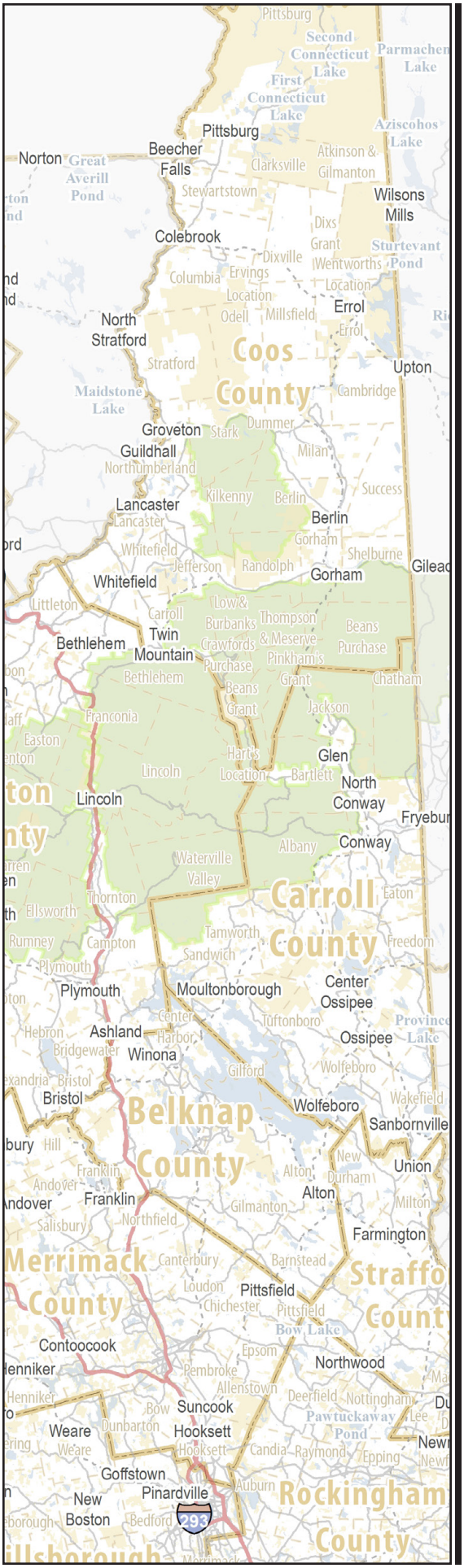


DOE/EIS-0463

FINAL

NORTHERN PASS TRANSMISSION LINE PROJECT ENVIRONMENTAL IMPACT STATEMENT

SUMMARY

U.S. DEPARTMENT OF ENERGY
OFFICE OF ELECTRICITY DELIVERY
AND ENERGY RELIABILITY
WASHINGTON, DC

AUGUST 2017

Department of Energy
Washington, DC 20585
August 2017

Dear Sir/Madam:

Enclosed is the final *Northern Pass Transmission Line Project Environmental Impact Statement* (DOE/EIS-0463) prepared by the Department of Energy (DOE) pursuant to the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations.

The United States Forest Service (USFS) – White Mountain National Forest, United States Environmental Protection Agency (EPA) – Region 1, United States Army Corps of Engineers (USACE) – New England District, and the New Hampshire Office of Energy and Planning (NHOEP) are cooperating agencies in the preparation of the EIS.

The proposed DOE action in the final EIS is to issue a Presidential permit to the Applicant, Northern Pass LLC, to construct, operate, maintain, and connect a new electric transmission line across the U.S./Canada border in northern New Hampshire (NH).

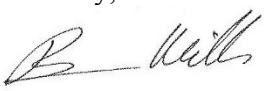
DOE has prepared this final EIS to evaluate the potential environmental impacts in the United States of the proposed action and the range of reasonable alternatives, including the No Action alternative. Under the No Action alternative, the Presidential permit would not be granted, and the proposed transmission line would not cross the U.S./Canada border.

In addition to its Presidential permit application to DOE, Northern Pass LLC applied to the USFS for a special use permit that would authorize Northern Pass LCC to construct, own, operate and maintain an electric transmission line to cross portions of the White Mountain National Forest under its jurisdiction. The final EIS will be used by the Forest Supervisor of the White Mountain National Forest to inform the Record of Decision in regard to this requested use.

DOE will use the EIS to ensure that it has the information it needs for informed decision-making.

The final EIS will also be posted on the project EIS website, http://www.northernpasseis.us/ and DOE's NEPA website at https://energy.gov/nepa/listings/environmental-impact-statements-eis.

Sincerely,



Brian Mills
Transmission Permitting and Technical Assistance,
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

FINAL

NORTHERN PASS TRANSMISSION LINE PROJECT ENVIRONMENTAL IMPACT STATEMENT DOE/EIS-0463

Summary

U.S. DEPARTMENT OF ENERGY
OFFICE OF ELECTRICITY DELIVERY
AND ENERGY RELIABILITY

COOPERATING AGENCIES

United States Forest Service – White Mountain National Forest
United States Environmental Protection Agency– Region 1
United States Army Corps of Engineers – New England District
New Hampshire Office of Energy and Planning

August 2017

COVER SHEET

RESPONSIBLE FEDERAL AGENCY: U.S. Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability

COOPERATING AGENCIES: United States Forest Service (USFS) – White Mountain National Forest (WMNF); United States Environmental Protection Agency (EPA) – Region 1; United States Army Corps of Engineers (USACE) – New England District; and New Hampshire Office of Energy and Planning (NHOEP)

TITLE: Northern Pass Transmission Line Project Environmental Impact Statement (DOE/EIS-0463)

LOCATION: Coös, Grafton, Belknap, Merrimack, and Rockingham counties in New Hampshire

CONTACTS: For additional information on this Environmental Impact Statement (EIS) contact:

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Office of Electricity Delivery and Energy Reliability, OE-20
U.S. Department of Energy
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Washington, DC 20585
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For general information on the DOE NEPA process, please write or call:

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Washington, DC 20585
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Telephone: (202) 586-4600 or leave a message at (800) 472-2756

ABSTRACT: Northern Pass Transmission, LLC (Northern Pass) has applied to the DOE for a Presidential permit to construct, operate, maintain, and connect a 192-mile (309-km) electric transmission line across the United States (U.S.)/Canada border in northern New Hampshire (NH). This final EIS addresses the potential environmental impacts of the Project (Proposed Action), the No Action Alternative, and ten additional action alternatives (Alternatives 2 through 6, with variations). The NH portion of the Project would be a single circuit ±320 kilovolt (kV) high voltage direct current (HVDC) transmission line running approximately 158 miles (254 km) from the U.S. border crossing with Canada in Pittsburg, NH, to a new direct current-to-alternating current (DC-to-AC) converter station to be constructed in Franklin, NH. From Franklin, NH, to the Project terminus at the Public Service of New Hampshire's existing Deerfield Substation located in Deerfield, NH, the Project would consist of 34 miles (55 km) of 345 kV AC electric transmission line. The total length of the Project would be approximately 192 miles (309 km).

PUBLIC COMMENTS: In preparing this final EIS, DOE considered comments received during the scoping period, which extended from February 11, 2011 to June 14, 2011, and was reopened from June 15, 2011 to November 5, 2013 (DOE accepted and considered all comments during the scoping period from February 11, 2011 to November 5, 2013), and the public comment period on the draft EIS (July 31, 2015 through April 4, 2016). Comments on the draft EIS were accepted during the 45-day period

following publication of EPA's Notice of Availability (NOA) in the *Federal Register* on July 31, 2015; the public comment period was extended until April 4, 2016 following publication of EPA's NOA of the supplement in the *Federal Register* on November 20, 2015. DOE held four public meetings on the draft EIS in Colebrook, NH on March 7, 2016; Waterville Valley, NH on March 9, 2016; Concord, NH on March 10, 2016; and Whitefield, NH on March 11, 2016. All comments were considered during preparation of this final EIS. Appendix L in Volume 3 of this EIS contains the comments received on the draft EIS and DOE's responses to these comments. This final EIS contains revisions and new information based in part on comments received on the draft EIS. Vertical bars in the margins marking changed text indicate the locations of these revisions and new information. Deletions are not indicated. Appendices J and K in Volume 2 and Appendix L in Volume 3 are entirely new parts of this EIS; therefore, they do not contain bars indicating changes from the draft EIS.

The EIS analyzes the potential environmental impacts of DOE issuing a Presidential permit for the proposed Northern Pass Project, which is DOE's proposed federal action. DOE will use the EIS to inform its decision on whether to issue a Presidential permit. Additionally, Northern Pass has applied to the USFS for a special use permit (SUP) authorizing Northern Pass to construct, operate, and maintain an electric power transmission line crossing portions of the WMNF. The WMNF Forest Supervisor will use the EIS to inform its decision regarding: 1) whether to issue a SUP under the Federal Land Policy and Management Act; 2) the selection of an alternative; 3) any need to amend the Forest Plan; and 4) what specific terms and conditions should apply if a SUP is issued.

Copies of the final EIS are available for public review at 30 local libraries and town halls, or a copy can be requested from Mr. Brian Mills. The EIS is also available on the Northern Pass EIS website (http://www.northernpasseis.us/). DOE will announce its decision on the Proposed Action in a Record of Decision (ROD) in the *Federal Register* no sooner than 30 days after the EPA publishes the NOA of the final EIS. The USFS will announce its draft decision on the Proposed Action in a draft ROD in the *Federal Register* shortly after the EPA publishes the NOA of the final EIS.

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SUMMARY

S.1 BACKGROUND

On October 14, 2010, Northern Pass Transmission, LLC[1] (Northern Pass or Applicant) applied to the Department of Energy (DOE) for a Presidential permit pursuant to Executive Order (EO) 10485, as amended by EO 12038, and the regulations codified at 10 Code of Federal Regulations (CFR) § 205.320 *et seq*. (2000), "Application for Presidential Permit Authorizing the Construction, Connection, Operation, and Maintenance of Facilities for Transmission of Electric Energy at International Boundaries."[2] The Presidential permit for the Applicant (OE Docket Number PP-362), if issued, would authorize Northern Pass to construct, operate, maintain, and connect facilities at the international border of the United States (U.S.) for the transmission of electric energy across the U.S./Canada border in northern New Hampshire (NH). DOE does not have siting or project alignment authority for projects proposed in applications for Presidential permits.

The DOE's Office of Electricity Delivery and Energy Reliability is responsible for reviewing Presidential permit applications and determining whether to grant a permit for electric transmission facilities that cross the U.S. international border. The DOE has determined that the issuance of a Presidential permit would constitute a major federal action and that an environmental impact statement (EIS) is the appropriate level of environmental review under National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] § 4321 *et seq*.).

The DOE has prepared this EIS in compliance with the requirements of NEPA, the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR Parts 1500–1508), DOE implementing procedures for NEPA (10 CFR Part 1021), DOE floodplain and wetlands environmental review requirements (10 CFR Part 1022), and other applicable federal laws. The DOE invited several federal and state agencies to participate in the preparation of this EIS as cooperating agencies because of their special expertise or jurisdiction by law. The cooperating agencies are the United States Forest Service (USFS) – White Mountain National Forest (WMNF), the United States Environmental Protection Agency (EPA) – Region 1, the United States Army Corps of Engineers (USACE) – New England District, and the New Hampshire Office of Energy and Planning (NHOEP).

After its initial application, on July 1, 2013, the Applicant submitted an amended application for a Presidential permit that reflected proposed changes to the route of the Project, and in July 2015, the DOE issued the draft *Northern Pass Transmission Line Project Environmental Impact Statement* (draft EIS) (80 *Federal Register* [FR] 45652 [July 31, 2015]). The draft EIS analyzed potential environmental impacts from the then proposed Project (as described in the amended Presidential permit application filed by Northern Pass on July 1, 2013) and the range of reasonable alternatives (collectively referred to as "the Project").

[1] Northern Pass Transmission, LLC is owned by Eversource Energy Transmission Ventures, Inc. (formerly NU Transmission Ventures, Inc.), a wholly-owned subsidiary of Eversource Energy (formerly Northeast Utilities), which is a publicly-held public utility holding company. Public Service of New Hampshire (PSNH) is also a wholly-owned subsidiary of Eversource Energy, and does business as Eversource Energy.

[2] Full text of the federal laws can be accessed at the following website: http://uscode.house.gov/browse.xhtml. EOs can be accessed at the following website: http://www.archives.gov/federal-register/executive-orders/disposition.html. Full text of the state laws can be access at the following website: http://www.nh.gov/government/laws.html.

Subsequent to the publication of the draft EIS, Northern Pass submitted a "Further Amendment to Presidential Permit Application" in August 2015 (Northern Pass 2015) that made changes to the Applicant's proposed Project. Specifically, the August 2015 amendment proposed to bury an additional 52 miles of the transmission line in roadway corridors between Bethlehem and Bridgewater, NH.[3] Approximately 49 miles of this additional burial is the same as was analyzed as part of Alternatives 4c and 5c in the draft EIS (each alternative is described in detail in **Section S.5**). Approximately 3 miles of additional burial in Bethlehem, NH, was not analyzed in the draft EIS, as it would extend immediately to the north of the alignment analyzed as Alternative 5c. Northern Pass also proposed a minor shift (less than 100 feet [30 m]) in the international border crossing location, two new transition stations (one in Bridgewater, NH, and one in Bethlehem, NH, to transition the line between overhead and underground), a change of the project size from 1,200 megawatts (MW) to 1,000 MW with a potential transfer capacity of up to 1,090 MW, and other design changes (e.g., change in converter technology and type of cable).

Although Northern Pass' revised proposal (referred to as Alternative 7) was principally evaluated within the draft EIS under a combination of several of the action alternatives, DOE determined that providing a supplement to the draft EIS would allow the potential environmental impacts of Alternative 7 to be more clearly displayed as an additional singular alternative and facilitate a comparison among the alternatives. DOE regulations provide that DOE may supplement a draft EIS at any time, to further the purposes of NEPA (10 CFR § 1021.314(b)).

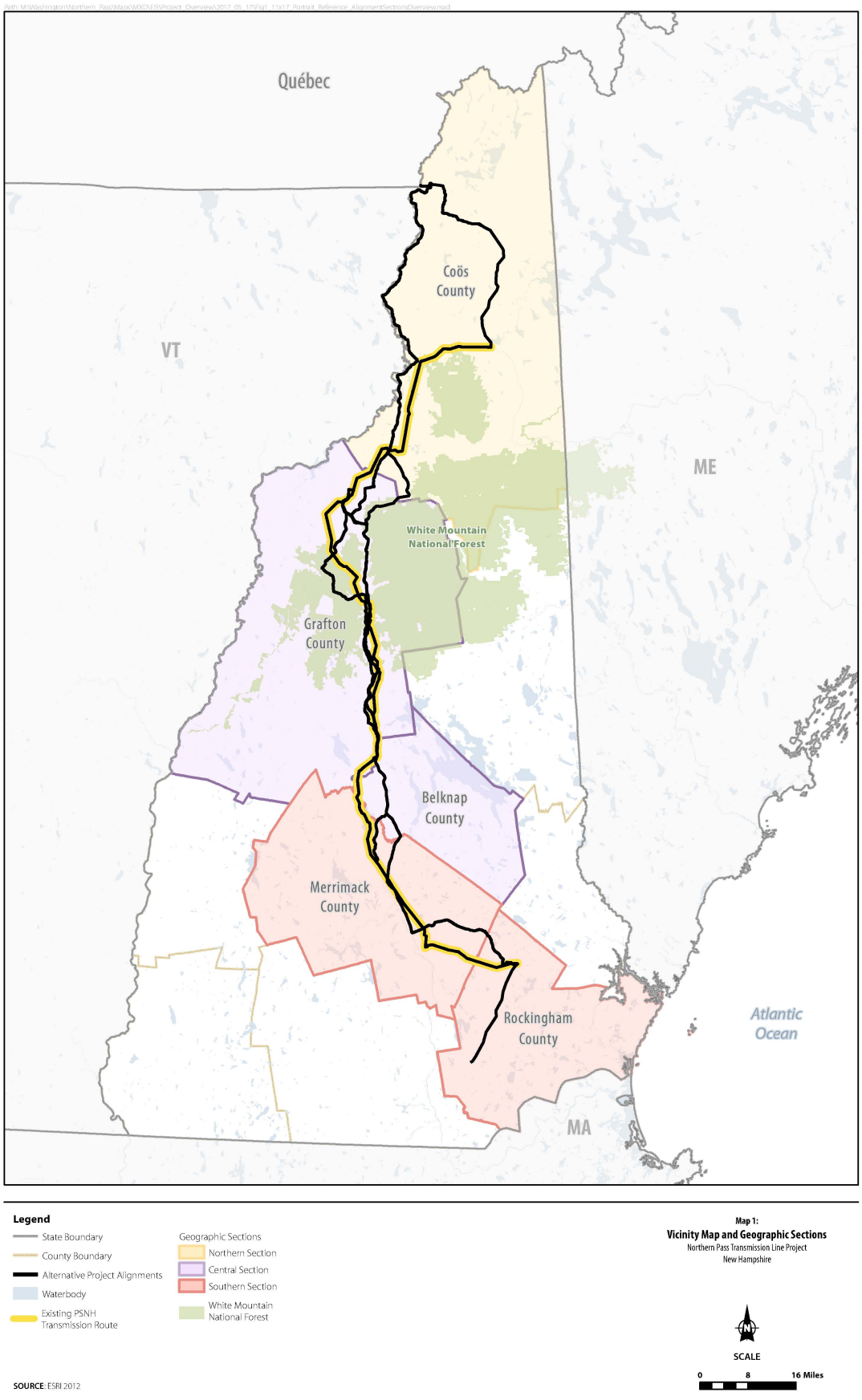
Thus, DOE issued a notice of intent (NOI) to prepare a supplement to the draft EIS (80 FR 58725 [September 30, 2015]) and, in November 2015, issued a *Supplement to the Draft Northern Pass Transmission Line Project Environmental Impact Statement* (DOE/EIS-0463-S1). The supplement to the draft EIS contains an analysis of the potential environmental impacts of Alternative 7 and supplemented the analysis contained in the July 2015 draft EIS.

