CONNECTICUT EXPANSION PROJECT

ENVIRONMENTAL REPORT

RESOURCE REPORT 10

ALTERNATIVES

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RESOURCE REPORT 10 – ALTERNATIVES

SUMMARY OF COMMISSION 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 alternatives sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site.	Not Applicable

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10.0 ALTERNATIVES

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee") 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 Connecticut Expansion Project (the "Project") in Albany County, New York, Berkshire and Hampden Counties, Massachusetts and Hartford County, Connecticut. The proposed Project involves (1) the construction of two sections of new 36-inch outside diameter ("OD") pipeline looping totaling 1.35 miles in New York ("New York Loop") and 3.81 miles in Massachusetts ("Massachusetts Loop"), and one section of new 24-inch OD pipeline looping totaling 8.10 miles in Massachusetts and Connecticut ("Connecticut Loop"); (2) minor modifications at the existing Agawam Compressor Station in Massachusetts ("Station 261"); and (3) appurtenant facilities, including a main line valve ("MLV"), cathodic protection, and pig launchers and receivers. To the extent that it is practicable, feasible, and in compliance with existing law, Tennessee proposes to locate the pipeline loops within or adjacent to the right-of-way ("ROW") associated with its existing pipelines designated as the 200 and 300 Lines. Tennessee proposes to begin construction of the Project facilities in the fourth quarter of 2015 and to place the facilities in-service by November 2016. Please refer to Resource Report 1 of this Environmental Report ("ER") for a more complete description of the Project components.

Tennessee undertook an extensive needs and alternatives analysis for the Project. Tennessee's primary objective in performing this analysis was to develop a project that would accomplish Tennessee's objective to meet the market demand for natural gas transportation service, while working to avoid or minimize potential adverse environmental impacts to the greatest extent practicable. As discussed below, Tennessee evaluated pipeline routing options based on regional topography, potential adverse environmental impacts, population density, existing land usage, and 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 (2014).

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. However, by not constructing the proposed Project, Tennessee would be unable to provide the necessary natural gas transportation service required to meet the expressed needs of the market. Given the constrained pipeline capacity situation in the northeast United States, other natural gas transmission companies would be required to increase their capacity and construct new facilities to meet the existing demand for the additional capacity. Such actions would only result in the transference of environmental impacts from one location to another but would not reduce or eliminate such impacts.

If existing natural gas transmission systems are not enhanced or expanded, energy shortages in times of peak demand may ensue, or users may revert to the consumption of alternative fuels, which may include oil and coal. Utilization of natural gas as the primary fuel offers the best alternative in terms of supply availability with the lowest environmental impact among available alternative energy sources, particularly with regard to air quality impacts. Existing natural gas delivery systems may be readily expanded to meet

increased demand with minimal impact to the environment. The no-action alternative was not found to be a feasible alternative for the Project since that alternative would not satisfy the purpose and need for the Project and ultimately would result in other, more significant impacts to the environment.

10.1.1 Energy Conservation

Reduction in the need for additional energy usage is the preferred option wherever possible. Conservation of energy reduces the demand for the limited and over-utilized fossil fuel reserves. Energy conservation is also advocated by both federal and the state authorities in New York, Massachusetts, and Connecticut. There remains an existing need for additional natural gas capacity that would be provided with the construction of this Project.[1] Energy conservation alone is not a viable alternative to the Project.

10.1.2 Energy Alternatives

Use of alternative fuels to supply the needs of the market would potentially result in adverse environmental impacts due to increased air pollutant emissions that would be minimized otherwise through the use of natural gas. In general, alternative energy sources for Tennessee's shippers include oil, coal, biomass, and nuclear fuels. State and federal air pollution control regulations indirectly promote the use of clean fuels to minimize adverse air quality impacts. These regulations were instituted to improve both air quality and the quality of life. Use of these alternative hydrocarbon energy sources would unnecessarily increase adverse air quality impacts, and these increased impacts would conflict with federal and state long-term energy environmental policies aimed toward attaining ambient air quality standards.

10.1.2.1 Wind Power

Wind power currently is not an option for providing the existing or projected power needs in the regions where the Project is located. Wind generation is not available in the Project area and cannot be precisely scheduled based on demand. Therefore, wind energy would not be able to provide the projected needs for the region as reliably and in the quantity that would be provided by natural gas.

10.1.2.2 Solar Power

Solar power is not an alternative to natural gas in this region due to climactic conditions, developmental costs, and reliability issues. For these reasons, renewable resources, such as solar power, are not being developed at a pace fast enough to provide for the projected energy needs in the region where the Project would provide service.

