Section 4 - Appendix 3

Northwest Energy Direct Project – Alternative Analysis

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 I; therefore, appendix references and page numbers contained within this document are not consistent with this permit application.

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NORTHEAST ENERGY DIRECT PROJECT

DOCKET NO. CP16-___-000

ENVIRONMENTAL REPORT

RESOURCE REPORT 10

ALTERNATIVES

PUBLIC

Submitted by:

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RESOURCE REPORT 10 – ALTERNATIVES
SUMMARY OF FILING INFORMATION

INFORMATION	FOUND IN
Address the "no action" alternative (§ 380.12 (l)(1)).	Section 10.1
For large Projects, address the effect of energy conservation or energy alternatives to the Project (§ 380.12 (l)(1)).	Section 10.1.1 Section 10.1.2
Identify system alternatives considered during the identification of the Project and provide the rationale for rejecting each alternative (§ 380.12 (l)(1)).	Section 10.2
Identify major and minor route alternatives considered to avoid impact on sensitive environmental areas (e.g., wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of the proposed route (§ 380.12 (l)(2)(ii)).	Section 10.3
Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site (§ 380.12 (l)(2)(ii)).	Sections 10.5 and 10.6

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10.0 ALTERNATIVES

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 also will be construction of appurtenant facilities, including mainline valves ("MLVs"), cathodic protection, and pig facilities through the Project area.

Tennessee anticipates commencing construction activities in January 2017 and placing the facilities in-service by November 2018 (with the exception of one proposed pipeline looping segment in Connecticut, which will be placed in-service by November 2019). Refer to Resource Report 1 of this Environmental Report ("ER") for a more complete description of the Project components.

Resource Report 10 describes the alternatives that have been considered as of the date of this report in developing the Project. Attachment 10a includes Project figures depicting those alternatives analyzed for the Project.

Tennessee undertook an extensive needs and alternative routing analysis for the Project. The primary objective in performing this analysis was to develop a project that will accomplish Tennessee's objective to provide up to 1.3 billion cubic feet per day ("Bcf/d") of additional natural gas transportation capacity to meet the growing energy needs in the northeast U.S., particularly in New York and New England, as is described in the Public Convenience and Necessity section of the certificate application and the Purpose and Need section of Resource Report 1 (Section 1.1.1), while working to avoid or minimize potential adverse environmental impacts to the greatest extent practicable. Tennessee evaluated pipeline routing options based on regional topography, environmental considerations, population density, existing land usage, construction safety, and feasibility considerations. Tennessee also considered route alternatives in conjunction with the Commission's routing guidelines as set forth in Section 380.15 of the Commission's regulations, 18 C.F.R. § 380.15.

10.1 NO-ACTION ALTERNATIVE

The "No-Action" Alternative for the Project would avoid the temporary and permanent environmental impacts associated with construction and operation of the currently proposed Project, but would not meet the purpose and need of the Project. By not constructing the proposed Project, Tennessee will be unable to provide the necessary natural gas transportation service required to meet growing energy needs in the Northeast U.S., specifically in New York and New England. The Project will provide up to up to 1.2

Bcf/day on the Supply Path Component and up to 1.3 Bcf/d on the Market Path Component[1] of additional natural gas transportation capacity to meet the growing energy needs of local distribution companies ("LDCs"), gas-fired power generators, electric distribution companies, industrial plants, natural gas producers and other New England consumers. The NED Project has significant market support as evidenced by the executed precedent agreements to date with various shippers for transportation service on both the Market Path Component and Supply Path Component facilities (the "Project Shippers"). Tennessee has executed precedent agreements with four New England LDCs, two natural gas producers, a municipal light department, and a power generator for 751,650 dekatherms per day ("Dth/d") of long-term firm transportation capacity on the Supply Path Component, and has executed precedent agreements with seven New England LDCs, a municipal light department, an industrial end-user, and a holding corporation for 552,262 Dth/d of long-term firm transportation capacity on the Market Path Component.[2] Tennessee is confident that the significant demand for natural gas and pipeline capacity in the northeast U.S., particularly the demand from the electric power generation market as a result of the initiatives underway with five of the six states in New England to facilitate the ability of electric distribution companies to contract for pipeline capacity and recover the costs in their rates, will result in additional contract commitments for the full Project capacity. Tennessee is in ongoing negotiations with other additional potential Project shippers and as additional precedent agreements are executed, Tennessee will supplement the record in this proceeding. As discussed in detail in the Public Convenience and Necessity section of the certificate application and in the Purpose and Need section of Resource Report 1, the new transportation capacity to be created by the Project will help alleviate the natural gas pipeline capacity constraint in the region by increasing capacity in high-demand markets in New York and New England, as well as provide shippers in New York and New England with greater access to prolific supply sources.

Given the constrained pipeline transportation capacity situation in the northeast U.S., without the proposed Project, other natural gas transmission companies would be required to increase their capacity and construct new facilities to meet the existing and growing demand for the additional natural gas transportation capacity. Such actions would only result in the transference of environmental impacts from one project to another and would not eliminate such impacts in their entirety.

The lack of a new pipeline in the region with new transportation capacity and access to supply sources will prolong the existing supply constraints in the proposed delivery areas, which will continue to contribute to winter-premium pricing and exacerbate price volatility for all natural gas users in these areas. If existing natural gas transmission systems are not enhanced or expanded, energy shortages in times of peak demand would continue to occur, and gas users, especially electric generators, would consume different fuels, including oil and coal. The lack of adequate natural gas transportation capacity also will increase the difficulty for consumers of natural gas, the operators of LDCs and natural gas-fired electric generating plants, and others in finding economical gas supplies. This in turn will lead to higher

[1] As discussed in more detail in Resource Report 1, the Supply Path Component encompasses the portion of the proposed NED Project extending from Troy, Pennsylvania to Wright, New York, while the Market Path Component encompasses the portion of the proposed NED Project extending from Wright, New York, to Dracut, Massachusetts.

[2] Project Shippers on the Supply Path Component and Market Path Component are identified in Exhibit I to the certificate application.

consumer gas and electric rates in a region which is already experiencing the highest rates in the country,[3] and even energy shortages during times of winter peak demand.

Utilization of natural gas for residential and commercial heating, power generation, industrial use, and transportation offers the best alternative in terms of supply availability with the lowest environmental impact among available energy sources, particularly with regard to air quality impacts. Existing natural gas delivery systems may be readily expanded to meet increased demand, while minimizing impacts to the environment. The No-Action Alternative would not provide the potential economic benefits associated with the proposed Project, including increased jobs, secondary spending, and tax revenues during construction, as well as increased property tax revenues to local governments during operations. Further, the No-Action Alternative would not provide the additional natural gas required by LDCs to support the increased energy demand of consumers in the northeastern U.S./New York and New England and/or consumers that do not currently have access to natural gas. The No-Action Alternative is not a feasible alternative for the Project because that alternative will not satisfy the purpose and need for the Project and ultimately will result in other, more significant impacts to the environment.

10.1.1 Energy Conservation

Energy conservation measures have and will continue to play an important role in reducing energy demand in the U.S. The Energy Policy Act of 2005 ("EPAct 2005") includes guidelines to diversify America's energy supply and reduce dependence on foreign sources of energy, increase residential and commercial energy efficiency and conservation (e.g., U.S. Environmental Protection Agency ["USEPA"] Energy Star Program), improve vehicular energy efficiency, and modernize domestic energy infrastructure (U.S. Congress 2005). While the EPAct 2005 and state and municipal programs promote increased energy efficiency and conservation by supporting new energy efficient technologies and increasing funds for energy efficiency research, and will most likely minimize energy use, they are not expected to eliminate the steadily increasing demand for energy or natural gas. Additionally, the implementation and success of energy conservation in curtailing energy use is a long-term goal, extending well beyond the timeframe of the proposed Project.

Reducing the need for additional energy usage is the preferred option wherever possible. Conservation of energy reduces the demand for limited and over-utilized fossil fuel reserves. Energy conservation also is advocated by both federal and state authorities. The Independent System Operator-New England ("ISO-NE") has forcasted savings stemming from state-sponsered energy efficiency programs and the anticipated growth of the states' programs.[4] ISO-NE estimated that the six New England states will invest $1 billion per year in energy efficiency programs between 2019 and 2024, resulting in average annual savings of 1,616 gigawatt hours ("GWh") and an average annual peak reduction of about 212 megawatts ("MW"). These savings resulting from the state-sponsored programs can be expected to slow the growth in energy usage and peak demand across the region. However, even with these programs, there remains an existing and growing need for additional natural gas capacity that will be provided with

[3] National Grid, National Grid Files for Winter Rates in Massachusetts (September 24, 2014), available at https://www.nationalgridus.com/aboutus/a3-1_news2.asp?document=8764. Massachusetts DPU Docket No. 14-115, National Grid petition approved on 11/7/14. http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=14-115%2f14115approval11072014.pdf

[4] See ISO-NE, Energy-Efficiency Forecast for 2019 to 2024, dated May 1, 2015, available at http://www.iso-ne.com/static-assets/documents/2015/05/eef-report-2019-2024.pdf

the construction of this Project.[5] Energy conservation alone is not a viable alternative to the proposed Project. While energy conservation reduces demand for energy sources such as natural gas, and may be a long-term alternative or partial alternative for the Project, implementation of sufficient energy conservation measures to eliminate the need for the proposed Project is not feasible in the short-term.

10.1.2 Energy Alternatives

In general, alternative energy sources for natural gas consumers include wind, solar, geothermal, coal, oils, nuclear, hydroelectric, and fuel cells. Use of alternative hydrocarbon-based fuels (e.g., oil and coal) to supply the needs of the market would result in adverse environmental impacts due to increased air pollutant emissions that will be otherwise minimized through the use of natural gas. State and federal air pollution control regulations indirectly promote the use of clean fuels to minimize adverse air quality impacts. These regulations are intended to improve both air quality and the quality of life. Use of alternative hydrocarbon energy sources will unnecessarily increase adverse air quality impacts, and these increased impacts will conflict with federal and state long-term energy environmental policies aimed toward attaining ambient air quality standards. While renewable alternative energy sources contribute to a diverse energy portfolio for users, they ultimately cannot provide for the energy needs that the Project will support and supply to the Northeast U.S. market. In 2012, the ISO-NE identified likely retirements of older coal- and oil-fired power plants/generators located in New England as of 2020, representing approximately 8.3 MW of capacity, and the need for replacement of these resources to meet the needs of power generators, including natural gas generation.[6] While nuclear power is a possible alternative to natural gas in New England, the 620 MW Vermont Yankee Nuclear power plant retired in December 2014. In October 2015, it was announced that the Pilgrim Nuclear Power Station, a 680 MW electric generating plant located in Plymouth, Massachusetts, would also retire, earlier than expected, by June 2019. Clean-burning natural gas will continue to be part of a diverse energy portfolio for users in the northeast region and also serves a bridge to renewables by providing a reliable energy supply while these alternative energy sources are further refined and developed.

10.1.2.1 Wind Power

Wind power technology has experienced advancements over the last 20 years, including reductions in installation costs, improved turbine performance, and reduced maintenance costs. Although wind projects have no operational emissions, such developments can negatively affect wildlife (particularly birds and bats), visual resources, and other environmental resources. Onshore wind power generation requires large, permanent turbines and supporting facilities, as well as construction of electric transmission lines, to connect wind facilities to transport the wind energy to consumers. These facilities have an impact on

[5] See the U.S. Department of Energy/Energy Information Administration's ("DOE/EIA") Annual Energy Outlook 2014 table data (Natural Gas Transmission and Distribution Model Regions), which projects sectors driving growth in U.S. natural gas consumption. U.S. total natural gas consumption is projected to grow from 25.6 trillion cubic feet (tcf) in 2012 to 31.6 tcf in 2040 in the AEO2014 Reference case. Natural gas production from the Marcellus Shale area is projected to grow from 1.9 tcf in 2012 to a peak production volume of approximately 5.0 tcf per year from 2022 through 2025. Natural gas produced from the Marcellus Shale area is projected to provide up to 39 percent of the natural gas needed to meet demand in markets east of the Mississippi River during that period (up from 16 percent in 2012). Although Marcellus Shale area production is projected to decline after 2024, it will provide enough natural gas to meet at least 31 percent of the region's total demand for natural gas through 2040. See U.S. Energy Information Administration, Annual Energy Outlook 2014, Report #DOE/EIA-0383 (2014), available at http://www.eia.gov/forecasts/aeo/ (DOE/EIA 2014). Even with energy conservation, additional natural gas pipeline capacity to transport gas in this region is needed.

[6] See ISO-NE, Strategic Transmission Analysis: Generation Retirements Study, dated December 13, 2012, available at http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/mtrls/2012/dec132012/retirements_redacted.pdf.

visual resources, because onshore wind turbines are constructed to capture wind high above the natural topography and will be constructed along highly visible ridge lines. Additionally, wind turbines directly impact resident and migratory birds, bats, and other wildlife from collision mortality, and indirectly impact wildlife as a result of habitat disturbance and loss. Construction of offshore wind power generation facilities may result in impacts on marine species. In contrast, the permanent right-of-way ("ROW") of the proposed pipeline area will be restored to pre-construction contours and maintained as herbaceous cover. Potential impacts on wildlife from the proposed Project are expected to be short-term and temporary, with the exception of habitat conversion in forested areas and the establishment of some aboveground facilities. Therefore, theoretical onshore wind generation facilities would result in greater impacts upon visual, vegetation, and wildlife resources than the proposed Project.

Wind power currently is not an option for providing the existing or projected power needs in the region where the Project is located. While there has been an increase in wind power capacity in Massachusetts, encouraged by streamlined siting and permitting, overall the capacity is slow to develop. As detailed above, wind power generation presents environmental issues and cannot be precisely scheduled based on demand. In the Project's general area, the sites with the highest wind velocities tend to be located along ridgelines in areas of steep slopes (National Renewable Energy Laboratory ["NREL"] 2010) which are challenging to access and generally highly visible. Wind power provides electrical output that is considered an intermittent and non-dispatchable source of generation as it does not generate electricity when the wind is not blowing. The Project will have the capability to provide fuel supplies and services to gas-fired generators to operate on short notice when renewable resources, such as wind, are not generating due to the intermittability associated with renewable generation.

Electricity demand also varies during the day in ways that the supply from wind and solar generation may not match, thus requiring the ISO-NE to balance the variable renewables by dispatching other wholly-dispatchable non-intermittent units, such as natural gas-fired generating units. While renewable resources provide some level of energy supply diversity, they are weather dependent and require hydropower or thermal resources to accommodate their variability, and pose both operational and interconnection challenges.

According to the ISO-NE,[7] wind power supplies about 1 percent of New England's annual electricity needs, but almost half of proposed generation in New England is wind power. According to the ISO-NE, developers are proposing to develop more than 5 MW of gas-fired generation and approximately 4 GW of wind generation, located mostly onshore in northern New England and offshore in southern New England. Many of these projects are proposed to be built in areas where the transmission system is already constrained, and some in areas where there is no transmission at all. Therefore, if the New England states intend to improve the deliverability of existing wind resources, develop new wind resources then those states will need to invest in additional electric transmission facilities to deliver that energy, which is largely sourced in the north, to where it is consumed, which for the most part is in southern New England. The ISO-NE has identified a number of transmission proposals by private developers vying to move clean energy supplies from Newfoundland and Labrador, Québec, and northern New England, particularly Maine, to southern New England.

Publicly available information as of September 2015 regarding proposed wind projects in the New England area is provided below. This is not intended to be a comprehensive listing and description of the

[7] Northeast Forum on Regional Energy Solutions. Remarks by Gordon Van Welie, President & CEO, ISO New England, April 23, 2015.

proposed wind proposals in the New England regions, but is intended to be representative of the types of projects emerging both inside and outside the region in response to the New England states' clean energy goals. Further, it is important to note that there is risk associated with the successful development of these proposed projects and they are unlikely to be developed in sufficient quantity in the timeframe needed for the Project.

Anbaric (Green Line Infrastructure Alliance)[8] is an independent transmission development company headquartered in Wakefield, Massachusetts. In 2014, Anbaric teamed with National Grid to create the "Green Line Infrastructure Alliance" ("GLIA"), which proposes to build an underground clean energy transmission system sufficient to bring 2,800 MW of wind from northern New England and hydroelectric power from Eastern Canada into southern New England. The GLIA is developing large-scale, high-voltage direct-current ("HVDC") transmission projects that combine wind and hydropower to address regional energy issues.

The proposed GLIA projects are in the early stages of development and are slated (if selected in forthcoming competitive procurements) to come on-line as follows: the first 400 MW phase of the Vermont Green Line (2019); the first 1,000 MW phase of the Maine Green Line (2021); the second 400 MW phase of the Vermont Green Line (2023); the second 1000 MW phase of the Maine Green Line (2025). Each of these projects has been engineered to provide a transmission path for wind and hydroelectric power into the bulk transmission system of New England. The proposed Maine Green Line is a hybrid land-and-sea HVDC project that will initially deliver 1,000 MW of wind from northern Maine, firmed up by imports of hydropower from eastern Canada, via a submarine cable to Massachusetts. The proposed Vermont Green Line, from northern New York to Vermont, will deliver 400 MW (expandable to 800 MW) of wind and hydropower under Lake Champlain. The 60-mile connection will be entirely buried underground or underwater. The Vermont Green Line will be a path for cost-effective renewables from New York and Canada to Vermont and the rest of New England. The Vermont projects terminate at the 345 kilovolts ("kV") bus at New Haven, Vermont. The first Maine Green Line will terminate at the 345 kV bus at Wakefield, Massachusetts.

Deepwater Wind Block Island, LLC is a wholly owned indirect subsidiary of Deepwater Wind Holdings, LLC ("Deepwater Wind"), headquartered in Providence, Rhode Island. In 2015, Deepwater Wind Block Island, LLC, began construction on the first offshore windfarm in the United States, a 30 MW, five-turbine windfarm located in the Atlantic Ocean, approximately 3 miles southeast of Block Island, Rhode Island. The project includes approximately 21.8 miles of 34.5 kV submarine transmission cable from Block Island to mainland Rhode Island capable of delivering power to and from the Rhode Island mainland. The project is expected to be in service in 2016. Deepwater Wind is also developing the Deepwater ONE project, located approximately 30 miles off the coast of Long Island, New York. The initial phase of the project will include 35 turbines, producing enough power for 120,000 households on Long Island. If approved, the project will begin construction in 2017, and be in service in 2018. Over time, the project will grow to 200 or more turbines generating 1,000 MW of clean energy for multiple power markets in the region

Wind power cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. Under these circumstances, wind energy will not be able to provide the projected heating and electric generation needs for the region as reliably and in the quantity that will be provided by the proposed Project facilities.

[8] http://greenlineinfrastructurealliance.com/.

10.1.2.2 Solar Power

Photovoltaic solar power systems convert sunlight directly into electricity. These systems generally are not well-suited for use as large-scale generation in the proposed Project area due to relatively low direct insulation, higher capital costs, potential reliability issues, and lower efficiencies. Solar power generation on an industrial scale requires large, permanent facilities with impervious cover and no shading to allow for photovoltaic panels and/or concentrated solar power ("CSP") to gather energy. With the exception of certain aboveground facilities pipelines generally result in a narrow permanent ROW that will be restored to pre-construction contours and maintained as herbaceous cover. In addition, the construction of a solar power generation facility also includes the construction of access roads ("ARs") and electric transmission lines necessary to transport the generated solar energy to consumers, resulting in additional environmental impacts. Further, solar power systems are not only among the highest of cost renewable energy, but they also provide electrical output that is considered an intermittent and non-dispatchable source of generation as it does not generate electricity when there is insufficient sunlight. Electricity demand also varies during the day in ways that the supply from solar generation may not match, thus requiring the ISO-NE to balance the variable renewables by dispatching other wholly-dispatchable, non-intermittent units, such as natural gas-fired generating units. While renewable resources provide some level of energy supply diversity, they are weather dependent and require other more conventional resources to accommodate their variability, and pose both operational and interconnection challenges. Finally, solar power cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project.

For these reasons, renewable resources, such as solar power, even with the efforts to increase solar power capacity in certain states impacted by the Project, are not being developed at a pace fast enough to provide for the projected energy needs in the region.

10.1.2.3 Geothermal Power

Large scale geothermal energy is available only at tectonic plate boundaries or at geothermally active hotspots. Due to a lack of these features in the Project area, geothermal energy is not be available for development as an alternative to natural gas. Although geothermal energy systems are available in the Project area, they are on smaller scales at individual homes and businesses. For example, systems installed at Harvard University in Boston, Massachusetss, Nichols College in Dudley, Massachusetts, and St. Josephs Hospital in Hudson, New Hampshire, each produce 90 tons, or 316 kilowatts (kW), of energy.[9] Geothermal heat pumps are used to circulate groundwater or other fluids through piping to be used for heat exchange. The system typically has a higher up-front cost compared to other traditional gas and oil heating and cooling systems, but may be paid back within three to seven years, based on energy savings, tax savings, and rebates.[10] While this renewable resource may provide some level of energy supply diversity, it is not available on a large enough scale to meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project.

[9] See Geothermal Drilling of New England, http://www.geothermalma.com/projects

[10] See New England Renewable Energy Systems, http://www.nerenewable.com/economical-advantages-commercial-geothermal-installation-services-company-contractors.html#

10.1.2.4 Coal

Coal is used for energy generation and is an alternative fuel to natural gas. However, relative to natural gas, the burning of coal results in greater emissions of pollutants such as nitrogen oxides ("NO_x"), sulfur dioxide ("SO_2"), greenhouse gases ("GHG"), and mercury (USEPA 2005). In 2010, coal comprised 46 percent of total U.S. electric power generation (DOE/EIA 2011). However, a number of coal-fired power plants in the northeast region that have served as baseload generators for electric power have recently closed or are planning to close in the near future. The Salem Harbor Station, located in northeast Massachusetts, closed in June 2014 and is expected to re-open as a natural-gas burning facility in 2016.[11] The Mount Tom Station, located in Western Massachusetts, closed in October 2014 and the Brayton Point Station, located in Southeastern Massachusetts, is scheduled to close in June 2017. The Massachusetts Clean Energy Center and the City of Holyoke and Town of Somerset are analyzing options for the Mount Tom and Brayton Point Stations.[12] Due to the greater environmental impacts associated with emissions from coal-burning power generation, it is unlikely that coal will displace the need for natural gas in the target market areas in the foreseeable future. Finally, coal cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. Therefore, coal does not represent a preferred alternative for replacing the natural gas to be supplied by the proposed Project.

10.1.2.5 Fuel Oil

Fuel oil is commonly transported by pipeline which may require construction of other pipeline systems to transport the fuel oil, which will likely have similar impacts as the proposed Project, but in a different location. Additionally, if increased fuel oil demand is met by foreign imports, additional development of bulk storage capacity, and refining facilities will be required. Reliance on fuel oil as an alternative to natural gas will increase the potential for environmental impacts such as oil spills; land development to construct or modify import, storage, and refining facilities; and pollution from air emissions. Alternatively, natural gas burns cleaner than other fossil fuels, is relatively inexpensive compared to other fossil fuels, and is domestically produced. While fuel oil is an alternative energy source for meeting future power generation needs in the Project area, fuel oil has no advantage over natural gas, and fuel oil necessitates increased environmental impacts in transportation and at the burner. Finally, use of fuel oil cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. For these reasons, particularly for facilities designed to use natural gas, fuel oil will not be a preferable alternative to the natural gas to be supplied by the proposed Project.

10.1.2.6 Nuclear

Energy from nuclear power is important nationally and accounted for approximately 9 percent of annual energy consumption nation-wide in 2011 (DOE/EIA 2013a). In New York, nuclear power currently accounts for about 14 percent of statewide generating capacity (New York Independent System Operator ["NYISO"] 2012). In New England (Massachusetts, Maine, New Hampshire, Vermont, Rhode Island,

[11] See Massachusetts Energy Facilities Siting Board's Certificate of Environmental Impact and Public Interest, issued February 25, 2014, in Docket No. 13-1, available at: http://www.mass.gov/eea/energy-utilities-clean-tech/energy-facilities-siting-board/efsb-decisions/power-plants.html.

[12] See Massachusetts Clean Energy Center's Reuse Studies for Coal-Fired Power Plants, available at http://www.masscec.com/content/reuse-studies-coal-fired-power-plants.

and Connecticut), nuclear energy accounted for approximately 12 percent of total energy consumption in 2012 (DOE/EIA 2013a). Although use of nuclear power may avoid GHG emissions that will otherwise occur with burning fossil fuels, the environmental and regulatory challenges concerning safety and security, the disposal and long-term storage of toxic and radioactive materials (i.e., spent fuel), and potential alterations to hydrological/biological systems will need to be addressed before any new nuclear power generation facilities are constructed. Nuclear power remains problematic given these factors.

The use of nuclear energy is not considered to be an option for meeting the existing and projected demand for energy in the region where the Project is located. The Vermont Yankee Nuclear Power Plant was shut down as of the end of 2014, further limiting the nuclear power available in the New England region (DOE/EIA 2013b) and as of 2015 this facility is slated for decommissioning. Due to the lengthy lead time to site a new nuclear facility and controversy with such projects, power generated from such a facility will not be available for development as an alternative to natural gas to be supplied by the proposed Project. The retirement of the 600 MW Vermont Yankee plant in late 2014 has increased the reliance of this region on natural gas-fired power generation and lead to higher gas and electricity prices without the proposed Project. Further increasing reliability on natural gas-fired power generation, on October 12, 2015, Entergy Nuclear Power Marketing submitted a formal request to ISO-NE to retire its Pilgrim Nuclear Power Station by June 1, 2019. The Pilgrim Nuclear Power Station is a 680-MW electric generating plant located in Plymouth, Massachusetts and is among the region's largest power plants and is one of three remaining nuclear stations in New England. Use of nuclear power cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. For these reasons, particularly for facilities designed to use natural gas, nuclear power will not be a preferable alternative to the natural gas to be supplied by the proposed Project.

10.1.2.7 Hydroelectric Power

Hydroelectric generation is fully commercialized with both large impoundment-type and run-of-river type projects in operation in the Northeast U.S. ranging from one MW to hundreds of MWs in capacity. There are a number of proposed electric transmission line projects designed to import hydroelectric power from Canada to New England that will require the construction of possibly three transmission lines linking Canadian hydroelectric generating facilities to southern New England load centers. These aboveground transmission line projects require exhaustive review and extensive siting approval from northern New England states, such as New Hampshire and Maine. Historically, given the strong opposition to recently proposed electric transmission projects in New England, it is likely that a large electric transmission line project designed to import hydroelectric power from Canada will face similar siting difficulties. In addition, use of domestic and imported hydroelectric power cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. For this reason, use of proposed hydroelectric power projects is precluded from being a viable alternative to the natural gas to be supplied by the proposed Project.

10.1.2.8 Electric Generation

Electrical energy is a second-tier energy source, meaning that electrical energy is generated from first-tier energy sources, such as natural gas, coal, oil, biomass, nuclear, geothermal, hydraulic head, wind, and solar radiation. The use of electric generation cannot meet the specific purpose and need of the Project and provide the required natural gas pipeline transportation capacity provided by the Project. For this reason, use of electrical energy is precluded from being a viable alternative to the natural gas to be supplied by the proposed Project.

10.1.2.9 Fuel Cells

Fuel cells are a developing alternative for generating electricity more directly and cleanly from fossil fuels or hydrogen; however, fuel cell technology is in the early phases of development. Small-scale fuel cell research and development is active, but reliable fuel cell systems representing an equivalent magnitude to the proposed Project are not expected to be available or cost-effective in the near future.

10.1.2.10 Other Energy Sources

Alternative fuel sources available include using liquefied natural gas ("LNG") and propane/air storage and vaporization. Although both alternatives have the potential to meet the Project objectives, Tennessee determined that these alternatives were not viable due to such factors as siting constraints, increased environmental impacts, and the time required to develop them. Therefore, supplying adequate volumes of natural gas through the construction of the proposed Project is the preferred alternative.

10.1.2.11 Energy Alternatives Conclusion

As increasing demand for electricity continues to rise, energy efficiency and conservation measures, along with more diversified renewable energy portfolios, will reduce the need to meet the growing demand by fossil-fueled power plants. In recognition of the need to diversify, the states in the Project area have all adopted policies, programs, and projects to reduce their state's dependence on fossil-fuel electric generation. While these measures will impact the overall demand for electricity from fossil fuel generation, the energy conservation and renewable alternatives do not meet the purpose and need of the Project, which will provide additional natural gas pipeline transportation capacity to its customers, including LDCs that will ultimately provide additional natural gas supplies to their customers for residential and commercial heating, drying and cooking, and industrial uses. Even with energy conservation and the growth of renewable energy resourecs, additional natural gas pipeline capacity to transport gas in this region is needed. The implementation of energy efficiency measures and the use of wind, solar, geothermal, coal, fuel oil, nuclear, hydroelectric, fuel cells, and other energy sources were analyzed and determined that, although they will provide a level of energy diversity and may slow the growth in energy usage and peak demand across the region, they are not sufficient to meet the Project's need. Accordingly, energy conservation and renewable resources would not be sufficient alternatives to meet the purpose and needs of the Project.

10.2 SYSTEM ALTERNATIVES

System alternatives are alternatives to the Project that will make use of other existing, modified, or proposed natural gas pipeline systems or existing compression to meet the stated purpose and need for a proposed Project. System alternatives involve the transportation of the equivalent amount of incremental natural gas volumes by the expansion of existing pipeline systems or by the construction and operation of other new pipeline systems. A viable system alternative will make it unnecessary to construct all or part of the proposed Project, and will involve the transportation of all or a portion of the additional natural gas volumes by expansion of another existing pipeline system or construction of a new pipeline system. Such modifications or additions will result in environmental impacts; however, the impacts will in all likelihood be similar to, and potentially greater than, that associated with construction of the proposed Project.

Although system alternatives that will result in less environmental impacts might be preferable to the proposed Project facilities, only those alternatives that are reasonable, consistent with existing law, and consistent with the underlying purpose and need of the Project are required to be considered for National Environmental Policy Act ("NEPA") purposes. Consequently, a viable system alternative must be technically and economically feasible and practicable to satisfy the Project's purposes, including meeting the market needs of the Project Shippers, as evidenced by executed precedent agreements, supporting the development of the Project.

Technical and feasible system alternatives were evaluated in the Project area (Figure 10.2-1) in terms of their ability to meet the Project objectives, which were defined by the incremental level of firm transportation services contracted for the market, as described in the certificate application and in Resource Report 1 of this filing. The facilities associated with the Project are necessary to provide the incremental firm transportation capacity to meet the growing energy needs in the Northeast U.S., specifically New England. The Project, upon completion, will provide up to 1.3 Bcf/d of additional natural gas transportation capacity to meet the growing energy needs of LDCs, gas-fired power generators, industrial plants, and other New England consumers. As discussed in detail in the Public Convenience and Necessity of the certificate application and in the Purpose and Need section of Resource Report 1, the new transportation capacity to be created by the Project will help alleviate the natural gas pipeline capacity constraint in the Northeast U.S. by increasing capacity in high-demand markets in New England. By constructing and placing the Project into service, additional natural gas quantities from prolific supply sources can be readily delivered to meet the growing demand for natural gas service in the northeast U.S. market area on both a seasonal and annual basis with detailed consideration given to providing such service economically, safely, and with minimal impact to affected landowners and the environment. With its existing system in place, Tennessee is able to facilitate construction, operation, and maintenance of the Project through construction of the Project facilities outlined in Resource Report 1 of this filing.

10.2.1 Existing Systems

10.2.1.1 Supply Path Component

Tennessee currently has no available firm capacity on its existing 300 Line and 200 Line systems (Figure 10.2-2) from the anticipated Project receipt points along the Pennsylvania to Wright, New York Pipeline Segment (the Supply Path Component of the Project). Tennessee considered expansion along its existing 200 Line via looping and compression; however, given the large Project volumes, the looping of the existing 200 Line became a contiguous new line and morphed into the Existing 200 Line Alternative as described in Section 10.3.1.4. Tennessee is, however, proposing to utilize its existing system corridors as much as possible by looping[13] or co-locating[14] with its existing facilities in its design of the NED

[13] Pipeline loops are those pipeline segments which are laid parallel to another pipeline and used as a way to increase capacity along what is possible on one line. These lines are connected to move a larger flow of gas through a single pipeline segment.

[14] Co-located pipelines are those that are laid parallel to another existing pipeline or utility, but are not connected in any way. The current route of Tennessee's proposed NED Project, in part, is located parallel and adjacent to, and, in some cases, overlaps existing utility easements (either pipeline or electric utility). This paralleling/overlapping of easements is commonly referred to as co-location. Refinement to the routing has occurred as the NED Project was developed through the pre-filing process in Docket No. PF14-22-000, and will continue to occur through the certificate process, which will incorporate information gained from field surveys, and landowner and stakeholder input. Tennessee's current proposed pipeline alignment along utility corridors is proposed to be generally located five (5) feet outside the existing utility easement, as set forth herein. Tennessee is proposing that the temporary construction workspace for the Project for these areas of co-location would overlap

Project facilities from Pennsylvania to Wright, New York. Where Tennessee does not have an existing corridor, Tennessee is proposing to co-locate the pipeline with other utility corridors where practicable and feasible, and in compliance with existing law.

As part of the Supply Path Component of the Project, Tennessee is proposing two separate 36-inch diameter pipeline looping segments that will generally parallel and adjacent to Tennessee's existing 300 Line in Pennsylvania (referred to as Loop 317-3 and Loop 319-3) to create additional transportation capacity from the anticipated receipt points to Tennessee's MLV 320. At that point, the Project will deviate from Tennessee's existing 300 Line and will extend north to Wright, New York. For the proposed pipeline that will extend north from the existing 300 Line to Wright, New York, Tennessee was unable to co-locate that segment with an existing utility corridor for the first 13 miles of that pipeline. However, from that point north to Wright, New York, Tennessee is proposing to generally co-locate a majority of its proposed pipeline with the certificated Constitution Pipeline Project corridor ("Constitution")[15] in Pennsylvania and New York.

Tennessee is proposing to deviate from Constitution's approved current route for approximately 13.59 miles (Segment D, milepost ["MP"] 10.28 to 23.87) to avoid areas of steep terrain, allow for a more optimal crossing of one large waterway, and minimize a crossing of a New York state forest. The location where the proposed route for the Project deviates from Constitution's approved alignment is identified as an alternative and discussed in Section 10.3.1.1.1 of this Resource Report 10. Tennessee originally proposed deviating from the Constitution route at two other locations (Segment C, MP 24.21 to 33.75 and Segment E, MP 39.61 to Segment F, MP 0.27); however, Tennessee has now adopted the Constitution route in those locations, as further detailed in Section 10.3.1.1.1.

10.2.1.2 Market Path Component

Tennessee has no available firm capacity on its existing 200 Line system from Wright, New York to Dracut, Massachusetts to provide service for the Market Supply Component of the Project. When Tennessee evaluated the market need in New England and the facilities that will be required to provide the infrastructure that New England needs to reduce high energy costs and enhance electric reliability, it conducted extensive evaluation of options to either: (1) loop its existing pipeline along the 200 Line pipeline corridor in southern Massachusetts; or (2) construct a new pipeline along a route across northern Massachusetts, utilizing existing transmission corridors where feasible. Tennessee determined that developing a route to parallel the entire length of its existing 200 Line will not be feasible, due to the level of urban congestion, constructability issues, environmental impact, and overall pipeline length. This route is examined as one of the alternative routes and is discussed below. Because the route paralleling Tennessee's entire existing 200 Line is not feasible, Tennessee is proposing the second option for the Market Path Component of the Project (referred to as Wright to Dracut Pipeline Segment), with a portion

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the existing powerline easement between 30 to 60 feet and that 20 feet of the 50-foot permanent easement overlap the existing powerline easement. Tennessee's permanent easement will generally be centered on the proposed pipeline. Depending on final field surveys and discussions with landowners, utility owners, and other stakeholders, the location and configuration of permanent easement and temporary workspaces may be refined.

[15] On December 2, 2014, the Commission issued an Order Issuing Certificates and Approving Abandonment, 149 FERC 61,199 (2014), for the Constitution Pipeline Project, which adopted the recommendations from the Constitution "Final Environmental Impact Statement: Constitution Pipeline and Wright Interconnect Projects," FERC Environmental Impact Statement ("EIS") No. 0249F, Docket Numbers CP13-499-000, CP13-502-000, and PF12-9-000 ("Constitution Final EIS ["FEIS"]") issued October 24, 2014. Information contained within this Resource Report 10 related to the Constitution Pipeline Project was based on the routing included in the FEIS, as approved by the certificate order.

of the route from Wright, New York, to Dracut, Massachusetts (Wright to Dracut Pipeline Segment, New York Portion), making use of the existing system where practicable and feasible.

The Wright to Dracut Pipeline Segment begins in Wright, New York, and traverses east where Tennessee is proposing to co-locate the pipeline along the existing 200 Line corridor for approximately 30 miles. Continuing to the east, Tennessee departs from its existing corridor and is proposing to parallel existing electric transmission corridors for approximately 139 miles (approximately 90 percent) of the route into Dracut, Massachusetts.

As part of the Project, Tennessee also is proposing the construction of pipeline laterals and looping segments to accommodate delivery point requests of certain Project Shippers. The existing Haverhill Lateral, Fitchburg Lateral, Beverly Salem Colonial Delivery Line, and the 200 and 300 Line systems are proposed to be modified as part of the Project to accommodate the delivery point requests.

A system analysis of the proposed Haverhill Lateral has been completed to determine if all or portions of the proposed route will be replaced within the existing ROW. The Haverhill Lateral will be a combination of new pipeline and take-up and relay (removing the existing 10-inch diameter line and replacing it with a 20-inch-diameter line within the existing ROW). Additionally, the Peabody Lateral will be a combination of new pipeline and take-up and relay (replacing the existing 8-inch Beverly Salem Colonial Delivery Line with a 24-inch diameter line).

10.2.2 Other Systems

In order to provide the necessary natural gas transportation service required to meet the growing energy needs in the Northeast U.S. that the proposed Project will otherwise provide, other pipeline systems in the vicinity of the Project area will need to be expanded and/or modified to transport up to 1.3 Bcf/d from Troy, Pennsylvania to Dracut, Massachusetts. To be considered a viable system alternative to the proposed Project, expansions or modifications of those pipeline systems will need to serve the same purpose and demand of the Project and create less environmental impacts than anticipated from the proposed Project (Figure 10.2-1). Tennessee's other proposed projects, including the Connecticut Expansion Project, Susquehanna West Project, Triad Expansion Project, and Orion Project, are separate and independent from the proposed Project and are designed to provide natural gas transportation service to different shippers to serve different markets, and are thus not considered viable system alternatives for the Project.

Tennessee does not have access to proprietary information concerning the flow characteristics of the existing interstate pipeline systems in the Pennsylvania, New York, and New England areas where the Project is proposed. However, based on publicly available information from open season notices and filings submitted to the Commission, as well as through access to other publicly available sources, Tennessee believes that these existing pipeline systems are at or near capacity. In particular, Tennessee relied on the following public filings, notices, reports, and studies:

- Portland Natural Gas Transmission System's ("PNGTS") Open Season Notice for Firm Service from December 3, 2013 to January 24, 2014 for its proposed Continent-to-Coast ("C2C") Expansion Project.
- ICF International: Gas-Fired Power Generation in Eastern New York and its Impact on New England's Gas Supplies, submitted to ISO-NE, November 18, 2013.

- ICF International: Access Northeast Project – Reliability Benefits and Energy Cost Savings to New England, dated February 18, 2015.
- ICF International: New England Energy Market Outlook – Demand for Natural Gas Capacity and Impact of the Northeast Energy Direct Project, dated September 9, 2015.
- Competitive Energy Services: Assessing Natural Gas Supply Options for New England and their Impacts on Natural Gas and Electricity Prices.
- Filings made by Spectra Energy Partners in its Algonquin Incremental Market ("AIM") Project proceeding (Docket No. CP14-96-000), Resource Report 10 Alternatives, dated February 2014.
- Filings made by Spectra Energy Partners in its proposed Atlantic Bridge Project proceeding (Docket No. PF 15-12), Resource Report 10 Alternatives, dated July 2015.
- Open Season Notice for Firm Service for Spectra Energy Partners', Eversource Energy's, and National Grid's proposed Access Northeast Project.
- Filings made by Iroquois Gas Transmission System, L.P. ("Iroquois") in its Market Access Project proceeding (Docket Nos. CP07-457-000 et al.).
- New Hampshire Public Utilities Commission's ("NHPUC") Report on Investigation into Potential Approaches to Mitigate Wholesale Electricity Prices.