In addition to its Presidential permit application to DOE, Northern Pass applied to the USFS on June 28, 2011, for a special use permit (SUP) that would authorize Northern Pass to construct, own, operate, and maintain an electric transmission line crossing portions of the WMNF. On September 5, 2013, Northern Pass submitted an amended SUP application to the USFS which also reflected proposed changes to the route of the Project. The USFS is a cooperating agency in the preparation of this EIS.

This EIS, *Northern Pass Transmission Line Project Environmental Impact Statement* (DOE/EIS-0463), analyzes potential environmental impacts from the Proposed Action (as described in the further amended Presidential permit application filed by Northern Pass on August 31, 2015 and analyzed as Alternative 7 in the supplement to the draft EIS) and the range of reasonable alternatives (collectively referred to as "the Project").

[3] The original Proposed Action (Alternative 2 in the draft EIS) included approximately 8 miles of underground cable. The revised Proposed Action (Alternative 7) includes an additional 52 miles of underground cable, for a total of approximately 60 miles of underground cable.

Map 1 (and in **Appendix A**), depicts the location of the Project.



The information provided in this document is a summary of the final EIS prepared by DOE. For each resource analyzed in the final EIS, a detailed Technical Report was prepared by independent experts at the direction of DOE. The analysis in these Technical Reports is summarized in the final EIS. The Technical Reports are available for review on the EIS website (http://www.northernpasseis.us/library/final-eis/technical-reports).

Vertical bars in the margins of the final EIS mark text that has changed since the issuance of the draft EIS or the supplement to the draft EIS, including revisions and new information based in part on comments received on the draft EIS (see **Appendix L** – Comment Response Document). The term "draft EIS" in this document refers to material included in the July 2015 draft EIS and the November 2015 supplement. Text that was included in the supplement to the draft EIS is not marked as a change unless the text was changed, as this text is considered part of the draft EIS and the two documents were combined. Deletions are not indicated.

This EIS was prepared to meet the following key objectives:

- Identify baseline conditions within the study area (see **Section 3.1** for a definition of the study area for each resource);
- Identify and assess potential impacts on the natural and human environment that may result in the U.S. from issuing the Presidential permit and the SUP for the Project;
- Describe and evaluate the range of reasonable alternatives to the Proposed Action in the U.S., including the No Action Alternative[4];
- Identify specific mitigation measures, as appropriate, to minimize potential environmental impacts; and
- Inform decision-making by the DOE, USFS, and other applicable federal and New Hampshire regulatory agencies responsible for the issuance of associated permits and approvals.

Information regarding Northern Pass' Presidential permit application and the NEPA process is available on the DOE website for the EIS, found at http://www.northernpasseis.us/. Additional project information is available on the Applicant's website at http://northernpass.us/.

S.2 PURPOSE OF AND NEED FOR ACTION

Northern Pass has applied to the DOE for a Presidential permit to construct, operate, maintain, and connect an approximately 192-mile (309-km), 1,090 megawatt (MW), high-voltage electric transmission line across the U.S./Canada border in New Hampshire. If granted, the Presidential permit would authorize the international border crossing. Applications for Presidential permits are evaluated based on the potential impacts that a proposed project could have on the environment, the operating reliability of the U.S. electric power supply, and any other factors relevant to the public interest. The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project at the international border crossing proposed in the amended Presidential permit application (Northern Pass 2015).

Northern Pass has also applied to the USFS for a SUP authorizing Northern Pass to construct, operate, and maintain an electric power transmission line crossing portions of the WMNF. The purpose of, and need for, the USFS's action is to decide whether to grant a SUP for the Project. The USFS will consider the application for use of National Forest System (NFS) lands and determine if the Project is in the public interest and is appropriate, based on the WMNF Land and Resource Management Plan (Forest Plan) (USDA

[4] **Chapter 2** of this EIS describes all alternatives considered in this analysis. **Chapter 2** also provides a description of the No Action Alternative, the Proposed Action, and the range of reasonable alternatives.

Forest Service 2005a). The Forest Supervisor will use the final EIS to inform the decision regarding: 1) whether to issue a Special Use Authorization under the Federal Land Policy and Management Act; 2) the selection of a preferred alternative; 3) any need to amend the Forest Plan; and 4) what specific terms and conditions should apply if a SUP is issued.

S.3 PROJECT OBJECTIVES

Northern Pass set forth a detailed a range of project objectives and benefits in its permit applications to the DOE and USFS. The DOE and the cooperating agencies reviewed this documentation and determined the following general project objectives.

Purpose: The purpose of the Project is to build and operate a participant-funded electric transmission line to deliver 1,090 MW of low-carbon, non-intermittent power (approximately 98 percent hydropower) from Québec to southern New Hampshire to serve the New England region.

Needs: The Project would address three primary needs concerning New England's electricity supply:

- Diverse electricity supply;
- Low-carbon electricity supply; and
- Non-intermittent electricity supply.

Each of these needs is described in greater detail below.

Electricity Diversity

New England Independent Systems Operator (ISO-NE) reported in their 2014 Regional System Plan that "New England is increasingly dependent on natural gas as a primary fuel for generating electric energy…" (ISO-NE 2014a). Subsequent ISO-NE studies and reports have confirmed this trend (ISO-NE 2015a and 2017a). In 2016 natural gas plants provided approximately 49 percent of the system's electric energy production, as compared to approximately 15 percent in 2000 and 45 percent in 2013 (ISO-NE 2013a, 2014a, and 2017a). The ISO-NE 2015 Regional System Plan notes that "New England increasingly relies on natural gas as a primary fuel for generating electric energy" due to the addition of new natural-gas-fired units; the generally low price of natural gas; the displacement of older, less efficient oil- and coal-fired units; and the recent retirements of non-natural-gas-fired generation (ISO-NE 2015a). ISO-NE predicts that natural-gas-fired generation's proportion of the system capacity mix will grow to approximately 56.7 percent by 2024 (ISO-NE 2015a). Currently natural-gas-fired generation represents almost half of proposed new generation projects in the region (ISO-NE 2017a). Approximately 4,200 MW of non-natural-gas-fired generation (primarily oil, coal, and nuclear units) will have shut down between 2012 and 2020, and over 5,500 MW of additional oil and coal capacity are at risk for retirement in the coming years (ISO-NE 2017a). The May 2017 retirement of the coal-fired Brayton Point Power Station in Somerset, Massachusetts, and the upcoming May 2019 retirement of the Pilgrim Nuclear Power Station in Plymouth, Massachusetts, represent a loss of over 2,200 MW of nameplate generating capacity within two years, and "uncertainty surrounds the future of 3,300 MW from the region's remaining nuclear plants" (ISO-NE 2017a). This heavy reliance on natural gas-fired capacity "can expose the region to significant energy supply, reliability, and price issues" (ISO-NE 2015a).

Because New England does not have indigenous supplies of natural gas, it depends on natural gas importation. ISO-NE's 2015 Regional System Plan states that New England's increasing dependence on natural gas "continuously exposes the regional electric power system to potential reliability problems and an associated increased cost of electricity when natural gas prices are high" (ISO-NE 2015a). A 2013 report commissioned by the New England States Committee on Electricity similarly concludes that "in the absence of infrastructure or other solutions to increase supply or reduce demand, New England will experience significant natural gas infrastructure constraints" (Black & Veatch Corporation 2013a). Cold-weather

conditions experienced in the 2013/14 winter season highlighted additional reliability concerns that existing natural gas infrastructure may not be able to meet the electric power system demand during peak winter conditions (Black & Veatch Corporation 2013a; ISO-NE 2014a). On cold days, natural gas supply pipelines run at or near maximum capacity solely to meet heating demand, leaving a severely limited supply to be used for electricity generation (ISO-NE 2017a). The limitations to natural gas supply threaten the reliable supply of electricity and drive up wholesale electricity prices and air emissions (ISO-NE 2017a). ISO-NE notes that during periods of extreme demand on the natural gas supply, ISO system operators could be forced to order controlled power outages if there were not enough supply to meet both heating and electricity generation demand (ISO-NE 2017a).

While some pipeline capacity was added in 2016 and more is expected in 2017 to serve increased demand from retail gas customers, it is not anticipated that the increased capacity will be sufficient to meet growing heating and electricity generation needs (ISO-NE 2017a). ISO-NE warns that "without timely investment to expand natural gas or LNG infrastructure, the region should expect significant energy market price volatility when the gas pipelines are constrained" (ISO-NE 2017a).

ISO-NE, regional stakeholders, and industry are taking actions to mitigate the regional risks due to its reliance on natural gas (ISO-NE 2013a, 2017a, NHOEP 2014a). A variety of generation alternatives are being considered by ISO-NE and New England states to increase the diversity of the electricity supply, including renewables (wind, solar, etc.), energy efficiency, imports of Canadian hydropower, and others (ISO-NE 2015a, 2017a, NHOEP 2014a).

The Federal Energy Regulatory Commission (FERC) has found that the Project would "diversify New England's power supply mix" (FERC 2011a).

Low Carbon Electricity Supply

In addition to diversifying the electricity supply, the utilization of low-carbon hydropower can help meet public policy goals to reduce greenhouse gas (GHG) emissions. In 2012 Hydro-Québec's generation capacity was 35,829 MW, 98 percent of which was hydroelectric power (NESCOE 2013a). Hydroelectric power is documented as a low-carbon energy source.[5]

Low-carbon hydropower can help achieve objectives and/or statutory requirements to reduce carbon emissions such as those presented in the New Hampshire Climate Action Plan, Regional Greenhouse Gas Initiative (RGGI), and the New England Governors' Regional Cooperation on Energy Infrastructure (NESCOE 2013a).[6] The New Hampshire Climate Action Plan includes a number of recommendations designed to "achieve a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels

[5] In 2010 DOE's National Renewable Energy Laboratory (NREL) conducted a comprehensive review and analysis of Life Cycle Assessment (LCA) studies to systematically review estimates of life cycle GHG emissions published between 1970 and 2010 from electricity generation technologies. The LCA considered emissions from all stages in the life cycle of an electricity generation technology, from component manufacturing, to operation of the generation facility to its decommissioning, and including acquisition, processing, and transport of any required fuels. The results of this study demonstrate that the greenhouse gas emissions from hydropower were equivalent to other sources of low-carbon power (wind and solar). Results can be found at http://www.nrel.gov/analysis/sustain_lca_hydro.html. Visit the following site to view comparative graphics displaying the lifetime GHG emissions from various energy sources: http://en.openei.org/apps/LCA/. Additionally, DOE's 2016 Hydropower Vision report notes the potential for GHG emissions avoidance through the development of hydropower resources (DOE 2016a).

[6] The New Hampshire Climate Action Plan can be found at: http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm
The Regional Greenhouse Gas Initiative website is located at: http://www.rggi.org/
The New England Governors' Regional Cooperation on Energy Infrastructure can be found at: http://www.nescoe.com/uploads/6_State_Joint_Statement_FINAL_4-22-15_12-3.36pm_w-sealsf.pdf.

by 2050," including the importation of Canadian hydropower (NHDES 2009). In February 2013 the RGGI released revised GHG emissions standards for participating states that include a reduction of the 2014 regional carbon dioxide budget of 45 percent (RGGI 2013a).[7] Additionally, the Hydropower Regulatory Efficiency Act of 2013 promotes the use of hydropower resources (Public Law 113-23 [2013]).

These national and regional policies are mirrored and enhanced in many individual New England state GHG emission mandates. Connecticut legislation mandates a reduction in GHG emissions of 80 percent below their 2001 level by January 2050, and Massachusetts has committed to a reduction of GHG emissions between 10 and 25 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050 (Conn. Gen. Stat. § 22a-200a; Mass. Gen. Laws ch. 21N, §§ 3-4). Additionally, several New England state legislatures have recognized public benefits associated with reductions in GHG emissions and/or other air pollutants (N.H. Rev. Stat. Ann. § 362-F:1; N.H. Rev. Stat. Ann. § 125-O; Mass. Gen. Laws ch. 23J, § 9[c][ii]; R.I. Gen. Laws § 39-26-1).

New England states have recently demonstrated their commitment to GHG emission reductions through two requests for proposals (RFPs) for renewable energy suppliers to the region. The "New England Clean Energy RFP" was issued on November 12, 2015 by state agencies and electric distribution companies in Connecticut, Massachusetts, and Rhode Island (Commonwealth of Massachusetts, et. al 2015). The RFP provided a mechanism for the states to procure low carbon energy generation along with the transmission infrastructure needed to deliver it. On August 8, 2016, Massachusetts passed bill H. 4568 – An Act to Promote Energy Diversity (the "Omnibus Energy Bill"), to competitively solicit and contract for approximately 1,200 MW of clean energy generation (2016 Mass. Acts 188). On March 31, 2017, Massachusetts electric distribution companies, in coordination with the State of Massachusetts Department of Energy Resources (DOER), issued an RFP for "Long Term Contract for Clean Energy Projects" (MA DOER 2017a). This solicitation seeks to procure an annual amount of electricity equal to approximately 9,450,000 MWh. This solicitation defines "Clean Energy Generation" as either: (i) firm service hydroelectric generation from hydroelectric generation alone; (ii) new Class I Renewable Portfolio Standard ("RPS") eligible resources that are firmed up with firm service hydroelectric generation; or (iii) new Class I RPS eligible resources (2016 Mass. Acts 188). This RFP was issued pursuant to Section 83D of Chapter 169 of the Acts of 2008 (the "Green Communities Act"), as amended by chapter 188 of the Acts of 2016, An Act to Promote Energy Diversity (the "Energy Diversity Act").

Non-Intermittent Power Supply

Lastly, the Project has the potential to contribute a non-intermittent (i.e., baseload) power supply to the region. The Commonwealth of Massachusetts' Omnibus Energy Bill recognizes the necessity of hydropower generation to provide reliable generation to meet Massachusetts' energy demand and achieve the greenhouse gas emissions goals of the Global Warming Solutions Act (MA Governor's Press Office 2016). In its recent report titled "*Quantifying the Value of Hydropower in the Electric Grid: Final Report*" the Electric Power Research Institute (EPRI) noted that hydroelectric resources "contribute significantly to the reliability of the grid in terms of energy, capacity, and ancillary services" (EPRI 2013a). The EPRI report suggests that hydropower has the potential to address other generation and load variability, provide scheduling to optimize energy and ancillary services, provide fast regulation response, and, as noted above, add generation diversity. In its 2017 Regional Electricity Outlook, ISO-NE notes that federal and state efforts to cut carbon emissions are impacting "traditional resource types needed to meet the region's electricity needs, balance intermittent renewable generation, and provide the grid-stability services that renewables don't" (ISO-NE 2017a). Currently, nuclear power provides roughly 30 percent of ISO-NE's baseload generation (ISO-NE 2017a). As these sources retire, as demonstrated by the recent retirement of non-natural-gas-fired baseload units described in the "Electricity Diversity" section above, there will be a

[7] For Canadian hydropower to be eligible for credit under RGGI, the generation and transmission facilities would need to be outfitted with tracking and reporting systems to validate the clean energy attributes of the electricity.

need in the near-term for non-intermittent, reliable power in New England (U.S. NRC 2015a). A whitepaper published by the New England States Committee on Electricity also states that "it is no longer possible to safely assume that nuclear power will continue to provide the same approximate percentage of the region's base load power for the next decades in the face of low natural gas prices" (NESCOE 2013a). With a decline in baseload power from nuclear sources, and a need to diversify to avoid over-reliance on natural gas, hydroelectric power provides non-intermittent power needs (NESCOE 2013a).

S.4 PUBLIC PARTICIPATION AND INTERAGENCY COORDINATION

Public participation and interagency coordination are integral elements of the NEPA process and are intended to promote open communication between DOE and regulatory agencies, Native American tribes, potential stakeholder organizations, and the public. All individuals and organizations potentially affected by or interested in the Project are encouraged to participate in the public involvement process.

S.4.1 COOPERATING AGENCIES

The DOE invited several federal and state agencies to participate in the preparation of the draft and this final EIS as cooperating agencies because of their special expertise or jurisdiction by law. The cooperating agencies are the USFS – WMNF, the EPA – Region 1, the USACE – New England Region, and the NHOEP.

S.4.2 PUBLIC INVOLVEMENT

S.4.2.1 Initial Public Scoping

The NEPA public scoping period began on February 11, 2011, following the DOE's publication of the Notice of Intent (NOI; 76 FR 7828). This and other relevant documents are available on the EIS website: http://www.northernpasseis.us. Through a notice in the *Federal Register* published on April 15, 2011 (76 FR 21338), DOE extended the scoping period to June 14, 2011.

