and

- Handled in accordance with the requirements specified in Section 205.101 or Subsections 205.270 through 205.272 and all other applicable requirements Part 205 (7 CFR Part 205.102).

Certified organic agricultural land consists of any field or farm parcel from which harvested crops are intended to be sold, labeled, or represented as "organic," and must:

- Have been managed in accordance with the provisions of Subsections 205.203 through 205.206;
- Have had no prohibited substances (as listed in Section 205.105) applied to it for a period of 3 years immediately preceding harvest of the crop; and
- Have distinct, defined boundaries and buffer zones, such as runoff diversions, to prevent the unintended application of a prohibited substance to the crop or contact with a prohibited substance applied to adjoining land that is not under organic management (7 CFR Part 205.202).

A list of organic farms crossed by the Project in New Hampshire is included in Table 1.0-1. Tennessee will continue to work with landowners to identify organic farms crossed by the Project in New Hampshire.

Table 1.0-1
Organic Farms Crossed by Pipeline Facilities in New Hampshire

Crop Type	County	Town	Tract Number	Segment[1]	Milepost of Parcel		Approx. Acreage Impacted (acres)	
					Enter	Exit	Construction	Operation
Organic Farm	Cheshire	Rindge	NH WD 168.00	I	25.11	25.18	1.02	0.41

Source: Survey Data.

[1] Each segment is associated with its own set of mileposts (MPs) beginning at MP 0.00.

Organic buffer zone consists of an area located between a certified production operation, or portion of a production operation and an adjacent land area that is not maintained under organic management. A buffer zone must be sufficient in size or other features (e.g., windbreaks or diversion ditches) must be in place to prevent the possibility of unintended contact by prohibited substances applied to adjacent land areas with an area that is part of a certified operation (7 CFR Part 205.2).

Organic System Plan ("OSP") is a plan of management of an organic production or handling operation that has been agreed to by the producer or handler and the certifying agent. The OSP includes written plans concerning all aspects of agricultural production or handling described in the Act and the regulations (7 CFR Part 205.2).

Prohibited substance is defined as a substance use of which is prohibited in any aspect of organic production or handling or not provided for in the Act or the regulations of this part and includes:

- Ash from manure burning;
- Arsenic;

- Calcium chloride - brine is prohibited for use, except as a foliar spray to treat a physiological disorder associated with calcium uptake, in this case the calcium chloride must be from a pure source, not a mixture or by-product;
- Lead salts;
- Potassium chloride - unless derived from a mined source and applied in a manner that minimizes chloride accumulation in the soil;
- Sodium fluoaluminate (mined);
- Sodium nitrate - unless use is restricted to no more than 20 percent of the crop's total nitrogen requirement;
- Strychnine;
- Tobacco dust (nicotine sulfate) (7 CFR Part 205.2 and 205.602); and
- All other substances prohibited in 7 CFR 205.105 (including, but not limited to, any synthetics, genetically engineered seed/crops, sewage sludge, and irradiation.

2.0 ORGANIC SYSTEM PLAN

Tennessee recognizes the importance of the individualized OSP to the organic certification process, understands that OSPs are proprietary in nature, and will respect the need for confidentiality. Tennessee will work with the landowner or tenant, the landowner's or tenant's certifying agent, and/or a mutually acceptable third-party organic consultant to identify site-specific construction measures to minimize the potential for decertification as a result of construction activities. Possible measures may include, but are not limited to:

- Pre- and post-construction equipment cleaning requirements;
- The use of drop cloths and clean-up procedures during welding and coating activities;
- Procedures for topsoil segregation, storage, and restoration;
- The planting of a deep-rooted cover crop in-lieu of mechanical decompaction. Seed used for this planting should be organic, or untreated if organic is not available;
- Providing applications of composted manure or rock phosphate. Rock phosphate must be from a natural source (pure mined);
- Prohibiting tobacco use while working on certified organic agricultural land to prevent the introduction of disease vectors (such as tomato mosaic virus);
- Prohibiting use of prohibited substances, as defined in Section 1.0, within certified agricultural land;
- Maintenance of appropriate organic buffer zones to eliminate drift and runoff of prohibited substances to certified organic agricultural land;
- Restricting use of prohibited substances in organic buffers zones to instances where the use and application of these substances will not result in contact with adjacent certified land (Section 3.0). Use of OMRI Listed® products in organic buffer zones as an alternative where contact with adjacent certified land may be unavoidable;
- Restoration and replacement of beneficial bird and insect habitat;
- The maintenance of organic buffer zones and use of organic seeds approved under the individual OSP for any cover crop;
- Locating access roads in a manner that causes the least amount of disruption to certified land; and
- Placement of fencing (untreated posts only) to prevent organic livestock from accessing the work area; and

- Vehicles, equipment, and materials (including equipment mats) will be inspected for remnant soils, vegetation, and debris, and will be cleaned of these materials before they are brought onto organic farmland. If required, a wash station may be set up outside the organic buffer zone and equipment will be power-washed with clean water (no soaps or chemicals). During dry periods, equipment will be cleaned using blown air.

3.0 PROHIBITED SUBSTANCES

Tennessee will not apply herbicides, pesticides, fertilizers, treated wood, or seed unless requested and approved by the landowner. No fuel or lubricant storage, or routine equipment maintenance will be allowed on certified organic agricultural land. Equipment will be checked by the Environmental Inspector ("EI") prior to entry into the property, and washed if necessary, to ensure that fuel, hydraulic, and lubrication systems are functioning properly before working on certified organic agricultural land. If prohibited substances, as defined in Section 1.0, are to be used on land adjacent to certified organic agricultural land, Tennessee will evaluate field conditions to ensure adequate buffers are maintained.

4.0 SOIL HANDLING, EROSION CONTROL, AND MITIGATION OF NATURAL RESOURCE IMPACTS

During construction, Tennessee's construction contractors ("Contractors") will implement Tennessee's Upland Erosion Control, Revegetation and Maintenance Plan (Attachment M14) and Tennessee's Wetland and Waterbody Construction and Mitigation Procedures (Attachment M15).

Topsoil and subsoil layers that are removed during construction on certified organic agricultural land will be stored separately and replaced in the proper sequence after the pipeline is installed. Unless otherwise specified in the site-specific OSP described above, Tennessee will not use this soil for other purposes. No topsoil or subsoil (other than incidental amounts associated with the movement of construction equipment) may be removed from certified organic agricultural land. Likewise, certified organic agricultural land will not be used for storage of soil from non-organic agricultural land.

On certified organic agricultural land, Tennessee will, to the extent practicable, implement erosion control methods consistent with the landowner or tenant's OSP and the Project ECP. On land adjacent to certified organic agricultural land, Tennessee's BMPs will be designed so that sediment from adjacent non-organic agricultural land will not be transported along the ROW and deposited on certified organic agricultural land. Treated lumber, non-organic hay bales, and non-approved metal fence posts will not be used for erosion control structures on certified organic agricultural land.

5.0 WATER IN TRENCHES AND WEED CONTROL

During construction, Tennessee will install trench plugs (as detailed in the ECP) at the boundaries of certified organic agricultural land to prevent water migration within the trench from adjacent land onto certified organic agricultural land. Likewise, Tennessee will not allow trench dewatering from adjacent land to be discharged or flow onto certified organic agricultural land. Additionally, all trench dewatering operations on certified organic agricultural land will be performed in accordance with Tennessee's ECP.

On certified organic agricultural land, Tennessee will, to the extent practicable, implement weed control methods consistent with the landowner's or tenant's OSP. In the case that all requirements of the OSP cannot be met, Tennessee will implement weed control methods consistent with the NOPS (7 CFR Part 205). Prohibited substances will not be used in weed control on certified organic agricultural land. In addition, Tennessee will not use prohibited substances to promote weed control on land adjacent to certified organic agricultural land in a manner that will potentially compromise the certified organic agricultural land.

6.0 MONITORING

In addition to the responsibilities of the EI described in the ECP, the following monitoring procedures will apply on certified organic agricultural land:

- The Independent Organic Inspectors Association ("IOIA")-trained EI or a USDA-approved organic certifier retained by Tennessee will monitor construction and restoration activities on certified organic agricultural land to ensure compliance with the provisions of this OFPP and will document and identify activities that could potentially result in decertification. Tennessee will pay for the cost of such monitoring;
- Instances of non-compliance will be documented according to the IOIA protocol and will be made available to the New Hampshire Department of Agriculture, Markets and Food ("NHDAMF"), the landowner, the tenant, the landowner's or tenant's certifying agent, and Tennessee; and
- If the EI is responsible for monitoring activities on certified organic agricultural land, he/she will be trained in organic inspection by the IOIA at Tennessee's expense, unless the EI has received such training during the previous 3 years.

7.0 COMPENSATION FOR DAMAGES RESULTING FROM CONSTRUCTION OR DECERTIFICATION

The settlement of damages to certified organic agricultural land will be based on crop yield and the need for additional restoration measures, all in accordance with the terms of the Easement Agreement. Following completion of construction Tennessee will be responsible for the cost of soil sampling, testing, and additional restoration activities, if dictated by the sampling results.

Should any portion of certified organic agricultural land be decertified as a result of construction activities by Tennessee, then Tennessee will be liable for those damages to the landowner or tenant for the duration of the decertification period, so long as a good faith effort is made by the landowner or tenant to regain certification.

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Tennessee Gas Pipeline
Company, L.L.C.
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ATTACHMENT M12

WINTER CONSTRUCTION PLAN

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

Tennessee has developed this Winter Construction Plan ("WCP") to outline the special procedures and best management practices ("BMPs") that will be implemented during the winter season construction period for installation of the Project facilities, should the need for winter construction become necessary. These special procedures and BMPs should be considered additions to the other plans, procedures, and BMPs Tennessee has specified for use on the Project and will be used in conjunction with those plans, procedures, and BMPs, as applicable.

This WCP will be considered to be in effect when any of the following conditions occur:

- The ground is frozen and plating of topsoil occurs;
- Equipment slippage occurs from operating on frozen ground or vehicles risk sliding outside established right-of-way ("ROW") clearing limits;
- Snow becomes too deep to safely conduct construction activities;
- Road crossings cannot be adequately compacted;
- Backfill material freezes to the extent that adequate compaction becomes difficult; and/or
- Topsoil stockpiles are frozen and cannot be uniformly redistributed across disturbed areas or separated from the sub-grade material.