10.2.2.1 Supply Path Component

For the Supply Path Component of the proposed Project (from Troy, Pennsylvania to Wright, New York), several existing pipelines serve or traverse the region, including Tennessee (discussed above), Transcontinental Gas Pipe Line Company LLC ("Transco"), Columbia Gas Transmission ("Colombia"), Millennium Pipeline Company ("Millennium"), and Dominion Transmission ("Dominion"). Tennessee anticipates these systems are near or fully subscribed based on documents filed with the FERC for Transco's New York Bay Expansion Project (Docket No. CP15-527), Rockaway Lateral Project (Docket No. CP13-36), and Northeast Connector Project (Docket No. CP13-132); Dominion's "New Market Project" (Docket No. CP14-497-000); as well as the certificated Constitution Pipeline Project (Docket No. CP13-499-000). These projects are designed to expand these pipeline companies' existing systems to provide additional transportation capacity to move gas production for shippers in the Marcellus production area to markets north and east. However, based on public information available about these projects, Tennessee anticipates that significant looping or additional compression will need to be added to those pipeline systems in order to provide equivalent transportation capacity to that proposed to be created by the proposed Project, likely resulting in similar, if not greater, environmental impacts than from the proposed Project. A summary of the proposed capacities of these projects is provided in Table 10.2-1.

Transco has announced its proposed Diamond East Project that will provide firm natural gas to markets in the Northeast U.S., but that project is proposing to serve different markets in Pennsylvania, New Jersey, and New York than the proposed Project, and is not further evaluated in this resource report. Other proposed projects, including Transco's Atlantic Sunrise Project (Docket No. CP15-138) and Leidy Southeast Expansion Project (Docket No. CP13-551), Colombia's East Side Expansion Project (Docket No. CP14-17), and the PennEast Pipeline Project (Docket No. CP15-558) will also serve different markets in Pennsylvania, New Jersey, and the Mid-Atlantic and southeast regions and are not further evaluated in this resource report.

10.2.2.2 Constitution Single Pipeline Alternative

With regard to Constitution, Tennessee notes that the Commission issued the Constitution FEIS (FERC 2014a) on October 24, 2014, and an Order Issuing Certificates and Approving Abandonment for that project on December 2, 2014 ("Constitution Order"). The Constitution FEIS contains a section in the Alternatives Section discussing Tennessee's NED Project, a portion of which is proposed to generally co-locate with the Constitution Pipeline Project from Susquehanna County, Pennsylvania, and Wright, New York (as discussed in more detail in Resource Report 1 in this filing).

In the Constitution Order, the Commission discussed an alternative to the Constitution Pipeline Project and the NED Project that would require the construction and operation of a single, larger-diameter pipeline alternative combining capacity of the two projects. The Commission concluded the single pipeline alternative would require Constitution to reassess the technical feasibility of many resource crossings and engineering design, and require Iroquois to reassess the turbines it was authorized to construct, operate, and modify at its Wright Compressor Station. The Commission further recognized that reassessment of the single, larger-diameter pipeline project would take at least several months, if not longer, to complete, further delaying construction and in service of the Constitution Pipeline Project. The Commission also noted that Tennessee and Constitution have different project objectives, customers, and market-driven obligations that may not be met by a combined project. *See Constitution Pipeline Co., LLC*, 149 FERC ¶ 61,199, at P 123 (2014). The Commission explicitly adopted the findings of Commission Staff in the Constitution FEIS, where Commission Staff discussed the possibility of requiring Constitution and Tennessee to build one larger diameter pipeline to accommodate the objectives of both projects. Although the Constitution FEIS acknowledged that construction of one larger pipeline rather than two smaller pipelines would generally reduce long-term environmental impacts (assuming that both pipeline projects will cross the same resources), it did note that a larger pipeline would require a wider construction ROW and additional workspaces at resource crossings. Further, the Constitution FEIS included discussion that if a larger pipeline was constructed, the extra capacity will not be immediately utilized, as sufficient takeaway capacity from Wright, New York, does not exist currently (e.g., the proposed Wright to Dracut Pipeline Segment of the NED Project).

The Constitution FEIS also included a discussion of the Commission's Certificate Policy Statement, under which the Commission applies a balancing test in reviewing proposals that weighs the environmental impacts of a project against purported benefits, noting that a project providing greater benefits will be approved with larger adverse or significant impacts to the environment. Commission staff stated that were it to recommend that Constitution construct a larger diameter pipeline, that recommendation would directly conflict the Commission's established policy on overbuilding. Also, based on available information, Commission Staff explained the Constitution Project and the NED Project have different project objectives, different shippers, and different market-driven obligations that may not be met by a combined project. Commission Staff also acknowledged in the Constitution FEIS that given the timeframe for the proposed NED Project, recommending the single pipeline alternative would delay Commission review of the Constitution Pipeline Project significantly and will be inconsistent with EPAct 2005. *See* Constitution FEIS, Section 3.3.5, Northeast Energy Direct Single Pipeline Alternative, pages 3-24 through 3-27, for the complete discussion.

If the Commission were to require as part of its review of the NED Project a single pipeline to be built in place of the Constitution Project and NED Project, the single pipeline project capacity would not be available to be used until the Commission completes its NEPA review and authorizes the NED Project, the NED Project receives all other necessary federal approvals, and is then constructed., Approval of a

single pipeline project would essentially vacate the Commission's certificate authorization in the Constitution Order and require Constitution and Tennessee to revisit and reassess all engineering and technical analyses for the two projects. Recommendation of this alternative would force Tennessee and Constitution to work together to propose a single pipeline project, causing additional delays that would not meet the purpose and need of both projects.

Despite delays in the construction of the Constitution Pipeline Project, however, the timing of the two projects is not likely to match up. According to Constitution's weekly status reports, it is anticipating receipt of remaining federal clearances to begin construction in the fourth quarter of 2015, as its shippers have requested an in-service date in 2016, a full two years before the in-service date for the NED Project. Therefore, delays, which would postpone construction until Tennessee's proposed start of construction in January 2017, would not meet the stated purpose and need of the Constitution Pipeline Project. Even if construction of the Constitution Project were to be delayed a year until the fourth quarter of 2016 or the first quarter of 2017, and theoretically completed in late 2017 or early 2018, recommendation and adoption of a single pipeline alternative would mean that the takeaway capacity would still not be available until the NED Project is approved and constructed, which is not anticipated until late 2018.

Tennessee has developed the routing for the NED Project to generally co-locate with the certificated route of the Constitution Pipeline Project from Susquehanna County, Pennsylvania to Wright, New York, as discussed in Resource Report 1, in order to reduce environmental and landowner impacts while still meeting the purpose and need of the NED Project. As acknowledged by the Commission in the Constitution Order, the Constitution Pipeline Project and the NED Project have been developed to meet different project objectives, and are supported by different shippers and different market-driven obligations that may not be met by a combined project.

10.2.2.3 Constitution Project System Alternative

In addition to the assessment of one larger diameter pipe to accommodate the needs of both Constitution and Tennessee's Pennsylvania to Wright, New York Pipeline Segment portion of the NED Project, a system compression alternative also has been considered, wherein additional compression above that currently authorized for the Constitution Pipeline Project will allow for transportation of a larger quantity of gas needed for the NED Project.

Based on the certificate issued by the Commission in the Constitution Order issued for the Constitution Pipeline Project, Tennessee understands that the Commission authorized the construction of a 30-inch, 1,440 pounds per square inch gauge ("psig") pipeline as part of the Constitution Pipeline Project and that shippers have subscribed for 650,000 Dth/d of transportation capacity on that project. In the Constitution Pipeline Project FEIS, Constitution estimated that the maximum capacity of its 30-inch line to be only 850,000 Dth/d – which only leaves an expansion of 200,000 Dth/d. In order to deliver gas to the Constitution Pipeline Project facilities, in addition to the compression that Tennessee assumes will need to be added by Constitution, Tennessee also will still need to construct approximately 16 miles of pipeline from its 300 Line in Pennsylvania to the southern portion of the Constitution system, and install compression and metering at that interconnect location. In any event, Tennessee anticipates that more transportation capacity is required for the Project than what the Constitution system will economically provide without looping of that system.

Tennessee has designed the proposed Project to meet the expressed needs of the Project Shippers, including requests to provide specific receipt points in Northeast Pennsylvania and specific delivery

points to the Project Shippers' existing systems in New England that are already connected to Tennessee's system, as well as to new delivery points on Tennessee's system. The proposed Project is independent from other proposed pipeline projects in the region and is designed to provide natural gas transportation service to the Project Shippers. The capacity to provide this transportation service must be available by November 2018 in order for the gas supply to be transported to the requested delivery points. Timing may not be able to be accommodated by expansions of pipeline systems that have not yet been proposed by other pipeline companies. Tennessee is not aware of any proposed, pending or recently approved projects in the region that also will meet the Project's objectives, including meeting the November 1, 2018 in-service date.

10.2.2.4 Market Path Component

For the Market Path Component of the proposed Project (extending from Wright, New York to Dracut, Massachusetts), six interstate pipelines, including Tennessee, serve the New England natural gas supply and delivery infrastructure as listed below (Figures 10.2-1 through 10.2-6):

- Tennessee owns and operates an interstate natural gas transmission system that extends from the states of Texas, Louisiana, and the Gulf of Mexico area, through the states of Texas, Louisiana, Arkansas, Mississippi, Alabama, Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, Rhode Island, and New Hampshire. To highlight the inadequate pipeline capacity into and within the New England region, Tennessee receives requests on an almost daily basis requesting transportation service to or within the New England region that greatly exceed Tennessee's available operating capacity. In the winter months (i.e., November through March), Tennessee is required each day to restrict its shippers' requested volumes for non-firm transportation service in this region. The extent of these restrictions over the past three winters ranges from an average low of approximately 0.7 Bcf/d, to an average high of 1.4 Bcf/d, with sustained periods of significantly greater restrictions (e.g., restricting up to 2.6 Bcf/d of shipper requests during the winter 2014/2015). These required restrictions on requested service that are affecting the New England region occur at multiple locations along Tennessee's system. Regardless of whether the restriction is made at a point in New England or into the New England region, these restrictions impact all priorities of Tennessee's various interruptible transportation services and limit Tennessee's ability to deliver gas in New England.
- Spectra Energy's Algonquin Gas Transmission Pipeline ("AGT") originates from southern New Jersey, Connecticut, and Massachusetts. The AGT system's proposed AIM Project, Atlantic Bridge Project, and Access Northeast Project will provide more transportation capacity on the AGT systems, but based on the public information about these projects, will not be capable of providing service to Tennessee's Project Shippers in New York, Massachusetts, northern Connecticut, and New Hampshire, unless AGT were to build an entirely new pipeline system that will essentially duplicate the Tennessee system. Such a project will involve the construction of hundreds of miles of new pipeline facilities, presumably resulting in significantly greater environmental impacts than the proposed NED Project facilities, which includes pipeline looping and co-location with existing facilities to the extent practicable and feasible. AGT has indicated[16] that its pipeline system in the New England region is as highly utilized as Tennessee's system throughout the year, with little to no transportation service available to shippers that have not

[16] AGT comments to the Massachusetts Department of Public Utilities Staff titled "Investigation by the Department of Public Utilities Into the Means By Which New Natural Gas Delivery Capacity May Be Added to the New England Market, Docket No. D.P.U. 15-37" (June 15, 2015).

contracted for firm service or are not able to acquire firm service released from another shipper that is not utilizing its contracted pipeline capacity. For example, AGT states that it has operated at essentially 100 percent load factor through its Southeast and Cromwell compressor stations for the past four to five years. Requests for transportation pursuant to interruptible contracts has been consistently rejected by AGT, i.e., only firm contracts have been able to be scheduled for delivery. AGT consistently has winter season timely cycle (NAESB) nominations for West to East transportation on its system that are 400 to 500 million dekatherms per day ("Mdth/d") higher than its current capacity.[17]

- The Iroquois system originates from Waddington, New York delivering Canadian supplies to the New York City, New York region. The Iroquois system currently serves southwestern Connecticut and Long Island, New York, but is not capable of serving Tennessee's Project Shippers in New York, Massachusetts, northern Connecticut, New Hampshire, Rhode Island, Maine, and Atlantic Canada, without significant expansions or constructing new pipeline facilities.
- The PNGTS system originates from Eastern Canada and provides Canadian supplies to the Boston, Massachusetts region**.** The PNGTS system's proposed C2C Expansion Project will provide additional transportation capacity on the TransCanada/Trans-Québec and Maritimes and Northeast pipeline ("M&NP"), but the PNGTS system is not capable of serving Tennessee's Project Shippers in New York, Massachusetts, northern Connecticut, Rhode Island, New Hampshire, Maine, and Atlantic Canada without building an entirely new pipeline resulting in significantly greater environmental impacts than the proposed Project.
- The M&NP originates from the Atlantic Canada Provinces and delivers Canadian production and LNG imports from Repsol Canaport LNG in New Brunswick to the New England region. These supply sources have diminished in recent years, which means that New England will need to replace these sources to preserve the current supply/demand status. The Canaport Terminal has the option of delivering natural gas to New England from the offshore natural gas production fields of the Sable Offshore Energy Project ("SOEP") and Deep Panuke in Nova Scotia, Canada. However, SOEP has experienced significant declines in production in the past few years and is fully expected to cease production completely within a decade.[18] Deep Panuke commenced production in the third quarter of 2013, but has experienced a number of "shut-ins" of production, and has had higher than expected operating costs. A number of energy analysts have indicated that future gas exploration and production activity around Deep Panuke and other Nova Scotia gas fields is uncertain.[19] If these fields continue to decline as analysts have projected, gas consumers in New England will need to replace this portion of their fuel supplies, which will increase the competition for already scarce pipeline capacity serving New England. Another source of competition for scarce pipeline capacity is the existing gas consumers in the Canadian provinces that are in the process of seeking gas imports from New England to meet their heating and power generation needs. Additionally, New England's access to gas supplies has become further constrained by the reduced frequency of firm cargoes at the regions' LNG import terminals. Since the price of imported LNG is typically a function of world oil prices, the cost of

[17] Ibid.

[18] Jupia Consultants Inc. report prepared for Atlantica Centre for Energy titled "Natural Gas Supply and Demand Report, New Brunswick and Nova Scotia, 2015-2025", Spring 2015; ICF International (for Eversource Energy and Spectra Energy), "Access Northeast Reliability Project – Reliability Benefits and Energy Cost Savings to New England" (2.18.15) (ICF International 2015); Competitive Energy Services (for the Industrial Energy Consumer Group), "Assessing Natural Gas Supply for New England for the Winter of 2013-14 and its Impact on Natural Gas and Electricity Prices" (4.5.13).

[19] Ibid.

imported LNG also is much higher than the cost of pipeline natural gas delivered to New England in an unconstrained market. Thus, when oil or LNG have been utilized as fuel to produce electricity in the past few years, the resulting cost has been substantially higher than if unconstrained natural gas had been utilized to produce the electricity. The U.S. Energy Information Administration projects that the price spread between natural gas and oil-based fuels in New England is expected to continue through 2040, and in fact, increase over time[20]. As LNG is a global commodity, New England consumers must not only compete with the rest of the world to have LNG spot cargoes available on peak days, which have resulted in extremely high gas prices, but they may not be able to secure gas at all, depending on the availability of spot cargoes. Even during the 2013-2014 winter, when spot prices spiked to $78/MMBtu, very few spot cargoes were delivered into New England terminals. Finally, bringing gas supplies from other production areas, including the Marcellus area, to the Project's markets will necessitate the construction of an entirely new pipeline that will essentially duplicate the Tennessee system from east to west. Such a project will involve the construction of hundreds of miles of new pipeline facilities, presumably resulting in significantly greater environmental impacts than the proposed NED Project facilities, which includes pipeline looping and co-location with existing facilities to the extent practicable and feasible.

- The Granite State Gas Transmission ("GSGT") system is located in New Hampshire and does not transport natural gas from supply areas outside New England into New England. This pipeline only distributes natural gas within the region. Therefore, in order to serve the Project Shippers, the GSGT will be required to construct an entirely new pipeline. Such a project will involve the construction of hundreds of miles of new pipeline facilities, presumably resulting in significantly greater environmental impacts than the proposed NED Project facilities, which includes pipeline looping and co-location with existing facilities to the extent practicable and feasible.

Other pipeline operators in the Project area have marketed transportation service moving natural gas into eastern New York and New England, including Spectra, AGT, Iroquois, and Millennium, who have each offered projects for shippers to consider through open seasons. Based on publicly available information, AGT's AIM Project was successful in attracting binding shipper commitments and is moving forward in the regulatory process. A certificate order for the AIM Project was issued by the Commission on March 3, 2015 in Docket No. CP14-96-000. The AIM Project began construction in June 2015 and is anticipated to be placed in-service in November 2016. AGT's Atlantic Bridge Project was also successful in attracting binding shipper commitments and has initiated the FERC pre-filing process in Docket No.PF15-12-000. The Atlantic Bridge Project is anticipated to be placed in service in November 2017. Spectra's Access Northeast Project, which will include approximately 125 miles of pipeline replacement, looping, and laterals, as well as LNG storage, liquefaction, and vaporization facilities, expects to initiate the FERC pre-filing process in the fourth quarter of 2015. Tennessee understands that other similar projects, such as Iroquois' South-to-North Project (linked with the PNGTS C2C Expansion Project and M&NP Joint Facilities) and Millennium's Corning to Ramapo Project have not been successful in securing sufficient shipper interest to move forward at the time of this filing. A summary of the proposed capacities of these projects is provided in Table 10.2-1.

[20] AGT comments to the Massachusetts Department of Public Utilities Staff titled "Investigation by the Department of Public Utilities Into the Means By Which New Natural Gas Delivery Capacity May Be Added to the New England Market, Docket No. D.P.U. 15-37", June 15, 2015.

Table 10.2-1
Proposed Capacity of Alternate Systems

Sponsor	Project	Capacity (Dth/d)(Status)
Williams	Constitution	650,000 (Approved)
Transco	New York Bay Expansion	230,000 (Proposed)
Transco	Rockaway Lateral & Northeast Connector	647,000 (In-service)
Dominion	New Market	112,000 (Proposed)
PNGTS	Continent to Coast	132,000 to 182,000 (Proposed; open season completed)
Spectra	AIM	up to 342,000 (Approved)
Spectra	Atlantic Bridge	up to 132,705 (Proposed; in pre-filing)
Spectra	Access Northeast	200,000 to 1,000,000 (Proposed; open season completed)
Millennium	Corning to Ramapo	not available (Proposed; open season completed)

While the projects identified above share the general common goal with Tennessee's NED Project of transporting natural gas to Northeast U.S. markets, including New York and New England, there are significant differences. While Tennessee's market area does partially overlap with AGT's and Millennium's market areas (for example in southeastern New York), there also are many other areas where only one or two of the pipeline systems have existing infrastructure, or where one pipeline can offer a more economical solution for transporting incremental gas supplies. In general, Tennessee's existing system serves more of western and northern Massachusetts, while AGT serves southeast Massachusetts. While either pipeline company will serve growing markets in Massachusetts, each company is typically better positioned to serve certain geographic areas due to the location of each company's existing pipeline infrastructure. However, the NED Project uniquely enables service to all areas of Massachusetts given its ability to serve the Tennessee 200 Line system as well as various markets on the AGT system. This Project has the potential to provide high pressure volumes to AGT's through the Joint Facilities, M&NP, and AGT's HubLine Pipeline system, which are needed to replace the rapidly declining imports from Canada. Additionally, via a backhaul, the Project significantly increases the capacity of Tennessee's 200 Line system and will increase deliverability at an important supply feed to AGT's system via an existing Tennessee-AGT interconnect at Mendon, Massachusetts. New England is experiencing the highest electricity and natural gas prices in the continental United States, which can be mitigated or eliminated through contracting for additional pipeline capacity in the region. Natural gas is the environmentally cleanest fossil fuel, and new supplies of gas capacity will create the opportunity for residences and businesses to convert from oil and other fuels for heating and manufacturing to less expensive and cleaner natural gas. Natural gas-fired generation is a necessary backup source of generation to support the growth in renewable technologies such as wind and solar that have intermittent and non-dispatchable characteristics.

According to an investigation by NHPUC to study potential approaches to mitigate the high and volatile electricity prices in New Hampshire and other New England states, the NED Project is preferable to Spectra's Access Northeast Project and PNGTS's Continent to Coast Project as the most cost-effective project to moderate future winter electricity prices and will provide the greatest benefits to regional electricity customers (NHPUC 2015). Each of the projects will enhance electric grid reliability by providing gas generators access to firm fuel suppliers, but the NED project will have the greatest benefit-to-cost ratio.

The cumulative impacts that the other proposed projects and the NED Project would have on each environmental resource are discussed in detail in each of the applicable Resource Reprots. The locations of the projects in relation to the NED Project are also identified in Figures 1.9-1 through 1.9-4 in Attachment 1a to Resource Report 1.

Tennessee believes that the NED Project is uniquely designed to provide the transformative solution that New England needs to bring low-cost, abundant and environmentally clean natural gas to New England, which will lower and stabilize energy costs for gas and electric customers, will serve other regional pipelines, and help stimulate economic growth, providing the opportunity for New England to benefit similarly to other regions of the U.S. where low-cost natural gas is transforming the economy. As a new path for gas into New England, the NED Project will create a large bi-directional pipeline system that will fundamentally improve natural gas flows, relieve existing bottlenecks, and enhance gas supply diversity and reliability for decades to come. The NED Project is designed to provide New York and New England with direct access to low-cost gas supplies in the "scale" necessary to significantly lower energy costs. Combined, the existing Tennessee system and the proposed NED Project are, among all pipeline systems serving New England, best situated and designed to serve the areas specifically identified by ISO-NE where additional generation is required to replace substantial amounts of oil and coal-fired generation retiring in the next few years without triggering electric transmission constraints.

In order to transport the Project-equivelant volume of 1.3 Bcf/d from the supply area to the destination locations, a daily total of 7,831 truckloads of compressed natural gas ("CNG") would be required. This would be based on each CNG jumbo tube trailer holding 166 thousand cubic feet ("Mcf") of gas at 3,000 psig. Loading, transporting, and delivering the CNG from the supply area to the destination would not be physically possible due to the number of trucks required (approximately 4,000 making two trips per day), the distane between the supply area and the delivery destinations, and the time required to load (2 hours minimum) each trailer since all 4,000 trailers would not be able to instantly deliver its load once arrived at a delivery point.

Currently, LNG is prohibited from rail transport as a cargo in tank cars. Recently, the Alaska Railroad Corporation ("ARRC") received approval of its November 2014 request to transport LNG in ISO-certified tankers atop flatcars. ARRC requested permission to run two trains per week with each consisting of 60-70 portable LNG tanks riding atop 30-70 flatcars. ARRC received permission to operate two LNG trains per week carrying a maximum of eight, 11,000-gallon LNG containers.

A liquefaction facility with rail car loading facilities would be needed near the well field. There are no current or planned liquefaction facilities in the production area. Site requirements are estimated to be 50 to 100 acres based on similar facilities. Since the pipeline does not deliver all of the gas to one location, several gasification locations would be needed at the rail car unloading facilities. Additional volumes of gas and LNG would be required to partially supply the energy needs of the end point facilities. Facilities required to move natural gas from the well field to LNG tanks include:

- Additional Gas Processing – Normally, natural gas taken directly from a well field requires some level of processing to remove water vapor and other naturally occurring components to meet pipeline tariffs. Since the liquefaction equipment is more sensitive to components other than pure methane, it is likely that gas taken directly from the well field would require additional processing.
- Liquefaction – Liquefaction facilities are combinations of processing components, commonly referred to as "trains", which transform the natural gas into a liquid.
- LNG Storage Tanks – To meet the capacity on a consistent basis, the facility would likely need at least two full containment, 160,000-cubic-meter LNG storage tanks.
- Other Storage Tanks – The facility would also need propane, ethylene, and amine storage tanks
- Flare system – A flare system would need to be provided to accommodate several levels of planned and unplanned hydrocarbon releases.
- Ancillary Facilities – Adequate power would need to be available or generated on site as well as cooling fans, boil off compression, fire suppression equipment, and standby generation.

Facilities required to move natural gas from LNG storage tanks to the delivery points include:

- LNG Storage Tanks – Full containment LNG storage tanks would be needed at the rail sites to off load the LNG. The size of these tanks would be determined by a logistical study of daily requirements and transportation capacity.
- Gasification – Gasification facilities consists of a high pressure fired vaporizers that transform the LNG into natural gas.
- Flare system – A flare system would need to be provided to accommodate several levels of planned and unplanned hydrocarbon releases.
- Ancillary Facilities – Adequate power would need to be available or generated on site, boil off compression, fire suppression equipment and standby generation. Additional compression may be needed to raise the gas presser to match the receiving pipeline.

10.3 ROUTE ALTERNATIVES

Several alternatives to the proposed NED Project pipeline facilities were evaluated as part of the planning and design process for this Project. The alternatives analysis for the pipeline routes was based on environmental and land use impacts, as well as permanent easement acquisitions, and overall Project costs. A route alternative is a linear segment of pipeline that deviates from the routing of the proposed pipeline facilities for the Project. Tennessee has analyzed three types of route alternatives (listed below).

- Major route alternatives significantly deviating in both length and distance from the proposed route of the pipeline facilities (Section 10.3.1).
- Minor route alternatives deviating from the proposed route of the pipeline facilities in the same general area as the proposed route (Section 10.3.2).
- Minor deviations involving minor adjustments to the proposed route to avoid specific features (e.g., topography, sensitive habitat, and structures) or to address landowner requests (Section 10.3.3).

Tennessee evaluated 16 major alternative routes (Figures 10.3-1 through 10.3-13), 23 minor alternative routes (Figures 10.3-14 and 10.3-20), and over 100 minor deviations. Of these minor deviations, 55 landowner requests and 46 agency requests are presented in Section 10.3.3. These comparisons of

alternatives to the proposed route for the Project pipeline facilities are detailed in Tables 10.3-1 through 10.3-10 (major route alternatives), Tables 10.3-11 through 10.3-15 (minor route alternatives), and Tables 10.3-16 and 10.3-17 (minor deviations-landowner and agency deviations).

Tennessee performed an analysis using desktop data to compare the proposed route for the Project's pipeline facilities against alternative routes. Although environmental survey data has been collected for the proposed route of the Project's pipeline facilities where access has been granted, a lack of comprehensive, consistent data does not allow for comparative assessments among the alternatives. Therefore, desktop data was utilized for the alternative analysis to present a more comprehensive, reliable, and consistent data set for alternatives analysis.

The factors considered by Tennessee in its selection of the proposed route for the Project's pipeline facilities, rather than the alternative routes and deviations, include landowner concerns, minimization of the number of affected landowners, minimization of adverse environmental impacts, ensuring constructability, promoting safety, and meeting Tennessee's goal to minimize the extent of potential disruption to communities during construction. Existing information sources such as field reconnaissance, aerial photography, topographic maps from the U.S. Geological Survey ("USGS"), and National Wetland Inventory ("NWI") maps were used during the route identification and evaluation processes.

When evaluating the routing options for the Project's pipeline facilities, Tennessee attempted to co-locate with its own existing pipeline facilities and ROW and other existing utility ROWs, to the extent practicable, feasible, and consistent with existing law. The use of co-location as a principle design element by Tennessee is necessitated not only by Commission guidelines which stress the use of existing corridor concept, but also due to the existing land use characteristics in the areas of the pipeline system. The utility corridor created by Tennessee's existing pipeline or other utilities or pipelines minimizes further environmental impacts and public disturbance, as well as construction costs. Siting pipeline facilities along existing corridors reduces the establishment of new corridors in previously undisturbed areas, while limiting environmental impacts and the number of affected landowners.

The selection of the major route alternatives discussed in Section 10.3.1 was dictated by several factors:

- Determination of the most cost-effective technical solution (i.e., looping or co-location versus addition of compression);
- Development of routing criteria;
- Identification of potential routing alternatives;
- Collection of data relative to each alternative;
- Evaluation of potential environmental and land use impacts; and
- Evaluation of routing alternatives against routing criteria.

The main determinants used to select the proposed route for the Project's pipeline facilities rather than the other alternative routes that were evaluated, pertained to minimizing the number of affected landowners, constructability issues, and Tennessee's goal to limit the extent of disruption on the communities that will potentially be affected during construction.

10.3.1 Major Route Alternatives

Major route alternatives include those that deviate from the proposed route for the Project's pipeline facilities for a significant distance (often a majority or more of the proposed route's length for a specific pipeline facility), and which provide a substantially different pathway from the supply area to the delivery area. In lieu of the proposed Project facilities that were selected to meet the Project objectives, Tennessee evaluated the alternative of constructing a new pipeline along with sixteen other alternative alignments as detailed below. The following sections and tables provide details for the major alternatives and were compiled utilizing publically available, federal, and other geographic information systems ("GIS") data set sources.

10.3.1.1 Pennsylvania to Wright Pipeline Segment Alternatives

Tennessee evaluated a total of six major alternatives along its proposed Pennsylvania to Wright Pipeline Segment. These alternatives consist of one area in which the proposed route for the Pennsylvania to Wright Pipeline Segment deviates from the certificated route for the Constitution Pipeline Project, two alternative locations where Tennessee considered deviating the Pennsylvania to Wright Pipeline Segment from the Constitution route, two alternative routes along the Interstate 88 ("I-88") corridor, and one alternative previously evaluated as part of Tennessee's contemplated Northeast Exchange ("NEEX") project, discussed in Section 10.3.1.1.3. The information detailed below pertains to the Constitution Pipeline Project route evaluated within the Constitution Draft Environmental Impact Statement ("DEIS") and FEIS (FERC 2014a,b) and approved in the December 2, 2014, certificate order.

10.3.1.1.1 Constitution Route 1 Alternative, Route 2 Alternative, and Route 3 Alternative

The following details two locations along the proposed Pennsylvania to Wright Pipeline Segment where deviations to the certificated Constitution route were considered. In addition, an alternative was considered to co-locate with Constitution in one area where the proposed Pennsylvania to Wright Pipeline Segment deviates from the Constitution alignment due to engineering constraints. As discussed below, the Constitution Route 1 Alternative, Constitution Route 2 Alternative, and Constitution Route 3 Alternative, which deviate from the certificated Constitution Pipeline Project alignment, were considered but not adopted for the Project (Table 10.3-1 and Figure 10.3-1).

Tennessee's Constitution Route 1 Alternative would deviate from the approved Project alignment where it co-locates with Constitution within Pennsylvania at Segment C, MP 24.21 of the Pennsylvania to Wright Pipeline Segment and returns to the proposed alignment at Segment C, MP 33.75. This alternative would be 12.00 miles in length, which is 2.40 miles longer than the proposed alignment. The alternative route would have provided optimal access to the Project for a potential Project Shipper and would be co-located with an existing powerline easement for approximately 4.61 miles only, as compared to the proposed Project alignment which is co-located in its entirety. Rerouting of the Project laterals would not be necessary for this alternative. In this area the proposed route for the Project is co-located with Constitution, resulting in less acres of land impact, and fewer wetland and waterbody impacts. Further, Tennessee determined that a potential Project Shipper can adequately access the pipeline along the proposed alignment so this alternative is not needed. For these reasons, this alternative was not selected over the proposed Project route.

Tennessee's Constitution Route 2 Alternative route would deviate from the Pennsylvania to Wright Pipeline Segment in New York at Segment D, MP 10.25 to align with the certificated Constitution

alignment and return to the Project alignment at Segment D, MP 23.87. This alternative is approximately 17.62 miles in length. Tennessee understands that the Constitution pipeline was sited in this location in order to provide access to its system for a contracted shipper for that project. Situated within Broome and Chenango Counties, New York, Tennessee's proposed route travels in a northeasterly direction and is approximately 4.05 miles shorter than the alternative route where it is co-located with the certificated Constitution alignment, resulting in less impacts to environmental resources and landowners. The Constitution Route 2 Alternative would traverse steep slope areas and include a crossing of Bennettsville Creek, and would also cross Melondy Hill State Forest at a different location than the proposed Project alignment. Rerouting of the Project laterals would not be necessary for this alternative. This alternative would result in fewer impacts to State forest/parks, Important Bird Areas ("IBAs")/Audubon forest blocks of importance, and the entire 17.62 miles are co-located with the certificated Constitution alignment, as opposed to the proposed Project route, which is entirely new ROW. However, due to its length, this alternative would have greater land impacts, cross more linear footage of wetlands, cross more waterbodies, and include more mileage within forested areas than the proposed route for the Project. For these reasons, this alternative was not selected over the proposed Project.

Tennessee's Constitution Route 3 Alternative would deviate from the proposed Project alignment that is proposed to be co-located with the certificated Constitution alignment in New York at Segment E, MP 39.61 of the Pennsylvania to Wright Pipeline Segment and returns to the proposed route at the Wright Meter Station at Segment F, MP 0.27. This alternative route is approximately 11.35 miles in length and 0.19 mile shorter than the proposed alignment. The alternative route would be entirely new ROW, as opposed to the proposed route, which would be co-located with the certificated Constitution alignment for its entirety. Neither the proposed route nor the alternative route crosses wetland complexes, and the Constitution Route 3 Alternative would cross two additional waterways (for a total of eight) as compared to the six waterway crossings that are part of the proposed alignment. The Constitution Route 3 Alternative would also cross eight more parcels than the proposed route. Rerouting of the Project laterals would not be necessary for this alternative. Tennessee, after review of the proposed route as compared to this alternative, determined that the alternative route will not provide for greater minimization of environmental impacts that are gained by co-locating with Constitution's route, and therefore was not selected over the proposed Project.

Table 10.3-1
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment to Constitution Alternatives

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment			Constitution Co-location and Deviation Alternative Routes			Difference (if applicable)[1]		
	1	2	3	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	1	2	3
Length of corresponding segment (miles)	9.6	13.57	11.54	12	17.62	11.35	-2.4	-4.05	0.19
Type of ROW									
New ROW (miles)	0	13.57	0	7.39	0	11.35	-7.39	13.57	-11.35
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	9.6	0	11.54	4.61	17.62	0	4.99	-17.62	11.54
ROW Requirements									
Pipeline construction requirements (acres)[2]	116.55	164.63	140.07	145.60	213.68	137.77	-29.05	-49.05	2.31
Pipeline operation requirements (acres)[2]	58.23	82.27	69.99	72.75	106.80	68.84	-14.52	-24.53	1.15
Wetlands									
Total wetland complexes crossed (number)[3]	3	3	0	6	3	0	-3	0	0
Total wetland crossed (linear ft/miles)[3]	524.1 / 0.10	377.5 / 0.07	0	1443.6 / 0.27	739.1 / 0.14	0	-919.5 / -0.17	-361.6 / -0.07	0
Palustrine forested ("PFO") wetland impacts[3] (construction/	0.33 / 0.16	0.59 / 0.29	0	1.60 / 0.08	0.00	0	-1.27 / 0.08	0.59 / 0.29	0
operation acres) (miles)	0.03	0.05	0	0.13	0	0	-0.1	0.05	0

Table 10.3-1
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment to Constitution Alternatives

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment			Constitution Co-location and Deviation Alternative Routes			Difference (if applicable)[1]		
	1	2	3	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	1	2	3
Palustrine scrub-shrub ("PSS") wetland impacts[3] (construction/ operation acres) (miles)	0	0.28 / 0.14	0	1.25 / 0.63	0.86 / 0.43	0	-1.25 / -0.14	-0.58 / -0.29	0
	0	0.02	0	0.1	0.07	0	-0.1	-0.5	0
Palustrine emergent ("PEM") wetland impacts[3] (construction/ operation acres) (miles)	0.88 / 0.44	0	0	0.45 / 0.23	0.83 / 0.41	0	0.43 / 0.21	-0.83 / -0.41	0
	0.07	0	0	0.04	0	0	0.03	0	0
Waterbodies									
Waterbodies crossed (number)	8	13	6	12	16	8	-4	-3	-2
Perennial waterbodies (number)	3	5	6	3	10	8	0	-5	-2
Major river crossings (number >100 ft)	0	0	1	0	0	1	0	0	0
Designated natural and scenic rivers (number)	0	0	0	0	0	0	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0	0	0	0	0	0	0

Table 10.3-1
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment to Constitution Alternatives

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment			Constitution Co-location and Deviation Alternative Routes			Difference (if applicable)[1]		
	1	2	3	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	1	2	3
Fish, Wildlife, and Vegetation									
Important Bird Areas/ Audubon forest blocks of importance (miles)	0	4.69	0	0	2.39	0	0	2.3	0
Cultural Resources									
National historic landmarks within 0.50 mile (number)	0	0	0	0	0	0	0	0	0
National Register of Historic Places (“NRHP”) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	0	0	1	0	0	2	0	0	-1
Land Use									
Forested lands crossed (miles)	8.2	8.5	5.1	8.3	10.4	5.2	-0.1	-1.9	-0.1
Agricultural lands crossed (miles)	1.1	4.1	5.8	2.8	6	5.7	-1.7	-1.9	0.1
Open (meadow, recreation, historic districts, etc.) (miles)	0.3	0.9	0.6	0.9	1.2	0.4	-0.6	-0.3	0.2

Table 10.3-1
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment to Constitution Alternatives

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment			Constitution Co-location and Deviation Alternative Routes			Difference (if applicable)[1]		
	1	2	3	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	1	2	3
Developed (residential, commercial/industrial) (miles)	0	0	0.2	0	0	0.1	0	0	0.1
Property Owners									
Parcels crossed (number)	54	87	70	83	99	78	-29	-12	-8
Federal and State Land									
Federal lands crossed (number/miles)	0	0	0	0	0	0	0	0	0
State forests/parks (number/miles)	0	3 / 0.76	0	0	1 / 0.06	0	0	2 / 0.70	0
Wildlife Management Areas (“WMAs”) (number/miles)	0	0	0	0	0	0	0	0	0
Trails									
National and state trails (number)	0	0	0	0	0	0	0	0	0
Other Environmental Features									
Landfills, quarries (count within 0.50 mile)	18	6	0	14	5	0	4	1	0
Environmental hazards (count within 0.50 mile)[4]	4	26	16	0	23	17	4	3	-1

Table 10.3-1
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment to Constitution Alternatives

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment			Constitution Co-location and Deviation Alternative Routes			Difference (if applicable)[1]		
	1	2	3	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	1	2	3

1 Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

2 Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

3 The data set includes publicly available data only.

4 Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.1.2 Interstate-88 Alternative

The I-88 Alternative to the proposed route of the Pennsylvania to Wright Pipeline Segment was discussed in detail in the Commission's Constitution DEIS (FERC 2014b), and in the Commission's Constitution FEIS (FERC 2014a), issued October 24, 2014 (referred to as "Alternative M" in the Constitution FEIS). The Constitution FEIS was adopted by the Commission in the certificate order authorizing the Constitution Project, including the routing for the Constitution pipeline in this area. The section below references the discussion of the I-88 Alternative based on the Constitution FEIS analysis.

In the Constitution FEIS, the Commission evaluated an alternative within the I-88 ROW (Figure 10.3-2). This alternative evaluated the possibility of co-locating with Constitution's proposed route from Pennsylvania to Wright, New York within or adjacent to the I-88 corridor, thereby reducing the need for disturbance in new areas. I-88 originates near Binghamton, New York, which is located to the north of the Susquehanna County, Pennsylvania production area, and proceeds approximately 118 miles to the northeast near Schenectady, New York. Constitution's proposed route and I-88 are located in the same general vicinity, both trending northeast-southwest. The I-88 corridor is managed by the New York State Department of Transportation ("NYSDOT"), with funding and oversight provided by the Federal Highway Administration ("FHWA").