During the initial public scoping period, seven public scoping meetings were held in March 2011 at several locations along the Project route (Pembroke, Franklin, Lincoln, Whitefield, Plymouth, Colebrook, and Haverhill, NH). The initial public scoping period closed on June 14, 2011.

S.4.2.2 Additional Public Scoping

On June 15, 2011, the DOE announced a reopening of the public scoping period, in anticipation of additional route information to be provided by Northern Pass, and stated that the scoping period would remain open until the DOE provided further notice of its closing (76 FR 34969). Following publication of the amended NOI (78 FR 54876; September 6, 2013), the public scoping period closed 60 days later on November 5, 2013.

Following the publication of the amended NOI, four additional public scoping meetings were held in September 2013 at several locations along the Project route (Concord, Plymouth, Whitefield, and West Stewartstown, NH).

Through the public scoping process, commenters expressed concerns over a broad range of topics, including, but not limited to, the NEPA process, the federal agencies' purpose and need, the range of alternatives to be considered in the draft EIS, potential socioeconomic impacts in the region, potential visual impacts, potential impacts to wildlife, and potential impacts to tourism.

S.4.2.3 Draft EIS Public Review Period

In July 2015 DOE issued the draft EIS. The public review period was initiated through publication of a Notice of Availability (NOA) in the *Federal Register* by EPA (80 FR 45652 [July 31, 2015]). Methods similar to those used during the scoping period were used to notify the public and applicable federal and state agencies of the public review period for the draft EIS, including distributing the document to individuals or parties who submitted scoping comments, and to other interested parties that requested a copy of the EIS. A legal notice was published in the Union Leader, the newspaper of record for the WMNF, on November 5, 2015.

DOE made the draft EIS available online at the Northern Pass EIS website (http://www.northernpasseis.us) and on the DOE NEPA website (http://energy.gov/nepa), and in hard copy and CD format at 30 public libraries located in the proposed Project area. The draft EIS was also circulated to federal, state, and local agencies with jurisdiction by law or special subject matter expertise and to any person, stakeholder organization, or agency that requested a copy (40 CFR § 1502.19).

Public hearings to receive comments on the draft EIS were scheduled for October 2015. As a result of Northern Pass' August 2015 revision to its proposal, DOE issued a NOI to prepare a supplement to the draft EIS (80 FR 58725 [September 30, 2015]). This notice extended the comment period until December 31, 2015, and postponed the public hearings (but did not identify new dates). On November 20, 2015, DOE issued the supplement to the draft EIS; EPA's NOA was published on November 20, 2015 (80 FR 72719 [2015]). Public hearings on the draft EIS and supplement were scheduled for December 2015 (80 FR 72716 [2015]). On December 4, 2015, the public hearings were postponed (new dates were not scheduled at this time) and the comment period was extended until April 4, 2016. On February 4, 2016, the public hearings were scheduled for March 2016 (81 FR 5995 [2016]). Four public hearings were held in March 2016 at several locations along the Project route (Colebrook, Concord, Waterville Valley, and Whitefield, NH).

The public comment period on the draft EIS and supplement to the draft EIS closed on April 4, 2016; in total, the comment period was open for 248 days. During the draft EIS comment period, the DOE received 1,037 comments. The final EIS includes, in **Appendix L**, a summary of the draft EIS public review period, all comments received on the draft EIS, and DOE's responses to those comments. All substantive comments submitted on the draft EIS were considered in preparing the final EIS, including those received after the close of the public comment period (approximately 15 comments).

S.4.2.4 Public Participation in the Section 106 Process

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (54 U.S.C. § 306108) requires federal agencies to take into account the effects of their undertakings and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. This process includes developing measures to avoid, minimize, or mitigate any adverse effects through consultation. Compliance with Section 106 requires consultation with the state historic preservation officer (SHPO) and other consulting parties (which may include federally-recognized Indian Tribes, representatives of local governments, the applicant, certain individuals and organizations with a demonstrated interest in the proposed undertaking due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties), and the public (36 CFR § 800.2). DOE is coordinating its compliance with Section 106 of the NHPA with its environmental review. The Section 106 review considers potential adverse effects to archaeological (underground) resources as well as architectural (aboveground) historic properties. The information gathered during the Section 106 process is being used to inform the EIS, as NEPA also requires consideration of potential impacts to historic and cultural resources (e.g., 40 CFR § 1502.16(g)). DOE sought public comment on cultural and historic property information through its environmental review and continues to provide updates and information to the public regarding the Section 106 process through DOE's Section 106 Consultation Page for the Project at http://www.northernpasseis.us/consultations/section106/.

S.5 ALTERNATIVES ANALYZED

This final EIS analyzes the No Action Alternative, the Proposed Action (as presented in the "Further Amendment to Presidential Permit Application" submitted in August 2015), and ten additional action alternatives (Alternatives 2–6 with variations). Many of the action alternatives are described here in terms of their similarities and differences with Alternative 2. Alternative 2 was used as the basis for comparison because it was the Proposed Action at the time the draft EIS was prepared and published. Even though Alternative 7 is now the Proposed Action (DOE's Preferred Alternative), for continuity and to avoid confusion, some of the alternative descriptions still refer to Alternative 2 as the basis for comparison.

Table S-1 describes each alternative analyzed, including a description of the converter stations and substations, and also provides the length of the transmission line (overhead, underground, and total) and the operational capacity. For a visual description of the alternatives, refer to Maps 5–19 in **Appendix A**.

Table S-1. Alternatives Considered in Detail

Alternative	Description	Length Overhead miles (km)	Length Underground miles (km)	Total Length miles (km)[a]	Operational Capacity (MW)
1	No Action	N/A	N/A	N/A	0
2	Primarily overhead in existing Public Service of New Hampshire (PSNH) transmission route, convert from HVDC to HVAC at Franklin Converter Station, overhead HVAC to Deerfield Substation	179 (288)	8 (13)	187 (301)	1,200
3	Underground in Alternative 2 alignment, convert from HVDC to HVAC at alternate North Road Converter Station, underground HVAC to Deerfield Substation	0	187 (301)	187 (301)	1,090
4	Underground in roadway corridors				
4a	Underground in roadway corridors, I-93 through Franconia Notch, convert from HVDC to HVAC at alternate North Road Converter Station, underground HVAC to Deerfield Substation	0	175 (282)	175 (282)	1,090
4b	Underground in roadway corridors, NH Routes 112 and 116 through WMNF, convert from HVDC to HVAC at alternate North Road Converter Station, underground HVAC to Deerfield Substation	0	190 (306)	190 (306)	1,090
4c	Underground in roadway corridors, NH Routes 112 and 116 through WMNF, US Route 3 from North Woodstock to Ashland, NH, convert from HVDC to HVAC at alternate North Road Converter Station, underground HVAC to Deerfield Substation	0	182 (293)	182 (293)	1,090
5	Alternative 2 except underground in roadway corridors in the vicinity of the WMNF				
5a	Alternative 2 except underground in I-93 corridor through Franconia Notch	156 (251)	28 (45)	184 (296)	1,090
5b	Alternative 2 except underground in NH Routes 112 and 116 through WMNF	170 (274)	21 (34)	190 (306)	1,200

Table S-1. Alternatives Considered in Detail

Alternative	Description	Length Overhead miles (km)	Length Underground miles (km)	Total Length miles (km)[a]	Operational Capacity (MW)
5c	Alternative 2 except underground in NH Routes 18, 112 and 116 through Sugar Hill, Franconia, Easton, NH, and WMNF	157 (253)	33 (53)	191 (307)	1,090
6	Underground in roadway corridors until Franklin, NH and co-located HVAC between Franklin and Deerfield, NH				
6a	Underground in roadway corridors, I-93 through Franconia Notch, convert from HVDC to HVAC at Franklin Converter Station, co-located overhead HVAC to Deerfield Substation	34 (55)	139 (224)	173 (278)	1,090
6b	Underground in roadway corridors, NH Routes 112 and 116 through WMNF, convert from HVDC to HVAC at Franklin Converter Station, co-located overhead HVAC to Deerfield Substation	34 (55)	154 (248)	188 (303)	1,090
7	Proposed Action – Alternative 2 except underground in NH Routes 18, 112, 116, and US Routes 3 and 302 from Bethlehem to Bridgewater, NH	132 (212)	60 (97)	192 (309)	1,090

[a] Due to rounding, the total length of the Project may vary slightly from the sum of its parts.

S.5.1 ALTERNATIVE 1 – NO ACTION ALTERNATIVE

Under the No Action Alternative, DOE would not issue a Presidential permit and the USFS would not issue a SUP for the Project, the proposed transmission system would not be constructed, and the potential impacts from the Project would not occur. The CEQ and DOE regulations require consideration of the No Action Alternative. The No Action Alternative serves as a baseline against which the potential environmental impacts of the Proposed Action and alternatives are evaluated.

S.5.2 ALTERNATIVE 2

Alternative 2 includes a proposed high-voltage direct current (HVDC) transmission line that, as currently designed, would be capable of transmitting up to 1,200 MW of power in either direction (Canada to the U.S. and U.S. to Canada). The northern HVDC converter station is proposed to be constructed at the Des Cantons Substation in Québec, Canada, and would be connected to an HVDC line that would run southward in Québec for approximately 45 miles (72 km) where it would cross the U.S./Canada border into Pittsburg, NH.

Alternative 2 would consist of a single circuit ±300 kilovolt (kV) HVDC transmission line running approximately 153 miles (246 km) from the U.S. border crossing with Canada in Pittsburg, NH, to a new direct current (DC)-to-alternating current (AC) converter station to be constructed in Franklin, NH. From Franklin, NH, to the Project terminus at the Public Service of New Hampshire's (PSNH's) existing Deerfield Substation located in Deerfield, NH, Alternative 2 would consist of 34 miles (55 km) of 345 kV AC electric transmission line. The total length of Alternative 2 would be approximately 187 miles (301 km).

As a part of the Project, system upgrades to existing PSNH AC transmission facilities would be required, including upgrades to the Deerfield Substation, Scobie Pond Substation (Londonderry, NH), and existing 345 kV transmission lines between the Deerfield Substation, Scobie Pond Substation, and Lawrence Road

Substation (Hudson, NH). For additional description of these upgrades, see **Chapter 2**, **Section 2.3.2.5**. All action alternatives would include similar upgrades.

S.5.3 ALTERNATIVE 3

Under Alternative 3, the Project would be constructed as an underground transmission cable for its entire length, and would be buried within the same alignment as Alternative 2, except for a slight deviation to accommodate an alternate to the proposed converter station to be located at the intersection of the existing PSNH transmission route and North Road in Deerfield, NH (North Road Converter Station).

The Project under Alternative 3 would be approximately 187 miles (301 km) in length, requiring approximately 184 miles (296 km) of HVDC burial between the U.S./Canada border crossing and the North Road Converter Station, and approximately 3 miles (5 km) of HVAC burial to the Deerfield Substation. Due to the total length of the buried section(s) included under Alternative 3, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[8]

S.5.4 ALTERNATIVE 4A

Under Alternative 4a, the Project would be constructed as an underground transmission cable for its entire length, and would be buried in existing roadway corridors (state and federal) except for a portion of the line totaling just over 2 miles (3 km) from the U.S./Canada border crossing in Pittsburg, NH to US Route 3 in Clarksville, NH that would be buried in a new transmission route. Within the WMNF, Alternative 4a would be buried in the I-93 roadway corridor. Map 17 in **Appendix A** illustrates the differences between Alternatives 4a, 4b, and 4c in the vicinity of the WMNF.

The Project under Alternative 4a would be approximately 175 miles (282 km) in length, requiring the burial of approximately 172 miles (277 km) of HVDC transmission cable from the U.S./Canada border crossing to the North Road Converter Station and 3 miles (5 km) of HVAC transmission cable to the Deerfield Substation. Due to the total length of the buried section(s) included in Alternative 4a, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[9]

S.5.5 ALTERNATIVE 4B

Under Alternative 4b, the Project would be constructed as an underground transmission cable for its entire length, and would be buried in existing roadway corridors (state and federal) except for a portion of the line totaling just over 2 miles (3 km) from the U.S./Canada border crossing in Pittsburg, NH to US Route 3 in Clarksville, NH that would be buried in a new transmission route. Alternative 4b would follow the same alignment as Alternative 4a except for the portion in the vicinity of WMNF where it would follow NH Routes 112 and 116. Map 17 in **Appendix A** illustrates the differences between Alternatives 4a, 4b, and 4c in the vicinity of the WMNF.

The Project under Alternative 4b would be approximately 190 miles (306 km) in length, requiring the burial of approximately 187 miles (301 km) of HVDC transmission cable from the U.S./Canada border crossing to the North Road Converter Station and 3 miles (5 km) of HVAC transmission cable to the Deerfield

[8] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[9] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

Substation. Due to the total length of the buried section(s) included in Alternative 4b, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[10]

S.5.6 ALTERNATIVE 4C

Under Alternative 4c, the Project would be constructed as an underground transmission cable for its entire length, and would be buried in existing roadway corridors (state and federal) except for a portion of the line totaling just over 2 miles (3 km) from the U.S./Canada border crossing in Pittsburg, NH to US Route 3 in Clarksville, NH that would be buried in a new transmission route. Alternative 4c would differ from Alternatives 4a and 4b between Whitefield and Franconia, NH, and North Woodstock and Ashland, NH where it would follow NH Routes 142, 112, and 116 and US Route 3. Map 17 in **Appendix A** illustrates the differences between Alternatives 4a, 4b, and 4c in the vicinity of the WMNF.

The Project under Alternative 4c would be approximately 182 miles (293 km) in length, requiring the burial of approximately 179 miles (288 km) of HVDC transmission cable from the U.S./Canada border crossing to the North Road Converter Station and 3 miles (5 km) of HVAC transmission cable to the Deerfield Substation. Due to the total length of the buried section(s) included in Alternative 4c, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[11]

S.5.7 ALTERNATIVE 5A

Under Alternative 5a, the Project would be identical to Alternative 2 for the entire length of the transmission line except for the portion in the vicinity of the WMNF where the Project would be buried for an additional 20 miles (32 km) in the I-93 corridor. Map 18 in **Appendix A** illustrates the differences between Alternatives 5a, 5b, and 5c in the vicinity of the WMNF.

The Project under Alternative 5a would be approximately 184 miles (296 km) in length, with approximately 28 miles (45 km) of HVDC burial. Due to the total length of the buried section(s) included under Alternative 5a, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[12]

S.5.8 ALTERNATIVE 5B

Under Alternative 5b, the Project would be identical to Alternative 2 for the entire length of the route except for the portion in the vicinity of the WMNF where the Project would be buried for an additional 13 miles (21 km) in the NH Route 116 and 112 corridors. Map 18 in **Appendix A** illustrates the differences between Alternatives 5a, 5b, and 5c in the vicinity of the WMNF.

The Project under Alternative 5b would be approximately 190 miles (306 km) in length, with approximately 21 miles (34 km) of underground HVDC transmission cable. The Project under Alternative 5b would be designed using technology capable of delivering 1,200 MW of power to Deerfield, NH.[13]

[10] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[11] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[12] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[13] The Applicant has indicated that buried segments of less than 24 miles (39 km) at a capacity of 1,200 MW would be economically reasonable.

S.5.9 ALTERNATIVE 5C

Under Alternative 5c, the Project would be identical to Alternative 2 for the entire length of the route except for the portion in the vicinity of WMNF where an additional 25 miles (40 km) of the Project would be buried in the NH Route 18, 112, and 116 corridors. Alternative 5c is identical to Alternative 5b except that it includes an additional portion of underground transmission cable through Sugar Hill, Franconia, and Easton, NH, and rejoins the existing PSNH transmission route at a different location in North Woodstock, NH. Map 18 in **Appendix A** illustrates the differences between Alternatives 5a, 5b, and 5c in the vicinity of the WMNF.

The Project under Alternative 5c would be approximately 191 miles (307 km) in length, with approximately 33 miles (53 km) of underground HVDC cable. Due to the total length of the buried section(s) included under Alternative 5c, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[14]

S.5.10 ALTERNATIVE 6A

Under Alternative 6a, the HVDC transmission cable would be buried in existing roadway corridors for approximately 139 miles (224 km) between the U.S./Canada border crossing and the proposed Franklin Converter Station. For approximately 34 miles (55 km) from the Franklin Converter Station to the destination substation in Deerfield, NH, the Project would be constructed as an overhead HVAC transmission line along the Alternative 2 alignment, co-located with the existing PSNH AC lines on a new set of towers. Map 17 in **Appendix A** illustrates the differences between Alternatives 6a and 6b in the vicinity of the WMNF.