2.0 SNOW MANAGEMENT

If a snow event is followed immediately by a period of melting and runoff, the typical erosion and sedimentation control BMPs specified in Tennessee's Environmental Construction Plans ("ECPs") for stormwater management will apply, and no special measures will be necessary. If a significant (greater than 6 inches) snowfall event occurs and is followed by an extended period of freeze, the following procedures will be implemented:

- Tennessee will minimize snow clearing activities by only clearing in active work areas.
- Plowing equipment used for snow removal operations will be equipped with 6-inch shoes to ensure blades do not remove topsoil or vegetation.
- Snow removal equipment will consist mainly of plowing equipment, such as bulldozers, loaders, utility trucks, dump trucks, or any construction vehicle that can be equipped with a plow and 6-inch shoes, and may include, but is not limited to, other equipment (e.g., snow blowers and hand shovels).
- Snow removal operators will blade no lower than a height sufficient for construction vehicles to safely navigate the ROW.
- Snow removal operators will adjust blade height in areas of slope changes to ensure that contact with the ground is minimized to the greatest extent practicable.
- If practical, snow removed from other parts of the ROW will be stored over the trench line prior to excavation to prevent deep frost penetration along the trench line. Prior to topsoil removal and trenching activities, this snow will be stockpiled within an outer 10-foot strip on the working side of the construction ROW that is reserved for snow storage.
- Alternatively, snow may be removed from the construction ROW and placed adjacent to spoil pile storage. Tennessee will not disturb the ground surface while removing the snow from within the ROW. Tennessee will work with the FERC and individual landowners on a site-specific basis where snow storage adjacent to the ROW is required.
- To permit access to the construction ROW, snow may be cleared from access roads ("ARs") by pushing or throwing the snow to the side of the road. Intersections, driveways, and other private roads will not be blocked by plowed or stockpiled snow. Removed snow will not mix with sidecast stored soils.
- If necessary to improve driving conditions, snow may be bladed level along the travel lane on the construction ROW, rather than removed.
- Snow generally will not be removed from soil storage areas until just prior to backfilling the pipe trench or the replacement of topsoil. Snow that could interfere with trench backfilling operations will be removed to create a safe work area. Care will be taken to avoid mixing of snow and soil during snow removal. Snow may be left on the stored topsoil pile while replacing subsoil to minimize the mixing of the two. A separation will be placed between stored soil piles to further ensure that mixing of subsoil and topsoil does not occur during the snow removal.
- Snow removal equipment will be confined within the limits of the workspace boundaries and ARs; up to 25 feet of additional temporary workspace ("ATWS") adjacent to the temporary workspace ("TWS") boundary may be used as needed and will be identified in compliance with Tennessee's Upland and Erosion Control, Revegetation, and Maintenance Plan ("Plan", Attachment J14).
- Heavy saturated snow may be pushed, lifted, dumped, and stored adjacent to the ROW, provided that equipment stays within the workspace boundaries, property is not damaged or encumbered by the snow, no soil or vegetation is removed, no cultural resources or rare species habitat are adversely impacted, and breaks are left in windrowed piles to allow for drainage and wildlife passage. Tennessee will work with individual landowners on a site-specific basis where snow storage adjacent to the ROW is required.
- In heavy snow, or in areas of significant snow drifts, snow may be stockpiled off the ROW using equipment mounted to construction vehicles within the ROW limits.
- Snow and ice will be removed from inside the pipe joints prior to alignment and welding.

3.0 FROZEN SOIL HANDLING

In warm weather conditions, all construction activities (topsoil removal and segregation, grading, trenching, pipe installation, backfilling, restoration, and clean-up) will be conducted in accordance with Tennessee's Upland Erosion Control Revegetation and Maintenance Plan ("Plan", Attachment M14) and Wetland and Waterbody Crossing Construction and Mitigation Procedures ("Procedures", Attachment M15) and Tennessee's ECPs, as appropriate. The following alternative methods will be implemented in frozen or partially frozen soil conditions, defined as the presence of frozen soils to a depth of 2 inches, or more, below the surface:

- Frozen topsoil stripping activities will be limited to the equipment capable of accurately stripping variable depths of topsoil; rippers mounted on a machine may be necessary to achieve depth penetration. If segregation of subsoil and topsoil cannot be accomplished without mixing, the topsoil salvage operation will cease until soil conditions improve and segregation requirements can be met.
- Tennessee will minimize the amount of open trench to reduce the amount of snow that will have to be removed.
- Tennessee will install highly visible construction fence around any open trenches in areas where the pipeline intersects known paths used for snowmobiling, hiking, or other activities.
- Where topsoil or soil stockpiles remain in place during the winter, breaks in the stockpiles at drainage crossings will be created to allow runoff and snowmelt to be diverted off the ROW. In areas where sites are not cleaned up by October 15, mulch or other methods of topsoil conservation, as described in Section 5.20 of the ECP, will be used to prevent loss of topsoil during the winter and throughout the spring melt. If requested by landowners, these stockpiles will be marked with high-visibility poles to alert snowmobilers and others of their presence.
- The Environmental Inspector ("EI") will suspend final clean-up activities and topsoil placement if topsoil cannot be evenly distributed. If the topsoil is frozen, the topsoil will be spread and allowed to thaw in the sun. Frozen topsoil will not be returned to the ROW if it cannot be graded evenly.
- If topsoil placement is suspended due to frozen conditions, normal temporary ROW stabilization procedures will be applied as ground conditions permit. The final clean-up schedule will vary, depending on ground conditions and time of construction. Where final clean-up and restoration have not been completed, the ROW will be left in a roughened condition to reduce the potential for erosion during snowmelt. In upland areas, a slight crown may be left over the pipeline to account for settling as backfilled soils thaw.
- To reduce the possibility of the trench spoil freezing, and if practicable, Tennessee's construction Contractor ("Contractor") may choose to excavate the trench after the pipeline has been welded.
- Prior to backfilling, frozen stockpiled subsoil will be skimmed to remove the frozen surface layer and expose unfrozen material. The unfrozen material will be used to backfill immediately over the pipeline to prevent damage to the coating of the pipeline.
- Final clean-up will occur once the ground is fully thawed when weather and right of way conditions are favorable, and the topsoil stockpiled over the winter has dried sufficiently. The schedule for final clean-up will be determined based on the specific site conditions and will be conducted in accordance with Tennessee's ECPs.
- The EI may halt work if it is determined that muddy conditions are too severe.

4.0 TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

During construction and prior to any winterization plan being implemented, all temporary and permanent erosion control and stabilization methods will be implemented in accordance with Tennessee's ECPs. Tennessee will monitor erosion control structures and stabilization efforts closely during periods of snowmelt. It is Tennessee's intent that all temporary erosion control measures will be fully operational for the duration of the winter and will be able to withstand spring thaw and snowmelt periods. Tennessee's EIs will verify that the erosion control measures are appropriate for the weather conditions and are fully functional. The following measures may be implemented during construction:

- Temporary erosion controls will be properly maintained during Project construction and reinstalled, as necessary, until permanent erosion controls are constructed. Erosion control devices will be inspected by the EIs and repaired, as necessary.
- Temporary slope breakers will be installed as described in the Project ECPs. If frozen ground prevents the installation of slope breakers, other erosion control methods will be utilized, and slope breakers will be installed prior to the spring thaw.
- Erosion control devices requiring repair or installation during frozen conditions will be temporarily repaired/constructed using sandbags until conditions dictate that they can be installed as described in the Project ECPs.
- Haybales that can be properly replaced without retrenching, during frozen conditions, will be staked using steel rebar.
- In cultivated lands, temporary slope breakers will be placed across the ROW. Breaks will be installed in snow and topsoil piles where they are intersected by the temporary slope breakers to promote water flow off of the ROW during the spring thaw.
- Appropriate erosion controls, as described in Section 5.18 of the ECP, will be used to stabilize topsoil and subsoil piles. Special care will be taken when installing erosion control measures to account for the volume and direction of flow expected during spring melt and heavy spring rains.
- Mulching will be used to stabilize soil surfaces and on stockpiled topsoil, where appropriate. In cases where significant snow cover exists, EIs will determine whether mulch should be applied. Where required, mulch will be applied in accordance with the ECPs.
- If necessary, temporary bridges and equipment mats may be removed for the winter season and stored within the ROW in an upland storage area. Any crossings remaining in place will be engineered to handle maximum predicted spring runoff flows and will be approved by the applicable regulatory agencies.
- In areas with sensitive fisheries, Tennessee will utilize temporary measures, as described in the ECPs and/or required by the applicable regulatory agency.
- If stream crossings are required outside of the dictated construction windows, prior to any activity, Tennessee will obtain approval from the applicable regulatory agency for each specific crossing.

5.0 LOWERING-IN AND BACKFILL

The following requirements and/or recommendations will be implemented during lowering-in and backfilling activities during the winter season:

- Prior to lowering-in of the pipe, the pipe trench will be cleared of snow to the greatest extent practicable.
- During backfill operations, precautions will be taken to limit the mixing of snow with spoil material, although it is recognized that some mixing of snow and soil is unavoidable during this process.
- The trench will be backfilled with unfrozen soils. If necessary, the first several inches of frozen backfill will be removed from the spoil piles to access unfrozen soils for backfilling. The segregated frozen spoil material, to be used as backfill once thawed, will be stabilized until the soils in the trench have thawed and any settling has occurred. This remaining spoil material will be used as backfill to make up for any settling after the soils in the trench have fully thawed.
- Backfilling activities will follow lowering-in activities immediately to prevent the infill of snow over the lowered-in pipe.

6.0 HYDROSTATIC TESTING/DEWATERING

The following requirements and/or recommendations will be implemented during hydrostatic testing activities that occur during the winter season:

- The temperature of the hydrostatic test water will be monitored continuously at the intake and discharge. The test manifolds will be insulated and a temporary shelter will be constructed around the test area. Portable heaters will be used inside the shelter to prevent the test manifolds from freezing.
- Hydrostatic test water discharge locations will be monitored for icing and effectiveness.
- Hydrostatic test dewatering will be conducted in accordance with Tennessee's ECPs, as appropriate. During the winter season, dewatering structures may need to be sized to handle more volume and may need to be located further away to avoid runoff back toward the trench due to decreased infiltration rates of frozen ground.
- No anti-freeze or additives to reduce the test water's freezing point will be used during hydrostatic testing.