[1] See the U.S. Energy Information Administration's Annual Energy Outlook 2014, which projects natural gas production from the Marcellus Shale area growing 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% of the natural gas needed to meet demand in markets east of the Mississippi River during that period (up from 16% in 2012). Although Marcellus Shale area production is projected to decline after 2024, it will provide enough natural gas to meet at least 31% of the region's total demand for natural gas through 2040. See U.S. Energy Information Administration, Annual Energy Outlook 2014 (with projections to 2040), Report #DOE/EIA-0383 (2014), available at http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf
Even with energy conservation, additional natural gas pipeline capacity to transport gas in this region is needed.

10.1.2.3 Geothermal Power

Large scale geothermal energy is available only at tectonic plate boundaries or at volcanic hotspots. Due to a lack of these features in the Project area, geothermal energy would not be available for development as an alternative to natural gas.

10.1.2.4 Coal

Coal is an alternative energy source, but compared to natural gas, coal necessitates increased environmental impacts from its extraction point to its combustion as a fuel. Coal is associated with significant mine pollution control problems and reclamation issues, as well as storage problems, and costly pollution controls at the burner. Therefore, coal does not represent a preferred alternative for replacing the natural gas to be supplied by the proposed Project.

10.1.2.5 Oil

While oil is an alternative energy source for meeting future power generation needs in the Project area, oil has no advantage over natural gas, and oil necessitates increased environmental impacts in transportation and at the burner. For these reasons, particularly for facilities designed to use natural gas, oil would not be a preferable alternative to the natural gas to be supplied by the proposed Project.

10.1.2.6 Nuclear

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. Due to the lengthy lead time to site a new nuclear facility, power generated from such a facility would not be available for development as an alternative to natural gas.

10.1.2.7 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. 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.

10.1.2.8 Fuel Cells

Fuel cells are a developing alternative for generating electricity more directly and cleanly from fossil fuels or hydrogen. 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.

10.1.2.9 Other Energy Sources

Alternative fuel sources available include using Liquefied Natural Gas (“LNG”) and propane/air storage and vaporization. Though 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 these alternatives. Therefore, supplying adequate volumes of natural gas through the construction of the proposed Project is the preferred option.

10.2 SYSTEM ALTERNATIVES

System alternatives would make use of other existing, modified or proposed natural gas pipeline systems or existing compression to meet the stated objectives of the proposed Project. A viable system alternative would make it unnecessary to construct all or part of the proposed Project, and would 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 would result in environmental impact; however, the impact in all likelihood would be similar to, or greater than that associated with construction of the proposed Project.

Although system alternatives that would result in less environmental impacts might be preferable to the selected 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 necessary contractual commitments made with Project Shippers supporting the development of the Project.

Technical and feasible system alternatives were evaluated in terms of their ability to meet the Project objectives, which were defined by the incremental level of firm transportation service contracted for by the market, as described in the certificate application and Resource Report 1 of this ER. The facilities associated with the Project are necessary to provide the incremental firm transportation capacity for the three Project shippers (Connecticut Natural Gas Corporation, The Southern Connecticut Gas Company, and Yankee Gas Services Company) on Tennessee's existing 200 Line and 300 Line systems. These shippers have signed binding precedent agreements for the entire amount of the Project capacity. By constructing and placing the Project into service, additional natural gas quantities from prolific supply sources such as the Marcellus Shale Formation 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 Connecticut Expansion Project through utilization of the various planned looping segments outlined in Resource Report 1 of this ER.

Tennessee, because it currently operates an interstate natural gas pipeline system in the northeast, evaluated its ability to supply the increased demand for natural gas transportation service in this area using efficiencies afforded by its existing system. Additionally, Tennessee considered system alternatives involving different configurations of pipeline looping and compression facilities within its own transmission system, as well as efficiency improvements and the construction of greenfield pipeline. These alternatives are described in the following sections. Tennessee used the following evaluation criteria when selecting reasonable and potentially environmentally preferable system alternatives to the Project:

- technical and economic feasibility and practicality;
- extent of environmental impacts; and

- ability to meet the Project objective to satisfy increased demand for natural gas transportation service from Wright Meter Station, located in Schoharie County, New York with deliveries to established markets in the northeast in the time frame requested by the Project shippers, given that alternative energy sources or conservation are not able to satisfy this demand.

In evaluating options for the construction and operation of the three proposed pipeline loops and the modifications at Station 261, Tennessee determined that given the existing pipeline, any pipeline looping should be co-located with the existing pipeline ROW to the maximum extent practicable, feasible, and as legally permitted. Co-locating new pipeline loops with an existing line is a preferred option as it minimizes the environmental impacts, numbers of affected landowners, constructability issues, and costs, as well as limits the extent of disruption to the communities that would be affected during construction. The modifications at Station 261 are entirely within the fence line of the existing compressor station, thus creating no additional impacts at that station.