The Project under Alternative 6a would be approximately 173 miles (278 km) in length. Due to the total length of the buried section included under Alternative 6a, the transmission system for this alternative would be developed with a capacity of 1,090 MW.[15]

S.5.11 ALTERNATIVE 6B

Under Alternative 6b, the HVDC transmission cable would be buried under or adjacent to existing roadways for approximately 154 miles (248 km) between the U.S./Canada border crossing and the proposed Franklin Converter Station. For approximately 34 miles (55 km) from Franklin, NH to the destination substation in Deerfield, NH, the Project would be constructed as overhead HVAC transmission line along the Alternative 2 alignment, co-located with the existing PSNH AC lines on a new set of towers. Alternative 6b would follow the same alignment as Alternative 6a except for the portion in the vicinity of WMNF where it would follow NH Routes 112 and 116. Map 17 in **Appendix A** illustrates the differences between Alternatives 6a and 6b in the vicinity of the WMNF.

The Project under Alternative 6b would be approximately 188 miles (303 km) in length. Due to the total length of the buried section included under Alternative 6b, the Project would use technology capable of delivering 1,090 MW of power to Deerfield, NH.[16]

[14] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[15] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

[16] DOE has determined that extended burial of a transmission line with a capacity of 1,090 MW would be practical and technically feasible. The burial of a transmission line with a capacity of 1,200 MW for extended distances would not be feasible. See **Section 2.1** for more information.

S.5.12 ALTERNATIVE 7 – PROPOSED ACTION

As described in the August 2015 "Further Amendment to Presidential Permit Application," DOE's Proposed Action and Agency Preferred Alternative is to issue a Presidential permit for the Project. Northern Pass, as the Applicant for the Presidential permit and SUP, would develop the Proposed Action as a transmission line to deliver electric power from Québec to southern New Hampshire.

Alternative 7 includes a proposed HVDC transmission line that, as currently designed, would be capable of transmitting up to 1,090 MW of power in either direction (Canada to the U.S. and U.S. to Canada). The northern HVDC converter station is proposed to be constructed at the Des Cantons Substation in Québec, Canada, and would be connected to an HVDC line that would run southward in Québec for approximately 45 miles (72 km) where it would cross the U.S./Canada border into Pittsburg, NH.

The Project would consist of a single circuit ±320 kV HVDC transmission line running approximately 158 miles (254 km) from the U.S. border crossing with Canada in Pittsburg, NH, to a new DC-to-AC converter station to be constructed in Franklin, NH. From Franklin, NH, to the Project terminus at PSNH's existing Deerfield Substation located in Deerfield, NH, the Project would consist of 34 miles (55 km) of 345 kV AC electric transmission line.

The Project would be similar to Alternative 2 but would include approximately 52 additional miles (84 km) of underground cable in roadway corridors between Bethlehem, NH and Bridgewater, NH. This section of underground cable would be similar to that included in Alternatives 4c and 5c. Map 19 in **Appendix A** illustrates the differences between Alternatives 4c, 5c, and 7.

The Project under Alternative 7 would be approximately 192 miles (309 km) in length, with approximately 60 miles (97 km) of underground HVDC cable. Refer to Map 16 in **Appendix A**.

S.6 ANALYSIS FRAMEWORK

S.6.1 DESCRIPTION OF GEOGRAPHIC ANALYSIS SECTIONS

For the purposes of understanding the various environmental settings associated with the Project, and to facilitate the analysis in this final EIS, the analysis of the Project was divided into three geographic sections and one administrative section defined by the WMNF (Maps 1–4 in **Appendix A**):

- Northern Section
- Central Section
- Southern Section
- WMNF Section

The Northern Section includes portions of the Project within Coös County, NH, as well as a small area of Vermont near the U.S./Canada border which includes Canaan, VT. The Central Section includes portions of the Project within Grafton and Belknap counties, NH. The Southern Section includes portions of the Project within Merrimack and Rockingham counties, NH. The WMNF Section is within the Northern and Central Sections and includes portions of the Project within the borders of the WMNF.

S.6.2 CONSTRUCTION SCHEDULE

This analysis assumes an operational in-service date of 2020, if DOE issues a Presidential permit for the Project. DOE selected this date for purposes of the EIS analysis, and the date is entirely independent of any other in-service dates or projections which may have been stated or published by the Applicant.

S.6.3 OPERATIONS AND MAINTENANCE

For the portions of the route where transmission lines presently exist, operation, maintenance, and repair would not change substantially from what currently occurs. Along the entire route, Northern Pass and PSNH would perform maintenance of the existing lines, maintenance of rebuilt lines, and implementation of the Project in accordance with Eversource Energy's system maintenance policies and procedures. Specific requirements for high voltage transmission lines include periodic patrols of infrastructure and vegetation management (including vegetation maintenance every three years within cleared areas, and side trimming and tree removal every ten years, or as required).

Maintenance activities in the transmission route, depending on the natural features and accessibility of the transmission route, would be carried out on foot, by line truck, by track mounted vehicle, by all-terrain vehicle, or by snowmobile, as authorized. All vegetation management and line maintenance activities associated with the Project's new lines or cables and upgrades to existing 345 kV lines would be performed in accordance with the New Hampshire Division of Forest and Lands Best Management Practice for Utility Maintenance (NHDRED 2010a) and the Forest Plan. This Best Management Practice publication provides guidance on several issues, including identifying appropriate means and methods for vegetation management and maintenance in or within the vicinity of jurisdictional wetlands. The Applicant would be required to provide a field manual summarizing the BMPs to all contractors performing maintenance work in the transmission route.

Maintenance associated with transition stations (where the Project would transition from aboveground to underground transmission), the HVDC converter station (Franklin Converter Station or alternate North Road Converter Station), the underground cables, and the Deerfield and Scobie Pond Substation upgrades (see **Section S.5.2**) would also be performed in accordance with Eversource Energy's system maintenance policies and procedures.

S.7 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER DETAILED ANALYSIS

Several technology, alignment, and construction alternatives were suggested during the public scoping and draft EIS review periods.[17] For various reasons, some of these alternatives were considered but eliminated from further detailed study. For additional detail regarding these alternatives, including reasons for elimination, see **Chapter 2, Section 2.4**.

The alternatives considered but eliminated include the following:

- Underground Transmission Cable with 1,200 MW Capacity;
- Underground Transmission Cable in Railroad and Connecting Roadway Corridors;
- Use the National Grid Phase I/II Route;
- Underwater Transmission Cable in Navigable Waterways;
- Overhead in Railroad and Connecting Roadway Corridors;
- Multiple Aboveground, Belowground Options in Alternative 2 Alignment;
- Other Transmission Projects;
- Power Generation Alternatives;
- Energy Conservation;

[17] Additionally, **Appendix J** contains an abbreviated analysis of a hybrid alternative utilizing a combination of routes to reduce potential impacts to certain resources.

- Alternative 2 except Underground Transmission Cable through Connecticut Headwaters;
- Transmission Line in an Aboveground Pipeline within Alternative 2 Alignment;
- Bury Existing Line, Install New Line as Proposed;
- Co-locate the Project (HVDC and HVAC) with the Existing Transmission Line on the Same Set of New Towers;
- Relocate Proposed Project Converter Station and Terminus Substation;
- Overhead Alternatives Convert to HVAC at the North Road Converter Station Location;
- Underground HVAC from the Franklin Converter Station to the Deerfield Substation; and
- Alternative Vermont Border Crossings.

S.8 MAJOR CONCLUSIONS

This section provides a general description of the main differences in potential environmental impacts among the action alternatives which were analyzed in detail. However, as summarized below and fully discussed in the final EIS, DOE has determined that issuance of a Presidential permit to the Applicant for construction, operation, and maintenance of the proposed Project under any of the action alternatives would not result in a significant impact to the environment. Before granting a Presidential permit, DOE must also determine if a proposed international electric transmission line would have an adverse impact on the reliability of the U.S. electric power supply system.

For comparison purposes, impacts in this section are considered within five groupings:

- Alternative 7 – Proposed Action;
- Alternative 2;
- Overhead with burial in the vicinity of the WMNF (Alternatives 5a, 5b, 5c);
- Fully/primarily underground (buried in the transmission route or buried along existing roads: Alternatives 3, 4a, 4b, 4c, 6a, 6b); and
- Alternative 1 – No Action Alternative.

Under all action alternatives: (1) no population-level effects to any protected species would be anticipated; (2) no disproportionately high and adverse human health or environmental impacts to minority or low-income communities would be expected; (3) no risks associated with EMFs would be expected; and (4) air emissions as a result of construction would not exceed *de minimis* thresholds.

Overall, Alternative 2 would impose the greatest potential environmental impacts as compared to the other action alternatives primarily because of visual impacts, vegetation removal and ground disturbance required for the creation of a new 40-mile (64 km) long, 120-foot (64 m) wide route in the Northern Section of the Project. Additionally, the construction of the Project as an overhead transmission line through the Central Section under Alternative 2 would result in the greatest temporary construction impact. Alternative 2 would also have the least cost of construction (approximately $1.09 billion). While the least cost construction alternative is favorable to the Applicant, as compared to the other action alternatives, it is the least advantageous to local taxing jurisdictions because tax revenues would be based on the value of the construction/infrastructure costs.

The alternatives that would be constructed entirely or primarily underground along existing roadway corridors (Alternatives 4a, 4b, 4c, 6a, and 6b) would impose the fewest environmental impacts due to the lack of visual impacts and use of already disturbed roadway corridors. However, all of the underground alternatives (including Alternative 3) would have the highest construction costs (between approximately $1.88 billion [Alternative 6a] and approximately $2.16 billion [Alternative 4b]). Because of the higher

construction cost, the underground alternatives would be disadvantageous to the Applicant but provide additional tax revenue to local taxing jurisdictions as compared to Alternative 2.

The alternatives involving the construction of aboveground transmission lines along most of the route and underground lines in vicinity of the WMNF (Alternatives 5a, 5b, 5c, and 7) would avoid visual impacts to the WMNF in general, and the Appalachian National Scenic Trail (ANST) in particular. These alternatives would require the same vegetation removal and ground disturbance in the Northern Section as under Alternative 2, resulting in the same types of adverse environmental impacts in that area. Construction costs would be higher than Alternative 2, ranging from approximately $1.18 billion (Alternative 5a) to approximately $1.41 billion (Alternative 7), but not as high as the fully/primarily underground alternatives.

Alternative 2, and the alternatives that would be constructed overhead along most of the route and constructed underground in the vicinity of the WMNF, would result in fewer short-term and permanent jobs as compared to the fully/primarily underground alternatives. The primarily overhead alternatives would be expected to create between 5,000 and 7,000 short-term jobs (over a three-year period) and between 760 and 900 permanent jobs, while the underground alternatives would be expected to create between 9,000 and 10,500 short-term jobs (over a three-year period) and between 1,200 and 1,400 permanent jobs.

Alternative 2, and Alternative 5b, would be constructed with a 1,200 MW delivery capacity. As a result, these two alternatives would produce the greatest decrease in annual wholesale electricity costs in New Hampshire ($10.1 million reduction) and in the ISO-NE region ($32.8 million reduction). Additionally, these two alternatives would also be expected to reduce CO_2 emissions by 10 percent across the region.

Comparatively, alternatives with a delivery capacity of 1,090 MW (Alternatives 3, 4a, 4b, 4c, 5a, 5c, 6a, 6b, and 7) would result in a smaller decrease in annual wholesale electricity costs of $8.6 million within New Hampshire, and $23.2 million within ISO-NE. These alternatives would be expected to reduce CO_2 emissions by 9 percent annually across the region.

S.8.1 ALTERNATIVE 7 – PROPOSED ACTION

Aboveground infrastructure in Alternative 7 would result in visual impacts, although impacts would be smaller than under Alternatives 2, 5a, 5b, and 5c due to the additional length of underground cable that would be required as compared to the other alternatives. This could result in adverse impacts to tourism and recreation in the affected areas. The transmission line would not be visible from the ANST and would therefore be consistent with the WMNF Forest Plan. The overhead transmission line could be visible from historic architectural resources and thus could adversely affect the historic context of these sites more than the underground alternatives.

Alternative 7 would result in moderate impacts to vegetated habitats as compared to the other action alternatives because there would be a need to clear approximately 40 miles (64 km) of new corridor in the Northern Section. Required widening of the existing corridor in the Central Section would be minor due to the additional section of underground cable in roadway corridors. This land disturbance would create the potential for impacts to archeological resources and wildlife, including protected species.

The construction cost of Alternative 7 would be greater than alternatives with fewer miles of underground cable, but less than the fully/primarily buried alternatives. It would have moderate economic impacts (including employment and tax revenue) compared to the other action alternatives. Visual impacts may reduce some residential property values along the proposed transmission route, which could also result in lower residential property tax revenue collections as compared to the fully/primarily underground alternatives.

Alternative 7 would have a moderate risk for operational hazards such as damage from extreme weather or intentional destructive acts, but would present a lower risk of exposing contaminated soils or groundwater

during construction, as compared to the fully/primarily underground alternatives. Impacts to traffic and transportation would be less under Alternative 7 than for the alternatives located exclusively/primarily underground in roadway corridors, but more than Alternatives 2, 3, 5a, 5b, and 5c. Some blasting maybe required for the underground portions of the route which would generate noise.

Alternative 7 would result in moderate long-term wetlands impacts as compared to the other action alternatives, with approximately 2 acres (0.8 ha) of direct impacts, 170 acres (69 ha) of temporary impacts, and 36 acres (15 ha) of secondary impacts. These impacts include wetland type conversion which could change the function and uses of the wetlands.

Construction of Alternative 7 would result in fewer impacts to soils and have less potential for erosion as compared to the alternatives with more overhead transmission line.

S.8.2 ALTERNATIVE 2

The primary impact of Alternative 2 would be to visual resources. This could result in adverse impacts to tourism and recreation in the affected areas. This alternative would be inconsistent with existing WMNF Forest Plan standards due to potential visual impacts. The overhead transmission line could also be visible from historic architectural resources and thus could adversely affect the historic context of these sites more than the fully/primarily underground alternatives.

Alternative 2 would also result in the greatest impacts to vegetated habitats as compared to the other action alternatives because of the need to clear approximately 40 miles (64 km) of new corridor in the Northern Section and additional width in the existing corridor within the Central and Southern Sections. This land disturbance would also increase the potential for impacts to archeological resources and wildlife, including protected species.

This alternative would result in the lowest construction cost and correspondingly the lowest economic impacts as compared to the other action alternatives. Because construction costs would be lower, as compared to the other action alternatives, the revenue collected by local taxing jurisdictions along the transmission route would also be lower. In addition, visual impacts may reduce some residential property values along the proposed transmission route, which could also result in lower residential property tax revenue collections as compared to the underground alternatives. Decreases in residential property values would be expected to be greatest under Alternative 2, as compared to other action alternatives.

Alternative 2 would have an increased risk for operational hazards such as damage from extreme weather or intentional destructive acts, but would present a lower risk of exposing contaminated soils or groundwater during construction, as compared to the underground alternatives. Impacts to traffic and transportation would be less under Alternative 2 than for the alternatives located underground in roadway corridors. Some blasting maybe required for the underground portions of the route which would generate noise.

Alternative 2 would also result in the greatest long-term wetlands impacts as compared to the other action alternatives, with up to 2 acres (0.8 ha) of direct impacts, 212 acres (86 ha) of temporary impacts, and 37 acres (15 ha) of secondary impacts. These impacts would include wetland type conversion which could change the function and uses of the wetlands.

Construction of Alternative 2 would result in the greatest impact to soils as compared to the other action alternatives. However, the majority of this impact would be temporary, construction-related disturbance.

S.8.3 OVERHEAD WITH BURIAL IN THE VICINITY OF THE WMNF (ALTERNATIVES 5A, 5B, AND 5C)

The differentiator among these alternatives is the roadway corridors along which the transmission line would be buried within, and in the vicinity of, the WMNF. For the most part, these differences do not result in appreciably different impacts among these alternatives. Important differences are noted below.

The primary impact of these alternatives would be to visual resources outside of the WMNF vicinity, which would be similar to Alternative 2. These alternatives would have the same impacts as Alternatives 2 and 7 in the Northern Section associated with clearing a new transmission corridor. Because the transmission line under Alternatives 5a and 5c would be buried within, and in the vicinity of, the WMNF, there would be no visual impacts to the ANST and these alternatives would be consistent with the WMNF Forest Plan. The transmission line under Alternative 5b could be visible in the background from the ANST, and this alternative would therefore be inconsistent with the WMNF Forest Plan. Further, impacts to tourism and recreation, to the extent they could occur, would be less under these alternatives than under Alternative 2 but greater than the fully/primarily underground alternatives.

These alternatives would cost between $1.18 billion and $1.25 billion to construct, which is slightly higher than Alternative 2 but lower than Alternative 7 and the fully/primarily underground alternatives. Thus, the economic impacts of the Project and impacts to local tax revenues would fall between the fully/primarily underground alternatives and Alternative 2. Potential impacts to residential property values would be slightly less than under Alternative 2, but greater than the fully/primarily underground alternatives.

Some blasting may be required for the underground portions of the route. As a result, noise impacts may be greater under these alternatives than under Alternative 2, but less than noise impacts for the fully/primarily underground alternatives. The burial of a portion of the line would also result in a slightly greater potential for impacts to traffic and transportation and to soils and potential for erosion than Alternative 2, but less than for the fully/primarily underground alternatives.

Other impacts of these alternatives would be similar to or slightly less than those for Alternative 2 because the majority of the transmission line would be located overhead. This includes impacts to vegetation, wildlife, and soils. Alternatives 5a, 5b, and 5c would impose up to 2 acres (0.8 ha) of direct impacts, 198 acres (80 ha) of temporary impacts, and 37 acres (15 ha) of secondary impacts to wetlands, including wetlands type conversion.