7.0 WINTER AND SPRING INSPECTIONS AND MONITORING

Tennessee's EIs will continue to inspect the condition of erosion control devices on a daily basis during active construction or within 24 hours of a 0.5-inch rain event, if safely accessible and weather permitting, to ensure that the erosion control devices remain in place and are effective. Winter construction monitoring of the ROW will identify the following:

- Erosion control structures requiring maintenance and repair;
- Areas along the ROW with slope instability; and
- Areas where significant levels of erosion are occurring along the ROW.

Inspectors will pay particular attention to areas with steep slopes, wetlands, waterbody crossings, and sensitive habitats.

The Contractor will attempt to complete repairs of damaged erosion control devices at the end of each working day. Tennessee will stockpile erosion control materials within designated staging areas during the winter season to ensure they are available for installation and repairs.

Site inspections will be completed in accordance with the Project ECPs. Tennessee will prepare weekly status reports for areas undergoing winter construction, as well as for previously disturbed areas where no construction is occurring during the winter season. These reports will identify areas where erosion control issues have been identified and corrected, along with areas where final resolution and repair will be deferred until spring due to inaccessibility or the likelihood of more significant damage resulting from attempts to effect repairs.

8.0 SPRING THAW CONDITIONS AND EROSION CONTROL MEASURES

Tennessee may implement the following procedures when working during spring thaw conditions:

- Contractors may use equipment best suited to existing ground conditions (i.e., low ground pressure equipment).
- Contractors may install equipment mats along the travel lane where soils are excessively wet and rutting is occurring to prevent mixing of topsoil and subsoil.
- Contractors may use frost driving measures, such as snow packing, to increase the load bearing capacity of the ground where necessary to remove equipment from the ROW.
- In excessively wet areas, construction activities will be postponed until early morning or evening when the ground is frozen.
- Equipment mats or geotextiles may be installed in excessively wet areas, as needed, to minimize rutting.
- Runoff water will be controlled by implementing Tennessee's ECPs.
- Erosion control measures will be inspected and repaired in accordance with the ECPs.
- Work will be suspended by the EI if it is determined that the area is excessively wet and rutting is occurring.

9.0 TRAINING AND REPORTING

Tennessee will conduct safety and specialized training for its EIs and general environmental awareness training for construction personnel and Contractors regarding proper field implementation of Tennessee's Plan and Procedures, the ECPs, regulatory conditions, and other restoration and mitigation measures. Tennessee will include copies of permits and related drawings in the Environmental Permit Package. Tennessee's Operation and Maintenance Plan will include copies of pertinent permits, with particular reference to long-term permit conditions.

Tennessee will be preparing weekly status reports regarding Project activities for submittal to FERC and other agencies for the duration of the Project, or as required by the FERC. Tennessee will include discussions of winter construction activities in the weekly FERC status reports to keep all involved agencies informed about the progress of winter construction activities, other winter ROW issues, and any corrective actions taken or scheduled.

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Tennessee Gas Pipeline
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ATTACHMENT M13

GENERAL TRAIL CROSSING PLAN

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LIST OF ACRONYMS and ABBREVIATIONS

Acronym	Full Name
AR	access road
CFR	Code of Federal Regulations
CI	Chief Inspector
Commission or FERC	Federal Energy Regulatory Commission
Crossing Plan	General Trail Crossing Plan
ECP	Environmental Construction Plan
EI	Environmental Inspector
GIS	Geographic Information Systems
LEI	Lead Environmental Inspector
MLV	mainline valve
MP	milepost
NED or Project	Northeast Energy Direct
PHMSA	USDOT's Pipeline and Hazardous Materials Safety Administration
ROW	right-of-way
Tennessee or TGP	Tennessee Gas Pipeline Company, L.L.C.
TWS	temporary workspace
U.S.	United States
USDOT	U.S. Department of Transportation

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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee" or "TGP") is filing an application seeking the issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the proposed Northeast Energy Direct Project ("NED Project" or "Project"). Tennessee proposes to expand and modify its existing pipeline system in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. The NED Project is being developed to meet the increased demand in the Northeast United States ("U.S.") for transportation capacity of natural gas.

The proposed Project will include construction of approximately 420 miles of pipeline (new pipeline, looping pipeline segments, and laterals) in Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut. Additionally, as part of the Project, Tennessee proposes to construct new compressor and meter stations and modify existing compressor and meter stations along its proposed and existing pipeline system. There will also be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

The Project proposes 14 trail crossings in the state of New Hampshire, including 5 hiking trails and 9 rail trails. Some trails are crossed more than once. All trails are detailed in Table 1.0-1 and on Figure 1-1, Trails Crossed by the Project in New Hampshire (Attachment A).

Tennessee has developed the following General Trail Crossing Plan ("Crossing Plan") in support of Tennessee's application for a certificate of public convenience and necessity from the FERC for the Project, as well as other federal and state permit approvals and authorizations. Additionally, this Crossing Plan serves to establish protocols to protect trail recreational users during construction and avoid or minimize impacts to preserve the integrity of the trails and the user experience. The purpose of this Crossing Plan is to:

- Minimize adverse effects to hiking trails and the environment;
- Maintain the trail experience for hikers to the extent practicable;
- Maintain the safety of hikers during construction; and
- Facilitate coordination with stakeholders throughout the regulatory process.

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Table 1.0-1
Trails Crossed by the Project in New Hampshire

Facility Name	County	Segment[1]	Nearest Milepost	Name of Area	Land Ownership/ Management	Existing Land Uses Crossed[2,3]	Direction from Pipeline	Distance from Pipeline[4] (ft)	Crossing Length (ft)	Area Affected (acres)[5,6]	
										Construction	Operation
Wright to Dracut Pipeline Segment	Cheshire	I	13.52	Cheshire Rail Trail	Monadnock Sno-Moles	UF, OL/ROW	Crossed by Pipeline	0	20	0.05	0.02
Wright to Dracut Pipeline Segment	Cheshire	I	22.86	Monadnock Rail Trail	Monadnock Sno-Moles	PFO	Crossed by Pipeline	0	20	0.04	0.02
Wright to Dracut Pipeline Segment	Hillsborough	J	1.49	Wapack Trail	Friends of the Wapack	UF, OL/ROW	Crossed by Pipeline	0	20	0.05	0.03
Wright to Dracut Pipeline Segment	Hillsborough	J	2.16	Wapack Trail	Friends of the Wapack	UF, OL/ROW	Crossed by Pipeline	0	20	0.26	0.03
Wright to Dracut Pipeline Segment	Hillsborough	J	2.68	Wapack Trail	Friends of the Wapack	UF, OL/ROW	Crossed by Pipeline	0	20	0.08	0.03
Wright to Dracut Pipeline Segment	Hillsborough	J	2.72	Wapack Trail	Friends of the Wapack	UF, OL/ROW	Crossed by Pipeline	0	20	0.05	0.02
Wright to Dracut Pipeline Segment	Hillsborough	J	2.79	Kidder Mtn Trail	Friends of the Wapack	UF, OL/ROW, PSS	Crossed by Pipeline	0	20	0.10	0.08
Wright to Dracut Pipeline Segment	Hillsborough	J	7.48	Greenville-Mason Rail Trail	Town of Mason	UF, OL/ROW	Crossed by Pipeline	0	20	0.07	0.03
Wright to Dracut Pipeline Segment	Hillsborough	J	7.74	Greenville Recreational Rail Trail	New Hampshire Parks and Recreation	N/A	NE	529	0	0.00	0.00
Wright to Dracut Pipeline Segment	Hillsborough	J	9.63	Mason Railroad Bed Trail	Town of Mason	UF, OL/ROW, RD, PFO	Crossed by Pipeline	0	773	2.23	0.89
Wright to Dracut Pipeline Segment	Hillsborough	J	9.76	Greenville-Mason Rail Trail	Town of Mason	UF, OL/ROW	Crossed by Pipeline	0	20	0.11	0.03
Wright to Dracut Pipeline Segment	Hillsborough	J	14.98	Granite Town Rail Trail	Town of Milford	UF, OL/ROW	Crossed by Pipeline	0	20	0.05	0.03

Table 1.0-1
Trails Crossed by the Project in New Hampshire

Facility Name	County	Segment[1]	Nearest Milepost	Name of Area	Land Ownership/ Management	Existing Land Uses Crossed[2,3]	Direction from Pipeline	Distance from Pipeline[4] (ft)	Crossing Length (ft)	Area Affected (acres)[5,6]	
										Construction	Operation
Haverhill Lateral	Rockingham	P	7.39	Salem Rail Trail	Friends of the Salem Bike-Ped Corridor	ROW, UF,OL/ROW, RD	Crossed by Pipeline	0	20	0.43	0.15
Fitchburg Lateral Extension	Hillsborough	Q	4.52	Mason Railroad Trail	Town of Mason	WB/OW	Crossed by Pipeline	0	20	0.04	0.03
									Total	**3.54**	**1.38**

Source: Based on data collected during field surveys in 2014 and 2015, available state-level landuse-landcover Geographic Information Systems ("GIS") data, and interpretation of aerial photography.

[1] Each segment is associated with its own set of mileposts ("MPs") beginning at MP 0.00.
[2] Land use is provided only for federal and state and recreational lands impacted by the project.
[3] RD = Roadways/Railroads; RE = Residential; UF = Upland Forest; CI = Commercial/Industrial; OL/ROW= Open Land; PEM/PFO/PSS = Wetland; AG = Agricultural; WB/OW= Waterbody; OTHER = Special Land Use; WETLAND = wetland type not classified by NWI as PEM, PSS, or PFO.
[4] Distance from pipeline is the shortest distance from the nearest edge of applicable property boundary to the pipeline; a value of 0 ft indicates that the pipeline traverses the land.
[5] For area affected, all trails crossed by the pipeline were assumed to have a width of 20 ft for quantifying impacts.
[6] This table quantifies federal and state recreational land impacts for the construction and operation of the pipeline facilities. This includes workspace for the pipeline, cathodic protection along the pipeline, hydrostatic testing for the pipeline, and meter/compressor stations along the pipeline. This does not include workspace for access roads ("ARs") or contractor yards, or facilities (meter and compressor stations) located on an existing TGP pipeline.