As a result of the Commission's review, several potential construction and/or engineering issues were identified regarding this alternative route in the Constitution proceeding:

- Blasting near the roadway will be required;
- Use of two-tone construction techniques on side slopes will be necessary to install the pipeline;
- Disruption of interstate traffic flow during blasting will likely occur;
- Delays caused by slow moving, heavy construction equipment operating near the roadway were likely; and
- Limited areas where the pipeline will be safely installed relative to the roadway.

The Commission's review of this alternative in its Constitution FEIS included a number of comments from the NYSDOT. Among other things, the Commission noted that the NYSDOT, for the safety of both motorists and construction workers, would not allow access to the construction workspace directly from I-88; rather, access would have to be obtained from adjacent private properties. In addition, Constitution would not be allowed access to the permanent ROW from I-88 during operations and placement of the pipeline within the controlled access area managed by the NYSDOT as it would obstruct pipeline construction as well as inspections and maintenance during pipeline operations (FERC 2014a). The NYSDOT had commented that the proposed Constitution pipeline would be required to comply with FHWA policy, (23 Code of Federal Regulations ["CFR"] 645, Subpart B) which states that "an applicant will be required to show that no feasible alternative routes exist to obtain approval of the I-88 route from NYSDOT and FHWA," of which the Constitution route would be considered a feasible alternative. Further, because the easements along I-88 are federally managed, Constitution would be required to successfully negotiate an easement for any portion of its project located within or crossing these access areas. If the NYSDOT refused to grant an easement or if a mutually agreeable easement would not otherwise be negotiated in these areas and the Commission were to grant a certificate order authorizing

the Constitution Pipeline Project[21], it would essentially be approving a non-buildable project, as federally managed lands cannot be acquired through the power of eminent domain.

As noted above, the Commission evaluated the I-88 major route alternative in its review of the Constitution route and determined the I-88 major route alternative did not offer major environmental advantages over the Constitution route and, therefore, this alternative route was eliminated from further consideration and was rejected in the Commission's FEIS for Constitution. After reviewing this information as part of its evaluation of major route alternatives, including the Commission's findings that the I-88 corridor is not a viable alternative, Tennessee eliminated this alternative from further evaluation as a possible alternative for the NED Project. Additionally, Tennessee has met with the New York State Department of Environmental Conservation ("NYSDEC") several times and agreed to investigate an I-88 Hybrid Alignment Alternative, which is discussed in Section 10.3.1.1.3.

Tennessee has determined that it will proceed with co-locating the proposed Pennsylvania to Wright Pipeline Segment of the NED Project with the certificated Constitution Pipeline Project alignment in this area rather than the I-88 Alternative. As discussed above, co-location will reduce impacts to environmental resources and to landowners. Since this route was certificated by the Comission for the Constitution project, the proposed route for the NED Project is consistent with the COmission's siting policy, under which co-location is an important design element to reduce environmental and landowner impacts.

Because this alternative has already received an extensive review by the Commission, a comparison table to the proposed route has not been provided in this Resource Report 10.

10.3.1.1.3 Interstate-88 Hybrid Alignment Alternative

During the scoping period for the Proejct as part of the pre-filing process (Docket No. PF14-22-000), the NYSDEC recommended the I-88 Hybrid Alignment Alterantive for Tennessee's consideration. The I-88 Hybrid Alignment Alternative would follow Constitution's conditionally approved route until approximately Oneonta, New York, then follow an existing transmission line to I-88, and then follow I-88 to Wright, New York. Tennessee has had multiple meetings with the NYSDEC and NYSDOT to discuss the routing of the pipeline adjacent to the highway as part of its alternative analysis for the Project. At the request of and with the concurrence of the NYSDEC and NYSDOT, Tennessee has agreed to evaluate a more constructible route alternative, deviating from the I-88 corridor where needed to accomodate engineering and constructability issues identified along I-88. This adjusted route alterntaive is identified as the I-88 Hybrid Alignment Alternative for puposes of this Resource Report 10. This alternative is shown in Figure 10.3-3 and a comparision of impacts of the proposed route and this alternative is included in Table 10.3-2. A more detailed supplemental report further analyzing this alternative will be submitted to the NYSDEC following the submittal of the final ER as part of the certificate application, and will also be provided to the NYSDOT and filed with the Commission in a supplemental filing.

The I-88 Hybrid Alignment Alternative would deviate from the proposed mainline route at approximately Pennsylvania to Wright Pipeline Segment, Segment E, MP 4.54, proceed north along a powerline ROW for approximately 3.9 miles, then proceed northeast along I-88 for 4.3 miles. The I-88 Hybrid Alignment Alternative then continues within one mile of I-88 for approximately 15.6 miles to the Lutheranville State

[21] As discussed in Section 10.2.1, on December 2, 2014, the Commission issued an Order Issuing Certificates and Approving Abandonment, 149 FERC 61,199 (2014), for the Constitution Pipeline Project.

Forest. The route crosses 1.84 miles through Lutheranville State Forest. Upon exiting the forest, the route would continue for approximately 6.6 miles until re-joining I-88. It would then proceed northeast along I-88 for approximately 9.1 miles before rejoining the proposed mainline route near the Supply Path Tail Station at approximately Pennsylvania to Wright Pipeline Segment, Segment E, MP 44.35. A comparison of the impacts of the proposed route and the I-88 Hybrid Alignment Alternative is set forth in Table 10.3-2.

The I-88 Hybrid Alignment Alternative route is 1.67 miles longer than the proposed route, including approximately 11.92 miles of co-location with I-88 and 5.22 miles of co-location with an electric utility corridor. There are engineering and constructability concerns relating to construction adjacent to I-88, including concerns associated with access to the ROW during construction (as well as operation and maintenance of the completed pipeline), placement of the pipeline in relation to the existing roadway pavement, blasting adjacent to I-88, and side slope construction, as discussed in more detail below.

According to consultations and meetings with the NYSDOT, construction and operations/maintenance access to the pipeline ROW will not be allowed from the NYSDOT ROW (see also 23 CFR § 645.211), which would require additional and longer permanent and temporary access roads, which would result in greater impacts. The NYSDOT also identified additional parameters set forthin its accommodation policies and the requirements of 23 CFR § 1.23 and 17 NYCRR Part 131. For instance, the pipeline would need to be installed as close to the outer edge of the NYSDOT ROW as possible, and upon request, Tennessee would be required to re-locate the pipeline at its own expense if a future highway project necessitates it. A relocation request may be due to future realignment of the highway, drainage improvements, slope stabilization work, or other highway corridor work. In addition to construction impacts associated with re-locating the pipeline, it would also likely require an outage, increasing Tennessee's risk of being unable to provide firm natural gas transportation service to its shippers as required under contractual agreements.

Much of the 11.92 miles of co-location along I-88 as part of this alternative route would occur in areas of shallow depth to bedrock where blasting would be required. Blasting rock adjacent to I-88 would create (1) safety concerns for motorists, (2) additional traffic impacts due to stoppage of traffic during blasting activities, and (3) additional operational constraints associated with the mobilizing the necessary blasting equipment to the area.

The steep side slopes along I-88 create construction challenges and would increase safety and environmental concerns both during and after construction. Side slope construction requires a wider ROW to accommodate the two-tone construction technique. This technique results in a greater disturbance to the ground than a flat surface or a steep slope installation due to the cutting of a shelf in the side of a mountain, which necessitates additional temporary workspace. The steep slopes also present concerns relating to stormwater management during and after construction, as well as during restoration and stabilization of the slope. Tennessee has attempted to avoid and minimize side slope areas to the maximum extent practicable throughout the entire Project. The proposed route in this area includes 0.52 mile of steep side slopes greater than 30 percent, and 5.42 miles of steep side slopes 15 to 30 percent. On the other hand, the I-88 Hybrid Alignment Alternative route includes 0.44 miles of steep side slopes greater than 30 percent, and 7.90 miles of steep side slopes 15 to 30 percent.

In addition to the concerns relating to I-88, the I-88 Hybrid Alignment Alternative results in additional environmental impacts, including increased impacts to wetlands, waterbodies, and developed areas.

Further, the I-88 Hybrid Alignment Alternative requires additional landowner impacts, an additional horizontal directional drill ("HDD"), and the relocation of the Supply Path Tail Station.

The increased length and increased steep side slope construction of the I-88 Hybrid Alignment Alternative directly results in increased construction and operation land requirements. There would be an increase of approximately 20.24 acres of land impacted during construction, and an increase in operational impact of 10.11 acres. The I-88 Hybrid Alignment Alternative would also cross an additional 1.08 miles of wetlands, impact an additional 12.99 acres of wetlands, and cross an additional nine watercourses. It will also require one additional HDD (under Charlotte Creek and Route 23), and a 1.84-mile crossing of Lutheran State Forest. Although the Alternative may be able to avoid impacts to Robert V. Riddle State Park by being located within the controlled access area off I-88, the 1.84-mile greenfiled crossing of Luthern State Forest would result in signifanclty greater impacts to state forest/parks than the proposed route's co-located 0.13-mile total crossings of Clapper Hollow State Forest and Petersburg Pass State Forest.

The I-88 Hybrid Alignment Alternative will also cross an additional 1.6 miles of developed areas and cross an additional 2 parcels of land. Due to the additional crossings of developed areas, the I-88 Hybrid Alignment Alternative may increase the number of High Consequence Areas ("HCAs") (as defined by USDOT regulations, 49 CFR Part 192), which Tennessee seeks to avoid or minimize per the applicable safety regulations

The increased length of the I-88 Hybrid Alignment Alternative would also require the Supply Path Tail Station to be re-located and additional compression horsepower to be installed, resulting in greater fuel consumption and greater air emissions. The revised location of this compressor station would be at a greenfield parcel, and may thus require additional land impacts than the current proposed location, which will impact approximately 35.16 acres of mostly forested, agricultural, and open land during construction.

Portions of the I-88 Hybrid Alignment Alternative, including the westernmost 7.3 miles and a 7.5 mile portion between Richmondville and Barnerville, were also discussed in detail in the Commission's Constitution FEIS (FERC 2014b), issued October 24, 2014 (referred to as "Modified Alternative M" in the Constitution FEIS) and Constitution's June 16, 2014, letter to the NYSDEC (Constitution 2014) (referred to as "NYSDEC Alt-M Segments" in Constitution's letter). The Commission indicated that although this route modification would be located west of and avoid the Robert V. Riddell State Park in the area east of the powerline, it would cross state park property south of I-88, or it would have to be located within the controlled access area off I-88, or both. Further, this area contains steep side slopes which become even more pronounced as the modified route proceeds northeast before rejoining the I-88 Alternative. The Commission did not consider this Modified Alternative M segment to be preferable to the corresponding Alternative M segment for these reasons.

Constitution's letter to the NYSDEC (Constitution 2014) indicated that while the Alt-M NYSDEC Segments may reduce some environmental impacts as compared to the Alternative M proposal (the Interstate-88 Alternative in 10.3.1.1.2) and Constitution's primary route, each of the Alt-M NYSDEC Segments would increase long-term safety and environmental risks associated with constructing and operating the pipeline in side slope areas adjacent to a major public highway. While some of the Alt-M NYSDEC Segments may reduce some environmental impacts, each of them would result in long-term environmental impacts. In contrast, many of the environmental impacts associated with Constitution's primary route and the Project's proposed route are short term in nature.

In conclusion, the areas where the I-88 Hybrid Alignment Alternative would co-located along I-88 still result in short and long-term safety and environmental concerns relating to access to the ROW, blasting adjacent to I-88, and side slope construction. Areas which were modified in order to make the alternative more constructible still result in additional environmental impacts, including increased impacts to total land, wetlands, watercourses, and state lands, as well as the relocation of the Supply Path Tail Station. The overall impact of the Project will thus still be minimized by collocating with the certificated Constitution Pipeline Project corridor as proposed. As noted above, a more detailed supplemental report further analyzing this alternative will be submitted to the NYSDEC following the submittal of the final ER as part of the certificate application, and will also be provided to the NYSDOT and filed with the Commission in a supplemental filing.

Table 10.3-2
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment
to I-88 Hybrid Alignment Alternative

Factor	**Proposed Route Pennsylvannia to Wright Pipeline Segment**	**I-88 Hybrid Alignment Alternative**	**Difference (if applicable)[1]**
Length of corresponding segment (miles)	39.81	41.48	-1.67
Type of ROW			
New ROW (miles)	0	24.34	-24.34
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	39.81	17.14	22.67
ROW Requirements			
Pipeline construction requirements (acres)[2]	482.69	502.93	-20.24
Pipeline operation requirements (acres)[2]	241.317	251.43	-10.113
Wetlands			
Total wetland complexes crossed (number)[3]	9	21	-12
Total wetland crossed (linear ft/miles)[3]	2969.3 / 0.56	8640.8 / 1.64	-5671.5 / -1.08
Palustrine forested ("PFO") wetland impacts[3] (construction/operation acres) (miles)	0.28 / 0.14 0.02	15.35 / 7.68 1.27	-15.07 / -7.54 -1.25
Palustrine scrub-shrub ("PSS") wetland impacts[3] (construction/ operation acres) (miles)	3.07 / 1.54 0.25	2.24 / 1.12 0.18	0.83 / 0.42 0.07
Palustrine emergent ("PEM") wetland impacts[3] (construction/operation acres) (miles)	3.45 / 1.73 0.29	2.20 / 1.10 0.18	1.25 / 0.63 0.11
Waterbodies			
Waterbodies crossed (number)	33	42	-9
Perennial waterbodies (number)	33	42	-9

Table 10.3-2
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment
to I-88 Hybrid Alignment Alternative

Factor	Proposed Route Pennsylvannia to Wright Pipeline Segment	I-88 Hybrid Alignment Alternative	Difference (if applicable)[1]
Major river crossings (number >100 ft)	0	0	0
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0
Cultural Resources			
National historic landmarks within 0.50 mile (number)	0	0	0
National Register of Historic Places (NRHP) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	0	1	-1
Land Use			
Forested lands crossed (miles)	29.2	25.9	3.3
Agricultural lands crossed (miles)	8.3	5.6	2.7
Open (meadow, recreation, historic districts, etc.) (miles)	2.3	8.5	-6.2
Developed (residential, commercial/ industrial) (miles)	0	1.6	1.6
Property Owners			
Parcels crossed (number)	255	257	-2
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	2 / 0.13	1 / 1.84	1 / -1.71
Wildlife Management Areas (“WMAs”) (number/miles)	0	0	0
Trails			
National and state trails (number)	0	0	0

Table 10.3-2
Comparison of the Proposed Route of the Pennsylvania to Wright Pipeline Segment
to I-88 Hybrid Alignment Alternative

Factor	Proposed Route Pennsylvania to Wright Pipeline Segment	I-88 Hybrid Alignment Alternative	Difference (if applicable)[1]
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	0	2	2
Environmental hazards (count within 0.50 mile)[4]	65	103	-38

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.1.4 Northeast Exchange Alternative

The NEEX Alternative was originally a separate proposed pipeline expansion project that Tennessee was developing as a competing project to Constitution, extending from Tennessee's existing Station 321 in Pennsylvania and traveling north and east to Wright, New York (Figure 10.3-4). Constitution's proposed route adopted a majority of the NEEX routing that Tennessee was developing, and the Commission's analysis of the Constitution route deemed that its proposed alignment is the most viable route in this area and approved this routing in the certificate order authorizing Constitution. A majority of the proposed NEEX route was adopted as part of the Constitution route and Tennessee's proposed route for the NED Project is, for the most part, co-located with the Constitution route (except as discussed above in Section 10.3.1.1.1), which has been certificated by the Commission. Rerouting of the Project laterals would not be necessary for this alternative.

Because this alternative route, in large part, follows the same route as the proposed NED Project, a comparison table to the proposed route is not provided within this Resource Report 10.

10.3.1.2 Wright to Dracut Pipeline Segment Alternatives

Tennessee evaluated a total of ten major alternatives along its proposed Wright to Dracut Pipeline Segment. These alternatives consist of alternative routes along Tennessee's existing 200 Line corridor; along Route 2 in Massachusetts; along the Massachusetts Turnpike; avoidance of Article 97 properties; and includes previously submitted routes where the Wright to Dracut Pipeline Segment has been subsequently modified.

10.3.1.2.1 New York Alternative

Subsequent to the submission of drafts Resource Reports 1 and 10 on November 5, 2014 in Docket No. PF14-22-000, Tennessee revised the proposed route of the Project, in part, to locate the Wright to Dracut Pipeline Segment along a portion of a New York powerline corridor (referred to as the New York Powerline Alternative, Section 10.3.1.2 in draft Resource Report 10, dated November 2014). On December 8, 2014, Tennessee submitted a filing to the Commission in which it adopted the New York Powerline Alternative (along with the New Hampshire Powerline Alternative, discussed below) as its proposed route as part of the Market Path component of the Project (Wright, New York to Dracut, Massachusetts).

This section discussed the New York Alternative, which was the originally proposed route for this portion of the Market Path component of the Project before it was replaced with the former New York Powerline Alternative. This alternative routing would locate the Wright to Dracut Pipeline Segment in both undeveloped and developed areas in New York and Massachusetts (Figure 10.3-5) and would not require rerouting of the Project laterals. This alternative would begin at approximately Segment F, MP 34.08 of the Wright to Dracut Pipeline Segment in New York, travel in a south/southeast direction, eventually turning east/northeast to interconnect with the mainline proposed route at approximately Segment G, MP 14.91 in Massachusetts, where the proposed route follows Tennessee's existing 200 Line. The alternative is located due south of the routing of the now proposed Wright to Dracut Pipeline Segment.

One of the main advantages of this alternative route is the minimization of impacts to state-owned land. This alternative, though, would require 14.21 miles of new ROW. The environmental impacts resulting from the new ROW do not outweigh the advantages of co-locating the proposed pipeline route with a powerline corridor, which lessens overall environmental impacts, including habitat fragmentation. The New York Alternative would also cross the Upper Housatonic River Area of Critical Environmental ("ACEC"), as well as the Hinsdale Flats Watershed ACEC, neither of which are crossed by the proposed Route. In addition, the proposed route would avoid the congested populated areas of Pittsfield and Dalton, Massachusetts. Both the proposed and alternative routes cross the Appalachian Trail while co-located with an existing electric transmission line utility corridor, so this is a neutral factor in the analysis of this alternative. A comparison of the impacts of the proposed route and the New York Alternative is set forth in (Table 10.3-3).

Based on this analysis, the New York Powerline Alternative was incorporated into the proposed Wright to Dracut Pipeline Segment in December 2014 in place of the original routing (now referred to as the New York Alternative). Tennessee has rejected this New York Alternative for the Project because, when compared to the now-proposed route for the Wright to Dracut Pipeline Segment, this alternative would have: (1) a longer overall route length and land requirements for new ROW; (2) more extensive cultural and environmental impacts; (3) greater number of wetland crossings; and (4) greater impacts to forest and agricultural areas.

Table 10.3-3
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to New York Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	New York Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	34.43	35.98	-1.55
Type of ROW			
New ROW (miles)	0	14.21	-14.21
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	34.43	21.77	12.66
ROW Requirements			
Pipeline construction requirements (acres)[2]	417.51	436.26	-18.75
Pipeline operation requirements (acres)[2]	208.71	218.09	-9.38
Wetlands			
Total wetland complexes crossed (number)[3]	33	38	-5
Total wetlands crossed (linear ft/miles)[3]	7,284.5 / 1.38	10,542.6 / 2.00	-3,258.1 / -0.62
PFO wetland impacts (construction/operation acres) (miles)[3]	7.82 / 3.91 0.65	15.05 / 7.53 1.24	-7.23 / -3.62 -0.59
PSS wetland impacts (construction/operation acres) (miles)[3]	5.40 / 2.70 0.45	2.03 / 1.02 0.17	3.37 / 1.68 0.28
PEM wetland impacts (construction/operation acres) (miles)[3]	3.46 / 1.73 0.29	7.06 / 3.53 0.58	-3.6 / -1.8 -0.29
Waterbodies			
Waterbodies crossed (number)	42	33	9
Perennial waterbodies (number)	32	28	4
Major river crossings (number >100 ft)	0	0	0
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	3.22	0.29	2.93
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	0	1	-1

Table 10.3-3
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to New York Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	New York Alternative	Difference (if applicable)[1]
Land Use			
Forested lands crossed (miles)	20.5	22.7	-2.2
Agricultural lands crossed (miles)	5.7	6.2	-0.5
Open (meadow, recreation, historic districts, etc.) (miles)	7.9	6.8	1.1
Developed (residential, commercial/industrial) (miles)	0.2	0.2	0
Property Owners			
Parcels crossed (number)	213	220	-7
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	5 / 2.03	5 / 2.32	0 / -0.29
WMAs (number/miles)	1 / 0.82	2 / 0.76	-1 / 0.06
Trails			
National trails (number)	5	5	0
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	3	1	2
Environmental hazards (count within 0.50 mile)[4]	38	454	-416

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.2 Massachusetts Alternative

Subsequent to the submission of drafts of Resource Reports 1 and 10 on November 5, 2014 in Docket No. PF14-55-000, Tennessee revised the proposed route of the Project to locate the Wright to Dracut Pipeline Segment along a portion of a powerline corridor located in New Hampshire (referred to as the

New Hampshire Powerline Alternative, Section 10.3.1.8 in draft Resource Report 10, dated November 2014). On December 8, 2014, Tennessee submitted a filing to the Commission in which it adopted the New Hampshire Powerline Alternative (along with the New York Powerline Alternative, discussed above as its proposed route for a portion of the Market Path component of the Project (Wright, New York to Dracut, Massachusetts). Adoption of the New Hampshire Powerline Alternative for a portion of the proposed Market Path route eliminated a large portion of the originally proposed route within Massachusetts. This proposed route modification for the Market Path component of the Project was intended to address comments and concerns expressed by affected stakeholders across various areas of the Project. Additionally, the proposed route modification, which takes advantage of a greater percentage of co-located facilities with existing power utilities, will provide economic service to several areas in northern Massachusetts and southern New Hampshire that are not currently served by an interstate pipeline. The revisions reflected in the December 8, 2014, filing are the product of countless public outreach meetings conducted by Tennessee with stakeholders, as well as the environmental review process itself.

The section discusses the Massachusetts Alternative, which is the originally proposed route for the portion of the Market Path component of the Project that was replaced with the former New Hampshire Powerline Alternative (Figure 10.3-6).

This Massachusetts Alternative would deviate from the proposed route in Massachusetts at approximately Segment H, MP 21.20, and travel in an easterly direction across the northern tier of Massachusetts into Dracut where it will rejoin the proposed route at Segment K, MP 2.45. The Massachusetts Alternative would require alternative routing of the Fitchburg Lateral Extension from what is currently proposed and also would require the addition of a lateral to provide the contract volumes to the Merrimack meter station.

While this Massachusetts Alternative is 12.87 miles shorter than the proposed route for the Project's pipeline facilities, the Massachusetts Alternative will still result in greater environmental impacts when compared to co-locating with an existing linear utility corridor. The information in Table 10.3-4 includes a comparison of the impacts of the proposed route versus the Massachusetts Alternative. While both routes will cross state-owned properties, the Massachusetts Alternative crosses a larger amount of wetland footage and two additional perennial waterbodies than the proposed route. The Massachusetts Route would also cross more of the Squannassit ACEC than the proposed route, and would also cross the Petapawag ACEC, which is not crossed by the proposed route. Although the Massachusetts Alternative impacts approximately 156.06 less acres of land for construction, and 77.98 less acres of land for operation, Tennessee determined that the New Hampshire Powerline Alternative will minimize overall environmental impacts, such as habitat fragmentation, by co-locating the majority of the route along an existing powerline corridor. For these reasons, the New Hampshire Powerline Alternative was incorporated into the proposed Wright to Dracut Pipeline Segment in place of the original routing (now referred to as the Massachusetts Alternative).

Table 10.3-4
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	80.31	67.44	12.87
Type of ROW			
New ROW (miles)	11.12	59.5	-48.38
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	69.18	7.94	61.24
ROW Requirements			
Pipeline construction requirements (acres)[2]	973.41	817.35	156.06
Pipeline operation requirements (acres)[2]	486.67	408.69	77.98
Wetlands			
Total wetland complexes crossed (number)[3]	80	88	-8
Total wetlands crossed (linear ft/miles)[3]	21,038.8 / 3.98	23,363.0 / 4.42	-2,324.2 / -0.44
PFO wetland impacts[3] (construction/operation acres) (miles)	17.80 / 8.90 1.47	34.35 / 17.17 2.84	-16.55 / -8.27 -1.37
PSS wetland impacts[3] (construction/operation acres) (miles)	13.49 / 6.74 1.12	8.64 / 4.32 0.71	4.85 / 2.42 0.41
PEM wetland impacts[3] (construction/operation acres) (miles)	16.89 / 8.45 1.4	10.51 / 5.26 0.87	6.38 / 3.19 0.53
Waterbodies			
Waterbodies crossed (number)	61	63	-2
Perennial waterbodies (number)	36	56	-20
Major river crossings (number >100 ft)	1	5	-4
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	0.78	0	0.78
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	2	3	-1

Table 10.3-4
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Alternative	Difference (if applicable)[1]
Land Use			
Forested lands crossed (miles)	52.9	49.8	3.1
Agricultural lands crossed (miles)	3.4	3	0.4
Open (meadow, recreation, historic districts, etc.) (miles)	18.9	11.7	7.2
Developed (residential, commercial/industrial) (miles)	4.4	2.6	1.8
Property Owners			
Parcels crossed (number)	919	607	312
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	6 / 1.52	26 / 6.90	-20 / -5.38
WMAs (number/miles)	0	9 / 2.01	-9 / -2.01
Trails			
National and state trails (number)	1	5	-4
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	0	2	2
Environmental hazards (count within 0.50 mile)[4]	382	133	249

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.3 Existing 200 Line Alternative

Co-locating a pipeline with Tennessee's existing 200 Line was considered as a major alternative to the Wright to Dracut Pipeline Segment proposed as part of the Project. Tennessee evaluated an alternative pipeline route, approximately 165 miles in length, that would be co-located with Tennessee's existing 200 Line beginning at the New York/Massachusetts border to Dracut, Massachusetts (Figure 10.3-7).

This alternative would deviate from the proposed Wright to Dracut Pipeline Segment at Segment G, MP 7.31 and extend southeast, crossing the Connecticut border, and rejoin the proposed route at Segment K, MP 2.45. Although the Existing 200 Line Alternative would be largely co-located with existing pipeline corridors, this alternative route is approximately 38.05 miles longer than the proposed route, traverses significantly more densely populated areas, and traverses approximately 24.56 additional miles of Important Bird Areas/Audubon blocks of importance. Also, the Existing 200 Line Alternative route along the existing pipeline system also would require the re-routing and addition of certain proposed delivery laterals in order to meet required delivery points (e.g., Fitchburg Lateral Extension, West Greenfield meter station, and Merrimack meter station). The re-routing of required laterals would occur through highly populated areas which would significantly increase environmental impacts and potentially lower the number of markets Tennessee may reach with the Project (Table 10.3-5).

The proposed route for the Wright to Dracut Pipeline Segment results in shorter delivery laterals that will disturb significantly fewer stakeholders and environmental resources than if Tennessee were to route the pipeline along its existing 200 Line system corridor. The Existing 200 Line Alternative would also cross the Upper Housatonic River ACEC and the Miscoe, Warren and Whitehall Watersheds ACEC, neither of which is crossed by the proposed route. The proposed route includes one crossing of the Appalachian Trail in Dalton, Massachusetts, but the Existing 200 Line Alternative crosses the Appalachian Trail three times and parallels within 500 feet of the Trail for approximately 1.1 miles in Tyringham, Massachusetts. Although the proposed route does traverse one National Wild and Scenic River ("NWSR") and includes one crossing of the Appalachian Trail, Tennessee will use construction methods to minimize the temporary impact to these resources during construction. The Existing 200 Line Alternative would also require an additional compressor station (Market Path Mid Station 5) or increases in line diameters for several pipe segments due to the additional 38 miles of pipeline length.

Tennessee did not select the Existing 200 Line Alternative because, when compared to the proposed route for the Wright to Dracut Pipeline Segment, this alternative would have: (1) a much longer overall route length and land requirements for the construction ROW; (2) significantly more extensive cultural and environmental impacts; (3) a greater number of stream and wetland crossings; (4) greater impacts to residences and developed areas; (5) greater impacts to Important Bird Areas; and (6) greater impacts to the Appalachian Trail.

Table 10.3-5
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Existing 200 Line Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	126.94	164.99	-38.05
Type of ROW			
New ROW (miles)	12.85	1.54	11.31
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	114.09	163.45	-49.36

Table 10.3-5
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Existing 200 Line Alternative	Difference (if applicable)[1]
ROW Requirements			
Pipeline construction requirements (acres)[2]	1,538.60	1,999.55	-460.95
Pipeline operation requirements (acres)[2]	769.27	999.84	-230.57
Wetlands			
Total wetland complexes crossed (number)[3]	129	311	-182
Total wetlands crossed (linear ft/miles)[3]	27,691.9 / 5.24	85,213.9 / 16.14	-57,522.0 / -10.9
PFO wetland impacts (construction/operation acres) (miles)[3]	22.50 / 11.25 1.86	66.90 / 33.45 5.53	-44.4 / -22.2 -3.67
PSS wetland impacts (construction/operation acres) (miles)[3]	17.91 / 8.95 1.48	36.04 / 18.02 2.98	-18.13 / -9.07 -1.5
PEM wetland impacts (construction/operation acres) (miles)[3]	23.01 / 11.50 1.9	92.21 / 46.10 7.63	-69.2 / -34.6 -5.73
Waterbodies			
Waterbodies crossed (number)	99	184	-85
Perennial waterbodies (number)	56	100	-44
Major river crossings (number >100 ft)	4	5	-1
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	2.82	27.38	-24.56
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	4	34	-30
Land Use			
Forested lands crossed (miles)	84.7	87.8	-3.1
Agricultural lands crossed (miles)	8.7	17.6	-8.9
Open (meadow, recreation, historic districts, etc.) (miles)	27.6	45.5	-17.9

Table 10.3-5
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Existing 200 Line Alternative	Difference (if applicable)[1]
Developed (residential, commercial/industrial) (miles)	5.1	13.3	-8.2
Property Owners			
Parcels crossed (number)	1,241	1,811	-570
Federal and State Land			
Federal lands crossed (number/miles)	0	1 / 1.72	-1 / -1.72
State forests/parks (number/miles)	7 / 1.94	33 / 12.38	-26 / -10.44
WMAs (number/miles)	9 / 3.74	16 / 3.63	-7 / 0.11
Trails			
National and state trails (number)	6	12	-6
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	2	15	-13
Environmental hazards (count within 0.50 mile)[4]	433	1,081	-648

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.4 Massachusetts Route 2 Alternative

Co-locating with Massachusetts Route 2 is considered a major alternative to the proposed Wright to Dracut Pipeline Segment. Tennessee evaluated an alternative pipeline route that would co-locate the Wright to Dracut Pipeline Segment of the NED Project adjacent to existing Route 2 within Massachusetts (Figure 10.3-8). This alternative deviates from the proposed route for the Wright to Dracut Pipeline Segment at Segment G, MP 7.3 and travels north of the proposed route for approximately 40 miles before running south of the proposed alignment where it turns north and crosses into New Hampshire, and then rejoins the proposed route at Segment K, MP 2.45. This alternative would require rerouting of the Fitchburg Lateral Extension, along with the addition of a lateral to serve the Merrimack meter station.

The proposed route of the Wright to Dracut Pipeline Segment is approximately 1.66 miles shorter in length than the Massachusetts Route 2 Alternative, resulting in less construction and operation impacts.

Overall the proposed route crosses 60 fewer wetland complexes and 14 fewer streams, and has fewer PFO, PSS, and PEM wetland impacts than the alternative route. As a result of the shorter length of the proposed route, the amount of land uses crosses and impacted, including a significantly smaller amount of developed area, is less than the Massachusetts Route 2 Alternative (Table 10.3-6). In addition, constructing and operating a pipeline co-located with roadways and within densely developed areas presents challenges both during installation of the pipeline and during operation and maintenance of the installed pipeline due to restricted access, restricted workspace, restricted construction timeframes, vehicular traffic, and potential for lane and/or road closures. Working within or adjacent to a state roadway easement poses potential traffic management and access issues during installation, operation, and maintenance activities. The Massachusetts Route 2 Alternative would also cross the Central Nashua River Valley ACEC, which is not crossed by the proposed route. The proposed route traverses one NWSR and includes one crossing of the Appalachian Trail. Since the alternative route also crosses the Appalachian Trail while co-located with an existing electric transmission line utility corridor, this was a neutral factor in the alternatives analysis. Tennessee will utilize construction methods to minimize the temporary impact to these resources during construction, such as providing continuous access around the construction area for hikers or recreational users.

Tennessee did not select this Massachusetts Route 2 Alternative because, when compared to the proposed route for the Wright to Dracut Pipeline Segment, this alternative has: (1) a longer overall route length and land requirements for the construction ROW; (2) significantly more extensive cultural and environmental impacts; (3) greater number of wetland and waterbody crossings; and (4) impacts a greater number of developed areas.

Table 10.3-6
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Route 2 Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Route 2 Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	126.94	128.6	-1.66
Type of ROW			
New ROW (miles)	12.85	28.83	-15.98
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	114.09	99.78	14.31
ROW Requirements			
Pipeline construction requirements (acres)[2]	1,538.60	1,558.83	-20.23
Pipeline operation requirements (acres)[2]	769.27	779.41	-10.14
Wetlands			
Total wetland complexes crossed (number)[3]	129	189	-60
Total wetlands crossed (linear ft/miles)[3]	27,691.9 / 5.24	48,854.5 / 9.25	-21,162.6 / -4.01
PFO wetland impacts (construction/operation acres) (miles)[3]	22.50 / 11.25 1.86	42.79 / 21.39 3.54	-20.29 / -10.14 -1.68

Table 10.3-6
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Route 2 Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Route 2 Alternative	Difference (if applicable)[1]
PSS wetland impacts (construction/operation acres) (miles)[3]	17.91 / 8.95 1.48	35.27 / 17.64 2.92	-17.36 / -8.69 -1.44
PEM wetland impacts (construction/operation acres) (miles)[3]	23.01 / 11.50 1.9	33.81 / 16.91 2.8	-10.8 / -5.41 -0.9
Waterbodies			
Waterbodies crossed (number)	99	113	-14
Perennial waterbodies (number)	56	75	-19
Major river crossings (number >100 ft)	4	8	-4
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	2.82	13.52	-10.7
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	4	28	-24
Land Use			
Forested lands crossed (miles)	84.7	44.6	40.1
Agricultural lands crossed (miles)	8.7	9.2	-0.5
Open (meadow, recreation, historic districts, etc.) (miles)	27.6	43.6	-16
Developed (residential, commercial/industrial) (miles)	5.1	30.3	-25.2
Property Owners			
Parcels crossed (number)	1,237	902	335
Federal and State Land			
Federal lands crossed (number/miles)	0	1 / 2.91	-1 / -2.91

Table 10.3-6
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Route 2 Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Route 2 Alternative	Difference (if applicable)[1]
State forests/parks (number/miles)	7 / 1.94	17 / 10.15	-10 / -8.21
WMAs (number/miles)	9 / 3.74	1 / 1.00	8 / 2.74
Trails			
National and state trails (number)	6	6	0
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	2	14	-12
Environmental hazards (count within 0.50 mile)[4]	433	1,172	-739

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.5 Mass Turnpike Alternative

Co-locating with the existing Massachusetts Turnpike (also known as I-90) is considered a major alternative to the Wright to Dracut Pipeline Segment of the proposed Project. Tennessee evaluated co-locating the Wright to Dracut Pipeline Segment adjacent to this highway within Massachusetts (Figure 10.3-9). This alternative leaves the proposed route at Segment G, MP 7.31 and travels south of the Proposed Route within the southern tier of the state and ties back into the proposed route at Segment K, MP 2.45. This alternative will require rerouting of the Fitchburg Lateral Extension, as well as laterals to serve the West Greenfield meter station and Merrimack meter stations.

The proposed route of the Wright to Dracut Pipeline Segment, when compared to the Mass Turnpike Alternative, is approximately 36.23 miles shorter in length, which subsequently results in significantly less construction and operation impacts. The proposed route crosses 57 fewer streams and 77 fewer wetland complexes and subsequently, has fewer wetlands impacts than the Mass Turnpike Alternative. As a result of the shorter length, the amount of land uses crossed and impacted is much less with the proposed route, including a significantly lesser amount of developed area impacted by the Project. A comparison of the impacts of the proposed route and the Mass Turnpike Alternative is provided in Table 10.3-7. In addition, constructing and operating a pipeline co-located with roadways and within densely developed areas presents challenges both during installation of the pipeline and operation and

maintenance of the installed pipeline due to restricted access, restricted workspace, restricted construction timeframes, vehicular traffic, and potential for lane and/or road closures. Working within or adjacent to a state roadway easement poses potential traffic management, and access issues, during installation, operation, and maintenance. The Mass Turnpike Alternative would also cross the Upper Housatonic River ACEC, the Miscoe, Warren and Whitehall Watersheds ACEC, and the Cedar Swamp ACEC, none of which are crossed by the proposed route. Both the alternative and the proposed route traverse the Appalachian Trail while co-located with an existing electric transmission line utility corridor, which is a neutral factor in the comparison analysis. Tennessee will utilize construction methods to minimize the temporary impact to these resources during construction of the proposed route, such as providing continuous access around the construction area for hikers or recreational users. The Mass Turnpike Alternative would also require an additional compressor station (Market Path Mid Station 5) or increases in line diameters for several pipe segments due to the additional 36 miles of pipeline length.

Tennessee did not select this Mass Turnpike Alternative because, when compared to the proposed route for the Wright to Dracut Pipeline Segment, this alternative has: (1) a much longer overall route length and land requirements for construction ROW; (2) significantly more extensive cultural and environmental impacts; (3) greater number of stream and wetland crossings; and (4) impacts a greater number of residences and developed areas.

Table 10.3-7
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Mass Turnpike Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	126.94	163.17	-36.23
Type of ROW			
New ROW (miles)	12.85	0	12.85
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	114.09	163.17	-49.08
ROW Requirements			
Pipeline construction requirements (acres)[2]	1,538.60	1,977.78	-439.18
Pipeline operation requirements (acres)[2]	769.275	988.89	-219.615
Wetlands			
Total wetland complexes crossed (number)[3]	129	206	-77
Total wetlands crossed (linear ft/miles)[3]	27,691.9 / 5.24	59,107.5 / 11.19	-31,415.6 / -5.95
PFO wetland impacts (construction/operation acres) (miles)[3]	22.50 / 11.25 1.86	45.81 / 22.91 3.79	-26.31 / -11.66 -1.93
PSS wetland impacts (construction/operation acres) (miles)[3]	17.91 / 8.95 1.48	36.81 / 18.41 3.04	-18.9 / -9.46 -1.56
PEM wetland impacts (construction/operation acres) (miles)[3]	23.01 / 11.50 1.9	52.73 / 23.37 4.36	-29.72 / -11.87 -2.46

Table 10.3-7
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Mass Turnpike Alternative	Difference (if applicable)[1]
Waterbodies			
Waterbodies crossed (number)	99	156	-57
Perennial waterbodies (number)	56	91	-35
Major river crossings (number >100 ft)	4	8	-4
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	2.82	10.36	-7.54
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	4	32	-28
Land Use			
Forested lands crossed (miles)	84.7	22.2	62.5
Agricultural lands crossed (miles)	8.7	8	0.7
Open (meadow, recreation, historic districts, etc.) (miles)	27.6	65.2	-37.6
Developed (residential, commercial/ industrial) (miles)	5.1	67.1	-62
Property Owners			
Parcels crossed (number)	1,237	882	355
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forest/parks (number/miles)	7 / 1.94	12 / 2.50	-5 / -0.56
WMAs (number/miles)	9 / 3.74	5 / 0.91	4 / 2.83
Trails			
National and state trails (number)	6	7	-1
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	2	10	-8

Table 10.3-7
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Mass Turnpike Alternative	Difference (if applicable)[1]
Environmental Hazards (count within 0.50 mile)[4]	433	2,063	1,630

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.6 Massachusetts Powerline Alternative

Tennessee has evaluated the Massachusetts Powerline Alternative as compared to the proposed route of the Wright to Dracut Pipeline Segment. This alternative route would be co-located with an existing Massachusetts powerline corridor (Figure 10.3-10). The alternative for the Wright to Dracut Pipeline Segment would begin at approximately Segment F, MP 34.08 traveling south of the proposed route and then returning to run in close proximity in the western portion of the state. Where the proposed route continues northeast into New Hampshire, this alternative would travel south, paralleling an existing powerline easement before finally returning at Segment K, MP 2.45. Eventually, the co-location of the pipeline along the powerline corridor would take a more northeasterly turn and terminate in Dracut, Massachusetts. This alternative would require rerouting of the Fitchburg Lateral Extension, as well as new laterals to serve the North Adams Custody (20103) meter station, West Greenfield meter station, and Merrimack meter station.