S.8.4 FULLY/PRIMARILY UNDERGROUND ALTERNATIVES (ALTERNATIVES 3, 4A, 4B, 4C, 6A, AND 6B)

The differentiators among the fully/primarily underground alternatives are the possible location of the proposed converter station, the proposed route of the transmission line (along the existing/proposed transmission route or along various road corridors), and a 34-mile (50 km) overhead segment in the Southern Section. For the most part, these differences do not result in appreciably different impacts among these fully/primarily buried alternatives. Important differences in impacts are noted below.

Impacts to visual resources, tourism, recreation, and historic architectural resources would be less for the fully/primarily underground alternatives as compared to the primarily overhead alternatives including Alternative 7.

The fully/primarily underground alternatives would result in the highest construction cost (between $1.88 billion and $2.16 billion) and correspondingly the highest economic impacts as compared to the other action alternatives. Because construction costs would be higher, as compared to the other action alternatives, the revenue collected by local taxing jurisdictions along the transmission line would also be higher. For most of the fully/primarily underground alternatives, residential property values along the underground routes

and associated residential property taxes would not be affected by these alternatives because long-term visual impacts would not occur. Some decrease in residential property values could occur in the Southern Section as a result of the 34-mile (50 km) overhead portion of the transmission line under Alternatives 6a and 6b.

The fully/primarily underground alternatives would require less vegetation removal and result in fewer impacts to archeological resources and wildlife, including protected species. During construction, blasting required for the underground alternatives would generate more noise than the overhead alternatives, which could impact noise receptors near the Project.

The fully/primarily underground alternatives would have a decreased risk for operational hazards such as damage from extreme weather or intentional destructive acts, and would present a higher risk of exposing contaminated soils or groundwater during construction, as compared to the overhead alternatives. Impacts to traffic and transportation would be greater for the alternatives located underground in roadway corridors than the primarily overhead alternatives.

With respect to the proposed route of an underground transmission line, creation of a new route in the Northern Section under Alternative 3 would result in more disturbance to vegetation and wildlife than the underground alternatives that would follow existing roadways (Alternatives 4a, 4b, 4c, 6a, and 6b). Alternative 3 would impose up to 3 acres (1 ha) of direct impacts, 194 acres (79 ha) of temporary impacts, and 15 acres (6 ha) of secondary impacts to wetlands, including wetland type conversion; Alternatives 4a, 4b, 4c, 6a, and 6b would impose up to 3 acres (1 ha) of direct impacts, 23 acres (9 ha) of temporary impacts, and <0.5 acre (<0.2 ha) of secondary impacts to wetlands.

Construction of the underground alternatives would result in fewer long-term impacts to soils as compared to the overhead alternatives. However, these impacts would be greater in the short-term because of the excavation needed for construction than those associated with the construction of overhead sections of other alternatives.

S.8.5 ALTERNATIVE 1 – NO ACTION ALTERNATIVE

Under the No Action Alternative, there would be no impacts to any of the environmental resources analyzed. The local taxing jurisdictions would not realize any increases in tax revenues as a result of the Project and no direct or indirect economic impacts would occur within the region. No additional short-term or permanent jobs would be created. There would be no change in the wholesale price of electricity in New Hampshire or the ISO-NE region and no project related change in the level of CO_2 emissions.

S.9 SUMMARY OF POTENTIAL IMPACTS ASSOCIATED WITH THE PROJECT

A summary of potential impacts from the construction, operation, maintenance, and emergency repairs associated with the Project (Alternatives 1, 2, 3, 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7) is presented in the following resource area discussions. **Chapter 3** (Affected Environment) summarizes the existing condition to provide context and explains analysis methods and critical terminology. The detailed impact analysis, along with Applicant Proposed Measures (APMs) to avoid or minimize potential impacts, is presented in **Chapter 4** (Environmental Impacts), **Chapter 5** (Cumulative Impacts), and **Appendix H** of this final EIS.

S.9.1 VISUAL RESOURCES

Table S-2. Summary of Potential Impacts to Visual Resources

Alternative	Net Change in Aggregate Scenic Impact	Aggregate Scenic Impact	Net Change in Miles (km) of Road with Visibility
1 (No Action)	0	85.9	0
2	68.7	154.7	48 (77)
3	0	85.9	0.3 (0.5)
4a	0	85.9	0.2 (0.3)
4b	0	85.9	0.2 (0.3)
4c	0	85.9	0.2 (0.3)
5a	63.7	149.6	45 (72)
5b	67.5	153.4	41 (66)
5c	65.4	151.4	45 (72)
6a	44.7	90.9	6 (10)
6b	44.7	90.7	6 (10)
7 (Proposed Action)	58.4	144.3	40 (64)

Note: The net change in visual resources is measured in comparison with the existing condition, or Alternative 1, which includes the existing PSNH transmission line. The existing condition has a visual magnitude rating of 1.63 (Very Low to Low), and a scenic impact rating of 1.39 (Very Low to Low). The existing PSNH transmission line crosses 144 publicly accessible roads as an overhead line and is visible from approximately 139 miles (224 km) of roads.
Refer to the Glossary for a definition of "scenic impact."

The methods used to determine the potential impact to visual resources are discussed in detail in **Chapter 3, Section 3.1.1**.

Overall, construction of the Project under all alternatives would result in short-term visual impacts from the presence of machinery and construction activities. For overhead portions of the Project (including portions of Alternatives 2, 5a, 5b, 5c, 6a, 6b, and 7), overstory vegetation removal and the visibility of aboveground structures and facilities would result in long-term impacts to visual resources. The visibility of large industrial-appearing lattice structures that have high form and color contrast with existing transmission structures and the surrounding environment, along with vegetation clearing and the construction of a new transmission route would contribute to this impact. Additionally, other permanent facilities, such as transition stations, would alter the visual character of the landscape. Underground portions of the Project (including Alternatives 3, 4a, 4b, 4c, and portions of 2, 5a, 5b, 5c, 6a, 6b, and 7) would not have long-term visual impacts from the transmission cable, but aboveground structures (transition stations, converter station, and substation) would have a visual impact.

S.9.2 SOCIOECONOMICS

Table S-3. Summary of Potential Impacts to Socioeconomic Resources – Construction

Alternative	Total Construction Costs ($ billion)	Economic Impacts from Construction ($ million)		Annual FTE Construction Jobs (over three years)	Reduction of Taxable Assessed Property Values ($ million)	Reduction in Annual Residential Property Tax Payments ($)
		Direct	Total			
1 (No Action)	--	--	--	--	--	--
2	$1.087	$328.5	$570.4	5,233	$11.8	$320,000
3	$2.128	$643.9	$1,116.1	10,240	--	--
4a	$2.034	$616.2	$1,070.4	9,816	--	--
4b	$2.163	$654.0	$1,134.8	10,411	--	--
4c	$2.094	$634.0	$1,101.3	10,100	--	--
5a	$1.180	$355.7	$615.9	5,655	$10.7	$290,000
5b	$1.252	$376.9	$652.3	5,991	$11.4	$310,000
5c	$1.227	$369.3	$639.1	5,869	$10.8	$290,000
6a	$1.876	$567.5	$988.4	9,062	$5.1	$140,000
6b	$2.002	$604.6	$1,051.5	9,645	$5.1	$140,000
7 (Proposed Action)	$1.410	$424.4	$734.6	6,747	$8.7	$240,000

Table S-4. Summary of Potential Impacts to Socioeconomic Resources – Operation, Maintenance, and Emergency Repairs

Alternative	Annual Economic Impacts ($ million)		Permanent FTE Jobs	Annual Reduction in Wholesale Electricity Costs – ISO-NE ($ million)	Annual Reduction in Wholesale Electricity Costs – NH ($ million)	Increase in Statewide Property Tax Annual Collections ($ million)	Percent Increase in Net Imported Electricity*
	Direct	Total					
1 (No Action)	--	--	--	--	--	--	--
2	$45.7	$112.1	760	$32.8	$10.1	$29.8	25.5%
3	$72.3	$194.0	1,333	$23.2	$8.6	$57.9	23.1%
4a	$70.9	$189.7	1,303	$23.2	$8.6	$56.5	23.1%
4b	$73.5	$197.5	1,357	$23.2	$8.6	$59.1	23.1%
4c	$72.3	$194.1	1,334	$23.2	$8.6	$58.0	23.1%
5a	$45.7	$114.5	782	$23.2	$8.6	$31.3	23.1%
5b	$48.7	$121.3	823	$32.8	$10.1	$32.9	25.5%
5c	$46.6	$117.2	801	$23.2	$8.6	$32.2	23.1%
6a	$66.9	$177.8	1,221	$23.2	$8.6	$52.5	23.1%
6b	$69.4	$185.4	1,274	$23.2	$8.6	$55.0	23.1%
7 (Proposed Action)	$51.4	$131.5	901	$23.2	$8.6	$37.0	23.1%

*Net imported electricity includes electricity delivered by the Project as well as other lines into ISO-NE from Canada.

The methods used to evaluate the socioeconomic effects of the Project are discussed in detail in **Chapter 3, Section 3.1.2**.

As depicted in **Table S-3**, total construction cost of the Project increases with increasing length of burial across the alternatives. Calculations of the overall economic impacts from construction of the Project is a proportionate function of construction spending. Similarly, alternatives with higher construction costs would be expected to create more construction-related employment. Construction of the Project may impact assessed residential property values and corresponding residential property tax payments to local taxing jurisdictions.

As summarized in **Table S-4**, ongoing operations, maintenance and repair of the Project would have lasting economic impacts within New Hampshire and throughout the area served by ISO-NE. Overall economic impacts, permanent employment, and statewide property tax collections are a function of the assessed value of the Project, which is directly tied to the capital cost of the Project and varies by alternative with the more costly alternatives having higher economic impacts, increased employment, and larger property tax collections.

Annual reductions in wholesale electricity costs (within NH and ISO-NE), and the percent increase in net imported electricity vary by the transmission capacity (1,200/1,090 MW) of the alternative.

Electricity generation from natural gas, oil, coal, and domestic hydropower would be expected to fall under all alternatives—slightly more with alternatives with a transmission capacity of 1,200 MW. Net imports, which includes electricity delivered by the Project as well as other lines into ISO-NE from Canada, would increase. Total net imports from Canada would provide no more than approximately 26 percent of the total electricity supply to ISO-NE.

No studies have been completed documenting the potential impacts of transmission lines on tourism, and there is no existing literature with which to judge the potential impact of the Project on tourism in New Hampshire. However, impacts to tourism appear to be more affected by macroeconomic factors such as the stability of the national economy and gasoline prices more than site-specific changes. While it is reasonable to conclude that overhead portions of the Project may have some level of impact to tourism within New Hampshire, and to individual locations proximate to the Project route, these are not quantifiable.

S.9.3 RECREATION[18]

Table S-5. Summary of Potential Impacts to Recreational Resources – Construction

Alternative	Point Sites	Potential Federal Wild and Scenic Rivers (type of crossing)	Sites with Spatial Area acres (ha)	Trails	
				miles (km)	ANST[a] Crossings
1 (No Action)	--	--	--	--	--
2	1	9 (overhead)	496 (201)	5.6 (9)	1
3	1	9 (buried)	496 (201)	5.6 (9)	1
4a	--	8 (buried)	112 (45)	0.3 (0.5)	1
4b	--	8 (buried)	141 (57)	0.2 (0.3)	1
4c	--	7 (buried)	82 (33)	0.2 (0.3)	1
5a	1	9 (overhead and buried)	312 (126)	1 (1.6)	1
5b	1	10 (overhead and buried)	410 (166)	0.9 (1.4)	1
5c	1	10 (overhead and buried)	334 (135)	0.9 (1.4)	1
6a	--	8 (overhead and buried)	127 (51)	0.4 (0.6)	1
6b	--	9 (overhead and buried)	155 (63)	0.3 (0.5)	1
7 (Proposed Action)	1	7 (overhead and buried)	295 (119)	0.8 (1.3)	1

Note: Point sites are recreational resources with small spatial area such as a scenic overlook, boat launch, etc. Sites with spatial area are recreational resources such as parks that have larger areas.
[a] ANST impacts are included in the total impact to trails.

Table S-6. Summary of Recreational Resources with Potential to Experience Long-Term Visual Impacts

Alternative	Point Sites	Sites with Spatial Area acres (ha)	Trails	
			miles (km)	ANST[a] miles (km)
1 (No Action)	--	--	--	--
2	15	2,267 (917)	9 (14)	0.1 (0.2)
3	--	--	--	--
4a	--	--	--	--
4b	--	--	--	--
4c	--	--	--	--
5a	13	2,121 (858)	8 (13)	0.1 (0.2)
5b	14	2,207 (893)	8 (13)	0.1 (0.2)
5c	14	2,161 (875)	8 (13)	0.1 (0.2)
6a	3	--	0.6 (0.9)	--
6b	3	--	0.6 (0.9)	--
7 (Proposed Action)	12	2,109 (894)	9 (14)	0.1 (0.2)

Note: Point sites are recreational resources with small spatial area such as a scenic overlook, boat launch, etc. Sites with spatial area are recreational resources such as parks that have larger areas.

[a] ANST impacts are included in the total impact to trails.
[b] Alternatives 3, 4a, 4b, and 4c would be located underground, and the construction and operation would not result in long-term impacts resulting from vegetation management. Therefore, long-term impacts to recreation would occur but would be due to limited aboveground structures

[18] Maps of the Project study area for recreation, including all recreational resources considered in this analysis, can be found in the Recreation Technical Report (http://www.northernpasseis.us/library/final-eis/technical-reports).

Short-term construction impacts would include closures of recreational resources and disruption of normal recreational activities and would be limited to the duration of construction, maintenance, and emergency repairs. Regarding impacts to trails, it is likely that trails would be closed at the trailhead during construction, limiting recreational use of portions of these trails beyond the portion directly impacted by construction activities. Short-term construction impacts of underground cable installation could persist for a longer duration, due to the more involved nature of construction.

Construction and operation of an overhead transmission line (including periodic vegetation management) would result in long-term visual impacts. These impacts may detract from the experience of users by affecting their sense of primitiveness and remoteness. There would be no long-term visual impacts resulting from underground cable.

Both Alternative 2 and Alternative 3 would cross the ANST at the existing PSNH transmission line crossing, Alternative 2, as an overhead line, and Alternative 3, as an underground cable. Under all other alternatives the Project would cross the ANST as an underground cable within an existing roadway corridor.

S.9.4 HEALTH AND SAFETY

Table S-7. Summary of Potential Health and Safety Impacts

Alternative	Summary of Impacts
1 (No Action)	No impacts.
2	Risks related to spills, hazardous materials, petroleum products, hazardous wastes, worker safety, public safety, and fires would be minimized through the implementation of APMs (see **Appendix H**). In particular, design measures would reduce risks related to extreme weather events. The Project would generate electric and magnetic fields (EMFs), but there would be no impact of the Project due to EMFs outside of the transmission route, and minimal (not harmful) potential impacts due to AC electric fields within the transmission route.
3	Risks related to spills, hazardous materials, petroleum products, hazardous wastes, worker safety, and fires would be similar to those of Alternative 2. Risks related to weather, public safety, and EMFs would be reduced because the cable would be buried. There could be an increased risk of unearthing hazardous materials and/or contaminated groundwater.
4a	Risks would be similar to those of Alternative 3 because both alternatives would be underground cable; however, there could be more transportation-related risks because the cable would be buried in a roadway corridor.
4b	Same as Alternative 4a
4c	Same as Alternative 4a
5a	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions
5b	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions
5c	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions
6a	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions
6b	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions
7 (Proposed Action)	Same as Alternative 2 for aboveground portions; same as Alternative 4a for underground portions

The Project could result in short-term and long-term impacts to health and safety related to construction, operation, maintenance, and emergency repairs. In general, construction and operation of the Project could create and/or increase risks related to: spills/leaks of hazardous materials, petroleum products, and hazardous wastes; exposure of contaminated soils or groundwater; damage to underground pipelines and utilities; fire hazards; fire support services; worker safety; EMFs; extreme weather events and natural disasters; and general public safety concerns. These risks could be either short-term impacts from construction or maintenance activities, or long-term impacts resulting from operation of the Project. These

risks could impact worker and public safety, as exposure to contaminated materials or a damaged transmission line can be dangerous.

Maintenance and emergency repair activities could include the same hazards as discussed for construction. Additional potential hazards during operation include EMFs, interference with an existing pipeline or utility, fallen lines or collapsed towers, lightning, extreme weather events, and fires at the transition stations, substations, or converter stations. The Applicant has committed to safety mitigation measures outlined in **Appendix H** and within the further amended Presidential permit application.

Installation of underground cable in roadways could create increased risks for workers, but these risks would be minimized through a transportation management plan (see **Appendix H**).

EMFs generated by underground portions of the Project would be below accepted limits. Overhead portions of the line, including HVDC and HVAC portions, would generate EMFs which would have no impact outside of the transmission route, and minimal impacts within the transmission route. There is no authoritative evidence that exposure to EMFs could increase or create a public health risk.