Once the Project objectives were established, technical system alternatives were designed using hydraulic modeling and analysis utilizing software to calculate the balanced steady state pressure-flow relationship for Tennessee's pipeline. The results provided by the hydraulic model were used in combination with Tennessee's vast experience with pipeline and compression installation and operation to design technically feasible system alternatives to satisfy the Project objectives.

Tennessee evaluated options for increased efficiency within its pipeline and compression systems to determine if incremental capacity to transport natural gas volumes could be added through the implementation of efficiency upgrades or modifications. While these options could be implemented to achieve a limited amount of benefit relative to the Project objectives, Tennessee determined that these measures alone would not be sufficient to provide the required capacity to transport the volumes of natural gas requested by the Project shippers. Alternative system configurations to meet the Project objectives were also evaluated, and are discussed below.

10.2.1 Modification of Existing Pipeline Systems

As discussed in Resource Report 1 and in the Public Convenience and Necessity section of the certificate application for the Project, the Project would provide an incremental addition of firm transportation capacity to Tennessee's existing pipeline system in its northeast U.S. market area. Tennessee has proposed facilities as part of the Project to transport natural gas from Tennessee's existing 200 Line and 300 Line systems to various delivery points in Connecticut, to meet the needs of the Project shippers that have executed long-term, binding precedent agreements with Tennessee for 100 percent of the Project capacity. Based on the commitments from the Project shippers to transport specific volumes of gas to Connecticut, any viable system alternative that would include modifications to existing pipeline systems would need to be capable of creating transportation capacity of up to 72,100 Dth per day from New York to Connecticut to meet the Project shippers needs, while creating less environmental impact than the proposed facilities.

Tennessee does not have access to proprietary information concerning the flow characteristics of the existing interstate pipeline systems in the Project area. However, based on publicly available information, including information from filings made with the Commission, it is Tennessee's understanding that these pipeline systems are at or near capacity (i.e., firm transportation capacity fully subscribed).

Based on Tennessee's understanding that the existing interstate natural gas pipeline systems in the Project area are at or near capacity[2], any of the existing systems in the Project area would require substantial expansions in order to transport an additional 72,100 Dth/d for deliveries to the Project Shippers' market areas. The Project shippers for this Project have requested specific delivery points to the Project Shippers' existing systems in Connecticut that are already connected to Tennessee's system. Regardless of the alternatives evaluated, the capacity to transport the Project shippers' natural gas to the selected delivery points requested by the Project shippers must be available by November 2016 pursuant to the binding precedent agreements executed by Tennessee and the Project shippers.

10.2.2 Options for Efficiency Improvements

Tennessee evaluated the use of installing internally coated pipe as an energy saving alternative to determine if the length of the pipeline looping segments could be reduced for the Project. The use of internal pipeline coating reduces the roughness of the pipe's internal wall. A smooth internal wall reduces the resistance or internal friction between the flowing gas stream and the wall of the pipe. Therefore, reducing internal friction reduces energy loss and also reduces required horsepower and fuel consumption to transport a given quantity of gas. This evaluation reduced the overall pipeline construction footprint by 0.35 miles of pipeline looping, thus resulting in less environmental impact to the affected areas. For the New York Loop, the decision to install internally coated 36-inch diameter pipe resulted in installing 1.35 miles of pipeline loop versus a calculated 1.40 miles of non-internally coated pipeline. For the Massachusetts Loop, 3.81 miles of pipeline looping will be installed versus a calculated 3.91 miles of pipeline without internal coating. Finally, for the Connecticut Loop, 8.10 miles of pipeline looping will be installed versus a calculated 8.30 miles without internal coating.

10.2.3 Pipeline Looping Option

Looping involves building or expanding the existing pipeline system by maximizing existing facilities and utilizing existing ROW to allow more volumes of gas to be delivered without having to build a completely new pipeline to customers. Looping generally consists of a segment of pipeline installed adjacent to an existing pipeline and connected to the existing pipeline at both ends. Looping allows more gas to be moved through the already installed existing system. Smaller sections of a second or third pipeline that tie-in to the existing pipeline network allow added transportation capacity while minimizing new pipeline length and cost. Based on commitments from the Project shippers, the Project will create additional transportation capacity of up to 40,100 Dth/d by installing three pipeline looping segments, modifying facilities at an existing compressor station, and minor appurtenant work, and will utilize 32,000 Dth/d of existing reserved capacity. Due to system configuration and needed pressures at various delivery points, Tennessee evaluated its facilities to determine the locations on its existing pipeline system where additional facilities could be installed to accommodate the expressed needs of the Project