1.1 REQUIRED PERMITS

Tennessee will obtain all necessary permits, licenses, and clearances relating to the installation of the pipeline through any sites or places that require a governmental license or permit. Tennessee will include copies of relevant environmental permit approvals and conditions in the construction bid packages and contracts.

The construction Contractor ("Contractor") will be required to comply with all permits and licenses obtained by Tennessee and comply with all the requirements related to the construction of the Project, as well as restoration of any areas disturbed by the construction of the Project. Table 1.1-1 includes a list of approvals required by federal, state, and local agencies for the Project facilities in New Hampshire, as well as information relative to the permit/approval status.

Table 1.1-1
Permits, Licenses, Approvals, and Certificates Required for Construction, Operation, and Maintenance of the Project in New Hampshire

Permit/Approval	Administering Agency	Status
Federal		
Certificate of Public Convenience and Necessity	Federal Energy Regulatory Commission	Certificate application to be submitted in the fourth quarter of 2015
Section 404/Individual Permits Section 10 Permits	U.S. Army Corps of Engineers-Baltimore District	Applications to be submitted in the fourth quarter of 2015
	U.S. Army Corps of Engineers-New York District	
	U.S. Army Corps of Engineers-Buffalo District	
	U.S. Army Corps of Engineers-New England District	
Endangered Species Act Section 7 Clearance, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act	U.S. Fish and Wildlife-Pennsylvania Field Office	Consultations in Progress
	U.S. Fish and Wildlife-New York Field Office	
	U.S. Fish and Wildlife-New England Field Office	
National Oceanic and Atmospheric Administration	Northeast Region	Consultation in Progress
Right-of-Way Grant Temporary Use Permit	U.S. Department of Interior-Bureau of Land Management	Application(s) to be submitted in the fourth quarter of 2015 (if necessary)

Table 1.1-1
Permits, Licenses, Approvals, and Certificates Required for Construction, Operation, and Maintenance of the Project in New Hampshire

Permit/Approval	Administering Agency	Status
New Hampshire		
New Hampshire Site Evaluation Committee	New Hampshire Certificate of Site and Facility	Application to be submitted in the first quarter of 2016
Clean Water Act 401 Water Quality Certificate	New Hampshire Department of Environmental Services-Watershed Management	Application to be submitted in the fourth quarter of 2015
Dredge and Fill Permit	New Hampshire Department of Environmental Services-Wetlands Bureau	Application to be submitted in the first quarter of 2016
Shoreland Permit	New Hampshire Department of Environmental Services-Wetlands Bureau	Application to be submitted in the first quarter of 2016
Air Emissions Permit	New Hampshire Department of Environmental Services- Air Resources Division	Application to be submitted in the fourth quarter of 2015
State Species Consultations	New Hampshire Department of Environmental Services- Natural Heritage Bureau	Consultations in Progress
	New Hampshire Fish and Game Department	
Section 106, National Historic Preservation Act Consultation	New Hampshire Division of Historical Resources	Consultations in Progress
National Pollutant Discharge Elimination System (“NPDES”) Construction General Permit	U.S. Environmental Protection Agency	Application to be submitted in the fourth quarter of 2016
Water Withdrawal and Discharge	New Hampshire Department of Environmental Services-Watershed Management	Will be covered under 401 application with withdrawal and discharge
Alteration of Terrain	New Hampshire Department of Environmental Services-Alteration of Terrain	Application to be submitted in the first quarter of 2016
Highway Crossing Permits	New Hampshire Department of Transportation	Applications to be submitted in the first quarter of 2016
Local Blasting and Road Crossing Permits	Local DPW	Applications to be submitted in the first quarter of 2016

2.0 GENERAL TRAIL CONSTRUCTION PLAN

This section details specific plans for crossing hiking trails, which includes notifications and coordination with any trail partners, trail specific construction procedures, restoration, revegetation and monitoring procedures, as well as operation and maintenance of the ROW. Tennessee's general construction procedures, including those for clearing, grading, fencing, erosion and sediment control, construction methods, restoration, revegetation, monitoring, and operation and maintenance, are outlined in the ECP.

2.1 NOTIFICATIONS AND COORDINATION WITH TRAIL PARTNERS

2.1.1 Pre-Construction Notification

Tennessee will notify landowners prior to the anticipated start of construction, or any planned surface disturbing activities, at hiking trail crossings. Tennessee considers the landowner as the primary contact and the landowner will facilitate notification with any additional trail partners.

2.1.2 Construction Status Reports

During active construction of the Project, Tennessee will be required to submit a weekly status report to the FERC, prepared by Tennessee's Lead Environmental Inspector ("LEI"). Tennessee will provide the status reports until restoration and initial permanent seeding/planting is completed for the Project.

2.1.3 Coordination with Landowners, Inspection, and Issue Resolution

Tennessee will provide relevant contact information for the Environmental Inspector ("EI") and Chief Inspector ("CI") on the Project, who will have day-to-day knowledge of schedule, construction status and compliance with the Crossing Plan. Any landowner or trail partner wishing to access the site for inspection or any other activities will need to receive Tennessee's mandatory Project Safety and Environmental Awareness Training.

Tennessee's Environmental Project Manager or designated individual will be the primary point of contact with the trail landowners. In the event an issue arises while constructing along any trails, the landowner will be contacted by the Environmental Project Manager or the LEI to resolve the issue in a timely manner.

2.2 TRAIL SPECIFIC PROCEDURES

2.2.1 Safety Procedures and Access for Trail Visitors

Tennessee recognizes that hiking trails in New Hampshire are highly utilized by the public for recreational purposes. As a result, Tennessee will minimize disruption to trail use by maintaining access during construction to the extent practicable. Based on the construction activity, Tennessee will utilize the methods detailed below for maintaining access to all trails:

- Unescorted – During site preparation, periods of inactivity and post-construction monitoring activities, Tennessee will utilize signs and construction exclusion fencing to demarcate any trails and allow safe, unescorted passage through the work area; and

- Escorted – During construction activities utilizing heavy equipment operation, Tennessee will require hikers to be escorted through the work area by safety personnel.
- Alternative Route – When available, Tennessee will temporarily divert hiker traffic to available public looping trails as an alternate route during discrete periods or during construction activities utilizing heavy equipment operation.

Table 2.2-1 summarizes Tennessee's specific construction activities in chronological order and their respective trail access methods. Timing of construction activities is discussed in further detail in Section 2.2.3.

Table 2.2-1
Summary of Construction Activities and Access Methods At Trail Crossings

Activity[1]	Activity Type	Access Method	Approximate Duration
Surveying and flagging of limit of construction	Site preparation	Unescorted	Not applicable
Installation of construction exclusion fencing along the trails	Site preparation	Unescorted	Not applicable
Installation of signs identifying upcoming construction activities	Site preparation	Unescorted	Not applicable
Tree Felling	Discrete period	Escorted	1 day
Tree and vegetation clearing of workspace[2]	Discrete period	Escorted	1-day
Installation of erosion control devices	Site preparation	Unescorted	Not applicable
Grading of workspace[2]	Discrete period	Escorted	1-2 days
Stringing of pipe	General construction	Escorted	1 day
Blasting[2,3]	Discrete period	Escorted	2 days
Trenching up to trails	General construction	Escorted	1 day
Trenching across trails, lowering-in, welding, weld inspection, pipe coating, backfill	Discrete period	Escorted	1-2 days
Restoration of ROW/planting activities	General construction	Escorted	1-2 days
Post-construction monitoring	Post-construction	Unescorted	Not applicable

[1] Activities are listed in a general chronological order, although actual activities may occur out of sequence.
[2] Timing of discrete periods is dependent largely on site conditions encountered at the trail crossing at the start of construction.
[3] Timing of blasting activities may result in a momentary interruption of trail access.

2.2.1.1 Work Area Access

At all trail crossings, construction of the new pipeline facilities will be sequenced to avoid interrupting use of the trails to the extent practicable:

- During site preparation activities and all other periods of inactivity, Tennessee will utilize signs and construction exclusion fencing to demarcate trails and allow safe, unescorted passage of hikers through the work area;
- During construction activities, Tennessee will staff high-traffic trail crossings with safety personnel to inform hikers of the construction and safely escort pedestrian traffic across the construction ROW:
    - If construction activity does not allow for safe passage at a trail crossing, pedestrian traffic will be directed through a cordoned-off area along the edge of the workspace to a crossing of the construction ROW set up a safe distance away;
    - When necessary, construction may momentarily be suspended to allow for safe passage of pedestrian traffic across the construction ROW;
    - If necessary, a temporary crossing of the trench will be installed to allow safe passage across the workspace;
- During post-construction monitoring activities, Tennessee will utilize signs to demarcate all trails and allow safe, unescorted passage through the work area.

2.2.1.2 Safety Concerns

During construction, specific safety requirements will be necessary to maintain safe conditions for the public and construction personnel. These requirements will include measures to notify trail users of the construction activities, protect the public, and allow safe passage across or around the construction ROW. The following safety measures will be maintained throughout the construction process at the trail crossings:

- Appropriate safety/exclusion fencing and signs will be installed across the ROW along the trails prior to the initiation of construction activities at the trail crossings;
- Signs will also be placed along the trails approximately 150 feet in either direction of the construction area;
- Information on the location and duration of the construction will be provided to the landowners such that notices can be posted at trail heads, park headquarters, and published on internet websites, as necessary;
- If blasting activities are required, within and in the vicinity of the trails, Tennessee will establish a 1,000-foot safety zone within which all non-essential personnel, including hikers, will not be permitted during blasting (Attachment M8 to the ECP, Blasting Management Plan):
    - During discrete blasting activities, access to the trails within the work area may be momentarily interrupted. Tennessee will post safety personnel along the trails in each direction to assure that no hikers enter the exclusion zone during blasting activities. To allow for safe passage of pedestrian traffic across the construction ROW, when necessary, hikers may be instructed to wait while blasting activities are momentarily suspended or are completed. Tennessee will avoid interrupting the use of the trails to the extent practicable;

  - Information on the location and duration of blasting will be coordinated closely with landowners on specific time periods when trail access may be temporarily interrupted such that notices can be posted at trail heads, park headquarters, and published on internet websites, as necessary;
- During active construction, safe access and utilization of the trails for visitors during overnight periods or periods of inactivity will be maintained by posting signs and demarcating the trails with construction exclusion fencing and, if necessary, a temporary crossing of the trench;
- Construction areas will be maintained in a sanitary condition at all times; waste materials (including but not limited to human waste, trash, garbage, refuse, oil and petroleum products, and ashes) will be disposed of in accordance with Tennessee's Waste Management Plan (Attachment M4 to the ECP).
- During the crossing of the trails, Tennessee's construction Contractor will store equipment within the construction ROW, in the evenings and potentially during non-working periods. Once construction is complete across the trails and restoration of the land is finalized, all equipment will be removed.
- Alternative trail routes will be clearly signed at the points where the trails intersect on both sides of the construction ROW and the closed trail will be cordoned off with orange construction fence.
- All intersections of ARs and hiking/biking trails will be clearly signed at the point of intersection to allow hikers/bikers safe passage across the access road.