S.9.5 TRAFFIC AND TRANSPORTATION

Table S-8. Summary of Potential Traffic and Transportation Impacts – Roads within Study Area and Miles (km) Buried in Roadway Corridors

Alternative	Roadways within Study Area					Miles (km) Buried in Roadway Corridor
	Interstates	US Highways	State Highways	Local Roads	Total	
1 (No Action)	--	--	--	--	--	--
2	3	5	22	186	216	6 (10)
3	3	5	22	186	216	6 (10)
4a	3	6	22	440	471	173 (278)
4b	3	6	25	499	533	188 (303)
4c	3	6	22	574	605	179 (288)
5a	3	5	22	208	238	26 (42)
5b	3	5	22	199	229	19 (31)
5c	3	5	22	247	277	31 (50)
6a	3	5	22	413	443	137 (220)
6b	3	5	25	472	505	152 (245)
7 (Proposed Action)	3	5	24	283	315	58 (93)

Note: The study area is defined as the Project corridors. The names and locations of all roadways are analyzed in the Traffic and Transportation Technical Report (http://www.northernpasseis.us/library/final-eis/technical-reports).

Impacts to traffic along these roads would occur throughout the life of the Project, particularly during construction, maintenance, and emergency repairs. Impacts to roads in the study area would include short-term lane closures or full road closures resulting from the installation of the Project. For overhead portions of the Project, closures would be relatively short as the transmission line is suspended across the roadway. For portions of the Project located underground in roadway corridors, traffic closures would likely be longer in duration in order to excavate the trench in the road surface or shoulder.

For overhead portions of the Project, aviators flying in the area (including commercial and private planes) would be required to avoid new aboveground structures, but no impacts to air traffic are expected.

S.9.6 LAND USE

Table S-9. Summary of Potential Land Use Impacts

Alternative	Land Use Conversion acres (ha)[a]	Forest Plan Standards Inconsistencies[b]
1 (No Action)	--	--
2	454 (184) non-developed to Developed, Open Space	1) Forest-wide, Recreation General Standard S-2, 2) MA 8.3 – Appalachian National Scenic Trail, Recreation Standard S-2, 3) MA 8.3 – Appalachian National Scenic Trail, Scenery Management Standard S-1, and 4) MA 8.3 – Appalachian National Scenic Trail, Scenery Management Standard S-2
3	454 (184) non-developed to Developed, Open Space	--
4a	28 (11) non-developed to Developed, Open Space	--
4b	28 (11) non-developed to Developed, Open Space	
4c	28 (11) non-developed to Developed, Open Space	--
5a	454 (184) non-developed to Developed, Open Space	--
5b	454 (184) non-developed to Developed, Open Space	1) MA 8.3 – Appalachian National Scenic Trail, Scenery Management Standard S-1
5c	454 (184) non-developed to Developed, Open Space	--
6a	28 (11) non-developed to Developed, Open Space	--
6b	28 (11) non-developed to Developed, Open Space	--
7 (Proposed Action)	454 (184) non-developed to Developed, Open Space	--

Notes:
[a] This column summarizes the land area that would be converted to a different land cover type (as defined in the National Land Cover Dataset and Multi-Resolution Land Characteristics Consortium, see **Section 3.1.6.1**) as a result of the Project.
[b] This column summarizes the analysis of the Project in relation to management direction (specifically Standards) in the WMNF Forest Plan. Inconsistencies with Forest Plan Standards would require amendments to the Forest Plan. MA 8.3 is Management Area 8.3 – Appalachian National Scenic Trail.

The majority of the Project would be located either in the existing PSNH transmission route (Alternatives 2, 3, and portions of 5a, 5b, 5c, 6a, 6b, and 7) or in an existing roadway corridor (Alternatives 4a, 4b, 4c, and portions of 5a, 5b, 5c, 6a, 6b, and 7). Where the Project is located in these areas there would be minimal change to the existing land use. The portion of new transmission route in the Northern Section would result in the conversion of currently non-developed land into Developed, Open Space. This conversion could limit future uses of this private land.

Table S-9 includes a summary of potential impacts of the Project as they relate to USFS management of National Forest System (NFS) lands. The Forest Plan provides guidance for managing and protecting natural resources and visitors' experiences on all National Forest lands. Standards and guidelines are the specific, technical direction for managing resources. Forest-wide standards and guidelines apply across all WMNF lands and management activities, unless more restrictive direction exists for a management area (MA). Management Area standards and guidelines apply only to land allocated to a specific MA. Forest-wide, and within MAs, a *standard* is a course of action that must be followed, or a level of attainment that must be reached, to achieve management goals and objectives, and can only be changed through an amendment to the Forest Plan. A *guideline* also is a required course of action or level of attainment, but permits operational flexibility to respond to variations in conditions. Guidelines can be modified or not implemented if site-specific conditions warrant, but the rationale for doing so must be documented in a project-level analysis and signed decision.

Impacts to conservation lands (parcels that are mostly undeveloped and protected from future development) would occur during construction, operation, maintenance, and emergency repairs. Construction impacts (e.g., vegetation clearing) to aesthetic, wildlife, water, and recreation values of these lands would be short-term. Long-term impacts would include diminishment of landscape character, fragmentation of wildlife habitat, impacts to stream health, riparian habitat, wetlands, and vernal pools, and effects to the recreation experience. These impacts would be in addition to those already occurring from the existing PSNH transmission line. Impacts would be less for alternatives located underground in roadway corridors, where there are limited conservation values currently. Refer to the analyses of impacts to Visual Resources (see **Section S.9.1**), Recreation (see **Section S.9.3**), Wildlife (see **Section S.9.11**), Vegetation (see **Section S.9.12**), and Water Resources (see **Section S.9.13**) for more information.

No impacts to federally designated Wild and Scenic Rivers would be expected under any alternative. State protected rivers are located in the study area, and the Applicant would be required to comply with certain protection measures.

Portions of the Project located underground in roadway corridors could complicate future use of these ROWs, including NHDOT road maintenance and future utility installations.

The portion of the Alternative 3 corridor which would be located within the existing PSNH transmission route is governed by more than 644 separate easements or other agreements. A review of a representative sampling of these easements indicates the majority of the easements do not grant the Applicant the authority to install or operate underground transmission cables within the land governed by the easements. Therefore, in order for Alternative 3 to be implemented, the majority of these easements would need to be amended through agreement with each individual land owner.

S.9.7 NOISE

Table S-10. Summary of Potential Noise Impacts

Alternative	Audible Corona Noise Level (dBA) During Operations			Exceed EPA Guidance Level of 55 dBA
	HVDC Transmission Line (below conductors)	345 kV AC Transmission Line (below conductors)	345 kV AC Transmission Line (150 feet [46 m] from centerline)	
1 (No Action)	--	--	--	--
2	28	44	36	No
3	No audible corona noise associated with underground lines			
4a	No audible corona noise associated with underground lines			
4b	No audible corona noise associated with underground lines			
4c	No audible corona noise associated with underground lines			
5a	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			
5b	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			
5c	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			
6a	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			
6b	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			
7 (Proposed Action)	Overhead portions would be identical to Alternative 2; No audible corona noise associated with underground lines			

Noise impacts from construction would occur for all action alternatives on a short-term basis. These impacts would result from the operation of construction equipment, blasting, and other construction activities. APMs presented in **Appendix H** would limit the timing and reduce the duration of these impacts. APMs would be expected to keep noise levels below United States Department of Transportation (USDOT) guidelines throughout Project construction. Construction noise could be more impactful for alternatives including burial in roadway corridors because these alternatives would be located in closer proximity to residences and sensitive noise receptors.

The audible noise due to the corona effect would not exceed the EPA guidance level Ldn of 55 dBA for outdoor areas beyond the transmission line. There would be no audible corona noise associated with underground portions of the Project.

Ongoing maintenance activities would include periodic transmission route maintenance activities (e.g., mowing) and routine road maintenance such as grading to maintain the private and public dirt and gravel access roads in a passable condition. Noise generated during repair or maintenance of the transmission lines would occur intermittently and for short durations, and noise generated during helicopter inspections would be short-term and localized.

S.9.8 HISTORIC AND CULTURAL RESOURCES

Table S-11. Summary of Potential Impacts to Archaeological Resources – Construction

Alternative	Within Direct APE[a]	NRHP-Listed[b]	NRHP-Eligible[b]	Not Yet Evaluated for NRHP Eligibility[b]
1 (No Action)	--	--	--	--
2	49	--	--	49
3	49	--	--	49
4a	30	--	--	30
4b	35	--	--	35
4c	36	--	--	36
5a	44	--	--	44
5b	52	--	--	52
5c	57	--	--	57
6a	36	--	--	36
6b	41	--	--	41
7 (Proposed Action)	43	--	--	43
AC System Support Projects	6	--	--	6

Source: Claesson et al. 2014a, 2015a, 2015b; Claesson and Peone 2016; Freedman et al. 2015
[a] The Area of Potential Effects (APE) is defined in **Section 3.1.8.2**.
[b] The National Register of Historic Places (NRHP) is described in **Section 3.1.8**, including a discussion of the process of determining eligibility.

Table S-12. Summary of Potential Impacts to Archaeologically Sensitive Areas – Construction

Alternative	Within Direct APE	Total Land Area within Potentially Disturbed Areas acres (ha)
1 (No Action)	--	--
2	254	150 (61)
3	254	109 (44)
4a	174	125 (51)
4b	216	118 (48)
4c	270	120 (49)
5a	233	136 (55)
5b	252	145 (59)
5c	273	140 (57)
6a	198	158 (64)
6b	241	161 (65)
7 (Proposed Action)	308	123 (50)
AC System Support Projects	45	--

Source: Claesson et al. 2014a, 2015a, 2015b; Claesson and Peone 2016; Freedman et al. 2015

Table S-13. Summary of Potential Impacts to Architectural Resources – Construction

Alternative	Within Indirect APE	Within Direct APE	NRHP-Listed or -Eligible (within Indirect APE)	Not Yet Evaluated for NRHP Eligibility (within Indirect APE)
1 (No Action)	--	--	--	--
2	226	30	17	209
3	225	29	16	209
4a	230	174	49[a]	174
4b	259	248	50[a]	202
4c	347	320	57[a]	283
5a	230	53	17	213
5b	226	34	17	209
5c	232	49	17	215
6a	218	188	27[b]	190
6b	246	212	26[b]	219
7 (Proposed Action)	327	72	20	301
AC System Support Projects	62	--	0[c]	49

Source: Claesson et al. 2014b; Dunham et al. 2017; Higgins et al. 2015, 2016a, 2016b, 2016c, 2016d, 2016e, 2016f

[a] Seven previously evaluated architectural resources were determined to be not NRHP-eligible.

[b] One previously evaluated architectural resources was determined to be not NRHP-eligible.

[c] Thirteen previously evaluated architectural resources were determined to be not NRHP-eligible.

Potentially affected historic and cultural resources were identified within a defined study area called the area of potential effects (APE). DOE determined the APE through Section 106 consultation for the Project (36 CFR § 800.4(a)(1)). The APE is the geographic area within which the proposed Project may directly or indirectly cause alterations in the character or use of historic properties (36 CFR § 800.16(d)). The direct APE consists of the area that could be directly physically impacted by the Project. The indirect APE consists of the area in which other impacts, such as visual impacts, could occur. The direct and indirect APE also allow for the identification, evaluation, and assessment of potential cumulative effects to historic and cultural resources from the proposed Project. For more information about the APE, see **Section 3.1.8.2**. For more information about Section 106 consultation, see **Section 3.1.8.**

Both short- and long-term adverse effects to archaeological resources (or sites) and archaeologically sensitive areas from construction of the Project would potentially result from surface and subsurface ground disturbance.[19] Construction activities would be expected to have the potential to result in short-term, adverse visual impacts on cultural landscapes and other architectural resources for the duration of construction activities. These visual impacts would have the potential to temporarily alter the setting of these architectural resources, as well as temporarily alter views of and from these resources. In addition, construction activities would have the potential for long-term, adverse effects on cultural landscapes and architectural resources that are located within disturbance areas and which are removed or damaged during construction. Long-term, adverse visual impacts on these resources could occur if they result in changes to the settings of, or views to and from, these architectural resources.

Proposed APMs to avoid, minimize or mitigate adverse effects to historic and cultural resources have been developed by the Applicant and are listed in **Appendix H**. Potential adverse effects on historic properties will be addressed through DOE's Section 106 consultation, in accordance with the Section 106 PA (see

[19] Within archaeologically sensitive areas, there is considered to be a higher likelihood of encountering archaeological resources (sites).

Section 1.6 and **Appendix K**). Through the implementation of the PA, DOE and consulting parties will develop appropriate measures to avoid, minimize or mitigate adverse effects, which may include the proposed APMs.

DOE is addressing potential adverse effects to historic properties in accordance with Section 106 of the National Historic Preservation Act and its implementing regulations (see **Section 3.1.8.1**). DOE will continue to consult with the Advisory Council on Historic Preservation (ACHP), New Hampshire Division of Historic Resources (NHDHR), the Vermont Division of Historic Preservation (VTDHP), as well as additional consulting parties, to satisfy its obligations under Section 106 of the NHPA.

S.9.9 ENVIRONMENTAL JUSTICE

A detailed evaluation of U.S. Census block group data compared the demographic composition of "potentially affected" population (residing within 1,000 feet [305 m] of the Project) against the surrounding "unaffected" population on a county-by county basis. This evaluation was performed separately for each alternative. Three specific demographic measures were identified for each block group: the percentage of minority residents, the median household income, and the percentage of families living below the poverty level.

The demographic composition of the "potentially affected" groups compared to the surrounding "unaffected" population shows very little to no differences in the percentage of minority residents, percentage of families living below the poverty level, and median household income levels. In considering EO 12898, DOE has not identified the potential for disproportionately high and adverse impacts that would affect minority or low-income populations under any of the action alternatives. Specific demographic data are presented for each geographic section in **Chapter 4**, **Sections 4.2.9, 4.3.9, and 4.4.9**.

S.9.10 AIR QUALITY

Table S-14. Summary of Potential Impacts to Air Quality - Construction Emissions and Loss of CO_2 Uptake from Vegetation Removal

Alternative	Total Construction Emissions (Entire Construction Period)							Loss of Carbon Sink from Forest Removal (metric tons CO_2)
	Criteria Pollutants (tons)						GHG Emissions (metric tons)	
	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2	
1 (No Action)	--	--	--	--	--	--	--	--
2	365	32	229	5	724	123	91,930	215,068
3	164	17	150	0	421	61	33,734	66,737
4a	134	14	124	0	336	48	27,663	16,599
4b	141	15	130	0	356	51	28,910	17,283
4c	140	14	129	0	353	51	28,744	17,226
5a	362	32	235	5	729	122	89,894	186,921
5b	374	33	241	5	749	126	93,288	206,295
5c	365	32	237	5	738	123	90,615	189,159
6a	183	18	149	1	414	63	41,440	16,711
6b	190	18	155	1	433	66	42,687	17,411
7 (Proposed Action)	333	30	222	4	691	114	81,529	159,651

Under all action alternatives, construction of the Project would result in the short-term emissions of nitrogen oxides, carbon monoxide, and carbon dioxide. Because portions of the Southern Section are located within nonattainment or maintenance areas, the General Conformity Rule would apply.[20] However, construction emissions would not exceed General Conformity *de minimis* thresholds within the applicable counties. Additionally, vegetation removal associated with construction (widening the existing, or creating a new, transmission route, and other infrastructure such as the converter station) would result in the loss of CO_2 uptake capacity. Additionally, the construction of the Scobie Pond Substation would result in the short-term emission of less than 3 metric tons of NO_x, approximately 2 metric tons of CO, and 601 metric tons of CO_2. This impact would be identical for all alternatives.

The electricity provided to the ISO-NE region from the Project could result in a decrease in the use of fossil fuels for thermal electricity generation. The reduction in CO_2 emissions from implementation of the Project could be approximately 2.8 million metric tons of CO_2 annually in 2030, over a 10 percent decrease from existing levels for alternatives with a 1,200 MW capacity, or 2.5 million metric tons of CO_2 per year, over a 9 percent decrease from existing levels for alternatives with a 1,090 MW capacity.

S.9.11 WILDLIFE

Table S-15. Summary of Potential Impacts to Wildlife Habitat

Alternative	Impacts to Wildlife Habitat acres (ha)
1 (No Action)	--
2	1,838 (744)
3	1,295 (524)
4a	295 (119)
4b	308 (125)
4c	296 (120)
5a	1,663 (673)
5b	1,770 (716)
5c	1,674 (677)
6a	426 (172)
6b	439 (178)
7 (Proposed Action)	1,494 (605)

A total of 5 federally- and 24 state-listed wildlife species have the potential to occur in the study area and were therefore considered in this analysis. For the majority of these federally- and state-listed species, there is no difference in effects determinations between action alternatives.

[20] The General Conformity Rule was promulgated by the EPA to ensure that the actions of federal departments or agencies conform to applicable state implementation plans (see **Section 3.1.10.1** for more information). The towns of Allenstown, Pembroke, and Concord, NH, in Merrimack County and Deerfield, NH, in Rockingham County have been designated as the Central New Hampshire area, which is in nonattainment for the 2010 SO_2 NAAQS.