The proposed route of the Wright to Dracut Pipeline Segment compared to the Massachusetts Powerline Alternative shows that it is less than 1 mile shorter in length. The proposed route crosses 137 fewer wetland complexes and 5.9 fewer miles of wetlands than the alternative route, which will subsequently result in less environmental impacts to these resources (Table 10.3-8). The Massachusetts Powerline Alternative would cross the Upper Housatonic River Watershed ACEC, the Hinsdale Flats Watershed ACEC, Central Nashua River Valley ACEC, Squannassit ACEC, and Petapawag ACEC, none of which are corssed by the proposed Wright to Dracut Pipeline Segment (only the Squannassit is crossed by the proposed Fitchburg Lateral Extension). Both the alternative route and the proposed route traverse the Appalachian Trail while co-located with an existing electric transmission line utility corridor. Tennessee will utilize construction methods to minimize the temporary impact to these resources during construction of the proposed route, such as providing continuous access around the construction area for hikers or recreational users.

This Massachusetts Powerline Alternative was not selected by Tennessee as it crosses a greater number of environmental resources and does not avoid the sensitive land features that the Commonwealth of Massachusetts requested be avoided (state-owned lands and lands with conservation restrictions). This alternative route also would cross numerous areas of congested construction and difficult construction. Furthermore, this alternative would move the Wright to Dracut Pipeline Segment further from the service areas of the Project Shippers, which will necessitate construction of longer laterals to provide service to the Project Shippers, resulting in additional environmental and landowner impacts.

Table 10.3-8
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Powerline Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Powerline Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	153.78	153.88	-0.1
Type of ROW			
New ROW (miles)	12.85	23.28	-10.43
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	140.93	130.6	10.33
ROW Requirements			
Pipeline construction requirements (acres)[2]	1,863.89	1,864.82	-0.93
Pipeline operation requirements (acres)[2]	931.92	932.49	-0.57
Wetlands			
Total wetland complexes crossed (number)[3]	148	285	-137
Total wetlands crossed (linear ft/miles)[3]	33,493.2 / 6.34	64,619.1 / 12.24	-31,125.9 / -5.9
PFO wetland impacts (construction/operation acres) (miles)[3]	29.09 / 14.54 2.41	56.08 / 28.04 4.64	-26.99 / -13.5 -2.23
PSS wetland impacts (construction/operation acres) (miles)[3]	22.59 / 11.30 1.87	34.54 / 17.27 2.86	-11.95 / -5.97 -0.99
PEM wetland impacts (construction/operation acres) (miles)[3]	25.02 / 12.51 2.07	57.36 / 28.68 4.74	-32.34 / -16.17 -2.67
Waterbodies			
Waterbodies crossed (number)	134	139	-5
Perennial waterbodies (number)	85	99	-14
Major river crossings (number >100 ft)	4	8	-4
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0

Table 10.3-8
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Powerline Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Powerline Alternative	Difference (if applicable)[1]
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	5.9	29.59	-23.69
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	4	19	-15
Land Use			
Forested lands crossed (miles)	102.1	78	24.1
Agricultural lands crossed (miles)	13.2	19	-5.8
Open (meadow, recreation, historic districts, etc.) (miles)	32.3	45.9	-13.6
Developed (residential, commercial/industrial) (miles)	5.8	9.8	-4
Property Owners			
Parcels crossed (number)	1,397	1,243	154
Federal and State Land			
Federal lands crossed (number/miles)	0	1 / 1.17	-1 / -1.17
State forests/parks (number/miles)	11 / 3.54	9 / 5.94	2 / -2.4
WMAs (number/miles)	9 / 3.74	17 / 7.09	-8 / -3.35
Trails			
National and state trails (number)	6	6	0
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	5	8	-3
Environmental hazards (count within 0.50 mile)[4]	468	856	-388

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

Table 10.3-8
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Massachusetts Powerline Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Massachusetts Powerline Alternative	Difference (if applicable)[1]

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.7 Combined New York and Existing 200 Line Alternative

Tennessee has evaluated a combination of both the New York and Existing 200 Line Alternatives as compared to the proposed route of the Wright to Dracut Pipeline Segment. This alternative route would cross both undeveloped and developed areas within New York and Massachusetts and would then be co-located with Tennessee's 200 Line and extend southeast, cross the Connecticut border, and rejoin the proposed route at Segment K, MP 2.45 (Figure 10.3-11a and Figure 10.3-11b). Significant rerouting of proposed laterals, and additional new laterals, would be required for this alternative.

The Existing 200 Line Alternative would require the re-routing or proposed laterals and the addition of proposed delivery laterals in order to transport gas to the required delivery points of the Project Shippers. These re-routed/new laterals would include a 12.65-mile North Adams Loop, a 24.54-mile Greenfield Extension, a 8.58-mile Northampton Loop, three segments of Fitchburg Lateral Extenstion looping totaling 9.07 miles, 8.3 miles of Concord Take-up and Relay, a 3.67-mile Nashua Loop, and a 6.16-mile West Nashua Extension. These re-routed/new laterals, totaling 72.97 miles, would be in addition to the proposed Maritimes Delivery Line, Haverhill Lateral, Lynnfield Lateral, and Peabody Lateral. These additional laterals would be routed through highly populated areas and would significantly increase environmental impacts due to their length. The laterals required for this alternative route are identified on Figure 10.3-11a and Figure 10.3-11b. Their impacts are not included in Table 10.3-9 as Tennessee assumes that adding 72.97 miles of pipline laterals to the Project scope would result in a significant increase in landowner and environmental impacts, including additional crossings of sensitive resources, such as waterbodies, wetlands, and forested areas, and likely increased impacts to state-owned lands.

The proposed route of the Wright to Dracut Pipeline Segment, when compared to the Combined New York and Existing 200 Line Alternative, is approximately 16.28 miles shorter in length, which subsequently results in significantly less environmental impacts as the result of construction and operations/maintenance. The proposed route crosses 55 fewer streams and 143 fewer wetland complexes and therefore has fewer wetlands impacts than the Combined New York and Existing 200 Line Alternative. As a result of the shorter length of the proposed route, the amount of land uses crossed and impacted is much less with the proposed route as compared to the alternative. The proposed route also traverses approximately 19.66 fewer miles of threatened and endangered species critical habitat in Massachusetts and approximately 20.85 fewer miles of Important Bird Area/Audubon forest blocks of importance than the alternative route. Both the Wright to Dracut Pipeline Segment and Combined New York and Existing 200 Line Alternative avoid the congested populated areas of Pittsfield and Dalton, Massachusetts. The Combined New York and Existing 200 Line Alternative would also require an additional compressor station (Market Path Mid Station 5) or increases in line diameters for several pipe

segments due to the additional 16 miles of pipeline length. See Table 10.3-9 for a comparison of the impacts of the proposed route and the alternative route.

Although the majority of the Combined New York and Existing 200 Line Alternative would be largely co-located with existing pipeline corridors, this alternative route is longer than the proposed route. Also, the Combined New York and Existing 200 Line Alternative route, where it is co-located along the existing pipeline system, would require the re-route of certain proposed delivery laterals in order to meet required delivery points (e.g., Fitchburg Lateral Extension and addition of laterals to serve the North Adams Custody meter station, West Greenfield meter station, and Merrimack meter station). The re-routing of required laterals would occur through highly populated areas, which would significantly increase environmental impacts and potentially lower the number of markets Tennessee may reach with the Project. The proposed route for the Wright to Dracut Pipeline Segment results in shorter delivery laterals that will disturb significantly fewer stakeholders and environmental resources than if Tennessee were to route the pipeline along its existing 200 Line system corridor. The Combined New York and Existing 200 Line Alternative would also cross the Miscoe, Warren and Whitehall Watersheds ACEC, which is not crossed by the proposed route. A portion of the Fitchburg Lateral which be needed as part of the Alternative Route would also cross the Central Nashua River Valley ACEC. The proposed route includes one crossing of the Appalachian Trail, but the Combined New York and Existing 200 Line Alternative crosses the Appalachian Trail three times and parallels within 500 feet of the Trail for approximately 1.1 miles in Tyringham, Massachusetts. Although the proposed route does traverse one NWSR and includes one crossing of the Appalachian Trail, Tennessee will use construction methods to minimize the temporary impact to these resources during construction.

Tennessee did not select this Combined New York and Existing 200 Line Alternative because, when compared to the proposed route for the Wright to Dracut Pipeline Segment, this alternative has: (1) a much longer overall route length and land requirements for construction ROW; (2) significantly more extensive cultural and environmental impacts; (3) greater number of stream and wetland crossings; (4) greater impacts to threatened and endangered species critical habitat and Important Bird Areas; (5) a greater impact to the Appalachian Trail; and (6) significantly more and longer delivery laterals.

Table 10.3-9
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Existing 200 Line Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	187.64	203.92	-16.28
Type of ROW			
New ROW (miles)	14.45	3.15	11.3
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	173.2	200.78	-27.58
ROW Requirements			
Pipeline construction requirements (acres)[2]	2274.33	2471.4	-197.07

Table 10.3-9
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Existing 200 Line Alternative	Difference (if applicable)[1]
Pipeline operation requirements (acres)[2]	1137.16	1235.79	-98.63
Wetlands			
Total wetland complexes crossed (number)[3]	159	302	-143
Total wetland crossed (linear ft/miles)[3]	36,347.7 / 6.88	78,669.8 / 14.90	-42,322.1 / -8.02
Palustrine forested ("PFO") wetland impacts (construction/operation acres) (miles)[3]	33.17 / 16.59 2.74	69.49 / 34.75 5.75	-36.32 / -18.16 -3.01
Palustrine scrub-shrub ("PSS") wetland impacts (construction/ operation acres) (miles)[3]	23.72 / 11.86 1.96	38.29 / 19.14 3.17	-14.57 / -7.28 -1.21
Palustrine emergent ("PEM") wetland impacts (construction/operation acres) (miles)[3]	26.35 / 13.17 2.18	72.37 / 36.18 5.99	-46.02 / -23.01 -3.81
Waterbodies			
Waterbodies crossed (number)	162	217	-55
Perennial waterbodies (number)	113	138	-25
Major river crossings (number >100 ft)	6	6	0
Intermidiate stream crossings (number 10-100 ft)	0	6	-6
Coldwater fisheries crossings (MA Only)[4] (number)	27	32	-5
Warmwater fisheries crossings (MA Only)[4] (number)	75	281	-206
Designated natural and scenic rivers (number)	2	0	2
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Threatened and Endangered Species critical habitat crossed (MA only)[4] (miles)	10.41	30.07	-19.66
Treatened and Endangered Species critical habitat within 1/4 mile of the ROW (MA only)[4] (number of polygons)	40	126	-86
Important Bird Areas/Audubon forest blocks of importance crossed (miles)	5.9	26.75	-20.85

Table 10.3-9
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Existing 200 Line Alternative	Difference (if applicable)[1]
Cultural Resources			
National historic landmarks within 0.50 mile (number)	0	0	0
National Register of Historic Places (NRHP) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	8	39	-31
Land Use			
Contiguous forest tracts greater than 100 feet long (number)	1,006	714	292
Forested lands crossed (construction/operation acres)[2] (miles)	1,375.8 / 687.9 113.5	1,254.5 / 627.3 103.5	121.3 / 60.6 10
Agricultural lands crossed (construction/operation acres)[2] (miles)	361.2 / 180.6 29.8	446.1 / 223.0 36.8	-84.9 / -42.4 -7
Open (meadow, recreation, historic districts, etc.) (construction/operation acres)[2] (miles)	228.5 / 304.2 3.7	457 / 608.5 50.2	-228.5 / -304.3 -12.5
Developed (residential, commercial/industrial) (construction/operation acres)[2] (miles)	34.5 / 149.1 5.7	69.1 / 223.6 12.3	-34.6 / -74.5 -36.6
Property Owners			
Parcels crossed (number)	1,666	2,061	-395
Federal and State Land			
Federal lands crossed (number/miles)	0	1 / 1.72	-1 / -1.72
State forests/parks (number/miles)	11 / 3.54	31 / 11.77	-20 / -8.23
Wildlife Management Areas (“WMAs”) (number/miles)	9 / 3.74	14 / 3.00	-5 / 0.74
Trails			
National and state trails (number)	6	12	-6
Other Environmental Features			
Landfills, mines, quarries, geological hazards (count within 0.25 mile)	1	8	-7
Environmental hazards (count within 0.25 mile)[5]	338	494	-156

Table 10.3-9
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Existing 200 Line Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Existing 200 Line Alternative	Difference (if applicable)[1]
Compressor Stations			
Number	5	6	-1
Combined horsepower (HP)	187,000	203,000	-16,000

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Massachusetts only. New York does not have publicly availably GIS data for this resource.

[5] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.8 Combined New York and Mass Turnpike Alternative

Tennessee has evaluated a combination of both the New York and Mass Turnpike Alternatives as compared to the proposed route of the Wright to Dracut Pipeline Segment. This alternative crosses both undeveloped and developed areas within New York and Massachusetts and would be co-located with the existing Massachusetts Turnpike (Figure 10.3-12a and Figure 10.3-12b). The alternative for the Wright to Dracut Pipeline Segment would deviate from the proposed route at Segment F, MP 34.08 in New York, travel in a south/southeast direction until tying into the Mass Turnpike Alternative where the route would travel south of the proposed route in the southern tier of the state and ties back into the proposed route at Segment K, MP 2.45. This alternative would require re-routing of the Fitchburg Lateral Extension, as well as new laterals to serve the North Adams Custody meter station, West Greenfield meter station, and Merrimack meter stations.

The Combined New York and Mass Turnpike Alternative will require the re-routing of proposed laterals and the addition of certain new delivery laterals in order to transport gas to the required delivery points of the Project Shippers. These re-routed/new laterals would include a 12.65-mile North Adams Loop, a 24.54-mile Greenfield Extension, a 1.84-mile Northampton Loop, two segments of Fitchburg Lateral Extension looping totaling 4.88 miles, 8.3 miles of Concord Take-up and Relay, a 3.67-mile Nashua Loop, and a 6.16-mile West Nashua Extension. These re-routed/new laterals, totaling 62.04, miles would be in addition to the proposed Maritimes Delivery Line, Haverhill Lateral, Lynnfield Lateral, and Peabody Lateral. These re-routed/new laterals would be routed through highly populated areas and would significantly increase environmental impacts due to their length. These laterals are identified on Figure 10.3-12a and Figure 10.3-12b. Their impacts are not included in Table 10.3-10 as Tennessee assumes that adding 62.04 miles of pipeline laterals to the Project scope would result in a significant

increase in landowner and enviornmental impacts, including additional crossings of sensitive resources, such as waterbodies, wetlands, and forested areas, and likely increased impacts to state-owned lands.

The proposed route of the Wright to Dracut Pipeline Segment, when compared to the Combined New York and Mass Turnpike Alternative, is approximately 13.74 miles shorter in length, which results in significantly less landowner and environmental impacts resulting from construction and operation/maintenance. The proposed route crosses 23 fewer streams and 8 fewer wetland complexes and therefore has fewer wetlands impacts than the Combined New York and Mass Turnpike Alternative. As a result of the shorter length of the proposed route, the amount of land uses crossed and impacted is much less for the proposed route than the alternative route. The proposed route also crosses approximately 4.86 fewer miles of threatened and endangered species critical habitat in Massachusetts and approximately 3.81 fewer miles of Important Bird Area/Audubon forest blocks of importance than the alternative route. By avoiding the congested populated areas of Pittsfield and Dalton, Massachusetts, a significantly lesser amount of developed area will be impacted. The Combined New York and Mass Turnpike Alternative would also require an additional compressor station (Market Path Mid Station 5) or increase in line diameters for several pipe segments due to the additional 14 miles of pipeline length. See Table 10.3-10 for a comparison of the impacts of the proposed route and the alternative route.

In addition, constructing and operating a pipeline co-located with roadways and within densely developed areas presents challenges both during installation of the pipeline and operation and maintenance of the installed pipeline due to restricted access, restricted workspace, restricted construction timeframes, vehicular traffic, and potential for lane and/or road closures. Working within or adjacent to a state roadway easement poses potential traffic management, and access issues, during installation, operation, and maintenance. The Combined New York and Mass Turnpike Alternative would also cross the Miscoe, Warren and Whitehall Watersheds ACEC and the Cedar Swamp ACEC, neither of which is crossed by the proposed route. A portion of the Fitchburg Lateral which be needed as part of the Alternative Route would also cross the Central Nashua River Valley ACEC. Both the alternative and the proposed route traverse the Appalachian Trail while co-located with an existing electric transmission line utility corridor, while the proposed route also traverses one NWSR. Tennessee will utilize construction methods to minimize the temporary impact to these resources during construction of the proposed route, such as providing continuous access around the construction area for hikers or recreational users.

Tennessee did not select this Combined New York and Mass Turnpike Alternative because, when compared to the proposed route for the Wright to Dracut Pipeline Segment, this alternative has: (1) a much longer overall route length and land requirements for construction ROW; (2) significantly more extensive cultural and environmental impacts; (3) greater number of wetland crossings; (4) impacts a greater number of residences and developed areas; and (5) significantly more and longer delivery laterals.

Table 10.3-10
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Mass Turnpike Alternative	Difference (if applicable)[1]
Length of corresponding segment (miles)	187.64	201.38	-13.74
Type of ROW			
New ROW (miles)	14.45	1.61	12.84
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	173.2	199.77	-26.57
ROW Requirements			
Pipeline construction requirements (acres)[2]	2,274.33	2,440.85	-166.52
Pipeline operation requirements (acres)[2]	1,137.16	1,220.45	-83.29
Wetlands			
Total wetland complexes crossed (number)[3]	159	167	-8
Total wetland crossed (linear ft/miles)[3]	36,347.7 / 6.88	42,124.3 / 7.98	-5,776.6 / -1.1
Palustrine forested ("PFO") wetland impacts (construction/operation acres) (miles)[3]	33.17 / 16.59 2.74	37.02 / 18.51 3.06	-3.85 / -1.92 -0.32
Palustrine scrub-shrub ("PSS") wetland impacts (construction/ operation acres) (miles)[3]	23.72 / 11.86 1.96	29.43 / 14.71 2.43	-5.71 / -2.85 0.47
Palustrine emergent ("PEM") wetland impacts (construction/operation acres) (miles)[3]	26.35 / 13.17 2.18	30.02 / 15.01 2.48	-3.67 / -1.84 -0.3
Waterbodies			
Waterbodies crossed (number)	163	186	-23
Perennial waterbodies (number)	114	130	-16
Major river crossings (number >100 ft)	6	9	-3
Intermidiate stream crossings (number 10-100 ft)	0	5	-5
Coldwater fisheries crossings (MA Only)[4] (number)	27	31	-4
Warmwater fisheries crossings (MA Only)[4] (number)	75	221	-146
Designated natural and scenic rivers (number)	1	0	1

Table 10.3-10
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Mass Turnpike Alternative	Difference (if applicable)[1]
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Threatened and Endangered Species critical habitat crossed (MA only)[4] (miles)	10.41	15.27	-4.86
Treatened and Endangered Species critical habitat within 1/4 mile of the ROW (MA only)[4] (number of polygons)	40	128	-88
Important Bird Areas/Audubon forest blocks of importance crossed (miles)	5.9	9.71	-3.81
Cultural Resources			
National historic landmarks within 0.50 mile (number)	0	0	0
National Register of Historic Places (NRHP) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	8	36	-28
Land Use			
Contiguous forest tracts greater than 100 feet long (number)	1,048	295	753
Forested lands crossed (construction/operation acres)[2] (miles)	1,375.8 / 687.9 113.5	441.2 / 220.6 36.4	934.6 / 467.3 77.1
Agricultural lands crossed (construction/operation acres)[2] (miles)	361.2 / 180.6 29.8	321.2 / 160.6 26.5	40 / 20 3.3
Open (meadow, recreation, historic districts, etc.) (construction/operation acres)[2] (miles)	457.0 / 228.5 37.7	770.9 / 385.5 63.6	-313.9 / -157 -471 / -25.9
Developed (residential, commercial/ industrial) (construction/operation acres)[2] (miles)	69.1 / 34.5 5.7	898.2 / 449.1 74.1	-829.1 / -414.6 -68.4
Property Owners			
Parcels crossed (number)	1,480	1,024	456

Table 10.3-10
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Combined New York and Mass Turnpike Alternative

Factor	Proposed Route Wright to Dracut Pipeline Segment	Combined New York and Mass Turnpike Alternative	Difference (if applicable)[1]
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	11 / 3.54	11 / 2.45	0 / 1.09
Wildlife Management Areas ("WMAs") (number/miles)	9 / 3.74	3 / 0.22	6 / 3.52
Trails			
National and state trails (number)	6	7	1
Other Environmental Features			
Landfills, mines, quarries, geological hazards (count within 0.25 mile)	1	7	-1
Environmental hazards (count within 0.25 mile)[5]	338	1095	-757
Compressor Stations			
Number	5	6	-1
Combined horsepower (HP)	187,000	302,000	16,000

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Massachusetts only. New York does not have publicly availably GIS data for this resource.

[5] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.1.2.9 Article 97 Avoidance and Co-location Alternatives

Within the Commonwealth of Massachusetts, the Wright to Dracut Pipeline Segment (Massachusetts Portion), prior to entering into New Hampshire, crosses a number of open space Article 97 properties, which are under the ownership and control of the Commonwealth of Massachusetts or its political

subdivisions.[22] As a result of changing the proposed route in December 2014 (to the current New Hampshire Powerline Alternative) from the route filed with the Commission on November 5, 2014 in Docket No. PF14-22-000 (the route across the northern tier of Massachusetts), the proposed Wright to Dracut Pipeline Segment now avoids the large majority of Article 97 properties in Massachusetts. For the portion of the route remaining within the Commonwealth of Massachusetts, Tennessee evaluated two alternatives for the proposed route of the Wright to Dracut Pipeline Segment to determine if it can avoid, minimize or mitigate crossing Article 97 properties. One of the alternative routes would avoid crossing identified Article 97 properties (Article 97 Avoidance Route Alternative) and the other alternative route would significantly avoid crossing such properties and would be co-located within or adjacent to existing utility corridors (Article 97 Co-location Route Alternative) (Figure 10.3-13). Both of these alternatives would require re-routing of certain of the proposed Project laterals. The western terminus of these alternatives, as shown in Figure 10.3-13, does not connect to the proposed route. The alternatives would begin at the New York/Massachusetts border, and would require the construction of the New York Alternative (described in Section 10.3.1.2.1) in New York. Because the Article 97 provisions are only applicable to Massachusetts, only the Massachusetts portions of the Article 97 Avoidance and Co-Location Alternatives are shown in Figure 10.3-13 and discussed in this section.

Tennessee has and continues to coordinate with the Massachusetts Department of Environmental Protection ("MADEP") and the Massachusetts Department of Conservation and Recreation ("MADCR") and has engaged with key state agencies including Massachusetts Energy and Environmental Affairs ("MAEEA") Division of Fisheries and Wildlife, and Department of Agricultural Resources regarding the Project and alternative routing to avoid, minimize, or mitigate impacts to Article 97 properties. During these agency meetings, Tennessee has endeavored to engage and understand the agencies' areas of concerns as Tennessee continues to evaluate routing alternatives for the Project, including areas with sensitive resources. As requested by these agencies, Tennessee has identified areas where it can utilize existing ROWs and/or co-locations with linear corridors as part of the routing of the Proejct pipeline. Additional information regarding Article 97 avoidance, minimization, mitigation, and consultations, is provided in Resource Report 8 of this ER.

10.3.1.2.9.1 Article 97 Avoidance Route Alternative

For the Article 97 Avoidance Route Alternative, Tennessee attempted to avoid the Article 97 properties that it had identified as crossed by the original proposed route including in the November 5, 2014 filing of draft Resource Reports 1 and 10 in Docket No. PF-14-22-000. Tennessee used GIS-based resource modeling to locate an alternative route that would avoid crossing the Article 97 properties prior to the route entering New Hampshire. GIS modeling was utilized by Tennessee to formulate an alternative route that would avoid the identified properties. This alternative route would require a major shift from locating the proposed route in rural/forested areas (which areas include the majority of Article 97 properties, whether owned by the state or its political subdivisions or encumbered with conservation

[22] Article 97 references to Article 97 of the Articles of Amendment to the Constitution of the Commonwealth of Massachusetts. This constitutional provision requires that any disposition or change in use of lands held for certain public purposes must first be approved by a two-thirds vote from both houses of the Legislature. In accordance with the Commonwealth of Massachusetts Office of Environmental Affairs policy "…[A]n Article 97 land disposition is defined as
a) any transfer or conveyance of ownership or other interests;
b) any change in physical or legal control; and
c) any change in use, in and to Article 97 land or interests in Article 97 land owned or held by the Commonwealth or its political subdivisions, whether by deed, easement, lease or any other instrument effectuating such transfer, conveyance or change."

easements) to urban areas, which are more congested. Avoiding the Article 97 properties also would create a route with constructability issues, including restricted access during construction and operation/maintenance, restricted workspace during construction, and restricted construction timeframes, as the alternative route will be located in highly developed areas.

The Article 97 Avoidance Route Alternative would be 138 miles in length, which is 4 miles longer than the proposed Wright to Dracut Pipeline Segment. The alternative route would require 126 miles of new ROW with only 12 miles of co-location with existing utility easements, as compared to the proposed route which incorporates 120 miles of co-location with existing utility easements. This alternative would impact 2,444 parcels, as compared to the 1,291 parcels located along the proposed route. The Article 97 Avoidance Route Alternative would also cross the Upper Housatonic River ACEC, the Hinsdale Flats Watershed ACEC, Squannassit ACEC, and the Petapawg ACEC, non of which are corssed by the proposed Writght to Dracut Pipeline Segment (only the Squannassit is crossed by the propsoed Fitchburg Lateral Extension).

Tennessee did not select the Article 97 Avoidance Route Alternative for the following reasons: (1) significantly less co-location with existing pipeline, powerline, and road easements; and (2) impacts to a much greater number of landowners, residences, and developed areas.

10.3.1.2.9.2 Article 97 Co-location Route Alternative

The Article 97 Co-location Route Alternative in the Commonwealth of Massachusetts significantly avoids identified Article 97 properties and, where feasible, co-locates with existing powerline easements where traversing identified properties. By locating this alternative adjacent to an existing utility corridor, impacts to the environment would be minimized. In western Massachusetts, this alternative route would utilize approximately 6.50 miles of existing powerline easements which cross Article 97 properties. While minimizing impacts to Article 97 properties, this Article 97 Co-location Route Alternative does not entirely avoid all Article 97 properties. The alternative route also would cross more densely developed urban areas, increasing construction difficulties such as restricted access during construction and operation/maintenance, restricted workspace during construction, and restricted construction timeframes.

The Article 97 Co-location Route Alternative would be 136 miles in length, which is 2 miles longer than the proposed Wright to Dracut Pipeline Segment. The alternative route would require 107 miles of new ROW with 29 miles of co-location, as compared to the proposed route which incorporates 120 miles of co-location with existing utility easements. This alternative will impact 2,398 parcels, as compared to the 1,291 parcels located along the proposed route. The Article 97 Co-Location Route Alternative would also cross the Upper Housatonic River ACEC, the Hinsdale Flats Watershed ACEC, Squannassit ACEC, and the Petapawg ACEC, non of which are corssed by the proposed Writght to Dracut Pipeline Segment (only the Squannassit is crossed by the propsoed Fitchburg Lateral Extension).

Tennessee did not select the Article 97 Co-location Route Alternative for the following reasons: (1) significantly less co-location with existing pipeline, powerline, and road easements; and (2) impacts to a much greater number of landowners, residences, and developed areas.

10.3.2 Minor Route Alternatives

Minor route alternatives deviate from the proposed route less substantially than major route alternatives, are often designed to avoid significant environmental resources or alleviate engineering constraints, and typically remain within the same general area as the proposed route.

Tennessee has designed and analyzed alternatives for a number of the proposed laterals, but not for all laterals.

Tennessee did not design and analyze an alternative route for the proposed Maritimes Delivery Line due to the short length of the lateral and the design criteria co-located with the Wrtight to Dracut Pipeline Segment. Given the start and end point of the lateral and the co-location design, no reasonable alternative was identified as any alternative would introduce new landowners, a new utility corridor, and environmental impacts greater than the proposed Project, and was therefore not evaluated for the Project.

Tennessee also did not design and analyze alternative routes for the proposed Loop 317-3 and Loop 319-3 in Pennsylvania or the 300 Line CT Loop in Connecticut because looping in these two areas necessitates routing along existing Tennessee pipeline ROW, which will limit the environmental impacts and the number of affected new landowners to the maximum extent practicable, consistent with the Commission's siting guidelines. Any proposed alternative to looping these segments would introduce new landowners, a new utility corridor, and environmental impacts greater than the proposed Project, and was therefore not evaluated for the Project.

Tennessee is evaluating an alternative to the Peabody Lateral, which will be included in a subsequent filing.

10.3.2.1 Andover Alternatives – Proposed Lynnfield Lateral

The Andover Alternatives are comprised of six minor route alternatives to the proposed Lynnfield Lateral that are situated to the east and west of the proposed route (Figure 10.3-14).

Lynnfield Alternative A leaves the proposed Lynnfield Lateral route at Segment N, MP 0.00, follows the Haverhill Lateral for 0.90 mile, returns at Segment N, MP 3.12, and is situated primarily east of the proposed route traveling around the eastern limits of the Town of Essex. The alternative parallels a utility corridor where it crosses west back to the proposed route. The alternative also deviates from the proposed Lynnfield Lateral route at Segment N, MP 7.38, and returns at Segment N, MP 10.68. As compared to the proposed lateral route, this alternative is 3.44 miles longer, crosses 16 more wetlands and three more waterways, impacts approximately 41.63 more acres of land during construction and 20.84 more acres during operation, and presents several obstacles, including a large wetland complex with an approximate 800-foot crossing. Also, the alternative crosses a large amount of forested property with a new route. Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Andover Alternative Route 1 leaves the proposed Lynnfield Lateral route at Segment N, MP 0.00, follows the Haverhill Lateral for 0.90 mile, returns at Segment N, MP 6.40, and is situated east of the proposed route traveling primarily west of and adjacent to I-93. The alternative also deviates from the proposed Lynnfield Lateral route at Segment N, MP 7.38, and return at Segment N, MP 10.68. As compared to the proposed lateral route, this alternative is 2.41 miles longer, crosses eight more wetlands, crosses the same number of waterways as the proposed route, and impacts approximately 29.10 more acres of land during

construction and 15.55 more acres during operation. This alternative does present several obstacles, including crossing a large wetland complex located between I-495 and Lowell Street, limited room between existing buildings, parking lots and I-93, and limited access for construction and operation of the lateral (Table 10.3-11). Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Andover Alternative Route 2 leaves the proposed Lynnfield Lateral route at Segment N, MP 2.33 (located on the opposite side of the co-located electric transmission line between Segment N, MP 0.29 and 1.68), returns at Segment N, MP 7.54, and is situated west of the proposed route paralleling a high power electric transmission line ROW. The alternative also deviates from the proposed Lynnfield Lateral route at Segment N, MP 8.76, and returns at Segment N, MP 10.68. This alternative travels through a highly developed area with limited room between the powerline easement and commercial and residential buildings to accommodate a new pipeline ROW. Due to these space constraints, the alternative route would require several shifts across the powerline easement in order to route the pipeline in this area. In addition, this alternative contains an approximate 2,000-foot crossing of a large inundated wetland complex that presents construction challenges. As compared to the proposed lateral route, this alternative is 1.95 miles longer, crosses 21 more wetlands two less waterways than the proposed route, and impacts approximately 23.65 more acres of land during construction and 11.85 more acres during operation. Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Andover Alternative Route 3 leaves the proposed Lynnfield Lateral route where it commences at Segment N, MP 0.00, follows the Haverhill Lateral for 1.26 miles, and returns at Segment N, MP 7.54, situated west of the proposed alignment traveling through undeveloped areas situated between dense developments before tying into the powerline easement. The alternative also deviates from the proposed Lynnfield Lateral route at Segment N, MP 8.76, and returns at Segment N, MP 10.68. This alternative faces spacing restrictions between housing developments and several large wetland crossings, including an approximate 1,000-foot crossing of an inundated wetland complex. Alternative Route 3 crosses I-495 and shares the same constraints as Alternative Route 2, discussed above, where it ties into the powerline easement. As compared to the proposed lateral route, this alternative is 2.78 miles longer, crosses 19 more wetlands and one less waterway than the proposed route, and impacts approximately 16.76 more acres of land during construction and more acres during operation. Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Andover Alternative Route 4 is similar to the Andover Alternative Route 2, but has slightly different routing at the beginning of the alignment where it is located on the opposite side of the co-located electric transmission line as Alternative Route 2. This alternative leaves the proposed Lynnfield Lateral route at Segment N, MP 2.33, returns at Segment N, MP 7.54, and is situated west of the proposed alignment traveling through undeveloped areas situated between dense developments before tying into the powerline easement. The alternative also deviates from the proposed Lynnfield Lateral route at Segment N, MP 8.76, and return at Segment N, MP 10.59. This alternative also faces spacing restrictions between housing developments and several large wetland crossings. Alternative Route 4 crosses I-495 and shares the same constraints as Alternative Route 2, discussed above, where it follows the powerline easement. As compared to the proposed lateral route, this alternative is 1.97 miles longer, crosses 19 more wetlands and two less waterways than the proposed route, and impacts approximately 23.71 more acres of land during construction and 11.89 more acres during operation. Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Andover Alternative Route 5 leaves the proposed Lynnfield Lateral route where it commences at Segment N, MP 0.00, follows the Wright to Dracut Pipeline Segment, Segment K, for 0.66 mile, and

returns at Segment N, MP 14.28, situated east of the proposed alignment and co-located with a powerline easement traveling through developed areas where the powerline is adjacent to Highway 213, and then undeveloped areas after it crosses the Merrimack River. As compared to the proposed lateral route, this alternative is 12.57 miles longer, crosses 48 more wetlands and three more waterways than the proposed route, impacts approximately 152.29 more acres of land during construction and 76.17 more acres during operation, crosses 0.64 mile of Important Bird Areas/Audubon forest blocks of importance, and has 15 additional NRHP eligible or potentially eligible cultural resources within 0.5 mile. Due to these issues, this alternative was not selected over the proposed Lynnfield Lateral route.

Table 10.3-11
Comparison of the Proposed Lynnfield Lateral to Minor Route Alternatives

Factor	Proposed Lynnfield Lateral	Alternative Lynnfield Lateral (A)	Andover Lateral Alternative Route 1	Andover Lateral Alternative Route 2	Andover Lateral Alternative Route 3	Andover Lateral Alternative Route 4	Andover Lateral Alternative Route 5	Difference (if applicable)[1]					
								A	1	2	3	4	5
Length of corresponding segment (miles)	14.28	17.72	16.69	16.23	17.06	16.25	26.85	-3.44	-2.41	-1.95	-2.78	-1.97	-12.57
Type of ROW													
New ROW (miles)	5.06	11.17	6.02	3.66	4.1	3.53	0	-6.11	-0.96	1.4	0.96	1.53	5.06
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	9.22	6.55	10.66	12.58	12.96	12.72	26.85	2.67	-1.44	-3.36	-3.74	-3.5	-17.63
ROW Requirements													
Pipeline construction requirements (acres)[2]	173.23	214.86	202.33	196.88	206.7	196.94	325.52	-41.63	12.53	17.98	8.16	17.92	-110.66
Pipeline operation requirements (acres)[2]	86.58	107.42	101.13	98.43	103.34	98.47	162.75	-20.84	6.29	8.99	4.08	8.95	-55.33
Wetlands													
Total wetland complexes crossed (number)[3]	36	52	44	57	55	55	84	-16	-8	-21	-19	-19	-48
Total wetlands crossed (linear ft/miles)[3]	14,262.0 / 2.70	16,348.6 / 3.10	16,139.9 / 3.06	21,641.1 / 4.10	24,302.6 / 4.60	22,083.6 / 4.18	22,399.7 / 4.24	-2,086.6 / -0.4	-1,877.9 / -0.36	-7,379.1 / -1.4	-10,040.6 / -1.9	-7,821.6 / -1.48	-8,137.7 / -1.54
PFO wetland complexes impacts (construction/ operation acres) (miles)[3]	15.16 / 7.58	22.22 / 11.11	21.65 / 10.82	23.49 / 11.74	22.62 / 11.31	24.52 / 12.26	29.48 / 14.74	-7.06 / -3.53	-6.49 / -3.24	-8.33 / -4.16	-7.46 / -3.73	-9.36 / -4.68	-14.32 / -7.16
	1.25	1.84	1.79	1.94	1.87	2.03	2.44	-0.59	-0.54	-0.69	-0.62	-0.78	-1.19
PSS wetland impacts (construction/ operation acres) (miles)[3]	5.15 / 2.57	4.34 / 2.17	2.90 / 1.45	8.28 / 4.14	15.42 / 7.71	9.75 / 4.88	7.34 / 3.67	0.81 / 0.4	2.25 / 1.12	-3.13 / -1.57	-10.27 / -5.14	-4.6 / -2.31	-2.19 / -1.1
	0.43	0.36	0.24	0.69	1.28	0.81	0.61	0.07	0.19	-0.26	-0.85	-0.38	-0.18
PEM wetland impacts (construction/operation acres) (miles)	12.36 / 6.18	10.88 / 5.44	12.42 / 6.21	17.79 / 8.90	17.60 / 8.80	16.30 / 8.15	14.47 / 7.23	1.48 / 0.74	-0.06 / -0.03	-5.43 / -2.72	-5.24 / -2.62	-3.94 / -1.97	-2.11 / -1.05
	1.02	0.9	1.03	1.47	1.46	1.35	1.2	0.12	-0.01	-0.45	-0.44	-0.33	-0.18
Waterbodies													
Waterbodies crossed (number)	18	21	18	16	17	16	21	-3	0	2	1	2	-3
Perennial waterbodies (number)	6	6	5	7	9	8	10	0	1	-1	-3	-2	-4
Major river crossings (number >100 ft)	1	1	1	2	2	2	1	0	0	-1	-1	-1	0
Designated natural and scenic rivers (number)	0	0	0	0	0	0	0	0	0	0	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish, Wildlife, and Vegetation													
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0	0	0	0	0.64	0	0	0	0	0	-0.64

Table 10.3-11
Comparison of the Proposed Lynnfield Lateral to Minor Route Alternatives

Factor	Proposed Lynnfield Lateral	Alternative Lynnfield Lateral (A)	Andover Lateral Alternative Route 1	Andover Lateral Alternative Route 2	Andover Lateral Alternative Route 3	Andover Lateral Alternative Route 4	Andover Lateral Alternative Route 5	Difference (if applicable)[1]					
								A	1	2	3	4	5
Cultural Resources													
National Historic Landmarks within 0.50 mile (number)	0	0	0	0	0	0	0	0	0	0	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	5	4	8	4	5	4	20	1	-3	1	0	1	-15
Land Use													
Forested lands crossed (miles)	3.6	7	3.3	3.2	2.9	3	10.2	-3.4	0.3	0.4	0.7	0.6	-6.6
Agricultural lands crossed (miles)	0.1	0.3	0.3	0.4	0.7	0.4	1.8	-0.2	-0.2	-0.3	-0.6	-0.3	-1.7
Open (meadow, recreation, historic districts, etc.) (miles)	6.9	7	4.9	8.5	8	8.4	9	-0.1	2	-1.6	-1.1	-1.5	-2.1
Developed (residential, commercial/industrial) (miles)	3.4	3.3	8.1	4.1	5.3	4.3	5.5	0.1	-4.7	-0.7	-1.9	-0.9	-2.1
Property Owners													
Parcels crossed (number)	180	242	143	195	211	170	334	-62	37	-15	-31	10	-154
Federal and State Land													
Federal lands crossed (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0
State forests/parks (number/miles)	0	1 / 0.01	0	0	0	0	3 / 0.33	-1 / -0.01	0	0	0	0	-3 / -0.33
WMAs (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0
Trails													
National and state trails (number)	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Environmental Features													
Landfills, quarries (count within 0.50 mile)	1	1	2	1	1	1	2	0	-1	0	0	0	-1
Environmental hazards (count within 0.50 mile)[4]	430	522	577	448	460	448	226	-92	-147	-18	-30	-18	204

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.2.2 Haverhill Lateral Alternative – Proposed Haverhill Lateral

Subsequent to the July 2015 second draft ER filing in Docket No. PF14-22-000, the location of the Market Path Tail Station was moved to its current proposed location. As a result of this change in compressor station locaiton, the route of the Haverhill Lateral has been modified. The current proposed Haverhill Lateral now more closely follows the Haverhill Lateral Alternative discussed in Section 10.3.2.2 of draft Resource Report 10 included with the July 2015 second draft ER. The configuration discussed in the July 2015 draft Resource Report 10 was not considered a viable alternative as it will no longer meet the Project's purpose and need due to the change in the connection with the existing pipeline at Segment P, MP 0.00. Thus, the July 2015 configuration was not analyzed as an alternative to the currently proposed Project.