2.3 RESTORATION, RE-VEGETATION AND MONITORING

This section details Tennessee's specific restoration, re-vegetation and monitoring plans, which includes permanent restoration measures, re-vegetation and seeding procedures, and monitoring procedures. Tennessee's general restoration, re-vegetation and monitoring procedures are outlined in the New Hampshire ECP.

Vegetation within the entire width of the operational ROW will be maintained in an herbaceous state. Tree clearing and maintenance within the operational ROW will result in the permanent conversion of upland forest to an herbaceous and low-shrub vegetation cover type within the new operational ROW.

2.3.1 Permanent Restoration Measures

- Final grading will be completed and permanent erosion control measures will be installed within 10 days after backfilling the trench, weather permitting.
- Construction debris will be removed from the ROW and the ROW will be graded so that the soil is left in the proper condition for planting.
- The ROW will be graded to pre-construction contours, as practicable.

2.3.2 Re-vegetation and Seeding

- The ROW will be limed, fertilized, seeded, and mulched in accordance with the specific requirements listed in Tables 10.4-1 through 10.4-3 of the ECP, unless otherwise requested by the landowners.
- Erosion control matting or netting will be applied to slopes steeper than 3:1 to prevent erosion and facilitate germination and revegetation.

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

2.3.3 Restoration Monitoring

- Tennessee will file annual activity reports with the landowners documenting problems at the trail crossings and corrective actions taken for 3 years following construction.
- Tennessee will conduct follow-up inspections during the first three growing seasons after seeding to determine the success of re-vegetation. Re-vegetation will be considered successful if 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, a qualified agronomist will be used to determine the need for additional restoration measures.

3.0 OPERATIONS AND MAINTENANCE

The Project will be owned, operated, and maintained by Tennessee. Tennessee will operate and maintain the newly constructed pipeline facilities in the same manner as it currently operates and maintains its existing interstate pipeline facilities in accordance with the requirements of the Commission, the U.S. Department of Transportations ("USDOT's") Pipeline and Hazardous Materials Safety Administration ("PHMSA") pursuant to 49 Code of Federal Regulations ("CFR") Part 192, and industry-proven practices and techniques.

The facilities will be operated and maintained in a manner that pipeline integrity is protected to ensure that a safe and continuous supply of natural gas reaches its ultimate destination. Maintenance activities will include regularly scheduled gas-leak surveys and measures necessary to repair any potential leaks. The latter may include repair or replacement of pipe segments. All fence posts, signs, marker posts, aerial markers, and decals will be maintained to ensure that the pipeline locations are visible from the air and ground. The pipeline and aboveground facilities will be patrolled on a routine basis, and personnel qualified to perform both emergency and routine maintenance on interstate pipeline facilities will handle maintenance.

The Project facilities will be patrolled on a periodic basis, as are Tennessee's existing facilities. This will provide information on possible leaks, construction activities, erosion, exposed pipe, population density, possible encroachment, and any other potential problems that may affect the safety and operation of the pipeline. In addition, Tennessee is a participant in both the "Dig Safe" system for New Hampshire and the National "811" call system. Under these systems, anyone planning excavation activities must call a dedicated telephone number to alert all utility companies. Representatives of the utility companies that may be affected then visit the site and mark their facilities so that the excavation can proceed with relative certainty as to the location of all underground lines. In addition, Tennessee employs damage prevention personnel responsible for monitoring, inspecting, and assessing all third-party activities near Tennessee's pipeline facilities.

Other maintenance functions will include:

- Periodic seasonal vegetation management of the Project ROW in accordance with the timing restrictions outlined in Tennessee's Project-specific ECPs for each state;

- Terrace repair, backfill replacement, and drain tile repair as necessary;
- Periodic inspection of water crossings; and
- Maintenance of a supply of emergency pipe, leak repair clamps, sleeves, and other equipment needed for repair activities.

Erosion problems on the pipeline ROW will be reported to the local operations supervisor. These reports may originate from landowners or company personnel performing routine patrols. Corrective measures will be conducted as needed.

ATTACHMENT A

Figures

Figure 1-1 Trails Crossed by the Project in New Hampshire

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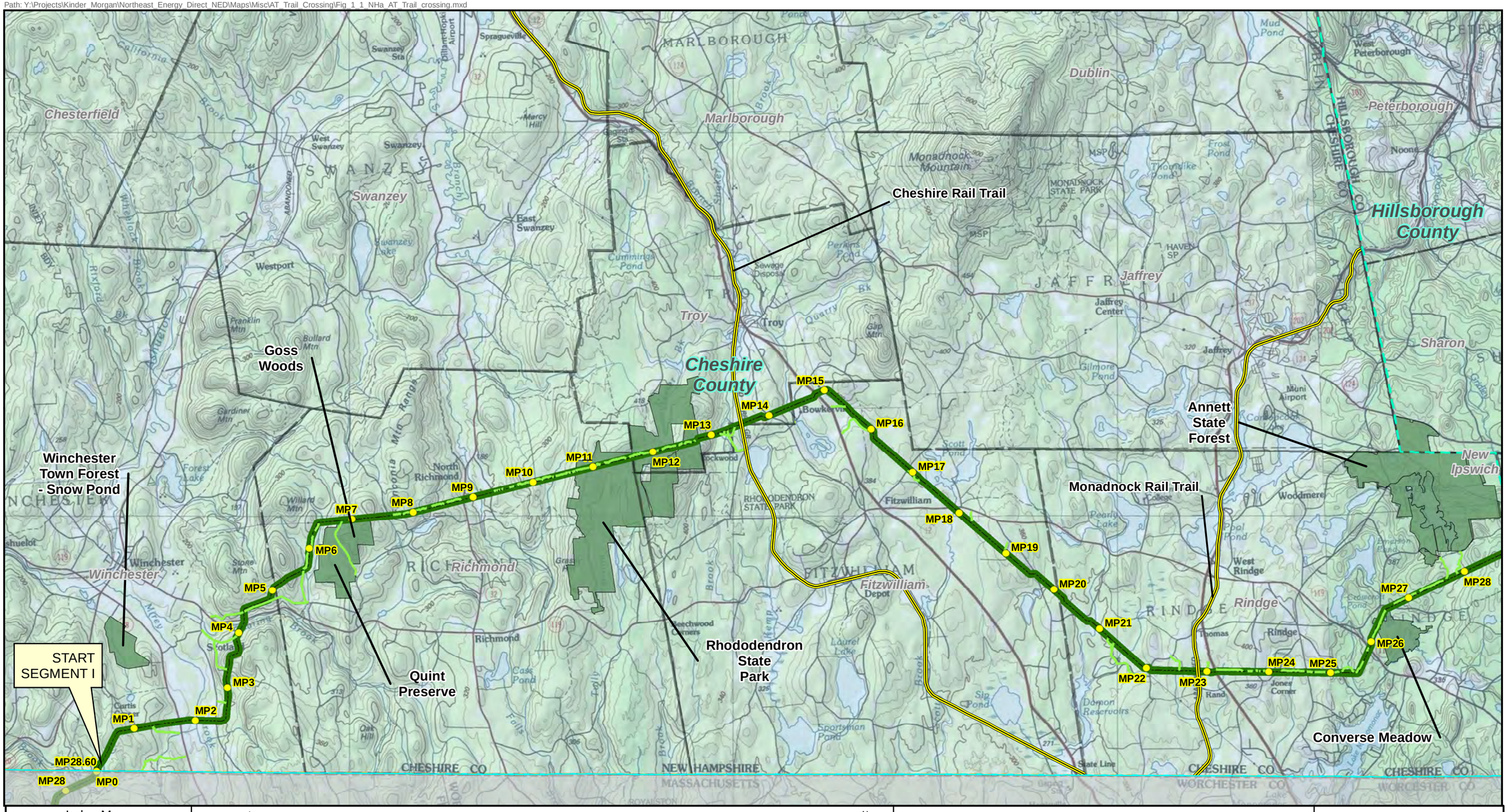

Index Map

Legend

- Milepost (MP)
- NED Wright to Dracut Pipeline Segment
- Access Road
- Compressor Station
- Meter Station
- County Boundary
- State Boundary
- Town Boundary
- Trails
- Federal and State Recreational Lands

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Trails Crossed by the Project in New Hampshire

0 0.5 1 2 Miles

1 inch = 8,000 feet

Tennessee Gas Pipeline Company, L.L.C.
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AECOM

November 2015

FIGURE 1-1A

Map Projection: NAD83 UTM18N Ft.