Table S-16. Determination Summary of Potential Project-wide Effects for Federally-Listed Wildlife Species

Species[a]	Determination of Effects by Alternative[b]
Canada Lynx (*Lynx canadensis*) FT, SE	**Impact for All Alternatives:** No lynx or suitable denning habitat located within study area; suitable foraging habitats are prevalent throughout the Northern Section. **ESA Determination for Alternatives 2, 3, 5a, 5b, 5c, and 7:** "May Affect, but is not Likely to Adversely Affect" **ESA Determination for Alternatives 4a, 4b, 4c, 6a, and 6b:** "No Effect" (Suitable habitat not located in study area)
Dwarf Wedgemussel (*Alasmidonta heterodon*) FE, SE	**Impact for All Alternatives:** Not detected in study area during Project-specific surveys, but could be present downstream.[b] **ESA Determination for All Alternatives:** "May Affect, but Not Likely to Adversely Affect"
Indiana Bat (*Myotis sodalis*) FE	**Impact for All Alternatives:** Localized, short-term effects resulting from disturbance/displacement during construction. **ESA Determination for All Alternatives:** "May Affect, but Not Likely to Adversely Affect"
Karner Blue Butterfly (*Lycaeides melissa samuelis*) FE, SE	**Impact for Alternatives 2, 3, 5a, 5b, 5c, 6a, 6b, and 7:** Localized, short-term effects resulting from disturbance/displacement during construction and maintenance actions, particularly in the Southern Section where wild lupine stands (the Karner Blue Butterfly host-plant) exist. **ESA Determination for Alternatives 2, 3, 5a, 5b, 5c, 6a, 6b, and 7:** "May Affect, and is Likely to Adversely Affect" **ESA Determination for Alternatives 4a, 4b, and 4c:** "No Effect" (Suitable habitat not located in study area)
Northern Long-eared Bat (*Myotis septentrionalis*) FT, ST	**Impact for All Alternatives:** Localized, short-term effects resulting from disturbance/displacement during construction and maintenance actions. **ESA Determination for All Alternatives:** "May Affect, but Not Likely to Adversely Affect"

Notes:
[a] Only species for which there are differences in effects determinations between action alternatives are listed in the table. All other federally-listed species have the same effects determinations for all action alternatives.
[b] Study area is defined as the extent of disturbance for each of the alternatives.
DOE (or its sub consultant) has made the determinations, based on the most current analysis. Current coordination/ consultation with the USFWS, USFS, and NHFG, may influence the final determinations.
Suitable habitat is located within the study area unless otherwise noted.
Key: FT = federally-threatened; FE = federally-endangered; SE = state-endangered; ST = state-threatened

For the majority of the 24 state threatened and endangered species considered in this analysis, localized, short-term, adverse effects would occur from disturbance/displacement during construction and maintenance actions. For the state threatened and endangered species with differences in impacts between action alternatives, the results are presented below.

Table S-17. Summary of Potential Project-wide Effects for State Threatened and Endangered Wildlife Species

Species[a]	Effects by Alternative[b]
Fish	
Bridle Shiner (*Notropis bifrenatus*) ST	**Alternative 2, 5a, 5b, and 5c:** No effect for construction and maintenance actions. **Buried Alternatives in Central and Southern Sections (including sections of Alternatives 3, 4a, 4b, 4c, 6a, 6b, and 7)**: localized, short-term, adverse effects resulting from disturbance/displacement during construction and maintenance actions.
Invertebrates	
Brook Floater Mussel (*Alasmidonta varicosa*) SE	**Alternative 2, 5a, 5b, 5c, 6a, 6b, and 7:** No effect for construction and maintenance actions. **Buried Alternatives in Southern Section (including sections of Alternatives 3, 4a, 4b, 4c)**: localized, short-term, adverse effects resulting from disturbance/displacement during construction and maintenance actions.

Notes:
[a] The list of species are all of those known to occur in the State of New Hampshire.
[b] Study area is defined as the extent of disturbance for each of the alternatives.
DOE (or its sub consultant) has made the determinations, based on the most current analysis to-date. Future coordination/consultation with the USFWS, USFS, and NHFG, may influence the final determinations.
Key: SE = State Endangered; ST = State Threatened; RFSS = Regional Forester Sensitive Species

Impacts to terrestrial species could involve direct mortality or injury to individuals, sensory disturbance, and increased depredation. Construction of the Project would result in habitat loss and modification. Habitat loss and/or modification of existing habitats in the study area during construction would also have adverse impacts on wildlife resources. The potential for wildlife collisions with vehicles traveling during construction along access roads or Project corridors would increase, causing increased mortalities and/or injuries. Populations of most wildlife species are prevalent in the state of New Hampshire and individuals from adjacent undisturbed habitats would be expected to return to the Project corridors following construction. While adverse impacts to wildlife in the form of mortality or physical injury could occur, no population-level effects are expected and the majority of adverse effects would be short-term.

Impacts to aquatic species could involve direct mortality or injury to individuals, sensory disturbance including noise, ground disturbance, turbidity, or visual activity, and increased depredation. With the application of APMs, avoidance of in-stream disturbance, and restoration of aquatic habitat following construction (see APMs in **Appendix H**), impacts to aquatic species would be minimized. Underground portions of the Project would result in additional impacts to aquatic species resulting from construction activity at waterbody crossings. Impacts would include habitat disturbance in trench areas and suspension of sediments, resulting in short-term, adverse impacts at the specific waterbody crossings. Impacts to aquatic habitat, including bank and channel disturbance, could be avoided through the use of horizontal directional drilling (HDD).

S.9.12 VEGETATION

Table S-18. Summary of Potential Impacts to Vegetation

Alternative	Impacts to Vegetated Habitats (including Forestlands) acres (ha)	Impacts to Forestlands acres (ha)
1 (No Action)	--	--
2	1,682 (681)	747 (302)
3	1,144 (463)	233 (94)
4a	159 (64)	58 (23)
4b	157 (94)	60 (24)
4c	132 (53)	60 (24)
5a	1,505 (609)	651 (263)
5b	1,607 (650)	717 (290)
5c	1,504 (609)	659 (269)
6a	306 (124)	58 (23)
6b	303 (123)	60 (24)
7 (Proposed Action)	1,303 (527)	558 (226)

A total of 95 federally- and state-listed plant species have the potential to occur in the study area and were therefore considered in this analysis. For the majority of these federally- and state-listed species (50 total species), there is no difference in effects determinations between the action alternatives. For these species, the following effects determination applies: "No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs (**Appendix H**), no population-level impacts are expected."

For four species analyzed (alpine brook saxifrage, diapensia, mountain sorrel, and Robbins' cinquefoil), it was determined that there is no suitable habitat in the study area and there would therefore be no effect. No federally-listed small whorled pogonia individuals were identified during Project-specific surveys or in state databases, but if populations are present in the study area, impacts to individuals could occur but no population-level impacts would be expected. The ESA determination for the small whorled pogonia for all action alternatives is: "May Affect, but Not Likely to Adversely Affect." For all species considered, no population-level impacts are expected from any action alternative.

Table S-19 presents the effects determinations for species which vary among the action alternatives.

Table S-19. Comparison of Project-wide Potential Effects for State-Listed Plant Species

Species	Effects by Alternative
Allegheny-vine/Climbing fumitory (*Adlumia fungosa*), SE	**Impacts for Alternatives 4a, 4b,4c, 6a, and 6b:** Known populations in the study area in Lancaster, NH based on NHB data (NHB 2014); impacts to individuals are expected; with the application of APMs, no population-level impacts are expected. **Impacts for Alternatives 2, 3, 5a, 5b, 5c, and 7:** if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Alpine manzanita (*Arctostaphylos alpina*), RFSS	**Impacts for Alternatives 2, 3, 5a, 5b, 5c, and 7:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 6a, and 6b:** No effect, study area does not cross suitable habitat.
Red threeawn (*Aristida longespica* var. *geniculata*), SE	**Impacts for Alternatives 2, 3, 5a, 5b, 5c, 6a,6b, and 7:** Known populations in the study area in the towns of Concord and Pembroke based on NHB data (NHB 2014); impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 4a, 4b, and 4c:** if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Clasping milkweed (*Asclepias amplexicaulis*), ST	**Impacts for Alternatives 2, 3, 5a, 5b, 5c, 6a, 6b, and 7:** Known populations in the study area in the Town of Concord based on NHB data (NHB 2014); impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 4a, 4b, and 4c**: if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Dwarf white birch (*Betula minor*), RFSS	**Impacts for Alternatives 2, 3, 5a, 5b, and 5c:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, , 6a, and 6b:** No effect, study area does not cross suitable habitat.
Wiegand's sedge (*Carex wiegandii*), RFSS, SE	**Impacts for Alternatives 2 and 3:** Known populations in the study area in the Town of Lincoln based on NHB data (NHB 2014); impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Faxon's hawthorn (*Crataegus faxonii*), SE	**Impacts for Alternative 7:** Known populations in the study area in the Towns of Franconia and Sugar Hill, NH, based on NHB data (NHB 2014); impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 2, 3, 4a, 4b, 4c, 5a, 5b, 5c, 6a, and 6b:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Mountain avens (*Geum peckii*), RFSS, ST	**Impacts for Alternatives 2 and 3:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** No effect, study area does not cross suitable habitat.

Table S-19. Comparison of Project-wide Potential Effects for State-Listed Plant Species

Species	Effects by Alternative
Wild lupine (*Lupinus perennis*) ST	**Impacts for Alternatives 2, 3, 5a, 5b, 5c, 6a, 6b, and 7:** Project-specific floristic surveys and NHB data (NHB 2014) identified several populations in Concord and Pembroke, NH within the study area; impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 4a, 4b, and 4c:** if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Alpine arctic cudweed (*Omalotheca supine*), RFSS, SE	**Impacts for Alternatives 2 and 3:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** No effect, study area does not cross suitable habitat.
Boott's rattlesnake-root (*Prenanthes boottii*), RFSS, ST	**Impacts for Alternatives 2 and 3:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** No effect, study area does not cross suitable habitat.
Satiny willow (*Salix pellita*), SE	**Impacts for Alternatives 4a, 4b, 4c, 6a, and 6b:** Known populations in the study area in the towns of Clarksville and Stewartstown, based on NHB data (NHB 2014); impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 2, 3, 5a, 5b, 5c, and 7:** If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.
Arizona cinquefoil (*Sibbaldia procumbens*), RFSS	**Impacts for Alternatives 2 and 3:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** No effect, study area does not cross suitable habitat.
Moss campion (*Silene acaulis* var. *exscapa*), RFSS	**Impacts for Alternatives 2 and 3:** No individuals observed during Project-specific field surveys nor listed in the NHB database for the study area (NHB 2014). If populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected. **Impact for Alternatives 4a, 4b, 4c, 5a, 5b, 5c, 6a, 6b, and 7:** No effect, study area does not cross suitable habitat.
Licorice goldenrod (*Solidago odora*) ST	**Impacts for Alternatives 2, 3, 5a, 5b, 5c, and 7:** NHB data (NHB 2014) identified several populations in Pembroke, NH within the study area; impacts to individuals are expected. With the implementation of APMs, no population-level impacts are expected. **Impacts for Alternatives 4a, 4b, 4c, 6a, and 6b:** if populations are present within the study area, impacts to individuals could occur; with the application of APMs, no population-level impacts are expected.

Source: NHB 2014 and USDA Forest Service 2012a
Notes: Geographic regions were identified using the USDA NRCS (2015a).
Key: RFSS = Regional Forester Sensitive Species; SE = state-endangered; ST = state-threatened

Both short-term and long-term impacts to vegetation would occur during construction. The potential impacts could result from vegetation disturbance and overstory vegetation removal. Long-term impacts would also result from operation, maintenance, and emergency repairs resulting from ongoing vegetation removal. Impacts would consist of those relating to clearing of vegetation for tower installation or line burial, service roads, and staging areas along and within the transmission route, access roads, converter stations, and substations (including the potential removal of listed plant species), maintenance of vegetation clearing so as not to interfere with aboveground or underground components, as well as the short-term and long-term disturbance in sensitive habitats.

Forest-cover located within the Project corridors would be permanently removed, although many areas would return to a scrub-shrub/young sapling state, providing many important functions of wildlife habitat. Forested wetland communities would be converted to scrub-shrub and herbaceous wetland communities, which would persist during operation of the Project. Implementation of APMs listed in **Appendix H**, including vegetation management and maintenance in accordance with the NHDFL's *Best Management Practices for Utility Maintenance,* would minimize adverse effects related to the Project. The conversion of forestlands to herbaceous or shrub communities would change the vegetation community species composition and suitability for a variety of wildlife species but would not be expected to have any population-level effects to vegetation resources because the majority of affected vegetation species are abundant in other parts of the state and region.

Invasive plant species, including noxious weeds, could be introduced and spread through introduction of plant propagules on construction equipment. Soil disturbance and compaction could potentially present conditions for such species to colonize, potentially resulting in both short-term and long-term adverse impacts. Implementation of the APMs (**Appendix H**), specifically an Invasive Species Management Plan, would minimize impacts to vegetation resources. Alternatives including buried transmission cable could have an increased risk for spreading invasive plant species because the areas of linear exposed soils could provide conditions for such species to colonize.

Fragmentation of contiguous vegetation communities or mature forest blocks associated with the creation and maintenance of a new transmission route in the Northern Section (included in Alternatives 2, 3, 5a, 5b, 5c, and 7) is a potential long-term impact that would extend throughout operation. It should be noted that for shade-tolerant plants, forest fragmentation and the creation of a new transmission route would decrease the extent of suitable habitat. However, the creation of a new transmission route would create new habitat for a variety of shade intolerant species.

Loss of forest cover in the transmission route could result in a potential long-term loss of biodiversity. However, the loss of forest cover in the transmission route and alterations of species composition along the transmission route edges would not result in regional impacts because the size of the impacted area would be negligible compared to the extensiveness of forest cover in surrounding areas. Plant species diversity could potentially increase locally through maintenance of the transmission routes in early successional plant communities, and potential creation of early successional wetlands in poorly drained areas. Any potential long-term effects associated with fragmentation and loss of biodiversity would be less for the underground cable due to the narrower transmission route (including portions of new transmission route in the Northern Section) and the previously-disturbed nature of roadway corridors.

S.9.13 WATER RESOURCES

Table S-20. Summary of Potential Impacts to Water Resources

Alternative	Wetland Disturbance acres (ha)			Impacts to Vernal Pools acres (ha)	Disturbance in Locations Overlying Aquifers acres (ha)	Disturbance in FEMA Flood Zones[a] acres (ha)	Miles (km) of Impaired Rivers Crossed	Disturbance to Water Supply Resources		
	Direct	Temporary	Secondary					PWS Wells	SWPAs acres (ha)	WHPAs acres (ha)
1 (No Action)	--	--	--	--	--	--	--	--	--	--
2	2 (0.8)	212 (86)	37 (15)	<0.5 (<0.5)	304 (123)	1,782 (721)	<0.5 (<0.8)	--	1,491 (603)	161 (65)
3	3 (1)	194 (79)	15 (6)	<0.5 (<0.5)	223 (90)	1,250 (506)	<0.5 (<0.8)	--	1,104 (447)	112 (45)
4a[b]	3 (1)	3 (1)	<0.5 (<0.2)	--	117 (47)	275 (111)	<0.5 (<0.8)	--	312 (126)	27 (11)
4b[b]	3 (1)	3 (1)	<0.5 (<0.2)	--	130 (52)	287 (116)	<0.5 (<0.8)	--	343 (139)	28 (11)
4c[b]	2 (0.8)	3 (1)	<0.5 (<0.2)	--	125 (51)	274 (111)	<0.5 (<0.8)	--	325 (132)	26 (11)
5a	2 (0.8)	182 (74)	36 (15)	<0.5 (<0.5)	299 (121)	1,606 (650)	<0.5 (<0.8)	--	1,204 (488)	165 (66)
5b	2 (0.8)	198 (80)	37 (15)	<0.5 (<0.5)	308 (124)	1,714 (693)	<0.5 (<0.8)	--	1,404 (569)	161 (65)
5c	2 (0.8)	183 (74)	36 (15)	<0.5 (<0.5)	311 (126)	1,618 (655)	<0.5 (<0.8)	--	1228 (497)	161 (65)
6a[b]	1 (<0.5)	23 (9)	<0.5 (<0.5)	--	194 (79)	407 (165)	<0.5 (<0.8)	--	443 (179)	75 (30)
6b[b]	1 (<0.5)	23 (9)	<0.5 (<0.5)	--	207 (84)	420 (170)	<0.5 (<0.8)	--	474 (192)	77 (31)
7 (Proposed Action)	2 (0.8)	170 (69)	36 (15)	<0.5 (<0.5)	264 (107)	1,438 (582)	<0.5 (<0.8)	--	1,036 (420)	87 (35)

Note: A vernal pool is a seasonal depressional wetland covered by shallow water for variable periods (often during winter or spring) that may be completely dry during summer and fall. An impaired river is a waterbody identified as impaired according to Section 303(d) of the Clean Water Act. A Public Water Supply (PWS) is defined as a piped water system having its own source of supply, serving 15 or more services or 25 or more people, for 60 or more days per year. Source Water Protection Areas (SWPAs) and Wellhead Protection Areas (WHPAs) are defined and regulated by the NH Department of Environmental Services under the NH State Drinking Water Act and federal Safe Drinking Water Act.