The Haverhill Lateral Alternative is a minor route alternative to the proposed Haverhill Lateral (Figure 10.3-15). The alternative route leaves the proposed route between Segment P, MP 2.44 and MP 3.20, between Segment P, MP 5.46 and MP 6.07, between Segment P, MP 6.64 and MP 7.80, and between Segment P, MP 8.41 and MP 9.00. As compared to the proposed lateral route, this alternative is 0.35 mile longer, crosses nine more wetlands and three more waterways, and impacts approximately 4.19 more acres of land during construction and 2.1 more acres during operation (Table 10.3-12). Due to these issues, this alternative was not selected over the proposed Haverhill Lateral route.

Table 10.3-12
Comparison of the Proposed Haverhill Lateral to Minor Route Alternative

Factor	Proposed Haverhill Lateral	Alternative Haverhill Lateral	Difference (if applicable)[1]
Length of corresponding segment (miles)	9.27	9.62	-0.35
Type of ROW			
New ROW (miles)	0.44	2.73	-2.29
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	8.83	6.89	1.94
ROW Requirements			
Pipeline construction requirements (acres)[2]	112.55	116.74	-4.19
Pipeline operation requirements (acres)[2]	56.23	58.33	-2.1
Wetlands			
Total wetland complexes crossed (number)[3]	19	28	-9
Total wetlands crossed (linear ft/miles)[3]	5,650.7 / 1.07	7,644.8 / 1.45	-1,994.1 / -0.38
PFO wetland impacts (construction/operation acres) (miles)[3]	6.26 / 3.13 0.52	12.66 / 6.33 1.05	-6.4 / -3.2 -0.53
PSS wetland impacts (construction/operation acres) (miles)[3]	2.06 / 1.03 0.17	2.06 / 1.03 0.17	0 0
PEM wetland impacts (construction/operation acres) (miles)[3]	4.26 / 2.31 0.38	2.79 / 1.39 0.23	1.47 / 0.92 0.15

Table 10.3-12
Comparison of the Proposed Haverhill Lateral to Minor Route Alternative

Factor	Proposed Haverhill Lateral	Alternative Haverhill Lateral	Difference (if applicable)[1]
Waterbodies			
Waterbodies crossed (number)	12	15	-3
Perennial waterbodies (number)	8	10	-2
Major river crossings (number >100 ft)	0	0	0
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	4	4	0
Land Use			
Forested lands crossed (miles)	2.3	2.5	-0.2
Agricultural lands crossed (miles)	0.7	0.7	0
Open (meadow, recreation, historic districts, etc.) (miles)	3.9	4.3	-0.4
Developed (residential, commercial/industrial) (miles)	2.3	2	0.3
Property Owners			
Parcels crossed (number)	245	211	34
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	0	0	0
WMAs (number/miles)	0	0	0
Trails			
National and State Trails (number)	0	0	0

Table 10.3-12
Comparison of the Proposed Haverhill Lateral to Minor Route Alternative

Factor	Proposed Haverhill Lateral	Alternative Haverhill Lateral	Difference (if applicable)[1]
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	0	0	0
Environmental hazards (count within 0.50 mile)[4]	94	98	-4

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.2.3 Fitchburg Lateral Extension Alternative – Proposed Fitchburg Lateral Extension

The Fitchburg Lateral Extension Alternative is a minor route alternative to the proposed Fitchburg Lateral (Figure 10.3-16). The Alternative Route leaves the proposed route at Segment Q, MP 8.24 to co-locate with Highway 31 and returns at Segment J, MP 7.49. As compared to the proposed lateral route, this alternative is 2.15 miles longer, and crosses threes fewer wetland complexes and one fewer waterway (Table 10.3-13). Due to the longer length, the alternative impacts approximately 26.13 more acres of land during construction and 13.07 more acres during operation than the proposed route.

The Fitchburg Lateral Alternative will cross approximately 7.46 miles of the Squannassit ACEC, while the proposed route will cross approximately 6.35 miles of the ACEC. Both the alternative route and the proposed route will cross approximately 6,815 linear feet of the Willard Brook State Forest. Tennessee has co-located the Project with an existing utility corridor through this area to minimize the impacts to the forest. Any changes to the existing landscape will be minor and confined to minimal widening of the existing cleared ROW as necessary for safe construction and operation of the pipeline. Tennessee will continue to coordinate with the MADCR and Massachusetts NHESP with regards to impact assessment, mitigation, and protection of state-listed plants and wildlife.

While this alternative is co-located and requires less new ROW than the proposed route, constructing and operating a pipeline co-located with roadways presents challenges both during installation of the pipeline and operation and maintenance of the installed pipeline due to vehicular traffic and potential for lane and/or road closures. Working within or adjacent to a state roadway easement poses potential traffic management and access issues, during installation, operation, and maintenance.

In addition to the added length and constraints associated with construction in more developed areas, the alternative has additional impacts to ACEC and Critical Natural Landscape; thus this alternative was not selected over the proposed Fitchburg Lateral.

Table 10.3-13
Comparison of the Proposed Fitchburg Lateral to Minor Route Alternative

Factor	Proposed Fitchburg Lateral	Alternative Fitchburg Lateral	Difference (if applicable)[1]
Length of corresponding segment (miles)	13.97	16.12	-2.15
Type of ROW			
New ROW (miles)	10.28	10.97	-0.69
Length of existing utility ROW (electric/pipeline/road/rail) (miles)	3.69	5.15	-1.46
ROW Requirements			
Pipeline construction requirements (acres)[2]	169.43	195.56	-26.13
Pipeline operation requirements (acres)[2]	84.67	97.74	-13.07
Wetlands			
Total wetland complexes crossed (number)[3]	6	3	3
Total wetlands crossed (linear ft/miles)[3]	1,384.8 / 0.26	493.8 / 0.09	891.0 / 0.17
PFO wetland impacts (construction/operation acres) (miles)[3]	2.76 / 1.38	0.59 / 0.29	2.17 / 1.09
	0.23	0.05	0.18
PSS wetland imapacts (construction/operation acres) (miles)[3]	0.41 / 0.20	0.41 / 0.20	0
	0.03	0.03	0
PEM wetland impacts (construction/operation acres) (miles)[3]	0	0.13 / 0.07	-0.13 / -0.07
	0	0.01	-0.01
Waterbodies			
Waterbodies crossed (number)	12	11	1
Perennial waterbodies (number)	12	10	2
Major river crossings (number >100 ft)	0	0	0
Designated natural and scenic rivers (number)	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0

Table 10.3-13
Comparison of the Proposed Fitchburg Lateral to Minor Route Alternative

Factor	Proposed Fitchburg Lateral	Alternative Fitchburg Lateral	Difference (if applicable)[1]
Fish, Wildlife, and Vegetation			
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0
Cultural Resources			
National Historic Landmarks within 0.50 mile (number)	0	0	0
NRHP eligible or potentially eligible cultural resources sites within 0.50 mile (number)	0	0	0
Land Use			
Forested lands crossed (miles)	10.8	8.5	2.3
Agricultural lands crossed (miles)	0.7	0.7	0
Open (meadow, recreation, historic districts, etc.) (miles)	2.1	2.3	-0.2
Developed (residential, commercial/ industrial) (miles)	0.4	4.7	-4.3
Property Owners			
Parcels crossed (number)	134	147	-13
Federal and State Land			
Federal lands crossed (number/miles)	0	0	0
State forests/parks (number/miles)	2 / 1.31	3 / 1.36	-1 / -0.05
WMAs (number/miles)	0	0	0
Trails			
National and State Trails (number)	0	0	0
Other Environmental Features			
Landfills, quarries (count within 0.50 mile)	1	2	-1
Environmental hazards (count within 0.50 mile)[4]	26	68	-42

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages based on a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

Table 10.3-13
Comparison of the Proposed Fitchburg Lateral to Minor Route Alternative

Factor	Proposed Fitchburg Lateral	Alternative Fitchburg Lateral	Difference (if applicable)[1]

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.2.4 Winchester-Richmond New Hampshire Alternatives

The Winchester-Richmond New Hampshire Alternatives are comprised of six minor route alternatives to the proposed Wright to Dracut Pipeline Segment (Figure 10.3-17) and are compared to the proposed alignment below (Table 10.3-14). Subsequent to the July 2015 second draft ER submittal, revisions were made at the request of landowners and agencies in this vicinity. The new proposed Wright to Dracut Pipeline Segment included in the certificate application and in this ER reflects these revisions. The route identified in the July 2015 second draft ER is discussed as Alternative 6 in Table 10.3-14.

The Winchester-Richmond Alternative Route 1 leaves the proposed route at Segment H, MP 27.82 and returns at Segment I, MP 6.45. The alternative route consists of primarily co-locating with existing powerline ROWs and travels north and west of the proposed route. This alternative is co-located within an existing powerline for the entire segment. As compared to the proposed route, the alternative route is 7.7 miles longer, crosses Pisgah State Park, crosses 54 additional parcels, crosses 4.6 more miles of forest and 0.15 more miles of wetlands, has 13 additional stream crossings, impacts approximately 93.25 more acres of land during construction and 46.63 more acres during operation, and requires an additional HDD. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Winchester-Richmond Alternative Route 2 leaves the proposed route at Segment I, MP 4.41, and returns at Segment I, MP 7.66, traveling east and south of the proposed route. This alternative traverses south of Stone Mountain and Scott Mountain. As compared to the proposed route, the alternative route is 0.61 mile longer, crosses 11 additional parcels, crosses 0.6 more miles of forest, and impacts approximately 7.32 more acres of land during construction and 3.66 more acres during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Winchester-Richmond Alternative Route 3 leaves the proposed route at Segment I, MP 4.41, and returns at Segment I, MP 6.45, traveling east and south of the proposed route. This alternative is 0.31 mile longer than the proosped route, crosses 10 additional parcels, crosses 0.1 more miles of forest and 0.3 miles of open land, and impacts approximately 3.8 more acres of land during construction and 1.91 more acres during operation than the proposed route. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Winchester-Richmond Alternative Route 4 leaves the proposed route at Segment I, MP 4.41, and returns at Segment I, MP 6.45, traveling west and north of the proposed route. This alternative traverses over Scott Mountain. As compared to the proposed route, the alternative route is 0.49 mile longer, crosses three additional parcels, crosses 0.4 more miles of forest and 0.1 more miles of open land, and impacts approximately 5.92 more acres of land during construction and 2.96 more acres during operation

than the proposed route. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Winchester-Richmond Alternative Route 5 leaves the proposed route at Segment I, MP 4.41, and returns at Segment I, MP 6.45, traveling west and north of the proposed route. This alternative reduces the amount of forest impacts. As compared to the proposed route, the alternative route crosses two additional parcels, but it is 5.2 miles shorter, and impacts approximately 0.63 less acre of land during construction and 0.31 less acre during operation than the proposed route. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment..

The Winchester-Richmond Alternative Route 6 was the proposed route that was identified in the July 2015 second draft ER. The alternative leaves the revised proposed route at Segment H, MP 27.82 and returns at Segment I, MP 6.45, traveling north and west of the proposed route. This alternative traverses between Stone Mountain and Scott Mountain. As compared to the proposed route, the alternative route is 0.11 mile shorter, crosses 0.2 less miles of forest, and impacts approximately 1.41 less acres of land during construction and 0.70 less acre during operation, The alternative route also crosses five additional parcels, and has one additional stream and two additional wetland crossings than the proposed route. For these reasons, this alternative, which was part of the proposed route, has not been included in the proposed Wright to Dracut Pipeline Segment and has been replaced with the current proposed route reflected in this certificate application and ER. The final route was selected based on the alternative analysis and consultations with landowners, which identified an aquifer protection area and Pulpit Falls and associated hiking trails, which are now avoided by the proposed route.

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Table 10.3-14
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Winchester-Richmond, New Hampshire Minor Route Alternatives

Factor	Proposed Route Wright to Dracut Pipeline Segment						Winchester-Richmond New Hampshire Alternative Routes						Difference (if applicable)[1]					
	1	2	3	4	5	6	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	Route 4 Alternative	Route 5 Alternative	Route 6 Alternative (July Filing)	1	2	3	4	5	6
Length of corresponding segment (miles)	7.25	3.3	2.1	2.1	2.1	7.25	14.95	3.91	2.41	2.59	2.05	7.14	-7.7	-0.61	-0.31	-0.49	5.2	0.11
Type of ROW																		
New ROW (miles)	7.25	2.1	2.1	2.1	2.1	7.25	0	3.91	2.41	1.75	2.05	4.99	7.25	-1.81	-0.31	0.35	0.05	2.26
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	0	1.2	0	0	0	0	14.95	0	0	0.83	0	2.14	-14.95	1.2	0	-0.83	0	-2.14
ROW Requirements																		
Pipeline construction requirements (acres)[2]	88.08	40.2	25.62	25.62	25.62	88.08	181.33	47.52	29.42	31.54	24.99	86.67	-93.25	-7.32	-3.8	-5.92	0.63	1.41
Pipeline operation requirements (acres)[2]	43.99	20.05	12.76	12.76	12.76	43.99	90.62	23.71	14.67	15.72	12.45	43.29	-46.63	-3.66	-1.91	-2.96	0.31	0.7
Wetlands																		
Total wetland complexes crossed (number)[3]	4	0	0	0	0	4	5	0	0	0	0	6	-1	0	0	0	0	-2
Total wetland crossed (linear ft/miles)[3]	906.8 / 0.17	0	0	0	0	906.8 / 0.17	1,666.1 / 0.32	0	0	0	0	2,198.1 / 0.42	-759.3 / -0.15	0	0	0	0	-1.291.3 / -0.25
Palustrine forested (“PFO”) wetland impacts (construction/operation acres) (miles)[3]	1.43 / 0.71 0.12	0 0	0 0	0 0	0 0	1.43/0.71 0.12	1.34 / 0.67 0.11	0	0	0	0	1.86 / 0.93 0.15	0.09 / 0.04 0.01	0 0	0 0	0 0	0 0	-0.43 / -0.22
Palustrine scrub-shrub (“PSS”) wetland impacts (construction/ operation acres) (miles)[3]	0.65 / 0.32 0.05	0 0	0 0	0 0	0 0	0.65 / 0.32 0.05	2.23 / 1.11 0.18	0 0	0 0	0 0	0 0	2.47 / 1.23 0.2	-1.58 / -0.79 -0.13	0 0	0 0	0 0	0 0	-1.82 / -0.91 0.03
Palustrine emergent (“PEM”) wetland impacts (construction/operation acres) (miles)[3]	0 0	0 0	0 0	0 0	0 0	0 0	0.24 / 0.12 0.02	0 0	0 0	0 0	0 0	0.71 / 0.35 0.06	-0.24 / -0.12 -0.02	0 0	0 0	0 0	0 0	-0.71 / -0.35 -0.06
Waterbodies																		
Waterbodies crossed (number)	8	7	4	4	4	8	21	7	4	4	4	9	-13	0	0	0	0	-1
Perennial waterbodies (number)	4	1	0	0	0	4	11	1	0	0	0	7	-7	0	0	0	0	-3
Major river crossings (number >100 ft)	0	0	0	0	0	0	1	0	0	0	0	0	-1	0	0	0	0	0
Designated natural and scenic rivers (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 10.3-14
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to Winchester-Richmond, New Hampshire Minor Route Alternatives

Factor	Proposed Route Wright to Dracut Pipeline Segment						Winchester-Richmond New Hampshire Alternative Routes						Difference (if applicable)[1]					
	1	2	3	4	5	6	Route 1 Alternative	Route 2 Alternative	Route 3 Alternative	Route 4 Alternative	Route 5 Alternative	Route 6 Alternative (July Filing)	1	2	3	4	5	6
Fish, Wildlife, and Vegetation																		
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cultural Resources																		
National historic landmarks within 0.50 mile (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
National Register of Historic Places (NRHP) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land Use																		
Forested lands crossed (miles)	6.2	2.9	1.8	1.8	1.8	6.2	10.8	3.5	1.9	2.2	1.6	6	-4.6	-0.6	-0.1	-0.4	0.2	0.2
Agricultural lands crossed (miles)	0.4	0	0	0	0	0.4	0.8	0	0	0	0	0.2	-0.5	0	0	0	0	0.2
Open (meadow, recreation, historic districts, etc.) (miles)	0.6	0.4	0.3	0.3	0.5	0.6	3.2	0.4	0.6	0.4	0.3	0.9	-2.6	0	-0.3	-0.1	0.2	-0.3
Developed (residential, commercial/industrial) (miles)	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0	0	0
Property Owners																		
Parcels crossed (number)	28	16	9	9	9	28	82	27	19	12	11	33	-54	-11	-10	-3	-2	-5
Federal and State Land																		
Federal lands crossed (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
State forests/parks (number/miles)	0	0	0	0	0	0	1 / 0.55	0	0	0	0	0	-1 / -0.55	0	0	0	0	0
Wildlife Management Areas (“WMAs”) (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trails																		
National and state trails (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Environmental Features																		
Landfills, quarries (count within 0.50 mile)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Environmental hazards (count within 0.50 mile)[4]	1	0	0	0	0	1	1	2	1	0	0	0	2	2	1	0	0	1

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Construction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

10.3.2.5 Amherst, Milford, Hollis, and Merrimack, New Hampshire Alternatives

The Amherst, Milford, Hollis, and Merrimack, New Hampshire Alternatives are comprised of seven minor route alternatives to the proposed Wright to Dracut Pipeline Segment (Figure 10.3-18) and are compared to the proposed alignment below (Table 10.3-15). Subsequent to the July 2015 second draft ER, revisions were made at the request of landowners and agencies in this vicinity. The new Proposed Wright to Dracut Pipeline Segment included in this certificate application and ER reflects these revisions. The route identified in the July 2015 second draft ER is discussed as Alternative 7 in Table 10.3-15.

The Alternative Route 1 consists of primarily co-locating with existing powerline ROWs and along Route 101A and Continental Boulevard. The alternative route primarily follows the proposed route between Segment J, MP 18.14 and MP 22.68, where it leave the proposed route to more closely follow Continental Boulevard before rejoining the proposed route at Segment J, MP 25.16. As compared to the proposed route, this alternative is 0.11 mile longer, crosses six additional parcels, has the same number of stream crossings and one few wetland crossing than the proposed route, and impacts approximately 1.32 more acres of land during construction and 0.67 more acre during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment

The Alternative Route 2 consists of primarily co-locating with Route 101 and County Road. The alternative route travels north of the proposed route where it leaves the route at Segment J, MP 18.14 and returns at Segment J, MP 25.16. As compared to the proposed route, this alternative, is 2.34 miles longer, crosses 32 additional parcels, crosses two additional waterbodies and four less wetlands than the proposed route, and impacts approximately 28.31 more acres of land during construction and 14.16 more acres during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Alternative Route 3 consists of primarily co-locating with Route 101 and County Road. The alternative route travels north of the proposed route where it leaves the route at Segment J, MP 16.25 and returns at Segment J, MP 25.16. As compared to the proposed route, this alternative crosses 25 additional parcels, is 2.34 miles longer, crosses 0.9 more miles of developed area, crosses two additional waterbodies and two less wetlands than proposed route, and impacts approximately 28.44 more acres of land during construction and 14.23 more acres during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Alternative Route 4 is similar to Alterative Route 1 in that it consists of primarily co-locating with existing powerline ROWs and along Route 101A and Continental Boulevard, with less co-location along Continental Boulevard than Alternative Route 1. Although this alternative is 0.15 mile longer and crosses six fewer parcels,it crosses 0.5 more miles of developed area, crosses the same number of waterbodies and two less wetlands than proposed route, and impacts approximately 1.74 less acres of land during construction and 0.87 less acre during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Alternative Route 5 is similar to Alterative Routes 1 and 4 in that it consists of primarily co-locating with existing powerline ROWs and along Route 101A and Continental Boulevard, with less co-location along Continental Boulevard than Alternative Route 1. As compared to the proposed route, this alternative crosses three fewer parcels, crosses two less welands and impacts approximately 2.13 less acres of land during construction and 1.07 less acres during operation, but it is 0.18 mile longer, and crosses 1.1 more miles of developed area. This route had constructability issues, including the crossings

of Continental Boulavard, the amount of ledge that would be encountered. In addition, based on consulatation with the landowners, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Alternative Route 6 is similar to Alterative Routes 1, 4, and 5 in that it consists of primarily co-locating with existing powerline ROWs and along Route 101A and Continental Boulevard. The alternative route primarily follows the proposed route between Segment J, MP 18.14 and MP 22.68, where it leaves the proposed route and travels east to follow the Everett Turnpike before rejoining the proposed route at Segment J, MP 25.35. This alternative is the same length as the proposed route and crosses eight fewer parcels. As compared to the proposed route, this alterantive crosses0.4 more mile of developed area, crosses one additional waterbody and one less wetland than proposed route, and impacts approximately 0.85 more acre of land during construction and 0.42 more acre during operation. For these reasons, this alternative was not selected over the proposed Wright to Dracut Pipeline Segment.

The Alternative Route 7 was the proposed route that was identified in the July 2015 second draft ER. The alternative leaves the proposed route at Segment J, MP 18.14 and returns at Segment J, MP 25.16, traveling north and west of the proposed route. As compared to the proposed route, this alternative is 0.13 mile longer, crosses 23 additional parcels, crosses one additional waterbody and one less wetland than proposed route, and impacts approximately 1.58 more acres of land during construction and 0.71 more acre during operation. This alternative requires a HDD under the Souhegan River, and also affects conservation land that multiple agencies and landowners requested be avoided. For these reasons, this alternative, which was part of the proposed route, has not been included in the proposed Wright to Dracut Pipeline Segment and has been replaced with the current proposed route reflected in this certificate application and ER.

Alternative 2, 3, and 7 each included impacts to the Ponemah Bog Wildlife Refuge and the Souhegan River and were not selected over the proposed Wright to Dracut Pipeline Segment. Alternatives 1, 4, 5, and 6 each incorporate multiple agency- and landowner-requested minor deviations identified in Table 10.3-16 and Table 10.3-17, including avoiding the wildlife refuge and river.

The proposed route, which is a modfied version of Alternative 6, addresses many of the issues raised by stakeholders. Tennessee is continuing to consult with agencies and landowners to evaluate alternatives in this area to further incorporate the Agency- and landowner-requested deviations.

Table 10.3-15
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to the Amherst, Milford, Hollis, and Merrimack, New Hampshire Minor Route Alternatives

Factor	Proposed Route Wright to Dracut Pipeline Segment							Amherst, Milford, Hollis, Merrimack New Hampshire Alternative Routes							Difference (if applicable)[1]						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7 (July Filing)	1	2	3	4	5	6	7
Length of corresponding segment (miles)	7.04	7.04	8.93	6.03	6.03	6.2	7.04	7.15	9.38	11.27	5.88	5.85	6.27	7.17	-0.11	-2.34	-2.34	0.15	0.18	0	-0.13
Type of ROW																					
New ROW (miles)	3.87	3.87	3.87	2.85	2.85	2.85	3.87	1.1	1.85	1.53	2.15	1.22	1.66	1.26	2.77	2.02	2.34	0.7	1.63	1.19	2.61
Length of existing utility ROW (electric/pipeline/ road/rail) (miles)	3.17	3.17	5.06	3.17	3.17	3.35	3.17	6.05	7.53	9.74	3.73	4.63	4.61	5.91	-2.88	-4.36	-4.68	-0.56	-1.46	-1.26	-2.74
ROW Requirements																					
Pipeline construction requirements (acres)[2]	85.47	85.47	108.31	73.15	73.15	75.29	85.47	86.79	113.78	136.75	71.41	71.02	76.14	87.05	-1.32	-28.31	-28.44	1.74	2.13	-0.85	-1.58
Pipeline operation requirements (acres)[2]	42.7	42.7	54.12	36.54	36.54	37.61	42.78	43.37	56.86	68.35	35.67	35.47	38.03	43.49	-0.67	-14.16	-14.23	0.87	1.07	-0.42	-0.71
Wetlands																					
Total wetland complexes crossed (number)[3]	10	10	11	8	8	8	10	9	6	9	6	6	7	9	1	4	2	2	2	1	1
Total wetland crossed (linear ft/miles)[3]	3,438.6 / 0.65	3,438.6 / 0.65	3,875.9 / 0.73	2,716.9 / 0.51	2,716.9 / 0.51	2,716.9 / 0.51	3,438.6 / 0.65	2,624.1 / 0.50	1,329.2 / 0.25	1,946.4 / 0.37	2,484.7 / 0.47	1,886.1 / 0.36	2,087.8 / 0.40	2,617.4 / 0.50	814.5 / 0.15	2,109.4 / 0.4	1,929.5 / 0.36	232.2 / 0.04	830.8 / 0.15	629.1 / 0.11	821.2 / 0.15
Palustrine forested ("PFO") wetland impacts (construction/operation acres) (miles)[3]	5.56 / 2.78 0.46	5.56 / 2.78 0.46	5.56 / 2.78 0.46	4.43 / 2.22 0.37	4.43 / 2.22 0.37	4.43 / 2.22 0.37	5.56 / 2.78 0.46	4.69 / 2.35 0.39	0.63 / 0.32 0.05	1.24 / 0.62 0.1	4.88 / 2.44 0.4	3.51 / 1.75 0.29	3.97 / 1.99 0.33	2.01 / 1.00 0.17	0.87 / 0.43 0.07	4.93 / 2.46 0.41	4.32 / 2.16 0.36	-0.45 / -0.22 -0.03	0.92 / 0.47 0.08	0.46 / 0.23 0.04	3.55 / 1.78 0.29
Palustrine scrub-shrub ("PSS") wetland impacts (construction/ operation acres) (miles)[3]	1.79/0.90 0.15	1.79/0.90 0.15	2.79/1.40 0.23	1.79/0.90 0.15	1.79/0.90 0.15	1.79/0.90 0.15	1.79/0.90 0.15	0.95/0.47 0.08	0.34/0.17 0.03	0.68/0.34 0.06	0.81/0.41 0.07	0.81/0.41 0.07	0.81/0.41 0.07	3.70/1.85 0.31	0.84/0.43 0.07	1.45/0.73 0.12	2.11/1.06 0.17	0.98/0.49 0.08	0.98/0.49 0.08	0.98/0.49 0.08	-1.91/-0.95 -0.16
Palustrine emergent ("PEM") wetland impacts (construction/operation acres) (miles)[3]	0.53 / 0.26 0.04	0.53 / 0.26 0.04	0.53 / 0.26 0.04	0 0	0 0	0 0	0.53 / 0.26 0.04	0.37 / 0.18 0.03	2.08 / 1.04 0.17	2.53 / 1.27 0.21	0 0	0 0	0 0	0.28 / 0.14 0.02	0.16 / 0.08 0.01	-1.55 / -0.78 -0.13	-2.0 / -1.01 -0.17	0 0	0 0	0 0	0.25 / 0.12 0.02
Waterbodies																					
Waterbodies crossed (number)	3	3	5	2	2	2	3	3	5	7	2	2	3	4	0	-2	-2	0	0	-1	-1
Perennial waterbodies (number)	2	2	4	1	1	1	2	1	4	5	1	1	3	3	1	-2	-1	0	0	-2	-1
Major river crossings (number >100 ft)	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	-1	-1	0	0	0	-1
Designated natural and scenic rivers (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waterbodies crossed with drinking water use designation (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 10.3-15
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to the Amherst, Milford, Hollis, and Merrimack, New Hampshire Minor Route Alternatives

Factor	Proposed Route Wright to Dracut Pipeline Segment							Amherst, Milford, Hollis, Merrimack New Hampshire Alternative Routes							Difference (if applicable)[1]						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7 (July Filing)	1	2	3	4	5	6	7
Fish, Wildlife, and Vegetation																					
Important Bird Areas/Audubon forest blocks of importance (miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cultural Resources																					
National historic landmarks within 0.50 mile (number)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
National Register of Historic Places (NRHP) eligible or potentially eligible cultural resources sites within 0.50 mile (number)	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	0	0	0	1
Land Use																					
Forested lands crossed (miles)	2.7	2.7	4	2.2	2.2	2.4	2.7	1.4	4.5	4.5	1.7	1.2	2.4	2.9	1.3	-1.8	-0.5	0.5	1	0	-0.2
Agricultural lands crossed (miles)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.2	0.2	0.1	1.3	0.3	0	-0.2	0.1	0.1	0.2	-1
Open (meadow, recreation, historic districts, etc.) (miles)	1.9	1.9	2.5	1.5	1.5	1.5	1.9	1.6	2.5	3.3	1.5	1.3	1.3	2.2	0.3	-0.6	-0.8	0.2	0.2	0.6	-0.3
Developed (residential, commercial/industrial) (miles)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	4	2.1	3	2.6	3.2	2.5	0.6	-1.9	0	-0.9	-0.5	-1.1	-0.4	1.5
Property Owners																					
Parcels crossed (number)	56	56	75	47	47	48	56	62	88	100	41	44	40	79	-6	-32	-25	6	3	8	-23
Federal and State Land																					
Federal lands crossed (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
State forests/parks (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wildlife Management Areas (“WMAs”) (number/miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trails																					
National and state trails (number)	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	-1	-1	0	0	0	-1

Table 10.3-15
Comparison of the Proposed Route of the Wright to Dracut Pipeline Segment to the Amherst, Milford, Hollis, and Merrimack, New Hampshire Minor Route Alternatives

Factor	Proposed Route Wright to Dracut Pipeline Segment							Amherst, Milford, Hollis, Merrimack New Hampshire Alternative Routes							Difference (if applicable)[1]						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7 (July Filing)	1	2	3	4	5	6	7
Other Environmental Features																					
Landfills, quarries (count within 0.50 mile)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Environmental hazards (count within 0.50 mile)[4]	243	243	243	240	240	243	243	248	91	112	240	239	229	102	-5	152	131	0	1	14	141

[1] Details the difference of the proposed route compared to the alternative. + = the proposed route contains an increase from the alternative. - = the proposed route contains a decrease from the alternative.

[2] Cnstruction ROW impacts calculated using a 100-foot-wide corridor. Permanent ROW acreages assumed a 50-foot-wide permanent ROW. These acreages are overestimates as reduced construction ROW widths in areas of wetlands and waterbodies were not incorporated.

[3] The data set includes publicly available data only.

[4] Information on environmental hazards taken from USEPA Facility Registry Service, which contains data sources from various federal entities such as federal cleanup programs or small waste generators. Facilities contained include those identified as "majors" or "special interest" and Brownfield properties from http://www2.epa.gov/enviro/geospatial-data-download-service.

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10.3.2.6 Wheeler Road Alternatives

The Wheeler Road Alternatives were two potential alternative re-routes that were developed and evaluated by Tennessee as requested by a landowner in the Dracut area. Due to the size and complexity of these alternatives and the changes they would have triggered within the proposed alignment if one of these alternatives was selected for the Project, the alternatives were presented and discussed as minor route alternatives, rather than as landowner-requested minor route deviations, in Section 10.3.2.5 in Draft Resource Report 10, included with the July 2015 second draft ER in Docket No. PF14-22-000. Subsequent to the July 2015 second draft ER filing, the Market Path Tail Station has been re-located, resulting in modifications to the Wright to Dracut Pipeline Segment, the Haverhill Lateral, the Lynnfield Lateral, and the Maritimes Delivery Line, as discussed in more detail in Resource Report 1 of this ER. As a result of these modifications, the Project and its facilities are no longer located on the property of the landowner that had requested these alternatives. Therefore, the Wheeler Road Alternatives are no longer applicable to the Project and were not further evaluated.

10.3.3 Landowner and Agency Requested Minor Route Deviations

A minor route deviation makes minor adjustments to the proposed route of the pipeline facilities to avoid minor issues such as topographic and man-made features. Because route deviations are considered to resolve localized resource issues (e.g., wetlands, residence, cultural resource sites), they are normally much shorter than major route alternatives or deviations. As proposed, the pipeline route minimizes impacts to the environment and optimizes Project constructability and economics. The deviations were evaluated based on direct stakeholder discussions, on-site evaluations where the landowner has granted permission, and desktop evaluations where landowner access has not been allowed. Because the consultation process is ongoing, additional landowner- and agency-requested minor route deviations will continue to be evaluated and updated versions of Tables 10.3-16 and 10.3-17 will be provided to the Comission throughout the course of the Project's review.

10.3.3.1 Landowner Requested Minor Route Deviations

Tennessee has been reviewing, considering, and incorporating landowner requests for minor route deviations as the proposed route is further evaluated and refined. These requests have been provided as comments filed with the Commission or presented during scoping meetings conducted by the Comission, comments provided informally directly to Tennessee, and comments from open houses conducted by Tennessee. Tennessee will continue to assess requests as they are received and will provide updates to the Comission as it continues to evaluate requests for deviations. Table 10.3-16 provides the requests and deviations evaluated as of the date of this Resource Report, some of which have been incorporated into the proposed route. These deviations address property owner access issues and requests to avoid coming into close proximity to residences and recreational hunting camps. The table includes all of the landowner-requested minor route deviations received as of September 4, 2015. Tennessee will continue to work with landowners to evaluate any additional deviation requests, and will update the Comission regarding its evaluation of minor route deviations received after September 4, 2015 in a supplemental filing. Tennessee acknowledges that Table 10.3-16 may not include all requests that were provided informally to Tennessee prior to the initiation of the pre-filing process in Docket No. PF14-22-000.