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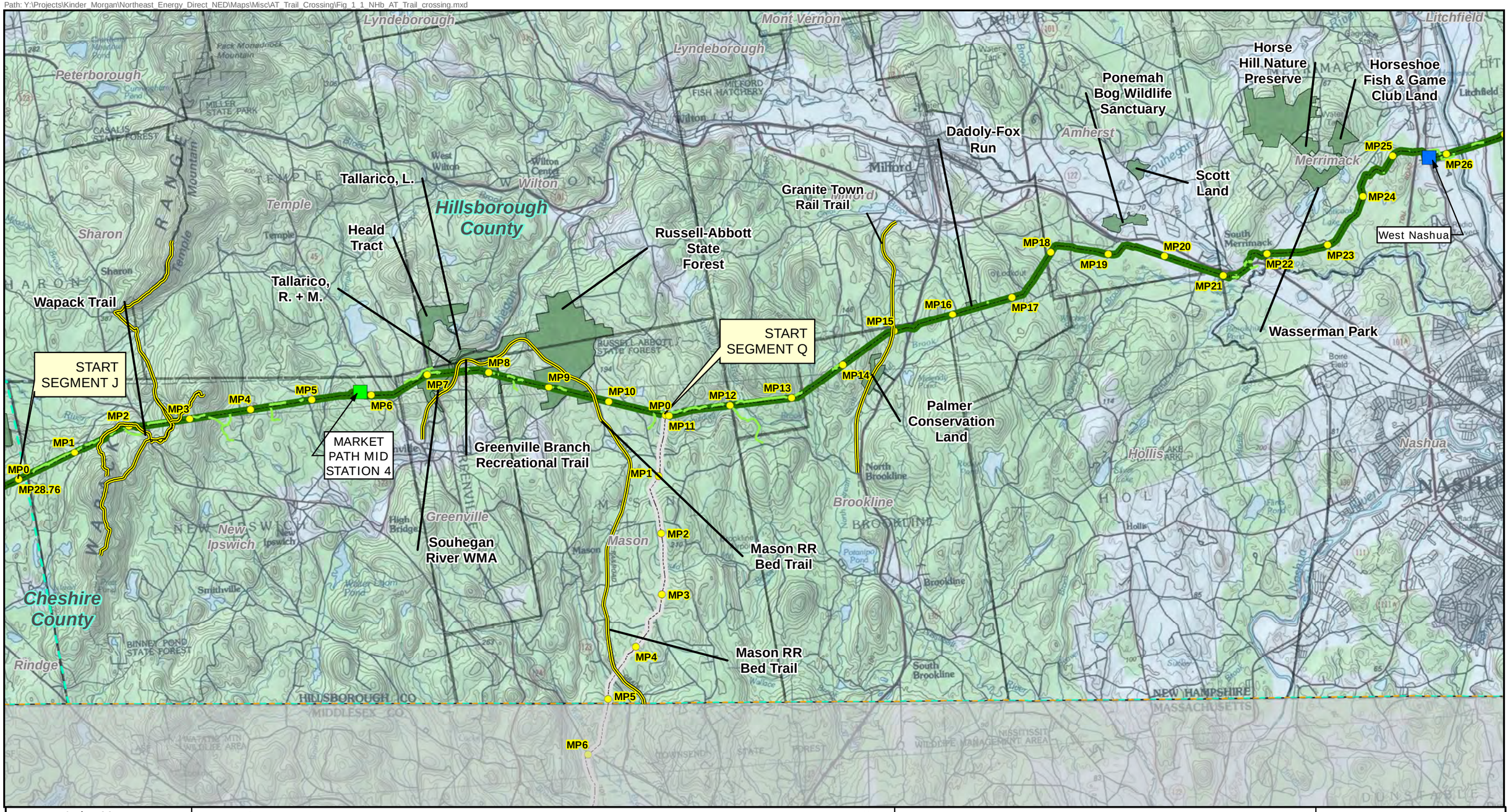

Index Map

Legend

- Milepost (MP)
- NED Wright to Dracut Pipeline Segment
- NED Fitchburg Lateral Extension
- Access Road
- Compressor Station
- Meter Station
- County Boundary
- State Boundary
- Town Boundary
- Trails
- Federal and State Recreational Lands

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Trails Crossed by the Project in New Hampshire

0 0.5 1 2 Miles

1 inch = 8,000 feet

Tennessee Gas Pipeline Company, L.L.C.
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FIGURE 1-1B

Map Projection: NAD83 UTM18N Ft.

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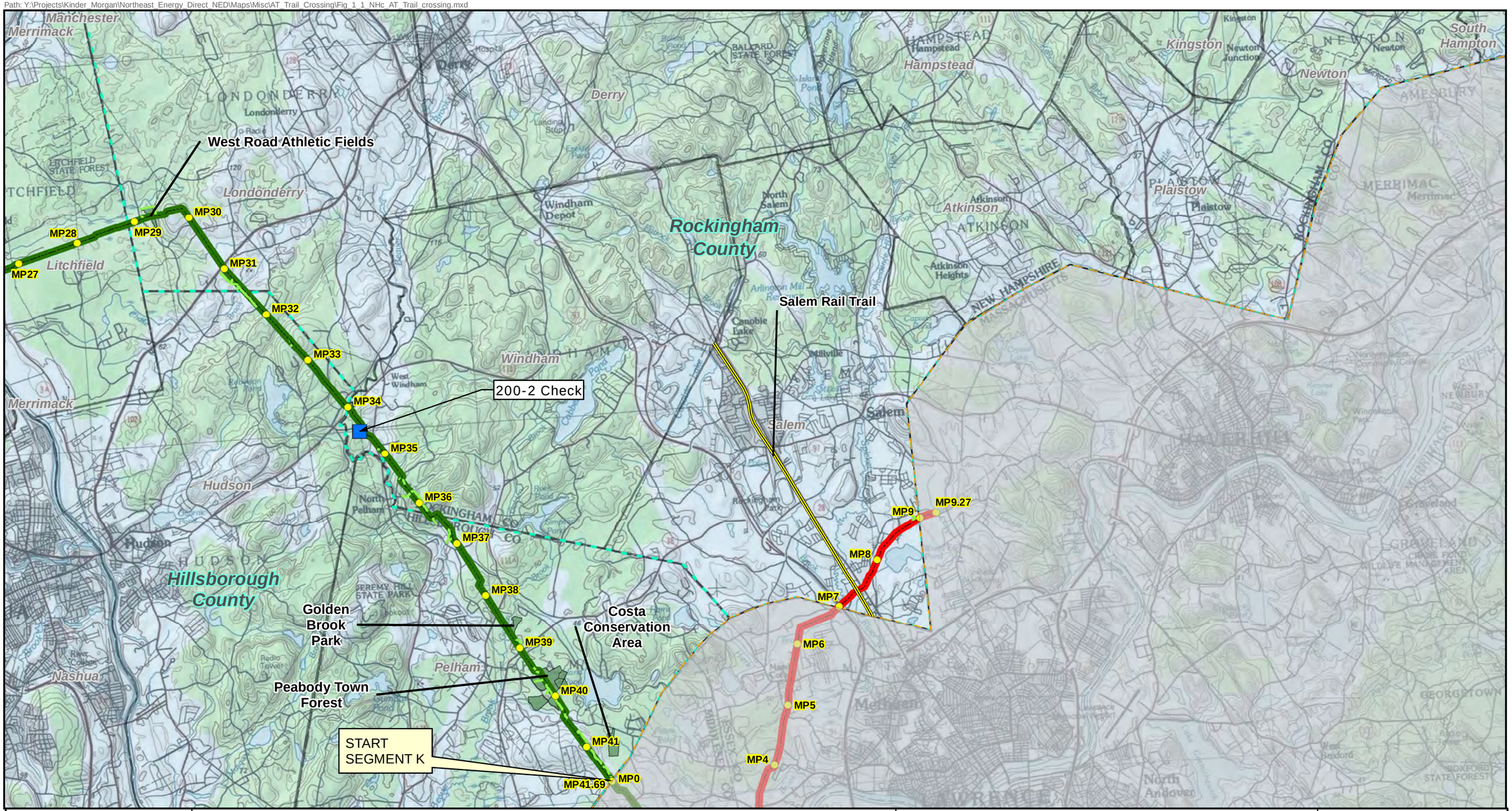

Index Map

Legend

- Milepost (MP)
- NED Wright to Dracut Pipeline Segment
- NED Haverhill Lateral
- Access Road
- Compressor Station
- Meter Station
- County Boundary
- State Boundary
- Town Boundary
- Trails
- Federal and State Recreational Lands

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Trails Crossed by the Project in New Hampshire

0 0.5 1 2 Miles

1 inch = 8,000 feet

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FIGURE 1-1C

Map Projection: NAD83 UTM18N Ft.

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ATTACHMENT M14

TENNESSEE'S UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

November 2015

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Tennessee's Upland Erosion Control, Revegetation, and Maintenance Plan document ("Plan") is based in its entirety on the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation and Maintenance Plan* (May 2013 version) ("Commission's Plan"). Tennessee has identified certain modifications to the provisions of the Commission's Plan and is requesting approval of these modifications, specific to the Northeast Energy Direct Project as part of the Environmental Report submitted for the Project. Justifications for these requested modifications are set forth in Tennessee's Project-Specific Environmental Construction Plans for each state, and are identified in bold text below.

I. APPLICABILITY

A. The intent of this Plan is to assist project sponsors by identifying baseline mitigation measures for minimizing erosion and enhancing revegetation. Project sponsors shall specify in their applications for a new FERC authorization and in prior notice and advance notice filings, any individual measures in this Plan they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in this Plan (or the applicant's approved plan). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. Provides equal or better environmental protection;
2. Is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or
3. Is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on wetland and waterbody systems are addressed in the staff's Wetland and Waterbody Construction and Mitigation Procedures (Procedures).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by section V). The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.
3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the FERC's Orders, stipulations of other environmental permits or approvals, or landowner easement agreements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Inspecting construction activities for compliance with the requirements of this Plan, the Procedures, the environmental conditions of the FERC's Orders, the mitigation measures proposed by the project sponsor (as approved and/or modified by the Order), other environmental permits and approvals, and environmental requirements in landowner easement agreements.
2. Identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;
3. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;
4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;
5. Identifying erosion/sediment control and soil stabilization needs in all areas;
6. Ensuring that the design of slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;
7. Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats; stopping dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and verifying that dewatering structures are removed after completion of dewatering activities;
8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;
9. Advising the Chief Construction Inspector when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;
10. Ensuring restoration of contours and topsoil;
11. Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;
12. Ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats) and onto roads, and determining the need for additional erosion control devices;
13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:
    a. On a daily basis in areas of active construction or equipment operation;
    b. On a weekly basis in areas with no construction or equipment operation; and
    c. Within 24 hours of each 0.5 inch of rainfall;

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;
15. Keeping records of compliance with the environmental conditions of the FERC's Orders, and the mitigation measures proposed by the project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;
16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and
17. Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with section III.E.

III. PRECONSTRUCTION PLANNING

The project sponsor shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way, extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads) that would be needed for safe construction. The project sponsor must ensure that appropriate cultural resources and biological surveys are conducted, as determined necessary by the appropriate federal and state agencies.
2. Project sponsors are encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of authorized work areas.
3. Plan construction sequencing to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into sensitive environmental resource areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.
2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction.
3. Develop procedures for constructing through drain-tiled areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction.
4. Engage qualified drain tile specialists, as needed to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, slash, mats, garbage, drill cuttings and fluids, excess rock) throughout the construction process. Disposal of materials for beneficial reuse must not result in adverse environmental impact and is subject to compliance with all applicable survey, landowner or land management agency approval, and permit requirements.

F. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and/or required by the FERC's Orders.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.
2. Develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.
3. Develop specific procedures in coordination with the appropriate agencies and landowners, as necessary, to allow for livestock and wildlife movement and protection during construction.
4. Develop specific blasting procedures in coordination with the appropriate agencies that address pre- and post-blast inspections; advanced public notification; and mitigation measures for building foundations, groundwater wells, and springs. Use appropriate methods (e.g., blasting mats) to prevent damage to nearby structures and to prevent debris from entering sensitive environmental resource areas.

G. SPILL PREVENTION AND RESPONSE PROCEDURES

The project sponsor shall develop project-specific Spill Prevention and Response Procedures, as specified in section IV of the staff's Procedures. A copy must be filed with the Secretary of the FERC (Secretary) prior to construction and made available in the field on each construction spread. The filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

H. RESIDENTIAL CONSTRUCTION

For all properties with residences located within 50 feet of construction work areas, project sponsors shall: avoid removal of mature trees and landscaping within the construction work area unless necessary for safe operation of construction equipment, or as specified in landowner agreements; fence the edge of the construction work area for a distance of 100 feet on either side of the residence; and restore all lawn areas and landscaping immediately following clean up operations, or as specified in landowner agreements. If seasonal or other weather conditions prevent compliance with these time frames, maintain

and monitor temporary erosion controls (sediment barriers and mulch) until conditions allow completion of restoration.

I. WINTER CONSTRUCTION PLANS

If construction is planned to occur during winter weather conditions, project sponsors shall develop and file a project-specific winter construction plan with the FERC application. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The plan shall address:

1. Winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);
2. Stabilization and monitoring procedures if ground conditions will delay restoration until the following spring (e.g., mulching and erosion controls, inspection and reporting, stormwater control during spring thaw conditions); and
3. Final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction right-of-way, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the FERC's Orders. Any project- related ground disturbing activities outside these areas will require prior Director approval. This requirement does not apply to activities needed to comply with the Plan and Procedures (i.e., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs) or minor field realignments and workspace shifts per landowner needs and requirements that do not affect other landowners or sensitive environmental resource areas. All construction or restoration activities outside of authorized areas are subject to all applicable survey and permit requirements, and landowner easement agreements.
2. The construction right-of-way width for a project shall not exceed 75 feet or that described in the FERC application unless otherwise modified by a FERC Order. However, in limited, non-wetland areas, this construction right-of- way width may be expanded by up to 25 feet without Director approval to accommodate full construction right-of-way topsoil segregation and to ensure safe construction where topographic conditions (e.g., side-slopes) or soil limitations require it. Twenty-five feet of extra construction right-of-way width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

   Project use of these additional limited areas is subject to landowner or land management agency approval and compliance with all applicable survey and permit requirements. When additional areas are used, each one shall be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material shall be included in the reports:

a. The location of each additional area by station number and reference to previously filed alignment sheets, or updated alignment sheets showing the additional areas;
b. Identification of the filing at FERC containing evidence that the additional areas were previously surveyed; and
c. A statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the authorized construction right-of-way width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:
   a. Cultivated or rotated croplands, and managed pastures;
   b. Residential areas;
   c. Hayfields; and
   d. Other areas at the landowner's or land managing agency's request.
2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.
3. Where topsoil segregation is required, the project sponsor must:
   a. Segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil); and
   b. Make every effort to segregate the entire topsoil layer in soils with less than 12 inches of topsoil.
4. Maintain separation of salvaged topsoil and subsoil throughout all construction activities.
5. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.
6. Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.
2. Probe all drainage tile systems within the area of disturbance to check for damage.
3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.
4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.
2. If crushed stone access pads are used in residential or agricultural areas, place the stone on synthetic fabric to facilitate removal.
3. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions. Repair any damages to roadway surfaces, shoulders, and bar ditches.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers
   a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Temporary slope breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

Silt fence, staked hay, straw bales and sandbags will not be used to construct temporary slope breakers in upland areas, as these barriers are not intended to convey concentrated flow, only minimal sheet flow. This provides more appropriate resource protection than the Commission's Plan.

   b. Install temporary slope breakers on all disturbed areas, as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following spacing (closer spacing shall be used if necessary):

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

   c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way.
   d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive environmental resource areas.
2. Temporary Trench Plugs
   Temporary trench plugs are intended to segment a continuous open trench prior to backfill.
   a. Temporary trench plugs may consist of unexcavated portions of the trench, compacted subsoil, sandbags, or some functional equivalent.

b. Position temporary trench plugs, as necessary, to reduce trenchline erosion and minimize the volume and velocity of trench water flow at the base of slopes.

3. Sediment Barriers
   a. Sediment barriers are intended to stop the flow of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive resources.
   b. Sediment barriers may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.
   c. At a minimum, install and maintain temporary sediment barriers across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.
   d. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary to prevent sediment flow into the wetland or waterbody.
4. Mulch
   a. Apply mulch on all slopes (except in cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.
   b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.
   c. Mulch all disturbed upland areas (except cultivated cropland) before seeding if:
      1) Final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in section V.A.1; or
      2) Construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.
   d. If mulching before seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.
   e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).
   f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.
   g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.
   h. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (i.e., temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.
   If construction or restoration unexpectedly continues into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring, file with the Secretary for the review and written approval of the Director, a winter construction plan (as specified in section III.I). This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.
2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section IV.F and inspected and maintained as specified in sections II.B.12 through 14. When access is no longer required the travel lane must be removed and the right-of-way restored.
3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench shall be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.
4. Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing.
5. Grade the construction right-of-way to restore pre-construction contours and leave the soil in the proper condition for planting.
6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration.
7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers
   a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.
   b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.
   c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

d. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland. Install trench breakers at wetland boundaries, as specified in the Procedures. Do not install trench breakers within a wetland.

2. Permanent Slope Breakers
   a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction right-of-way, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.
   b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing recommendations obtained from the local soil conservation authority or land managing agency.
      In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction right-of-way:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

   c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.
   d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction right-of-way to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction right-of-way, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.
2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil. If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.
3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General
   a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section V.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives
   Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as practicable after application.
3. Seeding Requirements
   a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.
   b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or the request of the landowner or land management agency. Seeding is not required in cultivated croplands unless requested by the landowner.
   c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section IV.F and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Dormant seeding or temporary seeding of annual species may also be used, if necessary, to establish cover, as approved by the Environmental Inspector. Lawns may be seeded on a schedule established with the landowner.
   d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section V.D.3.a through V.D.3.c.
   e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.
   f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).
   g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.
      Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands, offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

a) Signs;
b) Fences with locking gates;
c) Slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and
d) Conifers or other appropriate trees or shrubs across the right-of-way.

VII. POST-CONSTRUCTION ACTIVITIES AND REPORTING

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation and address landowner concerns. At a minimum, conduct inspections after the first and second growing seasons.
2. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise.
   Continue revegetation efforts until revegetation is successful.
3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in agricultural areas until restoration is successful.
4. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency per section V.A.6), revegetation is successful, and proper drainage has been restored.
5. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service.
6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and permanent access roads as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:
   a. Method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;
   b. Acreage treated;
   c. Dates of backfilling and seeding;
   d. Names of landowners requesting special seeding treatment and a description of the follow-up actions;
   e. The location of any subsurface drainage repairs or improvements made during restoration; and
   f. Any problem areas and how they were addressed.
2. The project sponsor shall file with the Secretary quarterly activity reports documenting the results of follow-up inspections required by section VII.A.1; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

The requirement to file quarterly activity reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advanced notice provisions in the FERC's regulations.

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Tennessee Gas Pipeline
Company, L.L.C.
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ATTACHMENT M15

TENNESSEE'S WETLAND AND WATERBODY CROSSING CONSTRUCTION AND MITIGATION PROCEDURES

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Tennessee's Wetland and Waterbody Construction and Mitigation Procedures document ("Procedures") is based in entirety on the Federal Energy Regulatory Commission's *Wetland and Waterbody Construction and Mitigation Procedures* (May 2013 version) ("Commission's Procedures"). Tennessee has identified certain modifications to the provisions of the Commission's Procedures and is requesting approval of these modifications, specific to the Northeast Energy Direct Project as part of the Environmental Report submitted for the Project. Justifications for these requested modifications are set forth in Resource Reports 2 and 8, and are identified in bold text below.

I. APPLICABILITY

A. The intent of these Procedures is to assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Project sponsors shall specify in their applications for a new FERC authorization, and in prior notice and advance notice filings, any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in these Procedures (or the applicant's approved procedures). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. Provides equal or better environmental protection;
2. Is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or
3. Is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on non-wetland areas are addressed in the staff's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

B. Definitions

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:
   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;
   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and

c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information must be filed with the Secretary of the FERC (Secretary) prior to the beginning of construction, for the review and written approval by the Director:

1. Site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and
2. Site-specific justifications for the use of a construction right-of-way greater than 75 feet wide in wetlands.

B. The following information must be filed with the Secretary prior to the beginning of construction. These filing requirements do not apply to projects constructed under the automatic authorization provisions in the FERC's regulations:

1. Spill Prevention and Response Procedures specified in section IV.A;
2. A schedule identifying when trenching or blasting will occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally-listed threatened or endangered species. The project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice;
3. Plans for horizontal directional drills (HDD) under wetlands or waterbodies, specified in section V.B.6.d;
4. Site-specific plans for major waterbody crossings, described in section V.B.9;
5. A wetland delineation report as described in section VI.A.1, if applicable; and
6. The hydrostatic testing information specified in section VII.B.3.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. The project sponsor shall develop project-specific Spill Prevention and Response Procedures that meet applicable requirements of state and federal agencies. A copy must be filed with the Secretary prior to construction and made available in the field on each construction spread. This filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

1. It shall be the responsibility of the project sponsor and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. The project sponsor and its contractors must, at a minimum, ensure that:
   a. All employees handling fuels and other hazardous materials are properly trained;
   b. All equipment is in good operating order and inspected on a regular basis;
   c. Fuel trucks transporting fuel to on-site equipment travel only on approved access roads;
   d. All equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;
   e. Hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas;
   f. Concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;
   g. Pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills; and
   h. Bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils have appropriate secondary containment systems to prevent spills.
2. The project sponsor and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, the project sponsor and its contractors must:
   a. Ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discoveries of contamination;
   b. Ensure that each construction crew has on hand sufficient tools and material to stop leaks; and
   c. Know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U. S. Coast Guard and the National Response Center) that must

be notified of a spill; and excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. Agency Coordination

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the FERC's Orders.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.
2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.
3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.
4. Notify appropriate federal and state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

B. INSTALLATION

1. Time Window for Construction
   Unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:
   a. Coldwater fisheries - June 1 through September 30; and
   b. Coolwater and warmwater fisheries - June 1 through November 30.
2. Extra Work Areas
   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where disturbed land.