[2] The U.S. Energy Information Administration, in a 2013 report, noted that key natural gas pipelines from supply areas to New England are full or nearly full. The report stated that the Algonquin Gas Transmission system and Tennessee's system transport most of the natural gas into the New England market and that both systems have been constrained. See Short-Term Energy Outlook Supplement: Constraints in New England likely to affect regional energy prices this winter, U.S. Energy Information Administration, January 18, 2013, available at http://www.eia.gov/forecasts/steo/special/pdf/2013_sp_01.pdf; see also Gas-Fired Power Generation in Eastern New York and its Impact on New England's Gas Supplies, ICF International, dated November 18, 2013, p. 2; Seizing the Historic Opportunity to Cut New England Energy Costs by Eliminating Gas Pipeline Bottlenecks, Anthony W. Buxton, Industrial Energy Consumer Group, p. 4

shippers while continuing to meet existing firm transportation obligations. The installation of the pipeline loops and the compressor station modifications and the use of existing reserved capacity will allow Tennessee to minimize the amount of pipeline looping segments installed and deliver the incremental volumes requested by the Project shippers, while maintaining service to existing shippers and pressure profiles along its system.

The existing flow dynamics and transportation obligations through the existing pipeline dictate where these loops need to be constructed. As natural gas leaves a compressor station and is transported through the pipeline, pressure is lost due to turbulence and friction between the pipeline and the natural gas. The pressure decreases at a faster rate as the gas is transported farther from the compressor station. The pressure will continue to decrease until the natural gas is recompressed at the next compressor station on the pipeline system. There is a lower limit to which the pressure is allowed to drop, which is determined by Tennessee's contractual and operational requirements. Therefore, each pipeline section between compressor stations is treated as its own individual pipeline for purposes of evaluating the addition of new facilities. The fact that one section is optimized to operate at the maximum capacity of the existing facilities does not necessarily translate to a benefit to the next section. The locations of compression additions or pipeline looping within a pipeline section are determined with the objective to maintain an inlet pressure which will allow the next compression station to discharge at the maximum allowable operating pressure.

For this Project, Tennessee evaluated its existing system to determine where pressure losses would occur to determine where added compression or looping would be needed to accommodate the required gas volumes and the delivery points. The three proposed loops will reduce pressure losses per mile and restore the pressure at the next compressor station, while allowing Tennessee to transport the additional volumes requested by the Project's shippers.

Tennessee evaluated the needs of the Project along with the existing system configuration, which consists of the completed sections of 200-1 and 200-2 Lines (24-inch and 30-inch OD pipelines, respectively) and a partial loop 200-3 Line (36-inch OD diameter pipeline). Tennessee is proposing to install a continuous 36-inch diameter OD pipeline loop for the New York Loop and the Massachusetts Loop. Tennessee selected these two looping segments since the existing Line 200-3 in both states already consists of 36-inch OD diameter pipeline, and the selection of this option represents the most logical and efficient choice in terms of hydraulic modeling evaluations as well as prudent pipeline operations to continue these existing looped sections with similar pipe diameter selections.

Tennessee selected the 24-inch OD diameter pipeline looping size for the Connecticut Loop along the existing 16-inch diameter Line 300-1 in an effort to eliminate the possibility of having to install additional or new compression equipment at existing or new locations. By selecting a 24-inch OD diameter pipeline loop for the Connecticut Loop, Tennessee is able to reduce friction losses along this new pipeline looping section and continue to maintain adequate pressure in its lines to support the needs of its existing shippers as well as meeting the needs of the Project shippers.

Tennessee did evaluate an option of installing a 42-inch OD pipeline looping segment as an alternative to the proposed New York Loop and Massachusetts Loop (both 36-inch OD pipeline looping segments) to determine if that option would minimize overall environmental impacts. Installing a 42-inch OD pipeline looping segment would allow for a shorter distance of pipeline looping and would reduce the overall amount of required new permanent easement. However, additional temporary workspace would be

needed during construction to accommodate constructing this larger diameter pipeline. The calculated length of the 42-inch OD pipeline looping required to fulfill the Project objectives would be 1.3 miles in New York and 3.5 miles in Massachusetts. This would result in the reduction of approximately 0.1 miles of length of new ROW in New York, along with the reduction of approximately 0.3 miles of length of new ROW in Massachusetts.