10.3.3.2 Agency Requested Minor Route Deviations

In Massachusetts, Tennessee evaluated routes which avoid or minimize traversing ACECs located either within or adjacent to Article 97 properties, which are under the ownership and control of the Commonwealth and its political subdivisions, or which have conservation easements in place. At the request of FERC, the ACECs in Massachusetts have been included on the applicable Figures in Attachment 10a. Tennessee will work with the Pennsylvania, New York, Massachusetts, New Hampshire, and Connecticut agencies to evaluate other agency-requested alternatives (Table 10.3-17). The table includes all of the agency-requested minor route deviations as of September 4, 2015.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
Pennsylvania								
13-SUS-0074.00-01	Pennsylvania to Wright Pipeline Segment	C	8.40	9.62	PA TW 74.00, PA TW 79.00, PA TW 80.00, PA TW 83.00	6,300	Approved	Deviation to avoid White Pine Trees that are registered with the Susquehanna Forest Landowners Association.
13-SUS-0074.00-02	Pennsylvania to Wright Pipeline Segment	C	8.41	8.77	PA TW 74.00, PA TW 76.02, PA TW 76.00, PA TW 77.00	1,900	Approved	Deviation to provide buffer between pipeline right of way and existing road.
13-SUS-0067.02-01	Pennsylvania to Wright Pipeline Segment	C	7.11	7.89	PA TW 67.02, PA TW 67.04, PA TW 71.00	4,200	Not Adopted	Deviation to reduce number of affected landowners; not adopted due to constructability issues related to existing pipeline infrastructure in the area.
13-SUS-0067.02-02	Pennsylvania to Wright Pipeline Segment	C	7.12	7.54	PA TW 67.02, PA TW 67.04, PA TW 67.05, PA TW 68.00	2,200	Approved	Deviation to reduce number of affected landowners and increase distance from houses.
13-SUS-0067.02-03	Pennsylvania to Wright Pipeline Segment	C	7.10	7.90	PA TW 67.02, PA TW 67.04, PA TW 71.00	4,400	Not Adopted	Deviation to reduce number of affected landowners; not adopted due to constructability issues related to existing pipeline infrastructure in the area.
13-SUS-0067.02-04	Pennsylvania to Wright Pipeline Segment	C	7.10	7.90	PA TW 67.02, PA TW 67.04, PA TW 71.00	4,300	Not Adopted	Deviation to reduce number of affected landowners; not adopted due to constructability issues related to existing pipeline infrastructure in the area.
13-SUS-XXXX.XX-12	Pennsylvania to Wright Pipeline Segment	C	6.15	8.40	PA TW 76.03, PA TW 67.05, PA TW 71.02, PA TW 77.00	16,500	Approved	Deviation to avoid the Woodbourne Forest and Wildlife Preserve owned by the Nature Conservancy.
13-SUS-XXXX.XX-05	Pennsylvania to Wright Pipeline Segment	C	N/A	N/A	PA TW 76.03, PA TW 67.05, PA TW 71.02, PA TW 77.00	6,300	Approved	Deviation to avoid the Woodbourne Forest and Wildlife Preserve owned by the Nature Conservancy; the Woodbourne Forest and Wildlife Preserve is already being avoided as part of Minor Route Deviation ID: 13-SUS-XXXX.XX-12.
13-SUS-XXXX.XX-06	Pennsylvania to Wright Pipeline Segment	C	N/A	N/A	PA TW 76.03, PA TW 67.05, PA TW 71.02, PA TW 77.00	7,900	Approved	Deviation to avoid the Woodbourne Forest and Wildlife Preserve owned by the Nature Conservancy; the Woodbourne Forest and Wildlife Preserve is already being avoided by Minor Route Deviation ID: 13-SUS-XXXX.XX-12.
New York								
14-BRO-0068.00-01	Pennsylvania to Wright Pipeline Segment	D	10.78	11.35	NY TW 68.00, NY TW 69.00, NY TW 70.00	3,000	Approved	Deviation to move the route farther away from the landowner's house, maple trees and apple trees.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
14-BRO-0100.00-03	Pennsylvania to Wright Pipeline Segment	D	14.49	14.93	NY TW 93.01, NY TW 100.01	2,300	Approved	Deviation to avoid bisecting landowners parcel to allow for planned future development.
14-BRO-0091.00-01	Pennsylvania to Wright Pipeline Segment	D	13.61	14.14	NY TW 91.00, NY TW 92.00, NY TW 94.00	4,100	Approved	Deviation to avoid hunting ground, trees, and tree stands.
14-DEL-0238.01-01	Pennsylvania to Wright Pipeline Segment	D	36.38	36.42	NY TW 237.00, NY TW 238.01	200	Approved	Deviation to move route farther away from swimming pool, leach field, and septic tank.
14-SCH-0585.00-02	Pennsylvania to Wright Pipeline Segment	E	N/A	N/A	N/A	1,600	N/A	Deviation to avoid a proposed structure to be constructed by landowner; the proposed pipeline no longer traverses this area due to a major route deviation.
14-SCH-0596.00-01	Pennsylvania to Wright Pipeline Segment	E	N/A	N/A	N/A	5,200	N/A	Deviation to reduce impacts to landowner's backyard; the proposed pipeline no longer traverses this area due to a major route deviation.
14-SCH-0625.00-01	Pennsylvania to Wright Pipeline Segment	E	N/A	N/A	N/A	4,400	N/A	Deviation to avoid landowner's underground caverns; the proposed pipeline no longer traverses this area due to a major route deviation.
01-REN-1884.00-01	Wright to Dracut Pipeline Segment	F	29.12	29.80	NY WD 1884.00, NY WD 1887.00, NY WD 1888.02, NY WD 1888.03	3,600	Approved	Deviation to avoid memorial trees that a landowner wishes to keep; the memorial trees are already being avoided by Minor Route Deviation ID: 01-ALB-1879.00-03.
01-REN-1888.03-01	Wright to Dracut Pipeline Segment	F	29.72	29.87	NY WD 1888.02, NY WD 1888.03, NY WD 1889.00, NY WD 1889.02, NY WD 1891.00	1,300	Approved	Deviation to avoid a row of memorial trees that a landowner wishes to keep.
01-REN-1914.00-01	Wright to Dracut Pipeline Segment	F	33.65	33.84	NY WD 1912.00, NY WD 1914.00, NY WD 1915.00, NY WD 1916.02	1,000	Approved	Deviation to move the route farther away from a house; route was already moved farther away from landowner's house as part of Minor Route Deviation ID: 01-REN-1912.00-01.
Massachusetts								
02-BER-0038.00-02	Wright to Dracut Pipeline Segment	G	6.90	8.41	MA WD 37.01, MA WD 38.00, MA WD 40.00, MA WD 51.00	8,000	Approved	Deviation to avoid landowner's peach orchard.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
02-BER-0051.00-01	Wright to Dracut Pipeline Segment	G	8.18	10.00	MA WD 51.00, MA WD 57.02, A WD 57.02	10,300	Approved	Deviation to avoid location of future development of a retention pond: the proposed retention pond is already being avoided as part of Minor Route Deviation ID: 02-BER-0038.00-02
02-BER-0144.00-01	Wright to Dracut Pipeline Segment	G	N/A	N/A	N/A	2,700	N/A	Deviation to avoid landowner's well and house; the proposed pipeline no longer traverses this area due to a major route deviation.
02-HAM-0213.00-01	Wright to Dracut Pipeline Segment	G	24.31	24.77	MA WD 158.03, MA WD 158.00	2,500	Approved	Deviation to avoid hunting camp.
01-HAM-0160.00-01	Wright to Dracut Pipeline Segment	G	24.95	25.31	MA WD 160.00, MA WD 162.00, MA WD 163.00, MA WD 165.00, MA WD 167.00	2,000	Approved	Deviation to avoid landowner's future house by moving the route to the north side of the powerline easement.
02-FRA-0338.00-01	Wright to Dracut Pipeline Segment	H	N/A	N/A	N/A	1,900	N/A	Deviation to avoid landowner's apple orchard, irrigation lines, and wetlands; the proposed pipeline no longer traverses this area due to a major route deviation.
02-FRA-0240.00-01	Wright to Dracut Pipeline Segment	H	0.68	1.94	MA WD 235.00, MA WD 236.00, MA WD 238.00, MA WD 239.00, MA WD 241.00	6,800	Approved	Deviation to avoid landowner's lot that will be used for the development of a house.
02-FRA-0243.00-01	Wright to Dracut Pipeline Segment	H	2.10	2.62	MA WD 243.00, MA WD 245.01, MA WD 246.00	2,700	Approved	Deviation to avoid landowner's septic system and pet burial site.
02-MID-0420.00-01	Wright to Dracut Pipeline Segment	K	N/A	N/A	N/A	9,700	N/A	Deviation to avoid landowner's property; not adopted due to a reduction in co-location and increased landowner impacts; the proposed pipeline no longer traverses this area due to a major route deviation.
16-MID-0005.01-01	Maritimes Delivery Line	L	N/A	N/A	N/A	9,800	N/A	Deviation to avoid landowner's property; not adopted due to constructability issues and increased landowner impacts; the proposed pipeline no longer traverses this area due to a major route deviation.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
16-MID-0434.00-02	Maritimes Delivery Line	L	N/A	N/A	N/A	6,800	N/A	Deviation to avoid landowner's property; not adopted due to constructability issues and increased landowner impacts; the proposed pipeline no longer traverses this area due to a major route deviation.
08-MID-0137.00-01	Lynnfield Lateral	N	N/A	N/A	N/A	400	N/A	Deviation to move route farther away from a house; he proposed pipeline no longer traverses this area due to a major route deviation.
08-MID-0024.00-02	Lynnfield Lateral	N	N/A	N/A	N/A	1,000	N/A	Deviation to move route farther away from a house; the proposed pipeline no longer traverses this area due to a major route deviation.
08-MID-0024.00-01	Lynnfield Lateral	N	N/A	N/A	N/A	500	N/A	Deviation within powerline easement to move route farther away from landowner's house; the proposed pipeline no longer traverses this area due to a major route deviation.
08-MID-0078.00-02	Lynnfield Lateral	N	4.86	4.97	MA LL 81.01, MA LL 81.00, MA LL 86.00	700	Not Adopted	Deviation to avoid landowner's parcel. not adopted due to increased impacts to adjacent landowner.
08-ESS-XXXX.XX-05	Lynnfield Lateral	N	N/A	N/A	N/A	N/A	N/A	Deviation to avoid landowner's backyard and protected lands in Andover, MA; the proposed pipeline no longer traverses this area due to a major route deviation.
08-ESS-XXXX.XX-06	Lynnfield Lateral	N	N/A	N/A	N/A	N/A	N/A	Deviation to move route farther away from Fish Brook and Andover Schools; the proposed pipeline no longer traverses this area due to a major route deviation.
07-ESS-0046.12-01	Haverhill Lateral	P	N/A	N/A	N/A	900	N/A	Deviation to avoid a wetland buffer surrounding the adjacent neighborhood; the proposed pipeline no longer traverses this area due to a major route deviation.
07-ESS-0039.00-01	Haverhill Lateral	P	N/A	N/A	N/A	1,500	N/A	Deviation to avoid bisecting undeveloped land that is intended to be subdivided in the future; the proposed pipeline no longer traverses this area due to a major route deviation.
04-WOR-0019.00-01	Fitchburg Lateral Extension	Q	11.93	12.33	MA FL 70.00, MA FL 71.00	2,100	Approved	Deviation to avoid an approved subdivision plan.
04-MID-0007.00-01	Fitchburg Lateral Extension	Q	5.75	6.54	MA FL 11.00, MA FL 12.00	4,200	Approved	Deviation to avoid landowner's two planned buildings.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
04-MID-0015.00-01	Fitchburg Lateral Extension	Q	N/A	N/A	MA FL 12.00, MA FL 18.00, MA FL 19.00	1,500	Approved	Deviation to avoid landowner's future gravel pit, route was already moved farther away from landowner's planned gravel pit as part of Minor Route Deviation ID: 04-MID-XXXX.XX-01.
New Hampshire								
18-CHE-0003.00-01	Wright to Dracut Pipeline Segment	I	N/A	N/A	NH WD 3.00, NH WD 25.00	22,300	Approved	Deviation to avoid landowner's tree farm.
18-CHE-0008.00-01	Wright to Dracut Pipeline Segment	I	N/A	N/A	N/A	3,100	N/A	Deviation to move route farther away from landowner's house and to avoid impacting landowner's white pine trees; the proposed pipeline no longer traverses this area due to a major route deviation.
18-CHE-0166.00-01	Wright to Dracut Pipeline Segment	I	24.95	25.55	NH WD 167.00, NH WD 170.00, NH WD 171.00, NH WD 171.00, NH WD 173.00, NH WD 172.00	3,100	Not Adopted	Deviation to avoid impacting landowners parcel; not adopted as the reroute will cause the pipeline to encroach on a neighboring house.
18-CHE-0126.01-01	Wright to Dracut Pipeline Segment	I	20.30	21.95	NH WD 126.01, NH WD 139.00, NH WD 141.00	9,100	Approved	Deviation to avoid landowner's drainage piping.
18-HIL-0306.00-01	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	28,500	Approved	Deviation to avoid routing pipeline adjacent to landowner's neighborhood as directed by landowner; these areas are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.
18-HIL-0348.00-01	Wright to Dracut Pipeline Segment	J	17.41	18.95	N/A	7,300	Approved	Deviation to avoid routing pipeline adjacent to landowner's neighborhood (Patricia Lane) and Amherst Christian Church; these areas are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.
18-HIL-0348.00-02	Wright to Dracut Pipeline Segment	J	18.30	18.90	N/A	3,700	Approved	Deviation to avoid routing pipeline adjacent to landowner's neighborhood (Patricia Lane) and Amherst Christian Church; these areas are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.
18-HIL-0348.00-03	Wright to Dracut Pipeline Segment	J	18.30	18.90	N/A	4,000	Approved	Deviation to avoid routing pipeline adjacent to landowner's neighborhood (Patricia Lane) and Amherst Christian Church; not adopted due to reduced co-location with powerline; these areas are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.

Table 10.3-16
Landowner-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Numbers	Length (ft.)	Status[3]	Reason for Minor Deviation
			Begin	End				
18-ROC-0481.00-01	Wright to Dracut Pipeline Segment	J	29.70	30.10	NH WD 482.00, NH WD 485.00	2,000	Not Adopted	Deviation to move route to the opposite side of the powerline and farther away from landowner's backyard not adopted as the reroute would be located in an area that is intended for a future powerline and would have increased impacts to an adjacent farm.
18-ROC-0542.00-01	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	392,000	Not Adopted	Deviation request by landowner is a major route alternative that was evaluated; this deviation would require a complete take-up and re-lay of an existing Tennessee pipeline; not adopted due to constructability issues related to infrastructure congestion along the proposed corridor and increased greenfield impacts.
18-HIL-0339.00-01	Wright to Dracut Pipeline Segment	J	18.14	18.94	NH WD 339.00, NH WD 353.00	4,300	Approved	Deviation to avoid subdivision, a water storage tank and a church.
04-HIL-0048.00-01	Fitchburg Lateral Extension	Q	2.73	3.75	NH FL 39.00, NH FL 26.00	4,700	Not Adopted	Deviation to avoid impacting landowner's planned specialty crop farm, horse pasture, and water well; the landowner's planned farm, horse pasture, and water well are already being avoided as part of Minor Route Deviation ID: 04-HIL-0048.00-02.
04-HIL-0048.00-02	Fitchburg Lateral Extension	Q	2.89	3.65	NH FL 39.00, NH FL 26.00	5,000	Approved	Deviation to avoid impacting landowner's planned specialty crop farm, horse pasture, and water well.
04-HIL-0003.00-01	Fitchburg Lateral Extension	Q	0.30	1.24	NH FL 13.00, NH WD 277.00, NH FL 2.00	5,600	Not Adopted	Deviation to avoid cutting off landowners from emergency egress during the construction of the pipeline. not adopted as the proposed route will not eliminate emergency egress for the landowners.

NOTE: This table includes all landowner requested minor route deviations received as of 9/4/2015.

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

[2] N/A - "Not Applicable." N/A indicates that the landowner requested minor route deviation is no longer in the vicinity of the preferred pipeline route and has no corresponding mileposts.

[3] The status of each landowner requested minor route deviation are defined below:

Approved = deviation was incorporated.

Pending = deviation is still under review.

Not Adopted = deviation is not incorporated.

N/A = deviation is no longer applicable due to a major route deviation causing the pipeline to move away from the area.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
New York								
14-DEL-0407.00-01	Pennsylvania to Wright Pipeline Segment	E	N/A	N/A	NY TW 400.00, NY TW 416.00	12,500	Approved	Deviation to avoid impacting wetlands on the Kernan Land Trust; Kernan Land Trust is already being avoided by Minor Route Deviation ID: 14-DEL-0407.00-02.
14-DEL-0407.00-02	Pennsylvania to Wright Pipeline Segment	E	16.51	19.45	NY TW 400.00, NY TW 416.00	13,500	Approved	Deviation to avoid impacting the Kernan Land Trust conservation property.
01-ALB-1868.00-01	Wright to Dracut Pipeline Segment	F	25.00	26.30	NY WD 1863.00, NY WD 1872.02	9,500	Not Adopted	Deviation to avoid forested land owned by the church; not adopted due to increased landowner impacts and due to route deviations proximity to a hospital.
Massachusetts								
02-BER-0188.00-01	Wright to Dracut Pipeline Segment	G	9.95	20.10	MA WD 57.03 & 58.00, MA WD 127.00	50,800	Not Adopted	Deviation to avoid watershed area; not adopted due to significant reduction in co-location with powerline and increased impacts to Article 97 properties.
02-BER-0072.00-01	Wright to Dracut Pipeline Segment	G	13.20	14.50	N/A	39,600	N/A	Deviation to avoid protected watershed area; the proposed pipeline no longer traverses this area due to a major route deviation.
02-BER-0135.00-01	Wright to Dracut Pipeline Segment	G	13.20	14.50	N/A	15,700	Approved	Deviation to avoid the Cleveland Brook Reservoir; the Cleveland Brook Reservoir is already being avoided as part of the approved NY/MA powerline route.
02-BER-0135.00-02	Wright to Dracut Pipeline Segment	G	13.20	14.50	N/A	15,500	Approved	Deviation to avoid the Cleveland Brook Reservoir; the Cleveland Brook Reservoir is already being avoided as part of the approved NY/MA powerline route.
02-BER-XXXX.XX-00	Wright to Dracut Pipeline Segment	G	N/A	N/A	N/A	N/A	Approved	Deviation to avoid routing adjacent to the Cleveland Reservoir watershed; the current route avoids impacting the Cleveland Brook Reservoir and minimizes impacts to the Cleveland Reservoir Watershed; no specific route was provided to further reduce impacts to the area.
02-FRA-0399.00-01	Wright to Dracut Pipeline Segment	H	10.67	12.08	MA WD 309.00, MA WD 311.00, MA WD 326.00	7,400	Approved	Deviation to avoid Mt. Grace Land Conservation Trust property.
02-FRA-XXXX.XX-01	Wright to Dracut Pipeline Segment	H	N/A	N/A	N/A	2,800	Pending	Deviation to avoid impact to the New England National Scenic Trail (NET) between Alexander Hill Road and Old Turnpike Road.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
02-FRA-XXXX.XX-02	Wright to Dracut Pipeline Segment	H	27.48	28.61	N/A	N/A	N/A	Deviations to avoid potential environmentally sensitive areas within Town of Warwick; requests have been made to assess route alternatives to assure selection of the most ideal route in relation to environmental and public impacts; the proposed project pipeline would cross 1.13 miles of land in the Town of Warwick; a portion of the proposed route in Warwick is co-located with a powerline; various environmental surveys are being conducted to identify and located environmentally sensitive features; no specific route was provided by the Town of Warwick and no specific avoidance area was clearly defined.
02-MID-0006.00-01	Wright to Dracut Pipeline Segment	K	N/A	N/A	N/A	N/A	N/A	Deviation to avoid religious statue; the proposed pipeline no longer traverses this area due to a major route deviation.
16-MID-0006.00-01	Maritimes Delivery Line	L	N/A	N/A	N/A	N/A	N/A	Deviation to avoid religious statue; the proposed pipeline no longer traverses this area due to a major route deviation.
08-MID-1135.00-01	Lynnfield Lateral	N	N/A	N/A	N/A	59,800	Not Adopted	Deviation to avoid congested residential neighborhoods along the Tewksbury and Andover town lines; the suggested deviation is referred to as, "Alternative 1- Haverhill Lateral Co-localization" and includes a request that the Lynnfield Lateral be co-located with Haverhill Lateral until it reaches the crossing of Forest Street in Methuen; at that point, the Lynnfield Lateral would deviate from Haverhill Lateral and continue southeast until it connects with I-93, with the Lynnfield Lateral continuing to parallel I-93 until it connects with the current route at MP 7.8; not adopted due to reduced co-location with powerline and constructability issues, including inadequate space to implement a HDD across the Merrimack River and utility congestion within the I-93 ROW.
08-MID-0031.00-02	Lynnfield Lateral	N	N/A	N/A	N/A	43,400	Not Adopted	Deviation to avoid congested residential neighborhoods along the Tewksbury and Andover town lines. The deviation is referred to as, "Alternative 2 - High Plain Crossing" and includes a request that the Lynnfield Lateral be relocated to a less populated area located near High Plain Road in Andover, MA; not adopted due to reduced co-location with powerline and constructability issues, including inadequate space to implement a HDD across the Merrimack River and utility congestion within the I-93 ROW.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
08-ESS-0051.00-01	Lynnfield Lateral	N	N/A	N/A	N/A	27,500	Not Adopted	Deviation to avoid congested residential neighborhoods along the Tewksbury and Andover town lines; the deviation is referred to as, "Alternative 3 - 495 Co-localization" and includes a request that the Lynnfield Lateral be co-located with I-495; not adopted due to reduced co-location with powerline, increased impacts to Article 97 properties, and constructability issues, including utility congestion within the I-495 ROW.
08-MID-0128.00-01	Lynnfield Lateral	N	7.40	8.70	MA LL 117.00, MA LL 130.00	7,100	Approved	Deviation to avoid conservation land, Article 97 property and vernal pools.
08-MID-0133.00-01	Lynnfield Lateral	N	8.78	10.70	MA LL 133.00, MA LL 166.00 & 168.00 & 164.00	9,000	Approved	Deviation to avoid impacting the 400-foot radius protection area surrounding the town's potable water wells; the potable water wells are already being avoided as part of Minor Route Deviation ID: 08-MID-0133.00-02.
08-MID-0133.00-02	Lynnfield Lateral	N	8.78	10.70	MA LL 133.00, MA LL 166.00 & 168.00 & 164.00	10,300	Approved	Deviation to avoid impacting the 400-foot radius protection area surrounding the town's potable water wells.
08-ESS-XXXX.XX-02	Lynnfield Lateral	N	0.87	2.48	MA PL 215.00, MA PL 240.00	8,600	Approved	Deviation to avoid town's potable water wells.
07-ESS-0048.00-01	Haverhill Lateral	P	N/A	N/A	N/A	41,000	Not Adopted	Deviation to avoid Town of Salem, NH by co-locating with existing Maritimes and Northeast Pipeline (M&NP) and Highway 213; not adopted due to construction issues, including limited space adjacent to M&NP due to development along the easement, underground utilities along the proposed deviation, and rock ledges along Highway 213.
04-MID-XXXX.XX-01	Fitchburg Lateral Extension	Q	5.08	13.97	N/A	Being Evaluated	Pending	Deviation requested to avoid the headwaters of the Squannacook River, an Aquifer Protection District, and the Squannassit Area.
02-BER-XXXX.XX-01	Fitchburg Lateral Extension	Q	5.08	13.97	N/A	Being Evaluated	Pending	Requests have been made to assess route alternatives to assure selection of the best route with the least environmental and public impacts.
02-BER-XXXX.XX-02	All Pipeline Segments in Massachusetts	N/A	N/A	N/A	N/A	Being Evaluated	Pending	Several deviations to avoid areas MACC sites as being environmentally sensitive; MACC also requests that route alternatives be assessed to assure selection of the best route with the least environmental and public impacts.
02-BER-XXXX.XX-03	Entire Project	N/A	N/A	N/A	N/A	N/A	On Going	Possible deviations to avoid critical habitats containing endangered/protected species; also requests for wildlife survey to be completed in order to determine if the current proposed route impacts any such habitats and to adjust routing accordingly.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
02-MID-1013.00-01	Wright to Dracut Pipeline Segment	N/A	N/A	N/A	N/A	1,400	N/A	Deviation to move route farther away from school buildings and sports facilities; the proposed pipeline no longer traverses this area due to a major route deviation.
02-MID-1077.00-01	Wright to Dracut Pipeline Segment	N/A	N/A	N/A	N/A	1,200	N/A	Deviation to avoid Dracut High School's planned development of future sports facilities, parking lot, and stormwater infrastructure; the proposed pipeline no longer traverses this area due to a major route deviation.
02-WOR-0629.01-01	Wright to Dracut Pipeline Segment	N/A	N/A	N/A	N/A	12,100	N/A	Deviation to impact fewer landowners; the proposed pipeline no longer traverses this area due to a major route deviation.
New Hampshire								
18-CHE-0001.00-01	Wright to Dracut Pipeline Segment	I	N/A	N/A	N/A	28,500	Approved	Deviation to avoid Loring Field Conservation Area, Pulpit Falls and associated hiking trails. these features are already being avoided by Minor Route Deviation ID: 02-FRA-0417.00-01
18-CHE-0034.00-01	Wright to Dracut Pipeline Segment	I	4.38	6.43	NH WD 29.00, NH WD 34.00	11,100	Not Adopted	Deviation to reduce wetland impacts, forested area impacts and to avoid bisecting 560 acre parcel. bisecting of this parcel is already being partially avoided and acceptable to land managing entity by Minor Route Deviation ID: 02-FRA-0417.00-01.
02-FRA-0417.00-01	Wright to Dracut Pipeline Segment	I	4.40	5.60	N/A	8,100	Approved	Deviation to avoid Pulpit Falls and associated hiking trails.
18-HIL-0358.00-02	Wright to Dracut Pipeline Segment	J	19.10	25.20	N/A	32,200	Approved	Deviation to avoid Ponemah Bog Wildlife Refuge, Souheagan River, Amherst NH Public schools and several residential neighborhoods.
18-HIL-0364.00-01	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	2,000	Not Adopted	Deviation to avoid Ponemah Bog Wildlife Refuge; these features are already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
18-HIL-0364.00-02	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	2,900	Not Approved	Deviation to avoid Ponemah Bog Wildlife Refuge; these features are already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
18-HIL-0340.00-01	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	33,300	Approved	Deviation to avoid Ponemah Bog Wildlife Refuge, several school buildings, Souheagan River and several neighborhoods; these features are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
18-HIL-0306.00-02	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	43,300	Approved	Deviation to avoid Ponemah Bog Wildlife Refuge, several school buildings, Souheagan River and several neighborhoods; these features are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.
18-HIL-0358.00-01	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	29,600	Approved	Deviation to avoid Ponemah Bog Wildlife Refuge, several school buildings, and Souheagan River; these features are already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
18-HIL-0436.00-01	Wright to Dracut Pipeline Segment	J	25.35	25.66	NH WD 434.00, NH WD 436.00, NH WD 437.00	1,700	Approved	Deviation within NHDOT's property to avoid an existing 16" water main.
18-HIL-XXXX.XX-03	Wright to Dracut Pipeline Segment	J	16.28	26.95	N/A	73,000	Approved	Deviation to avoid the Wellhead Protection Areas (WHPA) for the Merrimack Village District (MVD) Production Wells located in the Naticook Brook Aquifer; these features are already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
18-HIL-XXXX.XX-04	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	N/A	Approved	Deviation to avoid the Scott Conservation Land; this land is already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
18-HIL-XXXX.XX-05	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	5,300	Approved	Deviation to reduce number of crossings of Souheagan River; these features are already being avoided by Minor Route Deviation ID: 18-HIL-0358.00-02.
18-HIL-XXXX.XX-06	Wright to Dracut Pipeline Segment	J	N/A	N/A	N/A	N/A	Approved	Deviations to avoid bisecting neighborhoods including Simeon Wilson Road, Tamarack Lane, Rhodora Drive, and Patricia Lane that are cul-de-sacs with a single point of ingress and egress; the current proposed route avoids bisecting all referenced neighborhoods with the exception of Simeon Wilson Road; these neighborhoods are already being avoided by Minor Route Deviation ID:18-HIL-0358.00-02.
04-HIL-0023.00-01	Fitchburg Lateral Extension	Q	1.87	2.42	NH FL 17.00, NH FL 18.00, NH FL 21.00, NH FL 19.00, NH FL 20.00, NH FL 24.00	2,900	Approved	Deviation to avoid town-owned parcel.

Table 10.3-17
Agency-Requested Minor Route Deviations

Minor Route Deviation ID	Associated Pipeline	Segment[1]	Nearest Milepost[2]		Affected Parcel Number	Length (ft)	Status[3]	Reason for Minor Deviation
			Begin	End				
04-HIL-0053.01-01	Fitchburg Lateral Extension	Q	4.80	5.32	MA FL 2.01, MA FL 1.00, NH FL 50.00, NH FL 53.00, NH FL 52.00, NH FL 51.00	2,700	Approved	Deviation to avoid town-owned parcel.
Connecticut								
10-HAR-XXXX.XX-06	300 Line CT Loop	S	11.14	11.30	CT LT 740.00, CT LT 741.00, CT LT 741.02	1,200	Approved	Deviation to avoid future school.

NOTE: This table includes all agency requested minor route deviations received as of 9/4/2015.

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

[2] N/A - "Not Applicable." N/A indicates that the agency requested minor route deviation is no longer in the vicinity of the preferred pipeline route and has no corresponding mileposts.

[3] The status of each landowner requested minor route deviation are defined below:

Approved = deviation was incorporated.

Pending = deviation is still under review.

Not Adopted = deviation is not incorporated.

N/A = deviation is no longer applicable due to a major route deviation causing the pipeline to move away from the area OR no clear deviation or avoidance area identified.

10.3.4 Alternative Crossing Locations for the Appalachian Trail

The proposed route crosses the Appalachian Trail at approximately Wright to Dracut Pipeline Segment, Segment G, MP 9.54 in Dalton, Massachusetts. The Appalachian Trail at this location is on land owned by the MADCR. The Appalachian Trail Management Committee of the Appalachian Mountain Club Berkshire Chapter is a stewardship partner for the Appalachian Trail in Massachusetts. Tennessee has co-located the Project with an existing electric transmission line utility corridor through this area, which will minimize impacts. Many of the major alternatives described in section 10.3.1 also have crossings of the Appalachian Trail, which were considered in the evaluation of those major alternatives.

The New York Alternative (Section 10.3.1.2), Massachusetts Powerline Alternative (Section 10.3.1.7), and Article 97 Co-Located Route (Section 10.3.1.10.2) would each cross the Appalachian Trail at a different location in Dalton, Massachusetts, approximately 4.5 miles south of the proposed Wright to Dracut Pipeline Segment. These alternatives will also be co-located with an existing electric transmission line utility corridor, resulting in similar impacts as that of the proposed routes.

The Existing 200 Line Alternative (Section 10.3.1.4) and Combined New York and Existing 200 Line Alternative (Section 10.3.1.8) would each cross the Appalachian Trail three times within a 1.5 mile section in Tyringham, Massachusetts, approximately 19 miles south of the proposed Wright to Dracut Pipeline Segment. The Existing 200 Line Alternative and Combined New York and Existing 200 Line Alternative would be co-located with Tennessee's existing 200 Line corridor. The Appalachian Trail meanders across, and loosely parallels, the existing ROW, crossing it three times, and following within 500 feet of it for approximately 1.1 miles. Thus, these alternatives would have a greater impact on the Appalachian Trail than the proposed Wright to Dracut Pipeline Segment.

The Massachusetts Route 2 Alternative (Section 10.3.1.5) would cross the Appalachian Trail in Cheshire, Massachusetts, approximately 4.3 miles north of the proposed Wright to Dracut Pipeline Segment. The Massachusetts Route 2 Alternative would also be co-located with an existing electric transmission line utility corridor, resulting in similar impacts as that of the proposed route.

The Massachusetts Turnpike Alternative (Section 10.3.1.6) and Combined New York and Massachusetts Turnpike Alternative (Section 10.3.1.9) would cross the Appalachian Trail in Becket, Massachusetts, approximately 15.5 miles south of the proposed Wright to Dracut Pipeline Segment. The Massachusetts Turnpike Alternative and Combined New York and Massachusetts Turnpike Alternative would also be co-located with an existing electric transmission line utility corridor, resulting in similar impacts as that of the proposed route.

Article 97 Total Avoidance Route (Section 10.3.1.10.1) would cross the Appalachian Trail at a different location in Dalton Massachusetts, approximately 4.7 miles south of the of the proposed Wright to Dracut Pipeline Segment. The Article 97 Total Avoidance Route would cross the Appalachian Trail in a forested area which will require new ROW. Thus, this alternative would have a greater impact on the Appalachian Trail than the proposed Wright to Dracut Pipeline Segment.

Any changes to the existing landscape at the proposed Appalachian Trail crossing will be minor and confined to minimal widening of the existing cleared ROW as necessary for safe construction and operation of the pipeline. Tennessee will utilize construction methods to minimize the temporary impact to these resources during construction of the proposed route, such as providing continuous access around the construction area for hikers or recreational users. In a letter dated August 30, 2015, the Massachusetts

Appalachian Trail Committee recommended crossing the Appalachian Trail at an existing road crossing. However, the proposed Trail crossing location is approximately 2 miles from the nearest Trail road crossing. Routing the pipeline away from its proposed co-location with an existing electric transmission line utility corridor would result in additional environmental impacts associated with additional mileage, routing through greenfield forested areas, and routing through developed areas along roadways. Co-locating the Project in this segment, as well as following the General Trail Crossing Plan for Massachusetts (Attachment L14 of Appendix L) will minimize the impacts to the Trail in this area.

10.4 ALTERNATIVE PIPELINE DESIGN

Tennessee considered whether the take-up and relay construction technique, in which an existing Tennessee pipeline will be removed and replaced with a larger pipeline, will be used for the Project. Similar to the stove pipe construction and horizontal directional drill construction techniques, described in Resource Report 1, the take-up and relay construction technique is a specialized construction method which is useful for certain situations, but is often not the preferable method. In general, the take-up and relay construction technique is used in instances in which there is not sufficient space to add a pipeline loop by using additional easement or by stove pipe construction, but where there is sufficient access to the existing ROW such that a horizontal directional drill is not required.

Considerations with using the take-up and relay construction technique include:

- The existing pipeline must be taken out of service and removed prior to construction of the new, larger pipeline. This results in reduced capacity (or no capacity in the instance of a single line system) to serve a pipeline's firm transportation customers during the extensive outage period during construction. For projects serving the constrained gas markets in New England, this will lead to additional gas shortages and price increases for the pipeline's customers.
- Use of the take-up and relay construction techniques results in certain additional methane emissions as the last 50 to 100 psig of gas in the pipe to be lifted is vented to atmosphere.
- The take-up and relay construction technique typically requires working along an existing pipeline corridor in which the project sponsor has a pipe to be removed. In many instances a different corridor (such as powerline or competitor pipeline) is less congested (resulting in less landowner disturbance), offers a shorter route, and avoids more environmentally sensitive areas than the project proponent's corridor.
- The take-up and relay technique requires that the existing pipeline be removed and replaced with a larger pipeline than will have otherwise been used for looping. While costs can vary according to the particular circumstances, take-up and relay typically results in increased cost as compared to looping. This will either result in customers paying significantly more for gas transportation capacity, or in a project being uneconomic such that a project is not constructed, with supply shortages and price spikes are further exacerbated.
- Since the size of a pipeline installed using the take-up and relay construction technique is typically larger in diameter or longer than loop pipeline, total construction workspace requirements are generally comparable to, if not more, than for the loop construction. The size of the construction equipment, larger quantity of ditch spoil, need to dig the ditch twice (once for removal and once for enlarging the ditch) results in large amounts of construction workspace and impacts.

Given these considerations, Tennessee has identified two locations for the NED Project where use of the take-up and relay construction technique is the most appropriate construction technique given the

congested nature of the existing easement and the ability to avoid significant capacity reductions on these laterals. Tennessee is using the take-up and relay construction technique for the majority of the Haverhill Lateral, and for approximately 0.4 mile for the Beverly Salem Colonial Lateral.

Tennessee considered utilizing take-up of the existing 24-inch pipeline 300-1 Line and relay of a 42-inch pipeline rather than installing Loop 317-3 and Loop 319-3 along the 300 Line in Pennsylvannia. Replacing Tennessee's 24-inch existing 300-1 Line with a 42-inch-diameter pipeline of identical length is hydraulically equivalent. Take-up and relay offers no environmental advantages over the proposed Loops 317-3 and 319-3. Using take-up and relay to replace a portion of the 300-1 Line would result in significantly more tree clearing for temporary workspace ("TWS") than constructing a third loop as proposed (approximately 280 acres vs. 128 acres, respectively). Tennessee proposes to re-use the TWS cleared in 2011 and 2013 for installing the 300-2 Line as part of Tennessee's 300 Line Project and Northeast Upgrade Project, respectively, whereas creating TWS outside of 300-1 Line will generally require clearing of mature trees. In addition, taking up that existing pipeline will result in a significant capacity reduction of 185,000 Dth/d for existing firm shippers during the 2017 construction season, will require just as much TWS, require just as much compression, results in a system that is not as reliable for shippers (less pipelines during outages), causes additional methane emissions, and additional costs compared to adding a third loop. For these reasons, take-up and relay was not the recommended construction technique for the 300 Line loops in Pennsylvania.

Tennessee also considered utilizing take-up of the existing 16-inch pipeline 300-1 Line in Connecticut and relay of a 30-inch pipeline rather than installing the proposed 24-inch 300 Line Connecticut Loop. Take-up and relay offers no environmental advantages over the proposed loop. Taking up the existing pipeline will result in a significant capacity reduction for existing firm shippers during the 2019 construction season, results in a system that is not as reliable for the shippers (less pipeline capacity available during outages), causes additional methane emissions, and additional costs as compared to adding a looping section. For these reasons, take-up and relay was not the recommended construction technique for the Connecticut 300-1 Line.

10.5 ALTERNATIVE SITES FOR COMPRESSOR STATIONS

As part of the Project, Tennessee proposes to modify facilities at an existing compressor station, Station 319, located along Tennessee's existing 300 Line, as well as construct nine new compressor stations, which are described in Table 1.1-3. There are three Supply Path Component new compressor station sites, and six Market Path Component new compressor station sites. Because Station 319 is an existing facility (and work at that station will be limited to property owned by Tennessee, although the fenceline around the operational area of the compressor station will be moved on a permanent basis to accommodate new facilities, resulting in an additional one acre of impact), no site alternatives were evaluated for the work at this compressor station.

Several alternatives to the proposed NED Project compressor stations were evaluated as part of the planning and design process. Tennessee evaluated 9 Supply Path alternative sites and 21 Market Path alternative sites. The alternatives analysis for the compressor station sites was based on environmental and land use impacts, as well as permanent easement acquisitions. The following factors are considered when selecting the proposed locations for new compressor stations required for the NED Project:

- Engineering design and construction;
- System design limitations;

- Land/workspace requirements;
- Site elevation;
- Road access;
- Interconnecting pipe;
- Land availability; and
- Environmental impacts, including:
  - Agricultural areas;
  - Federal and state listed threatened and endangered species;
  - Cultural resource sites listed or eligible for listing on the NRHP;
  - Wetlands and waterbodies;
  - Noise Sensitive Areas ("NSAs");
  - Visibility; and
  - Emissions.

10.5.1 Supply Path Compressor Station Alternatives

10.5.1.1 Supply Path Head Station Alternatives

Tennessee evaluated four alternative sites in the Town of New Milford, Pennsylvania for the Supply Path Head Station compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-1.

Table 10.5-1
Supply Path Head Station Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	154 acres	127.00-1,031.00,000	Not selected because: 1) landowner did not grant survey permission, 2) location provides less than desirable concealment, 3) proximity of nearby houses, and 4) residence farming operation on property.
Alternative 2	11 acres	109.00-1,051.03,000	Not selected because: 1) property is not adjacent to ROW, located approximately 2,000 feet to the west of ROW, 2) parcel is too small at only 11 acres, and 3) location will be adjacent to existing compressor station, and emissions may have been a concern.
Alternative 3	107 acres	109.00-1,051.03,000	Not selected because: 1) not enough usable acreage due to existing production facilities and flow lines, 2) planned meter station, and 3) sloped terrain.
Alternative 4	62 acres	110.00-1,046.00,000	Not selected because of insufficient usable acreage due to existing production flow lines.
Alternative 5	102 acres	091.00-2,017.00,000	Site is under Phase I environmental evaluation.

10.5.1.2 Supply Path Mid Station Alternatives

Tennessee evaluated three alternative sites in the Towns of Franklin and Otego, New York for the Supply Path Mid Station compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-2.

Table 10.5-2
Supply Path Mid Station Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	118 acres	43.-1-39.1	Not selected because landowner has not granted survey permission.
Alternative 2	96 acres	76.-1-8.3	Not selected because: 1) residence on property, and 2) Tennessee successfully negotiated terms with landowner of the selected site.
Alternative 3	200 acres	331.00-1-1.02	Not selected because: 1) property not adjacent to Project ROW, and 2) Tennessee successfully negotiated terms with landowner of the selected site.

10.5.1.3 Supply Path Tail Station Alternatives

Tennessee evaluated two alternative sites in the Town of Schoharie, New York for the Supply Path Tail Station compression station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-3.

Table 10.5-3
Supply Path Tail Station Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	71 acres	71.-1-18	Not selected because: 1) topography too sloped in distant wooded area, and 2) too close to existing houses in the northern, less sloped farmed fields.
Alternative 2	76 acres	59.-2-27	Not selected because the majority of the property is recorded as culturally sensitive.

10.5.2 Market Path Compressor Station Alternatives

10.5.2.1 Market Path Head Station Alternatives

Tennessee evaluated two alternative sites in the Town of Wright, New York for the Market Path Head Station compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-4.

Table 10.5-4
Market Path Head Station Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	75 acres	61.-3-7.11	Not selected because protected species is present on property.
Alternative 2	91 acres	62.-1-12	Not selected because more suitable property was found at the selected site with flatter terrain.

10.5.2.2 Market Path Mid Station 1 Alternatives

Tennessee evaluated seven alternative sites in the Town of Nassau, New York for the Market Path Mid Station 1 compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-5.

Table 10.5-5
Market Path Mid Station 1 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	44 acres	191.-2-1.1	Not selected because: 1) proximity to existing houses, and 2) wetland areas on western part of property as shown on NWI Maps.
Alternative 2	85 acres	191.-1-1.1	Not selected because of proximity to existing residences.
Alternative 3	56 acres	190.-5-13	Not selected because property owner was unwilling to sell.
Alternative 4	60 acres	191.-4-1.1	Not selected because: 1) proximity to existing houses, and 2) wetland areas on western part of property as shown on NWI Maps.
Alternative 5	60 acres	180.-4-37.11	Not selected because property owner was unwilling to sell.
Alternative 6	43 acres	191.-5-6	Not selected because property owner was unwilling to sell.

Table 10.5-5
Market Path Mid Station 1 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 7	70 acres	190.-5-11	Not selected because 1) the set back from the powerline ROW will require an easement on additional property where access was not granted, and 2) the majority of the parcel is shown as wetlands on NWI Maps.
Alternative 8	63 acres	200.-9-6.11	Site is under Phase I environmental evaluation.
Alternative 9	64 acres	200.-9-10	Site is under Phase I environmental evaluation.

10.5.2.3 Market Path Mid Station 2 Alternatives

Tennessee evaluated two alternative sites in the Town of Windsor, Massachusetts for the Market Path Mid Station 2 compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-6. Subsequent to the July 2015 second draft ER filing in Docket PF14-22-000, Tennessee made a determination that it would move the location of the Market Path Mid Station 2 to a new location. The location that has been dismissed as the location for the compressor station is now considered Alternative 3 and is described in Table 10.5-6.

Table 10.5-6
Market Path Mid Station 2 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	60 acres	3450140000000040	Not selected because: 1) although parcel has access to East Windsor Road, the landowner is unwilling to allow an AR to be built; to obtain access from Peru Road, easements will be required from three landowners and Western Massachusetts Electric, and 2) there is a 140-foot elevation difference between the western and eastern boundaries of the parcel. The side of the hill will have to be carved out to provide a flat surface for the compressor station site, which will require significant rock removal and potentially will require blasting.
Alternative 2	18 acres 21 acres	3450100000000150 3450130000000160	Not selected because: 1) the parcel is owned by Western Massachusetts Electric, who still actively uses the property for staging and maintenance activities, and 2) the property owner unwilling to sell.

Table 10.5-6
Market Path Mid Station 2 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 3	90 acres	3450130000000140	This was the proposed site presented in the July 2015 draft ER filing. After further evaluation, the site was not selected due to the presence of multiple wetlands and creeks. The land across the street became available during the assessment of this site and presented fewer environmental impacts, therefore it was chosen as the preferred site and is depicted on site drawings provided in Volume III, Appendix R.

10.5.2.4 Market Path Mid Station 3 Alternatives

Tennessee evaluated four alternative sites in the Town of Northfield, Massachusetts for the Market Path Mid Station 3 compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-7.