Tennessee, to the extent practicable, has located extra work areas at least 50 feet away from water's edge. Extra work areas (ATWS) that cannot feasibly be located 50 feet away from water's edge due to other constraints are identified in a table (refer to Project-specific ECPs for each state and Resource Report 8) with the locations and justifications. Aerial alignment sheets illustrate all waterbody crossings, which provide equal or greater resource protection than the Commission's Procedures in the identified areas.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected.

c. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures
   a. Comply with the COE, or its delegated agency, permit terms and conditions.
   b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.
   c. Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction right-of-way, except where maintaining this offset will result in greater environmental impact.
   d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.
   e. Maintain adequate waterbody flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.
   f. Waterbody buffers (e.g., extra work area setbacks, refueling restrictions) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.
   g. Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques in accordance with the Plan, provided that the Environmental Inspector verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, the project sponsor must comply with all applicable Procedure requirements for "waterbodies" as defined in section I.B.1.
4. Spoil Pile Placement and Control
   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.
   b. Use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.
5. Equipment Bridges
   a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.
   b. Construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:
      (1) Equipment pads and culvert(s);
      (2) Equipment pads or railroad car bridges without culverts;
      (3) Clean rock fill and culvert(s); and
      (4) Flexi-float or portable bridges.

      Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.
   c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.
   d. Design and maintain equipment bridges to prevent soil from entering the waterbody.
   e. Remove temporary equipment bridges as soon as practicable after permanent seeding.
   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove temporary equipment bridges as soon as practicable after final cleanup.

g. Obtain any necessary approval from the COE, or the appropriate state agency for permanent bridges.

6. Dry-Ditch Crossing Methods
   a. Unless approved otherwise by the appropriate federal or state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries, or federally designated as critical habitat.
   b. Dam and Pump
      (1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.
      (2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:
         (i) Use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
         (ii) Construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
         (iii) Screen pump intakes to minimize entrainment of fish;
         (iv) Prevent streambed scour at pump discharge; and
         (v) Continuously monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.
   c. Flume Crossing
      The flume crossing method requires implementation of the following steps:
      (1) Install flume pipe after blasting (if necessary), but before any trenching;
      (2) Use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);
      (3) Properly align flume pipe(s) to prevent bank erosion and streambed scour;
      (4) Do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and
      (5) Remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.
   d. Horizontal Directional Drill
      For each waterbody or wetland that would be crossed using the HDD method, file with the Secretary for the review and written approval by the Director, a plan that includes:
      (1) Site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;
      (2) Justification that disturbed areas are limited to the minimum needed to construct the crossing;
      (3) Identification of any aboveground disturbance or clearing between the hdd entry and exit workspaces during construction;
      (4) A description of how an inadvertent release of drilling mud would be contained and cleaned up; and
      (5) A contingency plan for crossing the waterbody or wetland in the event the hdd is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

      The requirement to file HDD plans does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

Tennessee is proposing to cross streams with discernible flow at the time of construction via fluming or dam and pump, regardless of fisheries or critical habitat designation, unless otherwise approved by applicable federal and/or state regulatory agencies. Following this guidance provides greater resource protection than the Commission's Procedures, as discussed in more detail in Resource Report 2.

7. Crossings of Minor Waterbodies
   Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:
   a. Except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours.
      Streambanks and unconsolidated streambeds may require additional restoration after this period;
   b. Limit use of equipment operating in the waterbody to that needed to construct the crossing; and
   c. Equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification or protected status (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section v.b.5.
8. Crossings of Intermediate Waterbodies
   Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:
   a. Complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;
   b. Limit use of equipment operating in the waterbody to that needed to construct the crossing; and
   c. All other construction equipment must cross on an equipment bridge as specified in section v.b.5.
9. Crossings of Major Waterbodies

   Before construction, the project sponsor shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan must be developed in consultation with the appropriate state and federal agencies and shall include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The requirement to file major waterbody crossing plans does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

   The Environmental Inspector may adjust the final placement of the erosion and sediment control structures in the field to maximize effectiveness.

10. Temporary Erosion and Sediment Control

    Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the waterbody or adjacent upland.

Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. Install sediment barriers across the entire construction right-of-way at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. Removable sediment barriers (or driveable berms) must be installed across the travel lane. These removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;
b. Where waterbodies are adjacent to the construction right-of-way and the right-of-way slopes toward the waterbody, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the waterbody; and
c. Use temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

11. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.
2. For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.
3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.
4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.
5. Application of riprap for bank stabilization must comply with COE, or its delegated agency, permit terms and conditions.
6. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.
7. Revegetate disturbed riparian areas with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands.
8. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent

sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Plan.

In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

9. Sections V.C.3 through V.C.7 above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points.
2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.
3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of riparian areas.

VI. WETLAND CROSSINGS

A. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. The requirement to file a wetland delineation report does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

   This report shall identify:

   a. By milepost all wetlands that would be affected;
   b. The National Wetlands Inventory (NWI) classification for each wetland;
   b. The crossing length of each wetland in feet; and
   c. The area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

   The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing

pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction right-of-way width within the boundaries of a federally delineated wetland be expanded beyond 75 feet. Early in the planning process the project sponsor is encouraged to identify site-specific areas where excessively wide trenches could occur and/or where spoil piles could be difficult to maintain because existing soils lack adequate unconfined compressive strength.

Tennessee, to the extent practicable, has reduced the construction right-of-way to 75 feet or less in wetlands. Areas of workspace greater than 75 feet in wetlands are identified in a table (refer to Project-specific ECPs for each state and Resource Report 2), with locations and justifications for each area. Aerial alignment sheets illustrate each wetland crossing, which will provide equal or greater resource protection than the Commission's Procedures in the identified areas.

4. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.
5. Implement the measures of sections V and VI in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of sections V and VI cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:
   a. Spoil control;
   b. Equipment bridges;
   b. Restoration of waterbody banks and wetland hydrology;
   c. Timing of the waterbody crossing;
   d. Method of crossing; and
   e. Size and location of all extra work areas.
6. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads
   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

Tennessee, to the extent practicable, has located extra work areas at least 50 feet away from wetland boundaries. Extra work areas (ATWS) that cannot feasibly be located 50 feet away from wetland boundaries due to other constraints are identified in a table (refer to Project-specific ECPs for each state and Resource Report 8) with the locations and justification. Aerial alignment sheets illustrate each wetland crossing, which will provide equal or greater resource protection than the Commission's Procedures in the identified areas.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries, except where adjacent upland consists of cultivated or rotated

cropland or other disturbed land. The justification must specify the site-specific conditions that will not permit a 50-foot setback and measures to ensure the wetland is adequately protected.

c. The construction right-of-way may be used for access when the wetland soil is firm enough to avoid rutting or the construction right- of-way has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).
   In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing shall use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the construction right-of-way.
d. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetland.

2. Crossing Procedures
   a. Comply with COE, or its delegated agency, permit terms and conditions.
   b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.
   c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.
   d. Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.
   e. Limit construction equipment operating in wetland areas to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.
   f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.
      The project sponsor can burn woody debris in wetlands, if approved by the COE and in accordance with state and local regulations, ensuring that all remaining woody debris is removed for disposal.
   g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction right-of-way.
   h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are saturated. Immediately after backfilling is complete, restore the segregated topsoil to its original location.
   i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction right-of-way.
   j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.
   k. Remove all project-related material used to support equipment on the construction right-of-way upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.B.3.c, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings where necessary to prevent sediment flow into the wetland.
b. Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the wetland.
c. Install sediment barriers along the edge of the construction right-of- way as necessary to contain spoil and sediment within the construction right-of-way through wetlands. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any wetland. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology.
2. Restore pre-construction wetland contours to maintain the original wetland hydrology.
3. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Plan. In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

Tennessee proposes that permanent slope breakers may not always be appropriate for installation at wetland boundaries. At the discretion of the EI, LEI, and Tennessee's contractor, permanent slope breakers that may alter the permanent overland flow characteristics, consequently altering the wetland's characteristics will not be installed. Tennessee proposes the use of hay/straw bales as temporary slope breakers at the wetland boundaries until restoration is complete to ensure the wetland characteristics will remain intact in situations that permanent slope breakers are not used. Following this guidance provides greater long-term protection for the resource. More information to support this modification request may be found in Tennessee's Project-specific ECPs for each state (Volume II, Appendices J, K, L, M, and N).

4. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate federal or state agency.
5. Consult with the appropriate federal or state agencies to develop a project- specific wetland restoration plan. The restoration plan shall include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of invasive species and noxious weeds (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.
6. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction right-of-way with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).
7. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.
8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VII.A.4 of the Plan.

D. POST-CONSTRUCTION MAINTENANCE AND REPORTING

1. Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.
2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate federal or state agency.
3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of wetland areas.
4. Monitor and record the success of wetland revegetation annually until wetland revegetation is successful.
5. Wetland revegetation shall be considered successful if all of the following criteria are satisfied:
   a. The affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation);
   b. Vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction;
   c. If natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion; and
   d. Invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.
6. Within 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts and documenting success as defined in section VI.D.5, above. The requirement to file wetland restoration reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advance notice provisions in the FERC's regulations.

   For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement (in consultation with a professional wetland ecologist) a remedial

revegetation plan to actively revegetate wetlands. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.
2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.
3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.
2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address secondary containment and refueling of these pumps in the project's Spill Prevention and Response Procedures.
3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to minimize the potential for entrainment of fish.
2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.
3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.
4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.
2. Do not 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, unless appropriate federal, state, and local permitting agencies grant written permission.