Tennessee did not select this option as it did not offer a significant environmental advantage over the selected option. Installing 42-inch OD pipeline loop, which would be directly connected to an existing 36-inch OD pipeline, would require additional temporary workspace, thereby offsetting any reduction in overall impacts by the reduced length and also would require the installation of pieces of pipeline to transition from the current smaller diameter pipe to the larger diameter pipe for construction purposes. Operationally, the need to internally inspect the pipelines through the use of in-line inspection tools would require Tennessee to install more aboveground facilities, including two additional pig launchers and receivers in both states. Tennessee would need to keep all existing aboveground facilities in place for the existing pipeline and also install a total of four additional aboveground facilities than currently proposed for the Project. The financial cost to the Project's customers would also be increased since the anticipated cost to install the required amount of 42-inch OD pipeline looping for both states would exceed the estimated cost required to install the Project's scope of 36-inch diameter pipeline looping in those same areas.

10.2.4 Compression Option

Tennessee also evaluated an option to install additional compression horsepower at existing compressor station locations along its pipeline system in lieu of the proposed pipeline looping segments to satisfy the objectives of the Project. Tennessee evaluation one option that would involve the installation of a an additional 3,500 horsepower of compression, as well as replacing existing facilities, at existing Station 261 in Agawam, Massachusetts to achieve the Project objectives in lieu of installing the proposed Massachusetts Loop. However, Tennessee did not select this option since adding horsepower to the existing compressor station would result in higher atmospheric emissions from the compressor units, which is not allowed by the current air permit granted by the Massachusetts Department of Environmental Protection for this Station and Tennessee would be required to replace existing compression units and reduce total emissions from this source. Further, the addition of incremental horsepower at Station 261would result in higher Project and operating fuel costs to the customers, higher carbon and greenhouse gas emissions and increased friction losses along the existing pipeline system.

In lieu of installing the proposed Connecticut Loop, Tennessee evaluated the possibility of installing a new, greenfield compressor station near Tennessee's existing MLV 354-1 site on its 300 Line. For this option, Tennessee would need to install approximately 4,500 horsepower of compression to satisfy the Project objectives, along with other appurtenant facilities. This new compressor station would result in impacts from increased air emissions along with higher system fuel costs. The anticipated cost of constructing this new compressor station exceeds the estimated cost for constructing the proposed corresponding looping in this area. For these reasons, Tennessee opted not to select adding compression as compared to the Connecticut Loop.

10.3 ROUTE ALTERNATIVES

Alternatives to the proposed pipeline loops and modifications at Station 261 were evaluated as part of the planning and design process for this Project. The alternatives analysis for the Project facilities was based on environmental and land use impacts, as well as permanent easement acquisitions and overall Project costs. The following steps were used in the selection of the route alternatives discussed in Section 10.3.1 below:

1. determination of most cost effective technical solution (i.e., looping versus compression);
2. development of routing criteria;
3. identification of potential routing alternatives;
4. collection of data relative to each alternative;
5. evaluation of potential environmental and land use impacts; and
6. evaluation of routing alternatives against routing criteria.

Existing information sources such as field reconnaissance, aerial photography, topographic maps from the United States Geological Survey ("USGS") and National Wetland Inventory ("NWI") maps were used during the route identification and evaluation processes.

As discussed above, in evaluating the routing options for the three proposed pipeline loops, Tennessee determined that given the existing pipeline, the loops should be co-located with the existing pipeline ROW to the maximum extent practicable, feasible, and as legally permitted. The use of co-location as a principle design element by Tennessee is necessitated not only by Commission guidelines which stress the corridor concept, but also due to the existing land use characteristics in the areas of the loops. The utility corridor created by Tennessee's existing pipeline minimizes further environmental impacts and public disturbance, as well as construction costs. Locating pipeline facilities along the existing corridor reduces the establishment of new corridors in previously undisturbed areas, while limiting the number of affected landowners.

The main determinants used to select the preferred route over the other routes evaluated pertained to minimizing the number of affected landowners, constructability issues, and Tennessee's desire to limit the extent of disruption on the communities potentially being affected during construction.

10.3.1 Major Route Alternatives

In lieu of the proposed Project facilities that were selected to meet the Project objectives, Tennessee evaluated the alternative of constructing a new greenfield pipeline, to be routed from Tennessee's existing Wright Meter Station, located in Schoharie County, New York, to the East Granby Sales Meter Station, located in Hartford County, Connecticut. The new greenfield pipeline that was evaluated would be approximately 20-inch OD pipeline, 100 miles in length including appurtenant aboveground facilities . This new pipeline would not require the installation of any new compressor stations or modifications to any existing compressor stations. This option would require Tennessee to acquire new permanent ROW and to create new impacts to the environment and to landowners for approximately 100 miles of primarily previously undisturbed land. None of the impacted land would be co-located within 150 feet of existing utility corridors. Permitting for this option would be extensive, with overall environmental impacts associated with 100 miles of new pipeline significantly greater as compared to the proposed 13.26 miles of pipeline looping for the Project. In addition, cultural resource impacts would be far greater for the new

pipeline compared to the proposed Project facilities. Further, construction of a new pipeline through greenfield areas is likely to result in forest fragmentation and new impacts to agricultural lands that previously had not been impacted by natural gas or other utilities. The new impacts to resources would far exceed the impacts that would be anticipated when looping existing lines and using at least a portion of existing permanent ROW for construction workspace. In addition, the cost of greenfield construction in this area would far exceed the cost of looping existing lines.