Table 10.5-7
Market Path Mid Station 3 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	50 acres	60 6 1	Not selected because: 1) there is a 280-foot elevation difference between the northern and southern boundaries of the parcel; conceptual layouts were prepared placing the facilities on the flat areas at the top and bottom of the hill (the top of the hill was dismissed because it was too small; the bottom of the hill was dismissed because of lack of access), 2) the parcel is landlocked and will require road easements across additional properties, and 3) the 280-foot elevation difference presents significant challenges in terms of building an AR from Old Wendell Road to the base of the hill where the equipment will be installed.
Alternative 2	2 acres	2-2	Not selected because of the environmentally sensitive area around Pulpit Falls

Table 10.5-7
Market Path Mid Station 3 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 3	139 acres	N/A	Not selected because: 1) multiple wetland areas, 2) proximity to Pulpit Falls (i.e., environmentally sensitive area), 3) there is a 130-foot elevation difference between the hilltops and the property edges and two hilltops will require grading to provide a flat surface to accommodate the footprint of the station, and 4) the parcel is landlocked except for a private road and will require road easements from two landowners.
Alternative 4	30 acres 17 acres	2-7 2-13	Not selected because: 1) proximity to Pulpit Falls (i.e., environmentally sensitive area), 2) there is a 220-foot elevation difference between the western and eastern boundaries of the parcel and the side of the hill will have to be carved out to provide a flat surface for the compressor station site, which will require significant rock removal and potentially will require blasting, and 3) an easement will be required from a separate landowner.

10.5.2.5 Market Tail Station Alternatives

Tennessee evaluated three alternative sites in the Town of Dracut, Massachusetts for the Market Path Tail Station compressor station site based on the criteria identified previously. The reasons that these alternatives were not selected are presented in Table 10.5-8. Subsequent to the July 2015 second draft ER filing in Docket PF14-22-000, Tennessee made a determination that it would move the location of the Market Tail Station to a new location. The location that has been dismissed as the location for the compressor station is now considered Alternative 3 and is described in Table 10.5-8.

Table 10.5-8
Market Path Tail Station Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	45 acres	N/A	Not selected because: 1) close proximity to existing residences and subdivisions (several homes are within 600 feet of the proposed location of the compressor building, and over 30 homes are located less than 0.5 mile away), 2) the area north of the powerline ROW is too small to use, 3) the power company will not allow any permanent, aboveground structures within their ROW, and 4) there is an existing home/business within the property that will require purchase and removal. Not selected because the actual usable area is only 7 to 10 acres directly south and adjacent to the powerline ROW. The close proximity of this land to the powerline corridor will make it difficult to meet setback requirements from the power company with regard to blowdown stacks
Alternative 2	19 acres	37-73-1 37-73-2	Not selected because numerous wetlands were identified during field surveys.
Alternative 3	26 acres	79-F_714671_3073220	This was the proposed site presented in the July 2015 draft ER filing. The new site has less environmental impacts than the previously proposed site and also accommodates stakeholder requests.

10.5.2.6 Market Path Mid Station 4 Alternatives

Tennessee evaluated three alternative sites in the Town of New Ipswich, New Hampshire for the Market Path Mid Station 4 compressor station site based on the criteria identified previously. The reasons these alternatives were not selected are presented in Table 10.5-9.

Table 10.5-9
Market Path Mid Station 4 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 1	57 acres	15A-2	Not selected because numerous wetlands were identified during field surveys.
Alternative 2	178 acres	10-31	Not selected because of lead contamination in soil from commercial gun range

Table 10.5-9
Market Path Mid Station 4 Alternatives

Alternative	Parcel Size	Parcel ID	Reason for Dismissal
Alternative 3	70 acres	154-4-B	Not selected as the landowner was unwilling to sell
Alternative 5	36 acres total	NEW-10-9-A NEW-10-9-A NEW-10-9-A-3 NEW-10-9-A-2 10-9-A-4 NEW-10-20-9-4	Not selected as the land west of Temple Road between Temple Road and the western hydraulic boundary (located at MP 4.4) has been subdivided multiple times and has too many existing homes and communities surrounding the powerline corridor.
Alternative 6	19 acres	GRE-000003-000007-000000 GRE-000003-000006-000000	Not selected as the property is intersected by Blake Road and landowner has been unresponsive.
Alternative 7	149 acres	GRE-000003-000010-000000	Not selected as this land is owned by the State of New Hampshire and is part of the Soughegan River Wildlife Management Area
Alternative 8	34 acres	GRE-000003-000028-000000	Not selected as this land is owned by the Society for the Protection of New Hampshire Forests.
Alternative 9	20 acres	MAS-A-29	Not selected as this land is owned by the New Hampshire Forestry and Recreation Department.

10.5.3 Electric and Waste Heat Turbine Alternatives

Tennessee assessed the feasibility of using electric motor-driven compressor units rather than the natural gas-fired compressor units at the proposed compresor stations.[23] This feasibility analysis included consideration of reliability, availability, cost and environmental impacts, as discussed in more detail below.

10.5.3.1 Reliability

Based on reliability considerations, the installation of natural gas-fired compressor units is favored over installation of electric-driven compressor units. With natural gas being transported through the pipeline facilities, Tennessee will have natural gas available to use to fuel the natural gas-fired turbines used to power the compressor units. On the other hand, electricity to run the electric-driven compressor units may not be available at all times, due to power line outages (such as during storm events), or black or

[23] Tennessee is proposing electric motor-driven compressors to be installed at the Market Path Tail Station to be located in Dracut, Massachusetts; the remainder of the compressors to be installed for the Project are natural gas-fired compressor units.

brown outs (at times when demand exceeds supply, due to power plant outages or general lack of generating capacity). As nuclear, oil and coal generation units are retired in the New England region, the reserve margin of available electricity will continue to decline, which may exacerbate the reliability of electricity in that region until new power plants are constructed.

10.5.3.2 Availability of Electricity

Although Tennessee is currently proposing to co-locate a majority of the Market Path component of the NED Project with high voltage powerline easements, Tennessee will not necessarily have access to sufficient power to drive electric compressor units. Tennessee has been informed by one electric utility company that it does not allow taps into high voltage power lines due to the risk of that the high pressure line will be knocked off-line either during initial connection or during operation. For three of the Market Path compressor stations, power line laterals would therefore need to be constructed in order to connect to a more suitable source of power.

10.5.3.3 Cost

The natural gas-fired units were also favored over electric-driven units on a cost basis. While the costs to construct and operate gas and electric units are generally equivalent, the cost of the energy to run the compressor units is drastically different. As discussed in this certificate application, the electricity rates in the northeast U.S., and New England in particular, are among the highest in the nation. As demonstrated in Table 10.5-10 below, the fuel costs associated with electric compression is more than three times the cost of natural gas in this region of the country.

Table 10.5-10
Comparison of Gas and Electric Driven Compression

	Number of Units	Average Unit Size (HP)	Total Added (HP)	Avg HP Utilized (HP)	Daily Fuel (Mcfd)	Unit Fuel Cost ($/Mcfd)	Potential Annual Cost ($/year)
Gas Units							
Supply Head	3	17,500	52,500	19,336	3,403	$4.00	$4,968,579
Supply Mid	2	25,250	50,500	14,011	2,466	$4.00	$3,600,267
Supply Tail	2	25,250	50,500	13,689	2,409	$4.00	$3,517,525
Market Head	2	10,300	20,600	16,662	2,933	$4.00	$4,281,468
Market Mid 1	2	20,500	41,000	12,824	2,257	$4.00	$3,295,255
Market Mid 2	2	20,500	41,000	12,824	2,257	$4.00	$3,295,255
Market Mid 3	2	20,500	41,000	12,674	2,231	$4.00	$3,256,711
Market Mid 4	2	20,500	41,000	6,776	1,193	$4.00	$1,741,161
Market Tail	2	11,500	23,000	14,572	2,565	$4.00	$3,744,421
TOTAL	**19**	**-**	**361,100**	**-**	**21,713**	**-**	**$31,700,641**
Comparable Electric Units							
Supply Head	3	13,055	39,165	14,425	384,657	$0.13	$18,251,998

Table 10.5-10
Comparison of Gas and Electric Driven Compression

	Number of Units	Average Unit Size (HP)	Total Added (HP)	Avg HP Utilized (HP)	Daily Fuel (Mcfd)	Unit Fuel Cost ($/Mcfd)	Potential Annual Cost ($/year)
Supply Mid	2	18,837	37,673	10,452	278,725	$0.13	$13,225,525
Supply Tail	2	18,837	37,673	10,212	272,320	$0.13	$12,921,576
Market Head	2	7,684	15,368	12,430	331,463	$0.13	$15,727,906
Market Mid 1	2	15,293	30,586	9,567	255,112	$0.13	$12,105,069
Market Mid 2	2	15,293	30,586	9,567	255,112	$0.13	$12,105,069
Market Mid 3	2	15,293	30,586	9,455	252,128	$0.13	$11,963,479
Market Mid 4	2	15,293	30,586	5,055	134,797	$0.13	$6,396,128
Market Tail	2	8,579	17158	10871	289886	$0.13	$13,755,074
TOTAL	19	-	269,381	-	2,454,201	-	$116,451,825
Difference in Annual Cost							$84,751,184
Net Present Value of 20 Years of Operation							$721,534,607

Note: HP Utilized is from fuel models running with average volumetric load of 85 percent.

10.5.3.4 Environmental Impact

As noted above, using electric-driven compression rather than natural gas-driven compression would result in additional landowner and environmental resource impacts in order to build the necessary power infrastructure to build an electrical connection to a mid/high voltage transmission lines rather than to the low voltage coonnections that would be needed for natural gas compression. In addition to the construction of the mid/high voltage transmission lines, electric sub-stations to step the voltage down would also be needed at each electric-driven compressor station.

In addition, Tennessee notes that electric generation capacity in the four states in which new compressor stations will be installed as part of the Project is generated by using various fuel types, including coal, oil, and wood, as reflected in Table 10.5-11 below. Each of these fuel types have significantly more CO_2, NO_x and SO_2 emissions per amount of energy consumed than natural gas.

Table 10.5-11
Percentage of Installed Power Generation Capacity by Fuel Type (2014) – All Sources

Fuel Source	PA	NY	NH	MA
Coal	35.7%	3.3%	6.7%	9.0%
Hydroelectric/Pumped Storage	0.9%	18.6%	7.1%	1.4%
Natural Gas	24.0%	39.7%	22.5%	59.4%
Nuclear	35.6%	31.4%	52.0%	18.5%

Table 10.5-11
Percentage of Installed Power Generation Capacity by Fuel Type (2014) – All Sources

Fuel Source	PA	NY	NH	MA
Other	0.6%	0.7%	0.3%	2.8%
Other Biomass	0.9%	1.2%	0.6%	3.4%
Petroleum	0.4%	1.5%	1.5%	3.2%
Solar Thermal and Photovoltaic	0.0%	0.1%	0.0%	1.0%
Wind	1.6%	2.9%	2.1%	0.7%
Wood and Wood Derived Fuels	0.2%	0.5%	7.2%	0.4%

Source: EIA.gov – Net Generation by State by Type of Producer by Energy Source 2014

Based on the factors discussed above Tennessee has chosen to install natural gas-driven compression at all but one of the new compressor stations proposed to be contructed as part of the Project. Tennessee notes that it is proposing to install electric compression at the Market Tail Station near Dracut, Massachusetts due to a combination of factors unique to that area, including the compressors station being located in a non-attainment region; proximity to residential and commercial structures; proximity to appropriate medium voltage supply to run the electric-driven compression; and the anticipated highly variable operation at this compressor station and its smaller size as compared to the proposed stations to be installed on the mainline of the Market Path Component.

Tennessee also assessed the feasibility of using waste heat electric generation (cogeneration) for the proposed turbines at the newcompressor stations. Using the guideline presented in the study "Waste Energy Recovery Opportunities for Natural Gas Pipelines", conducted by the Interstate Natural Gas Association of America ("INGAA"), currently-available waste heat recovery may be economically viable for turbine-powered compressor stations with total station capacity of at least 15,000 hp, operating at more than 5,250 hours per year (i.e., an annual load factor of 60 percent or greater) (Hedman 2008). Each of the nine new compressor stations are not expected to operate at a consistent load factor of more than 60 percent, so the waste heat recovery would not be economically viable. With regard to the feasibility of waste heat recovery, the load factor of the new compressors will be driven by shipper requirements which in turn are driven by regional residential, commercial, industrial and power generation requirements which fluctuate and can be greatly affected by weather.

Additional factors impacting feasibility of waste heat recovery include the impact to landowners and environmental resources from the expanded footprint required for the substantial facilities for heat recovery and power generation. In addition, land is generally expensive and relatively constrained in the northeast. Many of the compressor station sites are constrained from a space perspective such that finding space for installation of large waste heat recovery systems and the associated large condensing fin-fan coolers is impractical without purchasing additional land and affecting additional landowners. Noise is also a potential issue at these compressor stations. The additive noise from the waste heat recovery equipment may result in a compressor station exceeding the Commission's noise requirements, without the addition of costly noise abatement facilities.

It is Tennessee's understanding from discussions with waste heat generators that the low voltage electric distribution lines that Tennessee is proposing to tie into for station needs with the proposed gas

compressors would also be suitable for selling excess power from waste heat recover into the grid, so Tennessee would not anticipate additional impact for power lines. If Tennessee were to install waste heat recovery equipment at the compressor stations, despite the limitations discussed above, compressor station consumption needs are anticipated to be be met at most of the stations (see Table 10.5-12). However, for all cases Tennessee would still need to install a connection to a low voltage power line for times when the compression is not running, the waste heat recovery unit is not running or is in start up mode, or for those compressor stations where compressor station consumption demand exceeds the capability of the waste heat generation. While, in theory, for the compressor stations where generation exceeds consumption, the excess power could be sold back into the elecrtric power grid, it does not appear that waste heat recovery is considered a renewable resource in the region where these compressor stations will be located. Since it is not a renewable resource, the electric power grid operators are not required to offer net metering for any excess electricity that Tennessee might generate in excess of its compressor station needs, resulting in further detriment to the economic viability of waste heat recovery.

Table 10.5-12
Projected Waste Heat Power Versus Compressor Station Requirements

	Projected Average Power Generation (KWH/mo)	**Projected Average Power Consumption (KWH/mo)**	**Projected Excess Power (KWH/mo)**
Supply Head	2,542,515	1,296,000	1,246,515
Supply Mid	1,842,324	1,296,000	546,324
Supply Tail	1,799,984	1,296,000	503,984
Market Head	262,983	1,296,000	-1,033,018
Market Mid 1	2,190,907	1,296,000	894,907
Market Mid 2	1,686,244	1,296,000	390,244
Market Mid 3	1,666,520	1,296,000	370,520
Market Mid 4	890,985	1,296,000	-405,015

Based on the information discussed above, Tennessee is not proposing to include waste heat recovery equipment systems at any of the proposed compressor stations.

10.6 ALTERNATIVE SITES FOR NEW METER STATIONS AND MLVS

As part of the Project, Tennessee proposes construct 15 new meter station and modify 14 existing meter stations located in New York, Massachusetts, New Hampshire, and Connecticut, which are described in Table 1.1-4 and 1.1-5 in Resource Report 1 of this ER. There are three new meter station sites in New York, ten new meter station sites in Massachusetts, and two new meter stations sites in New Hampshire. Because the 14 meter station modifications are at existing facilities and the modifications will occur in previouisly disturbed areas, no site alternatives were evaluated for the work at these meter stations.

As part of the planning and design process, new meter stations locations were dictated by where the pipelines (both new and existing) intersect and interconnect. Where possible, the new meter stations were

sited on existing Tennessee property or co-located with other new facilities (i.e., compressor stations). Additional specifics include:

- IGT-Constitution Bi-Directional Meter: Station site dictated by location of interconnection between the proposed Pennsylvania to Wright Pipeline Segment and the IGT-Constitution pipeline. The selected meter station site chosen will be co-located with the Market Head Compressor Station.
- NED Check: Station site dictated by location of interconnection between the proposed Pennsylvania to Wright Pipeline Segment and the proposed Wright to Dracut Pipleine Segment. The selected meter station site will be co-located with the Market Head Compressor Station.
- NED/200-Line Bi-Directional OPP & Check: Station site dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing Tennessee 200 mainlines. The selected meter station site will be co-located with the Market Head Compressor Station.
- North Adams Lateral Check: Station site dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing North Adams Lateral.
- West Greenfield: Station is a new delivery interconnect for Berkshire Gas. Proximity of station site dictated by location of the proposed Wright to Dracut Pipeline Segment and existing Berkshire Gas local distribution system.
- Maritimes: Station site dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing Spectra Maritimes pipeline.
- 200-1 Check: Station site dictated by location where the new Lynnfield Lateral ends and the new Peabody Lateral begins. Site chosen is the existing Tennessee Camp Curtis meter station site.
- Haverhill Check: Station site dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing Haverhill Lateral.
- Fitchburg Lateral Check: Station site dictated by location of interconnection between the new Fitchburg Lateral Extension and the existing Tennessee 268A-100 Lateral.
- Longmeadow Station: This is a new delivery interconnect for Columbia Gas. Proximity of station site dictated by location of existing Tennessee 200-1 Line and 200-2 Lines and existing Columbia Gas local distribution system off of Shaker Road.
- Everett Station: This is a new delivery interconnect for National Grid. Proximity of station site dictated by location of existing Tennessee 270C-1100 Lateral and existing National Grid local distribution system. Two potential sites are being considered at the south end of the Tennessee Lateral in Everett. North Adams Regulator: Regulator site is co-located with the North Adams Lateral Check, the site is dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing North Adams Lateral.
- Wilmington Regulator: Regulator station will be located at the existing Tennessee Wilmington meter station site. No permanent enlargement to existing site is anticipated.
- Merrimack: Station is a new delivery interconnect for Liberty Utilities. Proximity of station site dictated by location of proposed Wright to Dracut Pipeline Segment and existing Liberty Utilities local distribution system, east of Daniel Webster Highway. Three potential sites are being considered.
- 200-2 Check: Station site dictated by location of interconnection between the proposed Wright to Dracut Pipeline Segment and the existing Tennessee Concord laterals (270B-100 & 273C-100). Check meter site chosen is on existing Tennessee property.

Tennessee also proposes to construct 54 MLVs as part of the Project. Valve spacing is determined by many factors, but minimum spacing is defined in the USDOT regulations, 49 CFR Part 192. In areas of low population density (defined as Class 1), valves may be located up to 20 miles apart. In areas of medium population density (defined as Class 2), valves may be located up to 15 miles apart. In areas of high population density (defined as Class 3), valves may be located up to 8 miles apart. The locations of MLVs are identified in Table 1.1-6 in Resource Report 1 of this ER. Locations were determined based on a class location study utilizing digitized structure photo interpreted from aerial flights conducted in March 2015. Since then, 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, and will, if necessary, update MLV locations in a subsequent filing.

Mainline valves were located along the pipeline to satisfy spacing requirements based on class location. To the extent possible, proposed MLVs were located adjacent to existing Tennessee MLVs in areas of co-location with Tennessee's existing system and the proposed Constitution MLVs. The intent was to site MLVs adjacent to public roadways for easy access, limiting the need for permanent access roads.

10.7 ALTERNATIVE SITES FOR CONTRACTOR YARDS

Contractor yards proposed at this time represent locations that were utilized on past Tennessee projects, those approved for use for the construction of the Constitution Pipeline Project, and other locations as proposed by Tennessee. Tennessee has identified 198 contractor yards for the proposed Project, including 27 in Pennsylvania, 82 in New York, 52 in Massachusetts, 31 in New Hampshire, and 6 in Connecticut, which are described in Table 8.1-7. Tennessee is in the process of contacting these landowners and obtaining permission for survey and will obtain permission for use.

Tennessee does not anticipate requiring use of all 198 of the contractor yards identified in Table 8.1-7. Upon completion of the survey and consultation process, Tennessee will further evaluate the potential locations and make determinations on which yards will be used. The alternatives analysis for the contractor yard sites will be based on environmental and land use impacts, as well as land availability and temporary easement acquisitions. The following factors will be considered when selecting the proposed locations for contractor yards required for the NED Project:

- Engineering design and construction;
- System design limitations;
- Land/workspace requirements;
- Site elevation;
- Road access;
- Interconnecting pipe;
- Land availability; and
- Environmental impacts, including:
  - Agricultural areas;
  - Federal and state listed threatened and endangered species;
  - Cultural resource sites listed or eligible for listing on the NRHP;
  - Wetlands and waterbodies;

Subsequent to the July 2015 filing, two contractor yards have been eliminated from the list of proposed locations: NED-B-0100 in Tuscarora, Bradford County, Pennsylvania, and NED-K-0001 in Dracut,

Middlesex County, Massachuisetts. All potential contractor yards are included in Resource Report 8. Once the contractor yards have been surveyed and consultations completed, a determination will be made based on the criteria above, as to which contractor yards will be proposed for use during construction, and which will be identified as alternatives. Tennessee will provide a list of the selected contractor yards, the alternative contractor yards, and descriptions of why each were not selected in a supplemental filing.

10.8 ALTERNATIVES SUMMARY

After review of all construction, fuel source, system, and the No-Action Alternative, it is evident that the proposed Project is the preferred alternative. If the proposed Project is not constructed to help meet the growing market needs in the Northeast U.S. (i.e., the No-Action Alternative is selected), the Northeast U.S. markets may experience energy shortages in times of peak demand or users may revert to the consumption of alternative fuels, including oil and coal. Use of alternative fuels to supply the energy needs in the Northeast U.S. is not the best practicable alternative as compared to the use of cleaner-burning natural gas. In addition, although energy conservation is a valuable measure as part of an overall energy plan, energy conservation alone is not a solution to the current energy demand to be served by this Project.

As discussed herein, Tennessee conducted a route alternative analysis to assess various routes for the purpose of avoiding and minimizing impacts to environmental, socioeconomic, cultural/archeological, and other sensitive resources to the extent feasible and practicable, while at the same time ensuring that a constructible Project design will be accomplished. Other potential alternative routes were identified using stakeholder input, environmental survey information, engineering/design criteria, and existing GIS resource mapping. Each alternative has the potential to be viable, although many alternatives were deemed obsolete due to their lack of connectivity with the proposed route and some were deemed less desirable than others based on environmental and land use impacts, need for agency coordination, and constructability issues.

Tennessee is continuing to review major and minor route alternatives to the proposed Project facilities, and will use field surveys, engineering constructability design assessments, and stakeholder involvement to determine the appropriate routing and location for the Project facilities. The evaluation of alternatives is an on-going process and additional alternative identification, review, analysis, and supporting information will be provided to the Commission in supplemental filings.

10.9 REFERENCES

Constitution Pipeline Company, LLC. 2014. Response to NYSDEC March 17, 2014 Scope of Work. Letter from Lynda Schubring, Constitution Pipeline Company, LLC, to Stephen Tomasik, NYSDEC, dated June 16, 2014.

DOE/EIA. 2011. U.S. Coal Supply and Demand: 2010 Review. [Online WWW]. Available URL: http://www.eia.gov/coal/review/. [Accessed September 22, 2014].

DOE/EIA. 2013a. Annual Outlook 2013 with Projections to 2040. DOE/EIA-0383(2010). April 2013. [Online WWW]. Available URLs: http://www.eia.gov/forecasts/aeo/; http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2013&subject=2-AEO2013&table=2-AEO2013&region=1-1&cases=ref2013-d102312a. [Accessed October 6, 2014].

DOE/EIA. 2013b. Vermont Yankee Nuclear Plant Closure. [Online WWW]. Available URL: http://www.eia.gov/todayinenergy/detail.cfm?id=12851. [Accessed September 26, 2014].

DOE/EIA. 2014. Annual Energy Outlook 2014 with Projections to 2040. Energy Information Administration - Report No.: DOE/EIA-0383(2014). April, 2014. [Online WWW]. Available URL: http://www.eia.gov/forecasts/aeo/. [Accessed September 26, 2014].

FERC. 2014a. Constitution Pipeline and Wright Interconnect Projects. Final Environmental Impact Statement. FERC EIS No. 0249F. Docket Numbers CP13-499-000, CP13-502-000, and PF12-9-000. Issued October 2014.

FERC. 2014b. Constitution Pipeline and Wright Interconnect Projects. Draft Environmental Impact Statement. FERC EIS No. 0249D. Docket Numbers CP13-499-000, CP13-502-000, and PF12-9-000. Issued February 2014.

Hedman, BA. 2008. Waste Energy Recovery Opportunities for Interstate Natural Gas Pipelines. INGAA.

ICF International. 2015a. Access Northeast Project – Reliability Benefits and Energy Cost Savings to New England. Dated February 18, 2015.

ICF International. 2015b. New England Energy Market Outlook – Demand for Natural Gas Capacity and Impact of the Northeast Energy Direct Project. Dated September 9, 2015.

ISO-NE. 2015. Energy-Efficiency Forecast for 2019 to 2014. Dated May 1, 2015. Available URL: http://www.iso-ne.com/static-assets/documents/2015/05/eef-report-2019-2024.pdf. [Online WWW]. [Accessed October 22, 2015].

New England Renewable Energy Systems. 2012. How much does it cost? Available URL: http://nerenew.blogspot.com/2012/05/geothermal-how-much-does-it-cost.html. [Online WWW]. [Accessed October 5, 2015].

NHPUC. 2015. Report on Investigation into Potential Approaches to Mitigate Wholesale Electricity Prices. [Online WWW]. Available URL: https://www.puc.nh.gov/Electric/Wholesale%20Investigation/IR%2015-124%20Staff%20Report.pdf. [Accessed October 5, 2015].

NREL. 2010. New York 80-Meter Wind Map, Last updated September 30, 2013. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC. [Online WWW]. Available URL: http://www.windpoweringamerica.gov/pdfs/wind_maps/ny_80m.pdf. [Accessed September 26, 2014].

NYISO. 2012. Power Trends 2012. [Online WWW]. Available URL: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/power_trends_2012_final.pdf. [Accessed October 6, 2014].

U.S. Congress. 2005. Energy Policy Act of 2005. [Online WWW]. Available URLs: http://www.gpo.gov/fdsys/pkg/PLAW109publ58/pdf/PLAW-109publ58.pdf; http://energy.gov/sites/prod/files/2013/10/f3/epact_2005.pdf. [Accessed October 6, 2014].

U.S. Energy Information Administration. 2015. Net Generation by State by Type of Produce by Energy Source (EIA-906, EIA-920, and EIA-932). [Online WWW]. Available URL: http://www.eia.gov/electricity/data/state/. [Accessed November 4, 2015].

USEPA. 2005. National Emissions Inventory Data & Documentation. Last updated April 30, 2012. [Online WWW]. Available URL: http://www.epa.gov/ttn/chief/net/2005inventory.html. [Accessed September 22, 2014].

ATTACHMENT 10a

Figures

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LIST OF FIGURES

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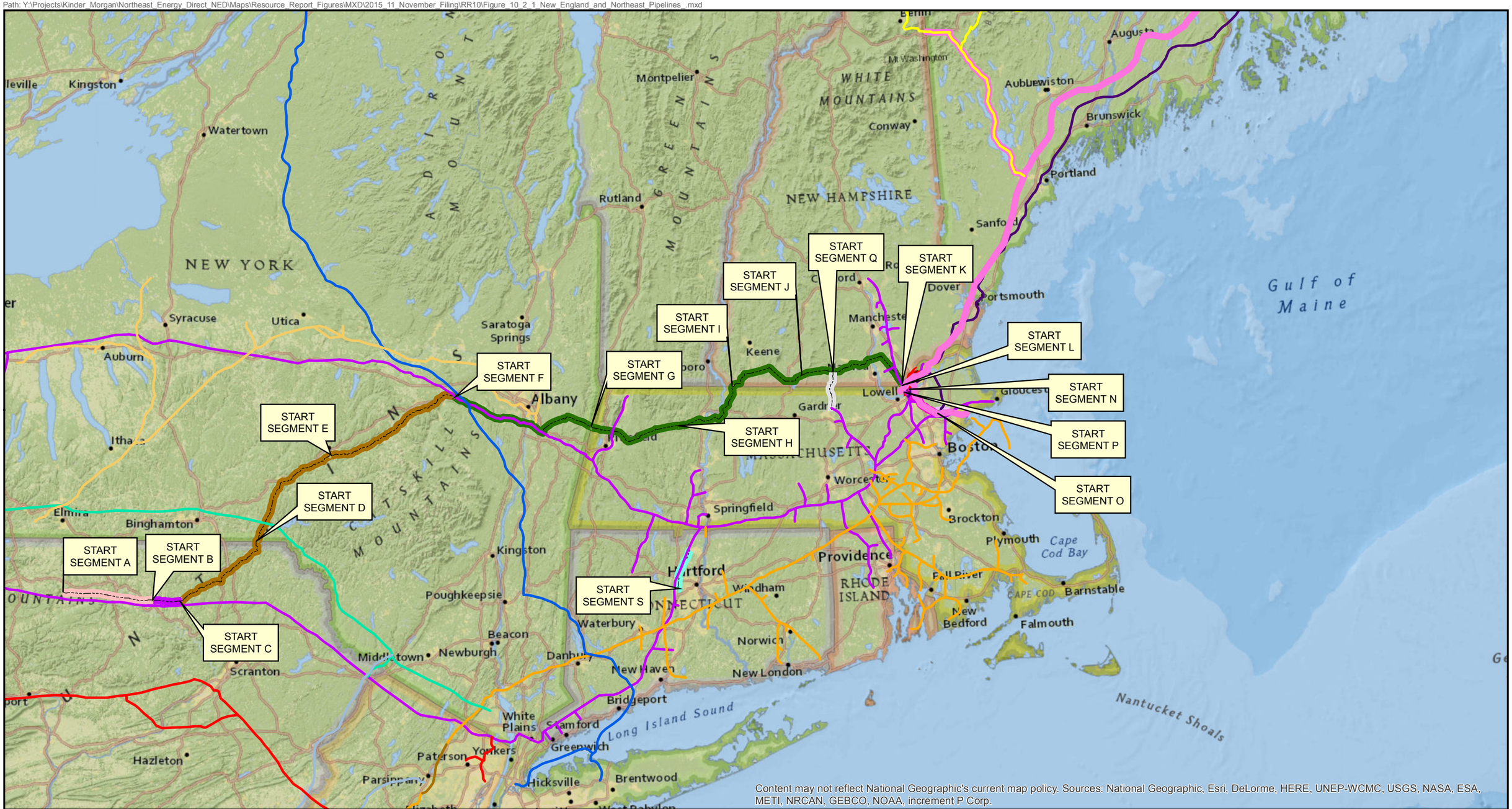

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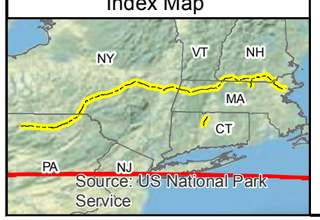

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- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Columbia Gas
- Dominion
- Iroquois
- M&NP and PNGTS Joint Facilities
- Maritimes & Northeast
- Millennium
- Portland Natural Gas Transmission System (PNGTS)
- Spectra Algonquin
- TGP 300L and 200L
- Texas Eastern
- Transcontinental

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

New England and Northeast Natural Gas Pipelines System

0 5 10 20 Miles

1 inch = 166,667 feet

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

AECOM

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November 2015

FIGURE 10.2-1

Map Projection: NAD83 UTM18N Ft.

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VERMONT
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MASSACHUSETTS
RHODE ISLAND
PENNSYLVANIA
CATSKILL MOUNTAINS
ONEIDA LAKE
CAYUGA LAKE
Rhode Island Sound
Boston
Providence
Hartford
Springfield
Worcester

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Source: US National Park Service

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- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- TGP 300L and 200L

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

TGP 300 Line and 200 Line System

0 5 10 20 Miles

1 inch = 110,000 feet

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

AECOM

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FIGURE 10.2-2

Map Projection: NAD83 UTM18N Ft.

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- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Spectra Algonquin

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

Spectra Algonquin System

0 5 10 20 Miles

1 inch = 110,000 feet

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

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November 2015

FIGURE 10.2-3

Map Projection: NAD83 UTM18N Ft.

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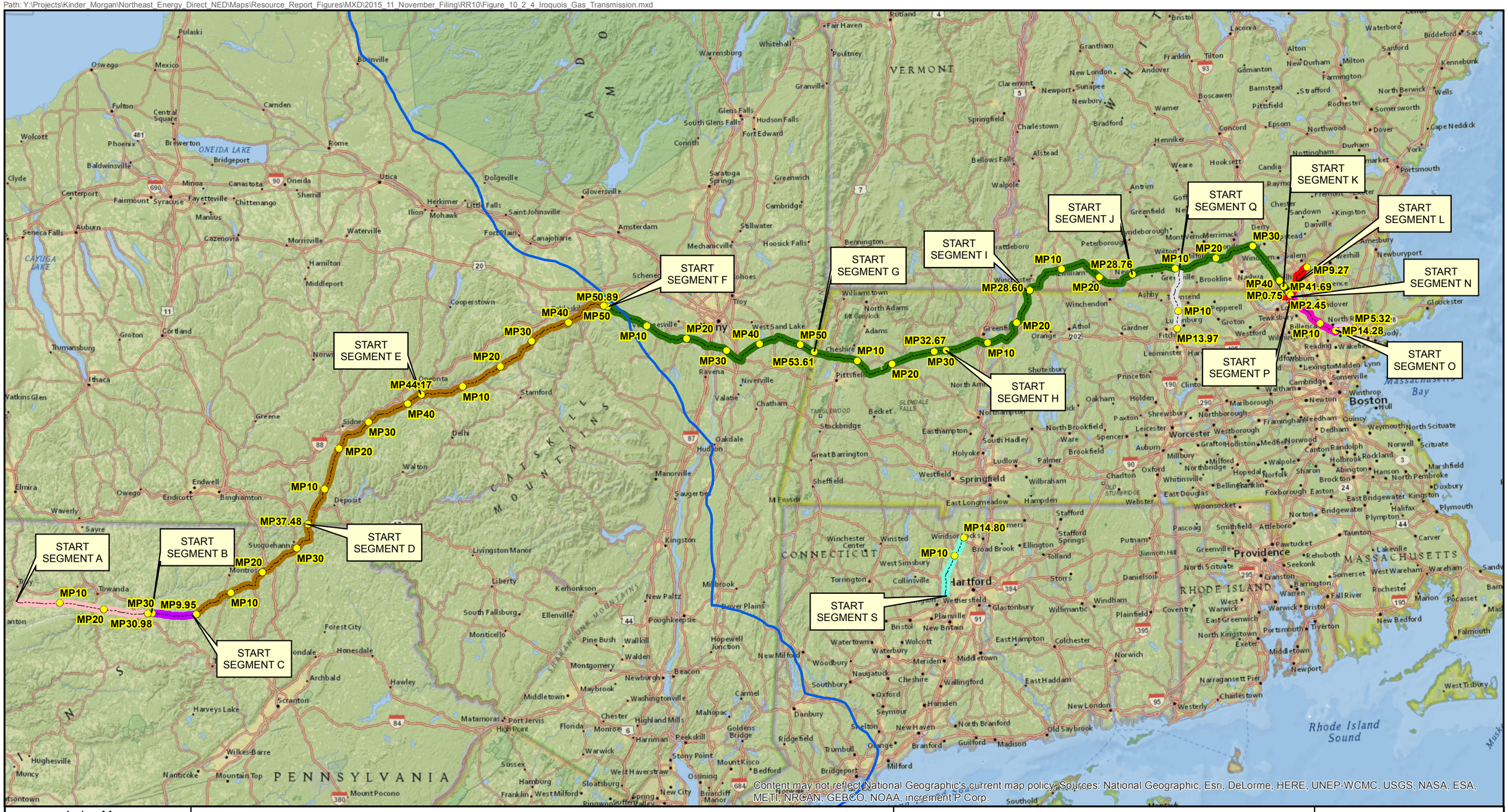

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- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Iroquois

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

Iroquois Gas Transmission System

0 5 10 20 Miles

1 inch = 110,000 feet

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

AECOM

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FIGURE 10.2-4

Map Projection: NAD83 UTM18N Ft.