Tennessee did not select this option because, when compared to the proposed option, this option has: (1) a much longer overall route length and land requirements; (2) more extensive permitting requirements associated with a greenfield pipeline; (3) far more extensive cultural and environmental impacts; and (4) greater potential for habitat disturbance and adverse impacts on threatened and endangered species.

10.3.2 Minor Route Alternatives

Minor route alternatives for the three proposed pipeline loops that were evaluated are discussed below.

10.3.3 Route Variations or Deviations

Minor route variations were evaluated to further minimize impacts along the existing Tennessee pipeline ROW. These variations primarily consider which side of the ROW the new pipeline would be located. Due to the linear nature of the Project, Tennessee's preferred design criteria is to locate the new loop on one side of the existing ROW and remain on that side to minimize cross-overs that would otherwise complicate construction. Four route variations were identified, one in New York, one in Massachusetts and two in Connecticut. The minor route variations that were evaluated and incorporated into the proposed Project are shown in Table 10.3.1-1.

TABLE 10.3.1-1
MINOR ROUTE VARIATIONS INCORPORATED INTO THE PROPOSED CONNECTICUT EXPANSION PROJECT

Milepost Begin	Milepost End	Pipeline Segment Route variation name	Location	Length (mi)	Reason for Incorporation
NEW YORK LOOP					
2.75	4.07	New York	Bethlehem	1.32	Steep drop off at the beginning of the loop
MASSACHUSETTS LOOP					
1.40	2.90	Massachusetts	Sandisfield	1.50	Accommodates landowner's request
CONNECTICUT LOOP					
0.80	2.50	Connecticut	Suffield	1.70	Variation minimizes impacts to landowners and road crossing
7.68	8.05	Connecticut	East Granby	0.37	Variation is required to facilitate the planned trenchless crossing of Nicholson Road

10.3.3.1 New York Loop

MPs 2.75 to 4.07

The existing 200-3 Line 36-inch OD pipeline loop in New York is located on the north side of the existing ROW. This variation involves a cross-over of the proposed New York Loop to the south side of the existing ROW and corresponding section of the construction ROW for a distance of approximately 1.32 miles. The proposed New York Loop has been relocated to avoid a steep drop-off on the north side to accommodate construction workspace and facilitate pipeline installation. No new landowners or wetlands/streams will be impacted by this modification. Since this variation provides adequate workspace to safely construct the pipeline, Tennessee incorporated this variation into the proposed pipeline route.

10.3.3.2 Massachusetts Loop

MP 1.40 to 2.90

The existing 200-3 Line 36-inch OD pipeline loop in New York is located on the south side of the existing ROW. Following prudent design criteria led to beginning the proposed Massachusetts Loop on the south side of the existing ROW. This variation involves a cross-over of the proposed 36-inch pipeline to the north side of the existing ROW and corresponding section of the construction ROW for a distance of approximately 1.50 miles. Streams and wetlands along the existing pipeline alignment generally are perpendicular to the proposed pipeline looping. Therefore, Tennessee would achieve limited reduction in environmental and landowner impacts by moving the pipeline looping from one side of the ROW to the other side since these resources exist on both sides of the ROW. Following this methodology, Tennessee began on the south side of the ROW and proceeded east. At approximate MP 2.7, an open water area (pond) exists on the south side of the existing ROW that would be impacted by the new pipeline and workspace. The landowner at this location requested that Tennessee avoid impacting this feature and to place the pipeline further away from the residence. Tennessee identified a suitable crossing location upstream of this location that would provide suitable workspace to accommodate the cross-over, as well as took into consideration other factors such as slope, other wetlands, and road crossings, and determined that the most suitable location to cross-over would begin at approximate MP 1.4. At this point, the pipeline is located on the north side of the ROW until approximately MP 2.9. At this location, Tennessee crosses back over the existing pipelines after crossing Cold Spring Road and proceeds easterly on the south side of the existing ROW to simplify construction due to side slope constraints and to minimize impacts to an existing stream. From this point, Tennessee remains on the south side of the ROW to the terminus at MP 3.8 east of South Beech Plain Road. No new landowners or wetlands/streams will be impacted by this modification. Since this variation was requested by the landowner and provides adequate workspace to safely construct the pipeline, Tennessee incorporated this variation into the proposed pipeline route.

10.3.3.3 Connecticut Loop

MP 0.8 to 2.50

Tennessee proposed to begin the Connecticut Loop on the east side of the existing 300 Line due to workspace limitations inside Station 261 in Agawam, Massachusetts. Following prudent design criteria, the pipeline loop begins and continues on the east side to approximate MP 0.80. This variation involves a

cross-over of the Connecticut Loop to the west side of the existing ROW and corresponding section of the construction ROW for a distance of approximately 1.70 miles to minimize impacts to residences, accommodate the crossing of North Street, and provide adequate workspace for construction. At approximate MP 2.50, the pipeline crosses over again to the east side of the ROW to again minimize impacts to nearby residences and accommodate the crossing of the intersection of Russell Avenue and Thistledown Road. From this point, the Connecticut Loop remains on the east side of the ROW to MP 7.68 near the terminus of the loop. No new landowners or wetlands/streams will be impacted by this modification. Since this variation minimizes impacts to residences and provides adequate workspace to safely construct the pipeline, Tennessee incorporated this variation into the proposed pipeline route.

MP 7.68 to 8.05

This variation involves a slight deviation from the existing 300 Line ROW for the proposed Connecticut Loop to facilitate the trenchless crossing of Degrayes Brook and Nicholson Road for a distance of approximately 0.35 miles (see Figure 10.3-1). The existing 16-inch pipeline and corresponding ROW at this location is located within a paved parking lot and commercial property built adjacent to the existing line. Adequate workspace does not exist within the existing easement or adjacent to the existing pipeline to accommodate the installation of the Connecticut Loop and also avoid impacting Degrayes Brook. In addition, due to recent development on the south side of Nicholson Road, research revealed numerous underground utilities and tunnels recently constructed across the existing 16-inch pipeline and ROW that would further complicate construction along the existing ROW. These utilities, installed between 18 to 20 feet below grade, serve to route stormwater from the development across the existing 16-inch pipeline to the detention pond on the east side of the existing ROW. Finally, landowner tract 769 contains a Conservation Easement on the portion of the parcel southwest of Degrayes Brook that would prohibit installation of a new pipeline. Therefore, the variation deviates from the existing ROW at approximately MP 7.70 and heads south via a horizontal directional drill (”HDD”) and rejoins the existing ROW at the terminus of the project at the East Granby Meter Station. The route variation at this location is required since there is no adequate workspace along the existing line and complicated underground utility crossings, and it avoids an open cut crossing of Degrayes Brook. A deviation further west is not feasible due to a Conservation Easement existing on parcel 769 that would prohibit pipeline installation. Since this variation minimizes impacts to commercial properties and simplifies construction associated with underground utilities, Tennessee incorporated this variation into the proposed pipeline route.

As proposed and under existing law, the proposed routing for the pipeline loops minimize impacts to the environment and optimizes Project constructability and economics. When evaluating minor alternative routes or minor route deviations, no one deviation changed, avoided or minimized environmental conditions or potential impacts over the proposed alignment. Therefore, deviations, not included above, from the existing 200 and 300 Line corridors were not considered viable and were not adopted as part of this Project.

10.4 ALTERNATIVE SITES FOR NEW COMPRESSION AND METER STATIONS

Although Tennessee is proposing modifications at existing Station 261, Tennessee is not proposing new compressor or meter stations as part of this Project; therefore an analysis of alternative sites is not applicable.

10.5 ALTERNATIVES SUMMARY

After review of all construction, fuel source, system, and the No-Action alternatives, it is evident that the proposed Project is the preferred alternative. If the proposed Project is not constructed to meet shipper demand (i.e., the No-Action Alternative is selected), the market served by the shippers that have executed binding precedent agreements for all of the Project's capacity 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 of Tennessee's natural gas shippers 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 of consumers served by this Project.

As discussed herein, Tennessee conducted a detailed system alternatives analysis, including consideration of efficiency improvements, a greenfield pipeline option, and pipeline looping and compression options. This detailed system alternatives analysis allowed Project designers to select the best configuration of proposed facilities, including preferred routes and siting for new pipeline loops to meet the needs of the market. Accordingly, Tennessee concludes that the proposed Project facility locations meet the Project's purpose and need while minimizing adverse impacts to landowners and the environment.