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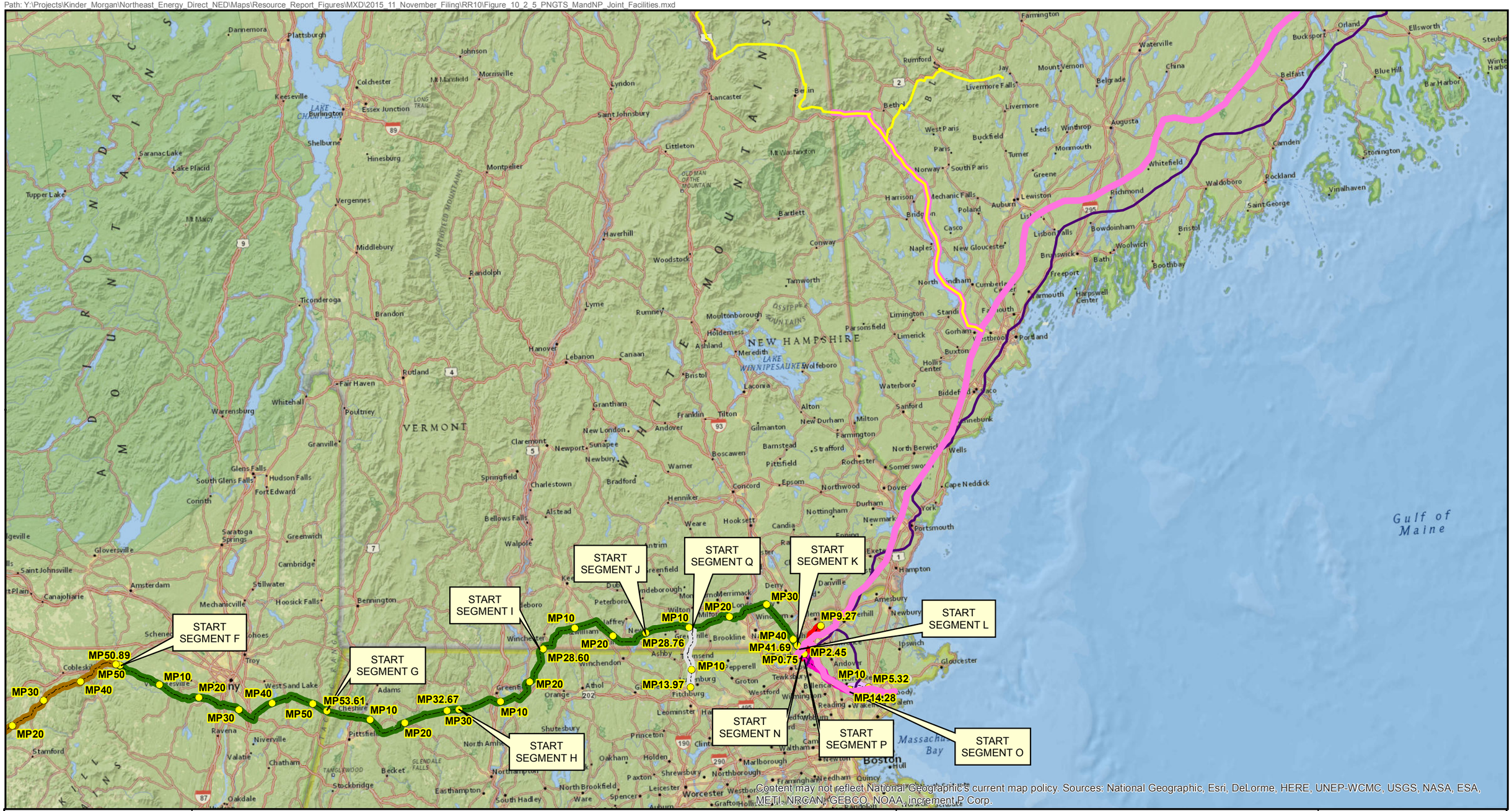

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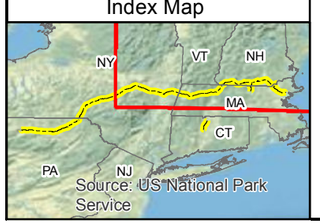

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- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- M&NP and PNGTS Joint Facilities
- Maritimes & Northeast (M&NP)
- Portland Natural Gas Transmission System (PNGTS)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

PNGTS, M&NP, and Joint Facilities

0 5 10 20 Miles

1 inch = 110,000 feet

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

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FIGURE 10.2-5

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- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Granite State

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

System Alternatives

Granite State System

0 5 10 20 Miles

1 inch = 110,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.2-6

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_1_Constitution_Deviation_123_Alt.mxd

START SEGMENT A
MP10
MP20
MP30
MP30.98
MP9.95
START SEGMENT B
START SEGMENT C
START SEGMENT D
MP37.48
MP30
MP20
MP10
Route Alternative 1
Route Alternative 2
START SEGMENT E
MP44.17
MP40
MP30
MP20
MP10
START SEGMENT F
MP50.89
MP50
MP40
Route Alternative 3
MP30
MP20
MP10
START SEGMENT G
MP50
MP53.61
MP10

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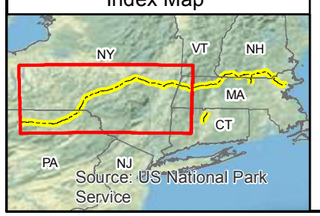
Index Map



Legend

- NED Loop 317-3
- NED Loop 319-3
- NED PA to Wright Pipeline Segment
- NED Wright to Dracut Pipeline Segment
- Milepost (MP)
- Constitution Route Alternative

N
W E
S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Constitution Route 1 Alternative, Route 2 Alternative, Route 3 Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

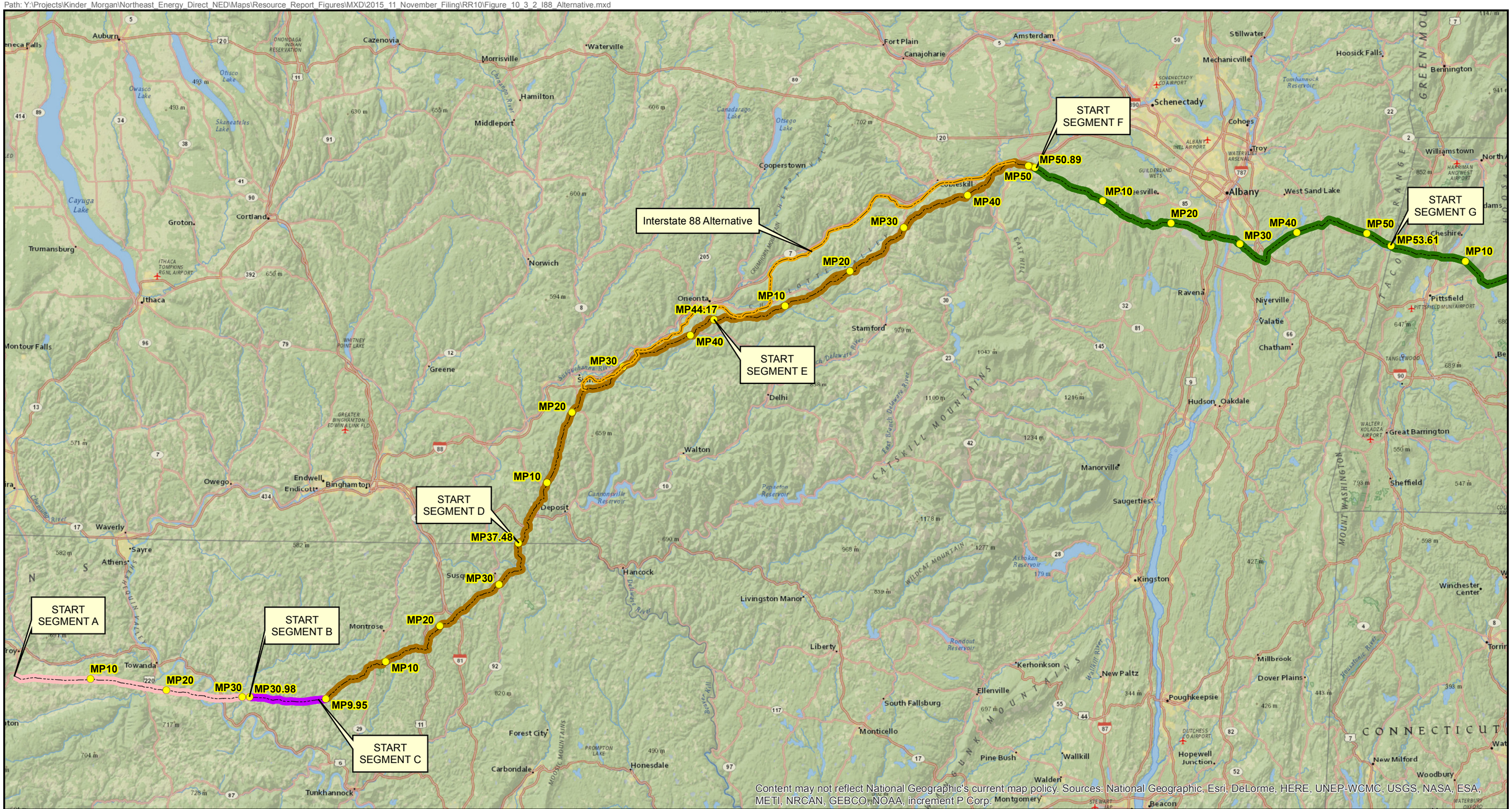
Mapsheet 1 of 1

November 2015

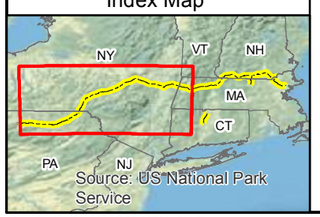
FIGURE 10.3-1

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_2_I88_Alternative.mxd



Index Map



Legend

- NED Loop 317-3
- NED Loop 319-3
- NED PA to Wright Pipeline Segment
- NED Wright to Dracut Pipeline Segment
- Milepost (MP)
- Interstate 88 Alternative

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Interstate 88 Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

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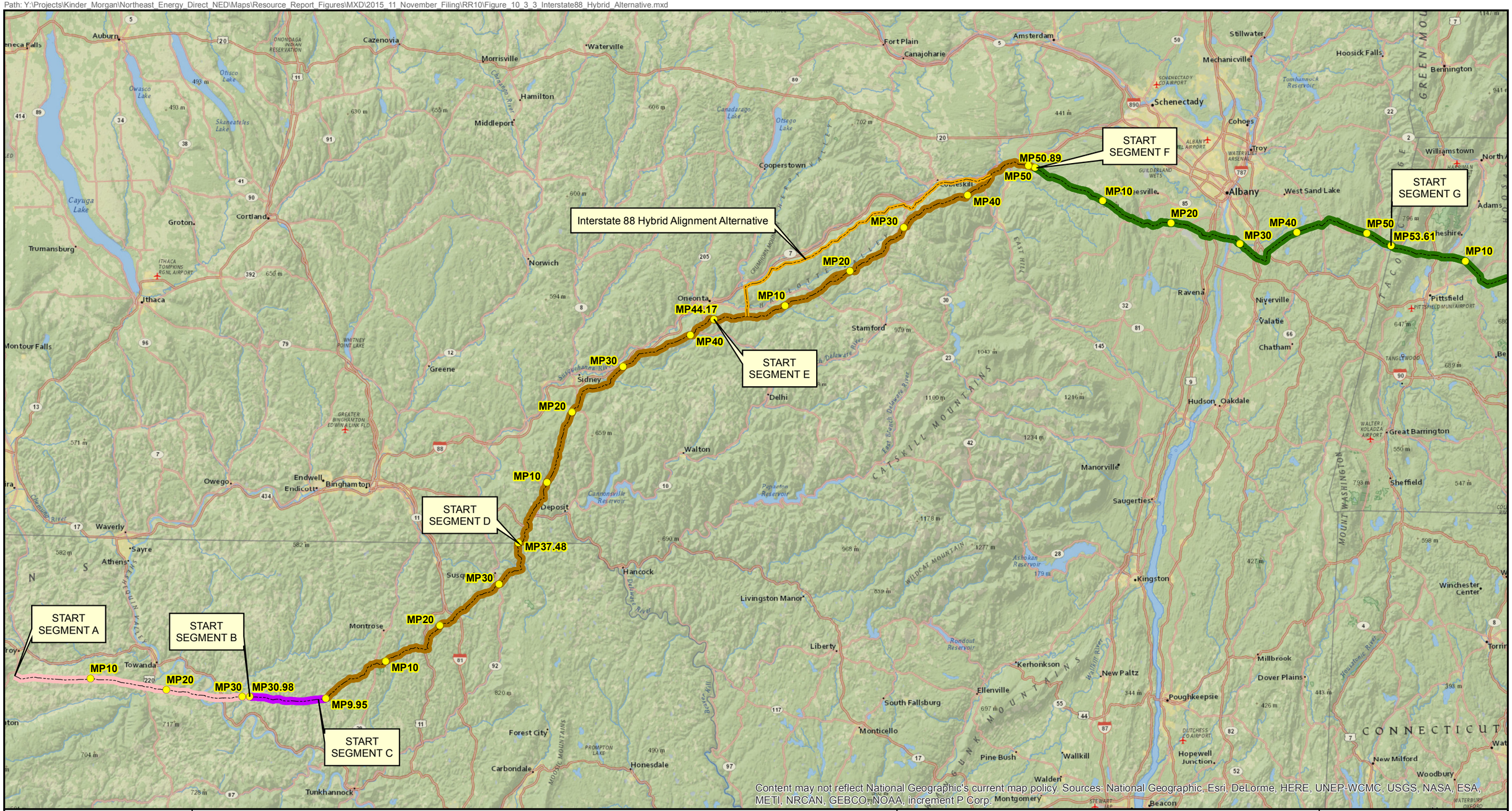
Mapsheet 1 of 1

November 2015

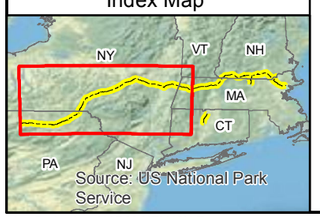
FIGURE 10.3-2

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_3_Interstate88_Hybrid_Alternative.mxd



Index Map



Legend

- NED Loop 317-3
- NED Loop 319-3
- NED PA to Wright Pipeline Segment
- NED Wright to Dracut Pipeline Segment
- Milepost (MP)
- Interstate 88 Hybrid Alignment Alternative

N
W E
S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Interstate 88 Hybrid Alignment Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-3

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_4_NE_Exchange_Alternative.mxd

START SEGMENT A
START SEGMENT B
START SEGMENT C
START SEGMENT D
START SEGMENT E
START SEGMENT F
START SEGMENT G
Northeast Exchange (NEEX) Alternative
MP9.95
MP10
MP20
MP30
MP30.98
MP37.48
MP40
MP44.17
MP50
MP50.89
MP53.61

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Index Map

Source: US National Park Service

Legend

- NED Loop 317-3
- NED Loop 319-3
- NED PA to Wright Pipeline Segment
- NED Wright to Dracut Pipeline Segment
- Milepost (MP)
- Northeast Exchange (NEEX) Alternative

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Northeast Exchange (NEEX) Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-4

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_5_New_York_Alternative.mxd

START SEGMENT E
MP44.17
MP40
MP30
MP20
MP10

START SEGMENT F
MP50.89
MP50
MP40
MP30
MP20
MP10

START SEGMENT G
MP53.61
MP50
MP40
MP30
MP20
MP10

START SEGMENT H
MP32.67
MP30
MP20
MP10

START SEGMENT I
MP28.60
MP20
MP10

START SEGMENT J
MP28.76
MP20
MP10

START SEGMENT Q
MP30
MP20
MP10
MP13.97

START SEGMENT S
MP14.80
MP10

New York Alternative

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Index Map

Source: US National Park Service

Legend

- NED PA to Wright Pipeline Segment
- NED Wright to Dracut Pipeline Segment
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- New York Alternative

Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

New York Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-5

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_6_Massachsuetts_Alternative.mxd

START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT Q
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT O
START SEGMENT P
START SEGMENT S
Massachusetts Alternative
MP40
MP50
MP53.61
MP10
MP20
MP32.67
MP30
MP10
MP20
MP28.60
MP10
MP20
MP28.76
MP10
MP20
MP30
MP40
MP0.75
MP41.69
MP2.45
MP9.27
MP10
MP13.97
MP10
MP14.28
MP5.32
MP10
MP14.80
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Massachusetts Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Massachusetts Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-6

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_7_Easting_200_Line_Alternative.mxd

START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT Q
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT O
START SEGMENT P
START SEGMENT S
MP40
MP50
MP53.61
MP10
MP20
MP32.67
MP30
MP10
MP20
MP28.60
MP10
MP20
MP28.76
MP10
MP20
MP30
MP40
MP41.69
MP0.75
MP2:45
MP9.27
MP10
MP13.97
MP10
MP5.32
MP14.28
MP14.80
MP10
Existing 200 Line Alternative
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND

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Index Map

Source: US National Park Service

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Existing 200 Line Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Existing 200 Line Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

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November 2015

FIGURE 10.3-7

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_8_Massachusetts_Route2_Alternative.mxd

START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT Q
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT O
START SEGMENT P
START SEGMENT S
Massachusetts Route 2 Alternative
MP40
MP50
MP53.61
MP10
MP20
MP32.67
MP30
MP10
MP20
MP10
MP28.60
MP10
MP20
MP28.76
MP10
MP13.97
MP20
MP30
MP40
MP41.69
MP0.75
MP2.45
MP9.27
MP10
MP14.28
MP5.32
MP14.80
MP10

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Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Massachusetts Route 2 Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N
W E
S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Massachusetts Route 2 Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-8

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_9_Mass-Turnpike_Alternative.mxd

START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT Q
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT P
START SEGMENT O
START SEGMENT S

MP40
MP50
MP53.61
MP10
MP20
MP32.67
MP30
MP10
MP20
MP28.60
MP10
MP20
MP28.76
MP10
MP30
MP20
MP10
MP13.97
MP40
MP41.69
MP0.75
MP2.45
MP9.27
MP10
MP14.28
MP5.32
MP14.80
MP10

Massachusetts Turnpike Alternative

MASSACHUSETTS
CONNECTICUT
RHODE ISLAND

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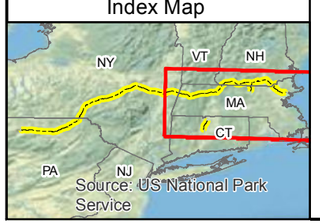
Index Map



Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Massachusetts Turnpike Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Massachusetts Turnpike Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-9

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_10_Massachusetts_Powerline_Alternative.mxd

START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT O
START SEGMENT P
START SEGMENT Q
START SEGMENT S

MP40
MP50
MP53.61
MP10
MP20
MP32.67
MP30
MP10
MP20
MP28.60
MP10
MP20
MP28.76
MP10
MP20
MP30
MP40
MP41.69
MP0.75
MP2.45
MP9.27
MP10
MP13.97
MP10
MP14.28
MP5.32
MP14.80
MP10

Massachusetts Powerline Alternative

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Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Massachusetts Powerline Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Massachusetts Powerline Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-10

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_11a_Combined_NY_and_Existing_200Line_Alt.mxd

START SEGMENT F
MP50.89
MP10
MP20
MP30
MP40
MP50
MP53.61
START SEGMENT G
North Adams Loop
MP10
MP20
MP32.67
MP30
START SEGMENT H
START SEGMENT I
MP10
MP20
MP28.60
START SEGMENT J
MP10
MP20
MP28.76
START SEGMENT Q
MP10
West Nashua Extension
MP30
MP20
Nashua Loop Line
START SEGMENT K
MP9.27
Concord T&R
MP40
MP41.69
MP2.45
MP0.75
START SEGMENT L
START SEGMENT N
MP10
MP5.32
MP14.28
START SEGMENT P
START SEGMENT O
MP10
MP13.97
Fitchburg Looping 3
Fitchburg Looping 2
Fitchburg Looping 1
Greenfield Extension
North Hampton Loop
Combined New York and Existing 200 Line Alternative
MP14.80
MP10
300 Line CT Loop
START SEGMENT S

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Index Map

Source: US National Park Service

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Combined New York and Existing 200 Line Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)
- Concord T&R
- Fitchburg Looping 1
- Fitchburg Looping 2
- Fitchburg Looping 3
- Greenfield Extension
- Nashua Loop Line
- North Adams Loop
- North Hampton Loop
- West Nashua Extension

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Combined New York and Existing 200 Line Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

Mapsheet 1 of 1

November 2015

FIGURE 10.3-11a

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_11b_Combined_NY_and_Existing_200Line_Alt.mxd

START SEGMENT F
MP50.89
MP10
MP20
MP30
MP40
MP50
MP53.61
START SEGMENT G
North Adams Loop
MP10
MP20
MP32.67
MP30
START SEGMENT H
Greenfield Extension
North Hampton Loop
START SEGMENT I
MP10
MP20
MP28.60
MP20
START SEGMENT J
MP28.76
MP10
START SEGMENT Q
West Nashua Extension
MP20
MP30
Nashua Loop Line
START SEGMENT K
MP9.27
Concord T&R
MP40
MP41.69
MP0.75
MP2.45
START SEGMENT L
START SEGMENT N
MP10
MP13.97
MP10
MP5.32
MP14.28
Fitchburg Looping 3
START SEGMENT P
START SEGMENT O
Fitchburg Looping 2
Fitchburg Looping 1
Combined New York and Existing 200 Line Alternative
MP14.80
MP10
300 Line CT Loop
START SEGMENT S

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, Swisstopo, and the GIS User Community, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Combined New York and Existing 200 Line Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)
- Concord T&R
- Fitchburg Looping 1
- Fitchburg Looping 2
- Fitchburg Looping 3
- Greenfield Extension
- Nashua Loop Line
- North Adams Loop
- North Hampton Loop
- West Nashua Extension

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Combined New York and Existing 200 Line Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

AECOM

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November 2015

FIGURE 10.3-11b

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_12a_Combined_New_York_and_Esting_200_Line.mxd

START SEGMENT F
MP50.89
MP10
MP20
MP30
MP40
MP50
MP53.61
START SEGMENT G
North Adams Loop
MP10
MP20
MP32.67
MP30
START SEGMENT H
MP10
START SEGMENT I
MP28.60
MP10
MP20
START SEGMENT J
MP28.76
MP20
MP10
START SEGMENT Q
West Nashua Extension
Nashua Loop Line
MP30
MP20
START SEGMENT K
MP9.27
START SEGMENT N
Concord T&R
MP40
MP41.69
START SEGMENT L
MP0.75
MP2.45
START SEGMENT P
MP10
MP5.32
MP13.97
Fitchburg Looping 3
MP14.28
START SEGMENT O
Fitchburg Looping 2
Fitchburg Looping 1
Greenfield Extension
North Hampton Loop
Combined New York and MassTurnpike Alternative
MP14.80
MP10
300 Line CT Loop
START SEGMENT S
MASSACHUSETTS
RHODE ISLAND
GREEN MOUNTAINS
TACONIC RANGE
MOUNT WASHINGTON

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Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- NED Maritimes Delivery Line
- NED Lynnfield Lateral
- NED Peabody Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- NED 300 Line CT Loop
- Milepost (MP)
- Combined New York and MassTurnpike Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)
- Concord T&R
- Fitchburg Looping 1
- Fitchburg Looping 2
- Fitchburg Looping 3
- Greenfield Extension
- Nashua Loop Line
- North Adams Loop
- North Hampton Loop
- West Nashua Extension

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Combined New York and Mass Turnpike Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

Mapsheet 1 of 1

November 2015

FIGURE 10.3-12a

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_12b_Combined_NY_and_Mass_Turnpike_Alt.mxd

START SEGMENT F
MP50.89
MP10
MP20
MP30
MP40
MP50
MP53.61
START SEGMENT G
North Adams Loop
MP10
MP20
MP32.67
MP30
START SEGMENT H
Greenfield Extension
START SEGMENT I
MP10
MP20
MP28.76
MP28.60
MP20
MP10
START SEGMENT J
START SEGMENT Q
West Nashua Extension
MP30
MP20
MP10
Concord T&R
MP10
MP13.97
Fitchburg Looping 3
Nashua Loop Line
START SEGMENT K
MP9.27
START SEGMENT N
MP40
MP41.69
MP0.75
MP2.45
START SEGMENT L
START SEGMENT P
MP10
MP5.32
MP14.28
START SEGMENT O
Fitchburg Looping 2
Fitchburg Looping 1
North Hampton Loop
Combined New York and MassTurnpike Alternative
MP14.80
MP10
300 Line CT Loop
START SEGMENT S

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

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- NED Haverhill Lateral
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- NED 300 Line CT Loop
- Milepost (MP)
- Combined New York and MassTurnpike Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)
- Concord T&R
- Fitchburg Looping 1
- Fitchburg Looping 2
- Fitchburg Looping 3
- Greenfield Extension
- Nashua Loop Line
- North Adams Loop
- North Hampton Loop
- West Nashua Extension

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Combined New York and Mass Turnpike Alternative

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

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FIGURE 10.3-12b

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_13_Article97_and_CoLocation_Alternative.mxd

START SEGMENT F
START SEGMENT G
START SEGMENT H
START SEGMENT I
START SEGMENT J
START SEGMENT Q
START SEGMENT K
START SEGMENT L
START SEGMENT N
START SEGMENT P
START SEGMENT O
START SEGMENT S

MP50.89
MP10
MP20
MP30
MP40
MP50
MP53.61
MP10
MP20
MP30
MP32.67
MP10
MP20
MP28.60
MP10
MP20
MP28.76
MP10
MP20
MP30
MP40
MP41.69
MP0.75
MP2.45
MP10
MP13.97
MP10
MP5.32
MP14.28
MP14.80
MP10

Article 97 Total Avoidance Route
Article 97 Co-located Route

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- Article 97 Co-located Route
- Article 97 Total Avoidance Route
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Major Route Alternatives

Article 97 Avoidance and Co-location Alternatives

0 2.5 5 10 Miles

1 inch = 64,000 feet

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

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FIGURE 10.3-13

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_14_Lynnfield_Lateral_Alternatives.mxd

MP40

START SEGMENT K

MP41.69

START SEGMENT L

MP0.75

START SEGMENT N

MP2.45

START SEGMENT P

Andover Lateral Alternative 1

Andover Lateral Alternative 5

Andover Lateral Alternative 2

Alternative Lynnfield Lateral (A)

Andover Lateral Alternative 4

Andover Lateral Alternative 3

MP10

MP5.32

MP14.28

START SEGMENT O

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- Milepost (MP)
- Alternative Lynnfield Lateral (A)
- Andover Lateral Alternative 1
- Andover Lateral Alternative 2
- Andover Lateral Alternative 3
- Andover Lateral Alternative 4
- Andover Lateral Alternative 5

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Minor Route Alternatives

Lynnfield Lateral Alternatives

0 0.5 1 2 Miles

1 inch = 10,000 feet

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

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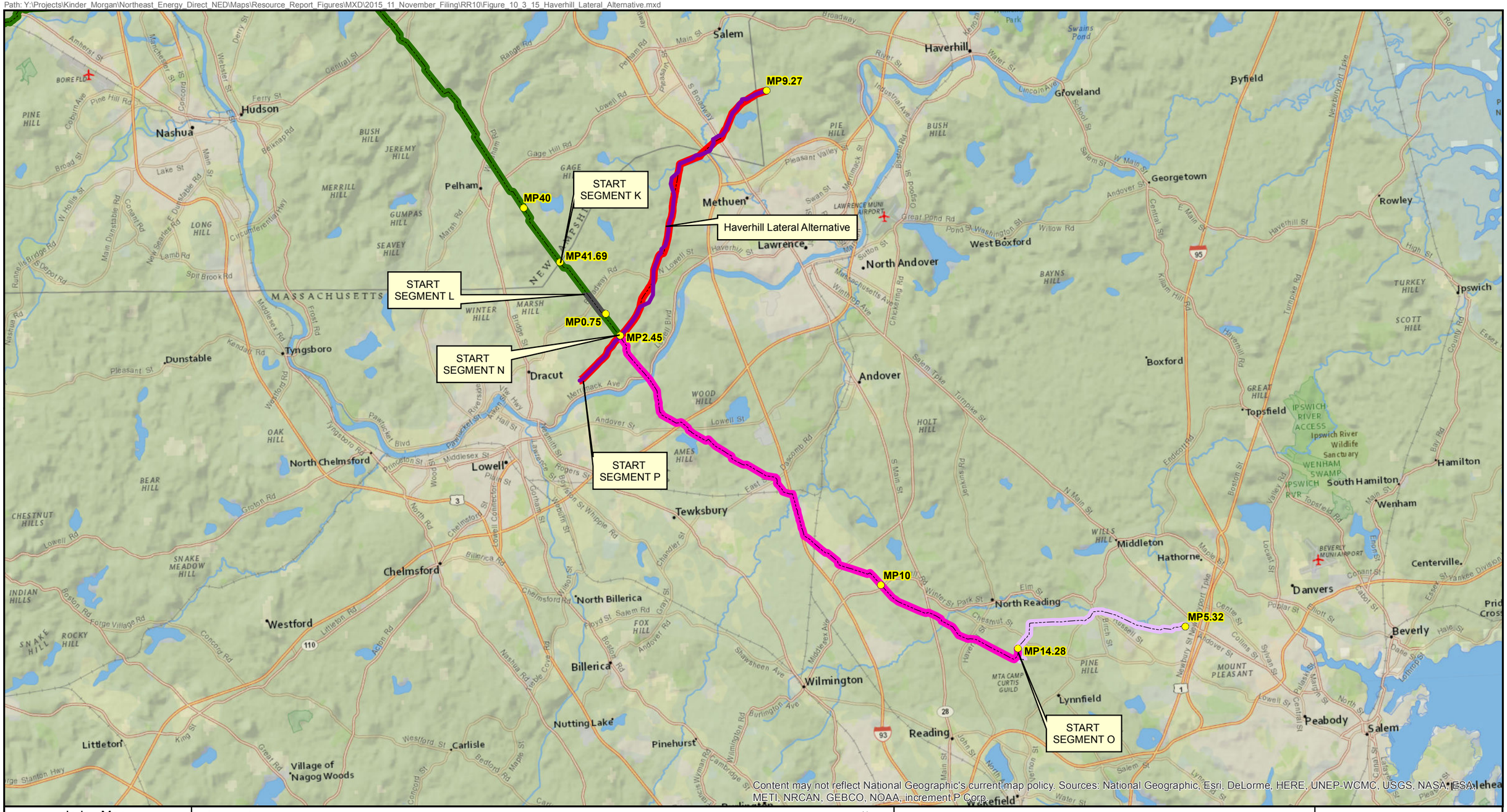
FIGURE 10.3-14

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_15_Haverhill_Lateral_Alternative.mxd



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Legend

- NED Wright to Dracut Pipeline Segment
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- NED Peabody Lateral
- NED Haverhill Lateral
- Milepost (MP)
- Haverhill Lateral Alternative

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Minor Route Alternatives

Haverhill Lateral Alternative

0 0.5 1 2 Miles

1 inch = 12,500 feet

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

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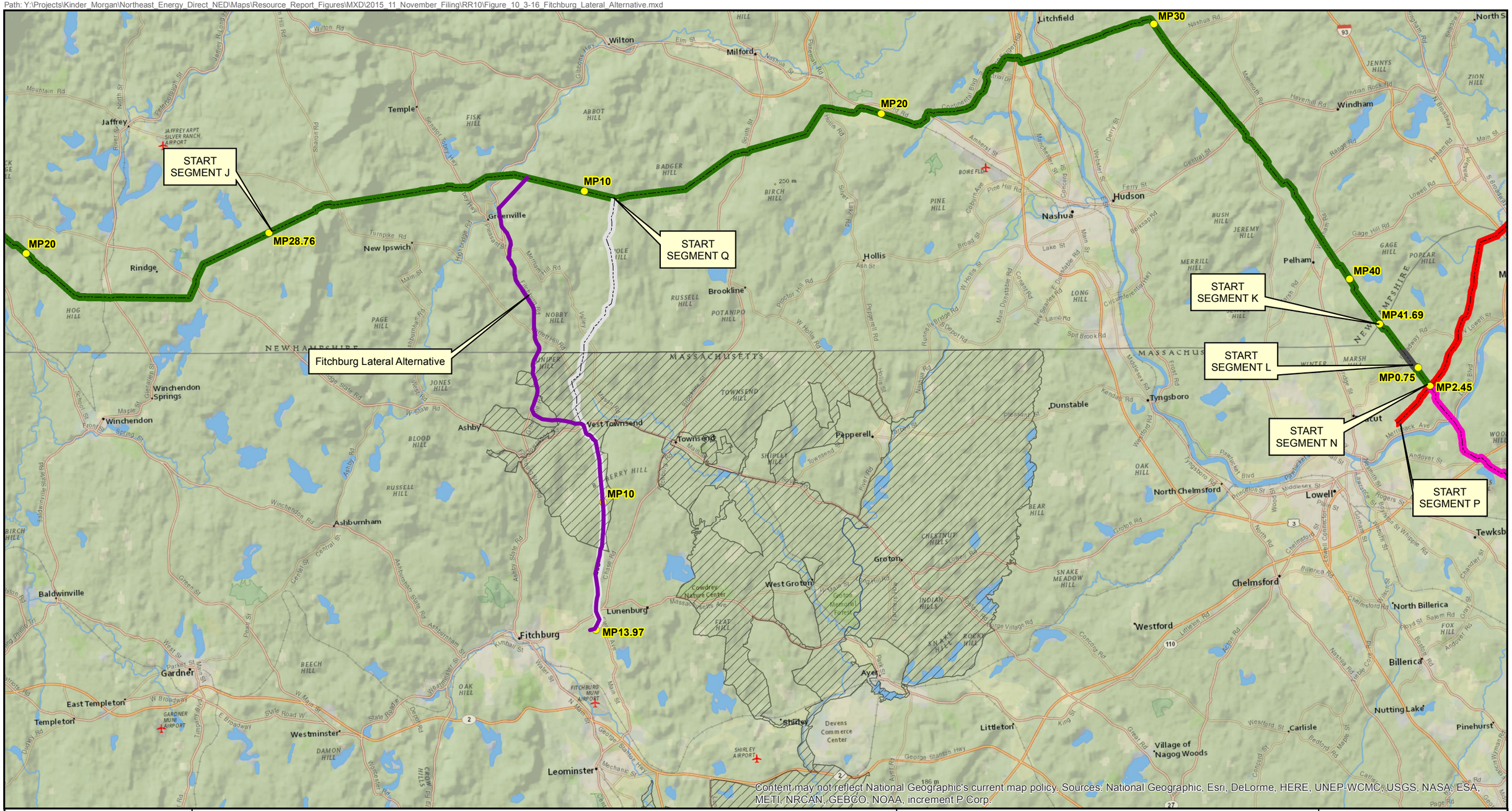
FIGURE 10.3-15

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3-16_Fitchburg_Lateral_Alternative.mxd



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- NED Lynnfield Lateral
- NED Haverhill Lateral
- NED Fitchburg Lateral Extension
- Milepost (MP)
- Fitchburg Lateral Alternative
- Areas of Critical Environmental Concern (MassGIS April 2009)

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Minor Route Alternative

Fitchburg Lateral Alternative

0 1 2 4 Miles

1 inch = 15,000 feet

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

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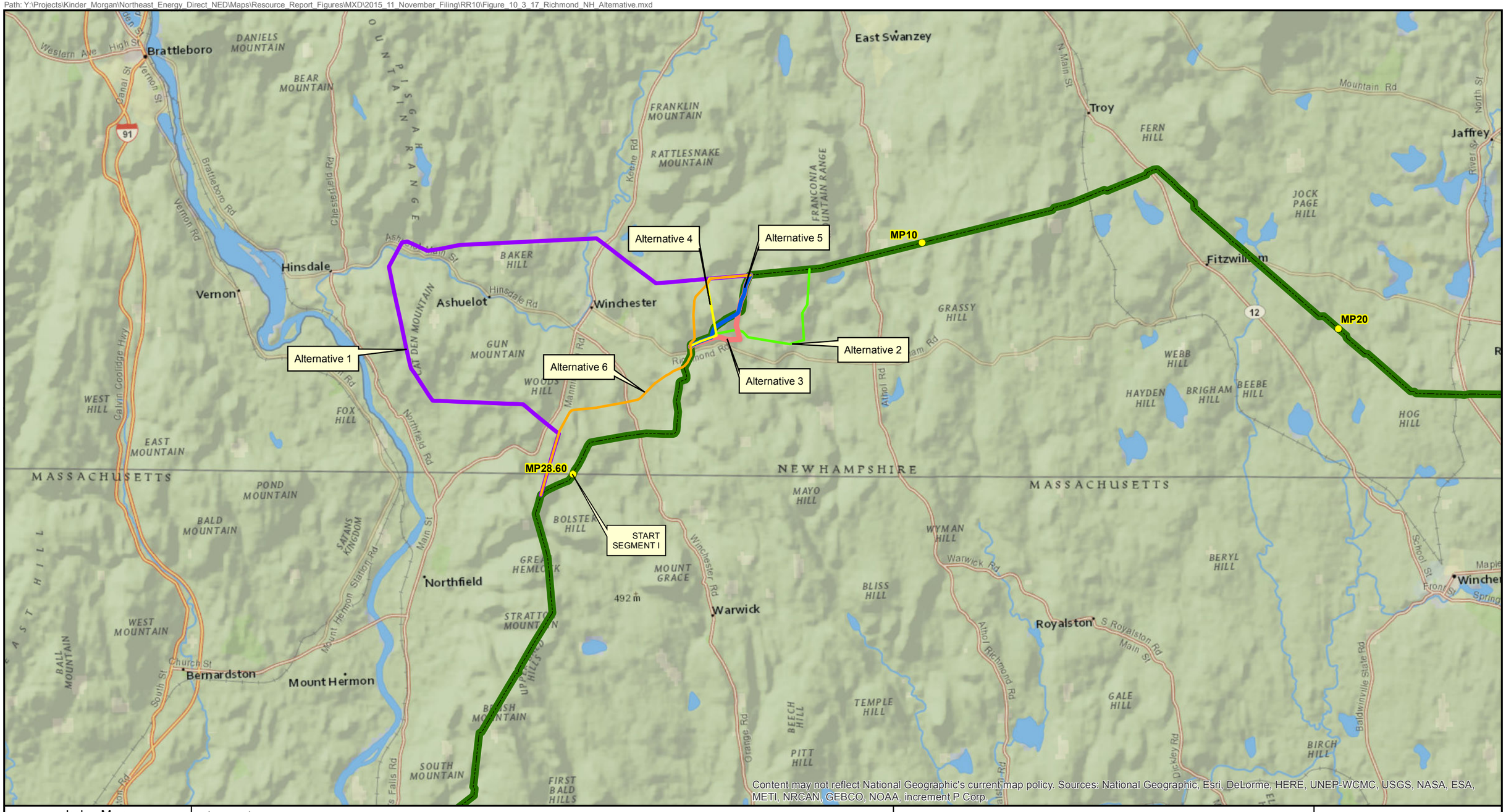
FIGURE 10.3-16

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_17_Richmond_NH_Alternative.mxd



Index Map

Legend

- NED Wright to Dracut Pipeline Segment
- Milepost (MP)
- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5
- Alternative 6

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Minor Route Alternatives

Winchester-Richmond New Hampshire Alternatives

0 0.5 1 2 Miles

1 inch = 10,000 feet

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

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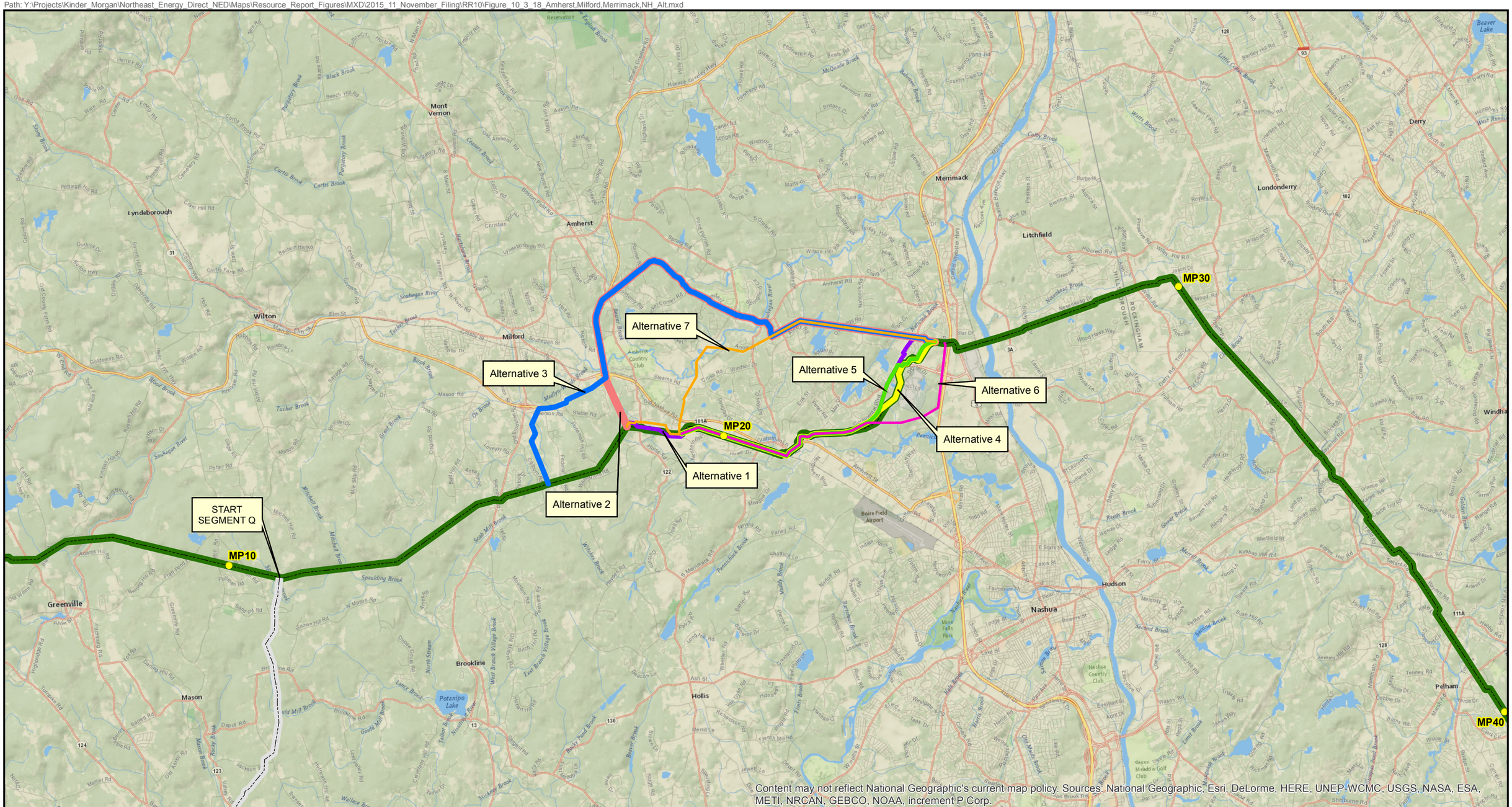
FIGURE 10.3-17

Map Projection: NAD83 UTM18N Ft.

Path: Y:\Projects\Kinder_Morgan\Northeast_Energy_Direct_NED\Maps\Resource_Report_Figures\MXD\2015_11_November_Filing\RR10\Figure_10_3_18_Amherst,Milford,Merrimack,NH_Alt.mxd



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- NED Wright to Dracut Pipeline Segment
- NED Fitchburg Lateral Extension
- Milepost (MP)
- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5
- Alternative 6
- Alternative 7

N W E S

Tennessee Gas Pipeline Company, L.L.C.

Northeast Energy Direct Project

Minor Route Alternatives

Amherst, Mildford, Hollis, Merrimack New Hampshire Alternatives

0 0.5 1 2 Miles

1 inch = 9,000 feet

Tennessee Gas Pipeline Company, L.L.C.
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FIGURE 10.3-18

Map Projection: NAD83 UTM18N Ft.