Tennessee Gas Pipeline Company, L.L.C.
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CONNECTICUT EXPANSION PROJECT

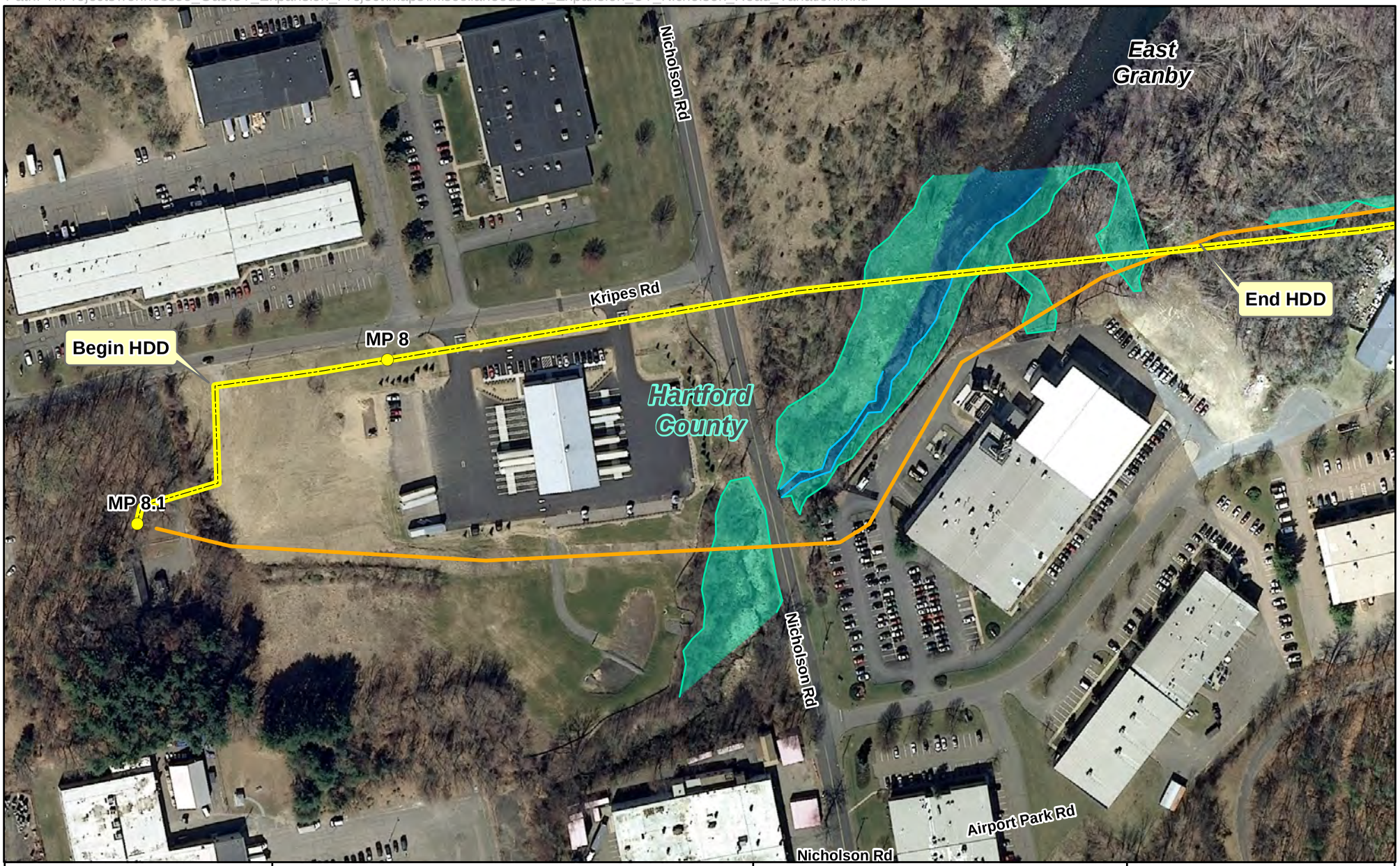
Connecticut, Massachusetts and New York

RESOURCE REPORT 10

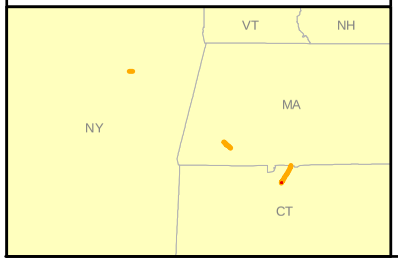
ATTACHMENT A

FIGURE

Path: Y:\Projects\Tennessee_Gas\CT_Expansion_Project\Maps\Miscellaneous\CT_Expansion_CT_Nicholson_Road_Variation.mxd



Site Location



Legend

- Mileposts
- Proposed Project Centerline
- Existing Pipeline Centerline
- Streams
- Wetland Lines
- Waterbodies
- Wetlands

Tennessee Gas Pipeline Company, L.L.C.

Connecticut Expansion Project

Nicholson Road Alternative

Connecticut

1 inch = 200 feet

0 100 200 400 Feet

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Figure 10.3-1

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