[a] Including all FEMA Flood Zones (Zone A, Zone AE, and Zone X).

[b] No vernal pools were identified in the Project corridor. Additional surveys may be conducted, as necessary.

The Project would result in short-term and long-term impacts to water resources related to construction, operation, maintenance, and emergency repairs. Overhead configurations would span the majority of streams, rivers, and riparian areas and minimize impacts to these resources. In areas where transmission cables would be buried, measures would be taken to minimize impacts, including directionally drilling under larger channels and replacing culverts where necessary. Although there would be some secondary water quality and habitat effects from canopy reduction, mitigation would be undertaken to address those effects. APMs to minimize water resource and wetland impacts can be found in **Appendix H**.

Direct impacts to wetlands include permanent construction, temporary impacts include clearing but no loss of function within various wetland types. Secondary impacts include the conversion of palustrine forested (PFO) wetlands to palustrine emergent (PEM) and palustrine scrub-shrub (PSS) wetlands within a 100-ft buffer near stream crossings. Wetland impacts would be much less extensive under alternatives located underground in roadway corridors because there are fewer wetland resources adjacent to roadways compared with the new transmission route and existing PSNH transmission route, and the area of disturbance for these alternatives is smaller (i.e., disturbance would primarily occur on a road surface). Impacts to wetlands under Alternative 3 are considered temporary; however, due to the amount of trenching proposed, there would be an increased risk of damage to wetland function and values.

Water resources potentially affected by construction would include watersheds, surface water, groundwater, floodplains, and wetlands. General short-term construction impacts would include changes or modification of groundwater or surface water (streams and rivers) quantity and/or quality, potential sedimentation, changes in water flow patterns, increased bedrock fracturing near rock blasting areas (temporarily affecting turbidity in groundwater wells near the blast zone), and increased turbidity in surface water. In general, aboveground facilities would be able to span wetlands and waterbodies, thereby reducing potential impacts.

Impacts to water resources from underground construction would be similar to aboveground construction, except that soil disturbance and resulting erosion and sedimentation would be greater from short-term construction activities, such as excavation of the trench. Trenching would result in impacts on water quality from increased turbidity, potential downstream sedimentation, changes in water flow patterns, and increased likelihood of pollutants reaching waterbodies. Stream crossings could include installation methods for minimizing short-term construction impacts to water quality including trenching or HDD, and/or attaching to existing infrastructure such as bridges. HDD would have the potential for leaks of HDD drilling fluid, which could cause drilling fluid to become suspended or dispersed, impacting water quality.

All action alternatives also include an expansion of the Scobie Pond Substation. This activity would impact 0.2 acre (0.1 ha) of wetlands, no vernal pools, 5 acres (2 ha) overlying aquifers, 5 acres (2 ha) in FEMA flood zones, and less than 0.1 mile (0.2 km) of CWA 303(d) impaired waterbodies. The impacts of other structures, including converter stations and the Deerfield Substation, are captured in **Table S-20**.

S.9.14 GEOLOGY AND SOILS

Table S-21. Summary of Potential Impacts to Geologic and Soil Resources

Alternative	Total Ground Disturbance acres (ha)	Disturbance to All Hydric Soils acres (ha)	Disturbance to Prime Farmland, Farmland of Statewide Importance, or Farmland of Local Importance acres (ha)
1 (No Action)	--	--	--
2	1,838 (744)	48 (19)	465 (188)
3	1,295 (524)	51 (21)	345 (140)
4a	295 (119)	7 (3)	103 (42)
4b	308 (125)	7 (3)	111 (45)
4c	296 (120)	6 (2)	109 (44)
5a	1,663 (673)	47 (19)	421 (170)
5b	1,770 (716)	49 (20)	462 (187)
5c	1,674 (677)	47 (19)	431 (174)
6a	426 (172)	13 (5)	210 (85)
6b	439 (178)	13 (5)	219 (89)
7 (Proposed Action)	1,494 (605)	48 (19)	399 (161)

The majority of soil impacts would be short-term and occur during the construction phase. Overstory vegetation removal and ground disturbance associated with clearing and widening the transmission route, constructing laydown areas, and other construction activities would likely result in short-term soil erosion. These impacts would be expected to be localized and extend primarily through the construction period, especially if these features are returned to their pre-existing condition.

Blasting could be used during construction in localized areas for any action alternative, potentially resulting in impacts to surficial geology. While there are several geologic faults within the study area, the likelihood that an earthquake strong enough and close enough to the Project corridor to result in any impacts is low.

Long-term soil impacts would result from clearing and grading for permanent access/maintenance roads, transmission structures, transition stations, converter stations, and the expansion of the Deerfield Substation. These activities could result in compaction and erosion.

The impact of underground cable, and particularly Alternative 3, would be greater than for an overhead line. While the total area of ground disturbance for alternatives including overhead transmission is greater than the area of disturbance for the installation of underground cable, the impacts would require more grading, trenching, and other excavation along with backfilling resulting in more soil disturbance and exposure to erosion during construction. Impacts on soils from construction of the underground cable using directional drilling would be localized and impacts would not be expected with the implementation of APMs for erosion, sediment control, and restoration of the disturbed Project corridor (see **Appendix H**). The impact of cable burial in roadway corridors would be generally less than burial in the new or existing PSNH transmission route because much of the disturbance would be limited to the road surface.

S.9.15 CUMULATIVE IMPACTS

Cumulative impacts are presented in **Chapter 5**, **Section 5.1** for all alternatives and resources considered. Past, present, and reasonably foreseeable future actions that could, with implementation of the Project, have cumulative environmental impacts are listed in **Appendix D**. Fourteen projects were considered, as appropriate for each resource, in four general categories: transportation (e.g., NHDOT Transportation Projects), energy (e.g., Future Wind Projects), regional (e.g., General Regional/County Growth), and miscellaneous (e.g., City of Franklin Brownfield Project – Former Guay's Garage).

Multiple activities occurring at the same time and in the same vicinity would have greater impacts than just one project. Alternatives that involve the majority of the transmission line being constructed aboveground (Alternatives 2, 5a, 5b, 5c, and 7) would result in a moderate contribution to cumulative impacts on visual resources and soils and geology; a moderate beneficial contribution to cumulative impacts at a more localized scale on socioeconomics; a minor contribution to cumulative impacts on recreation, health and safety, noise, wildlife, vegetation, and water resources; a negligible contribution to cumulative impacts on land use; no cumulative impact to environmental justice; and a long-term beneficial contribution to cumulative impacts on air quality. Alternative 2 would result in a negligible contribution to cumulative impacts on traffic and transportation. Alternatives 5a, 5b, 5c, and 7 would result in a substantial short-term contribution to traffic and transportation. Depending on the resource, the impacts would be short-term and/or long-term in duration.

Alternatives that involve the majority of the transmission line being buried (Alternatives 3, 4a, 4b, 4c, 6a, and 6b) would result in limited vegetation clearing and impacts to wildlife and wildlife habitat, direct mortality to certain wildlife species, soil disturbance and erosion, stormwater runoff, increased noise levels, increased construction traffic and traffic delays along roadways, increased short-term emissions, decreased long-term air emissions, limited changes to land use, increases in health and safety concerns and roadway workers, changes in socioeconomic indicators, and potential impacts to historic and cultural resources. The alternatives that would be constructed underground along existing roadways (Alternatives 4a, 4b, 4c, 6a, and 6b) would impose the fewest environmental impacts due to the lack of visual impacts and use of already disturbed roadway corridors. Multiple activities occurring at the same time and in the same vicinity would have greater impacts than just one project. Alternatives 3, 4a, 4b, 4c, 6a, and 6b would result in a moderate beneficial contribution to cumulative impacts at a more localized scale on socioeconomics; a minor contribution to cumulative impacts on noise, vegetation, and water resources; a negligible contribution to cumulative impacts on visual resources, recreation, health and safety, and land use; no cumulative impact to environmental justice; and a long-term beneficial contribution to cumulative impacts on air quality. Alternative 3 would result in a moderate contribution to cumulative impacts on soils and geology; a minor contribution to cumulative impacts on wildlife; and a negligible contribution to cumulative impacts on traffic and transportation. Alternatives 4a, 4b, 4c, 6a, and 6b would result in a substantial short-term contribution to cumulative impacts on traffic and transportation and a negligible contribution to cumulative impacts on soils and geology. Depending on the resource, the impacts would be short-term and/or long-term in duration.

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Map 19: Alternative 7 Comparison Map

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Québec
Coös County
VT
ME
White Mountain National Forest
Grafton County
Belknap County
Merrimack County
Rockingham County
Atlantic Ocean
MA

Legend

- State Boundary
- County Boundary
- Alternative Project Alignments
- Waterbody
- Existing PSNH Transmission Route

Geographic Sections

- Northern Section
- Central Section
- Southern Section
- White Mountain National Forest

SOURCE: ESRI 2012

Map 1:
Vicinity Map and Geographic Sections
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
0 8 16 Miles

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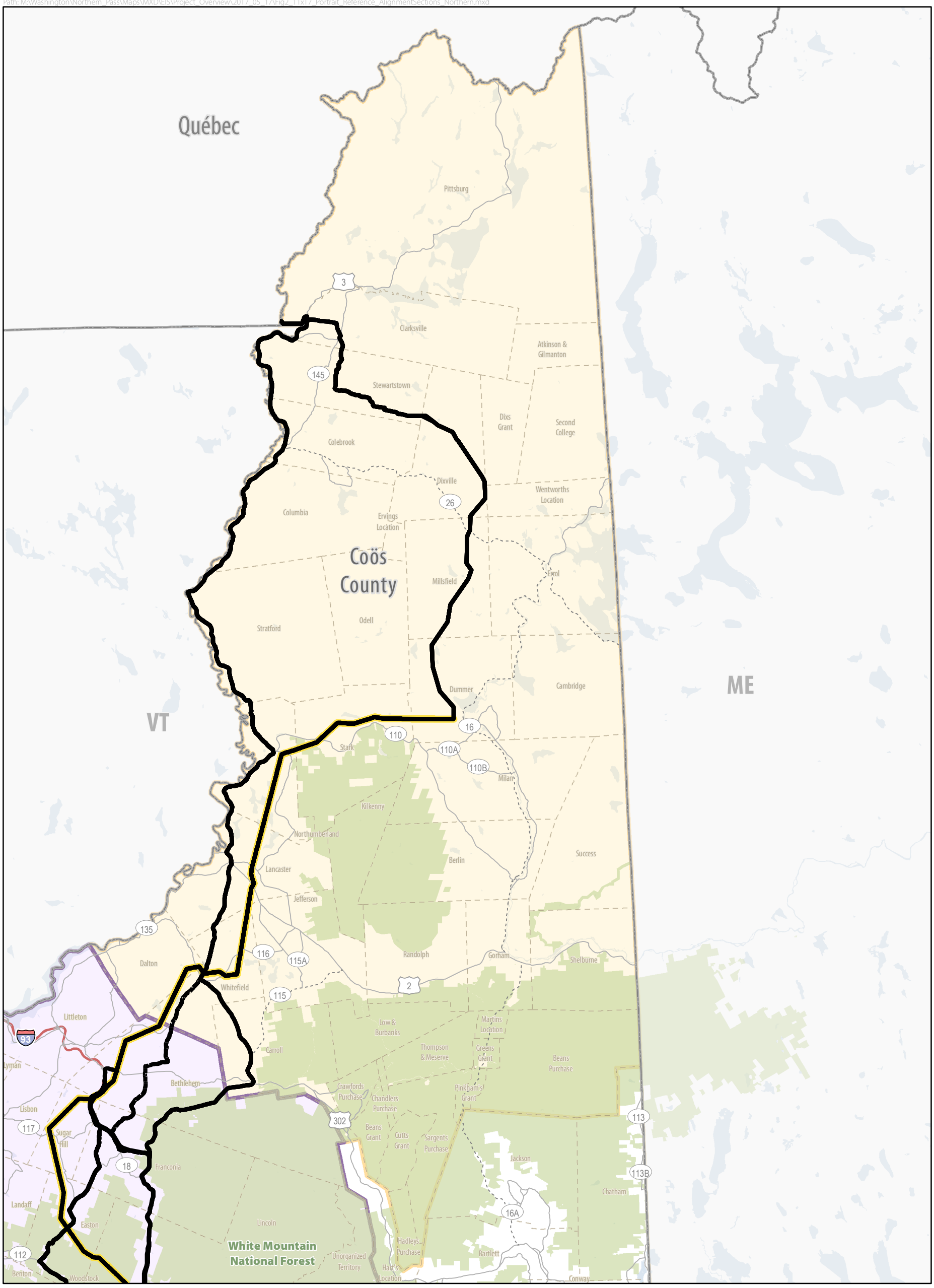

Legend

- State Boundary
- Political Boundary
- County Boundary
- Alternative Project Alignments
- Waterbody
- Existing PSNH Transmission Route

Geographic Sections

- Northern Section
- Central Section
- Southern Section
- White Mountain National Forest

SOURCE: ESRI 2010; ESRI 2012

Map 2:
Northern Section
Northern Pass Transmission Line Project
New Hampshire

N

SCALE

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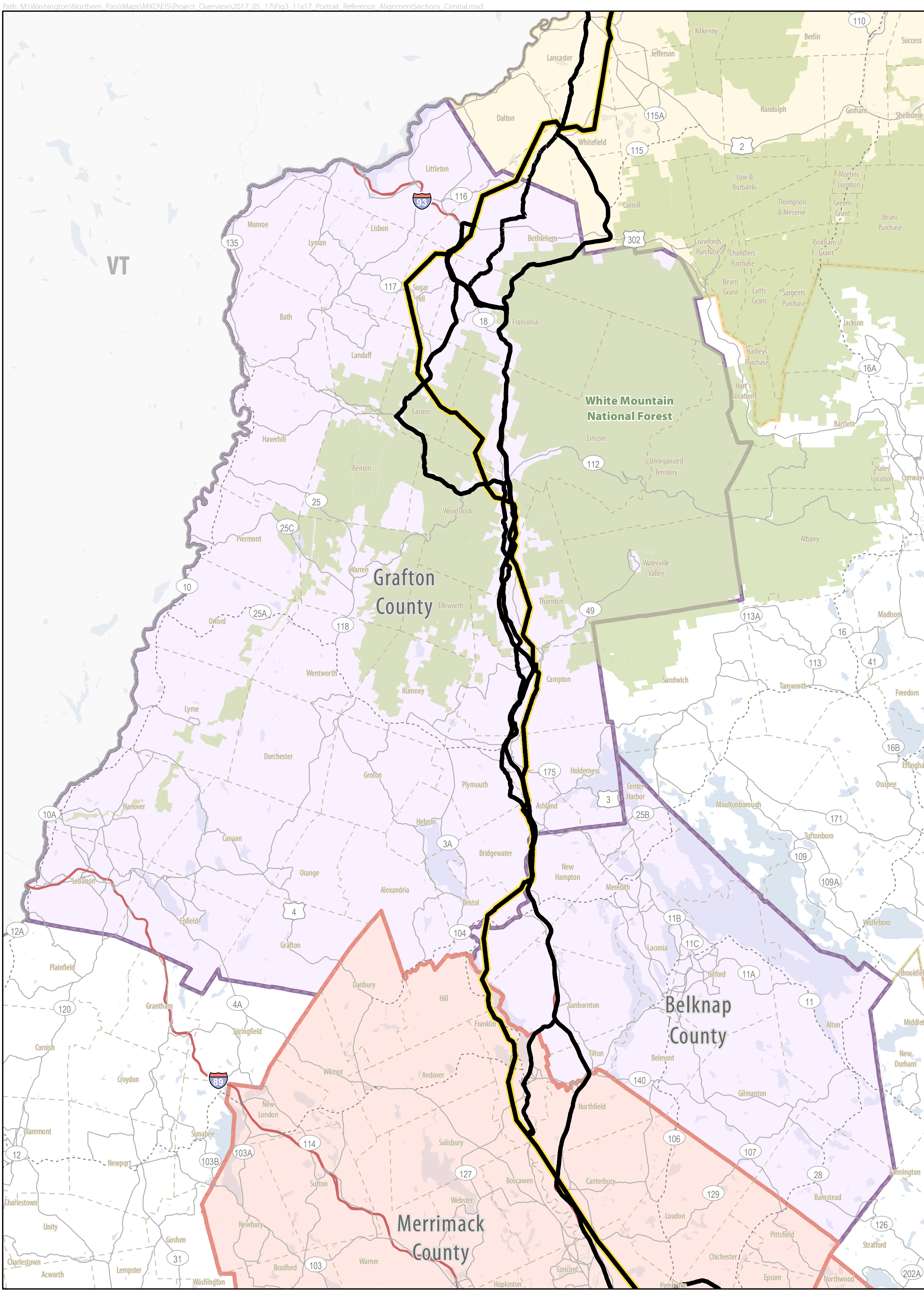

Legend

- State Boundary
- Political Boundary
- County Boundary
- Alternative Project Alignments
- Waterbody
- Existing PSNH Transmission Route

Geographic Sections

- Northern Section
- Central Section
- Southern Section
- White Mountain National Forest

SOURCE: ESRI 2010; ESRI 2012

Map 3:

Central Section

Northern Pass Transmission Line Project
New Hampshire

N

SCALE

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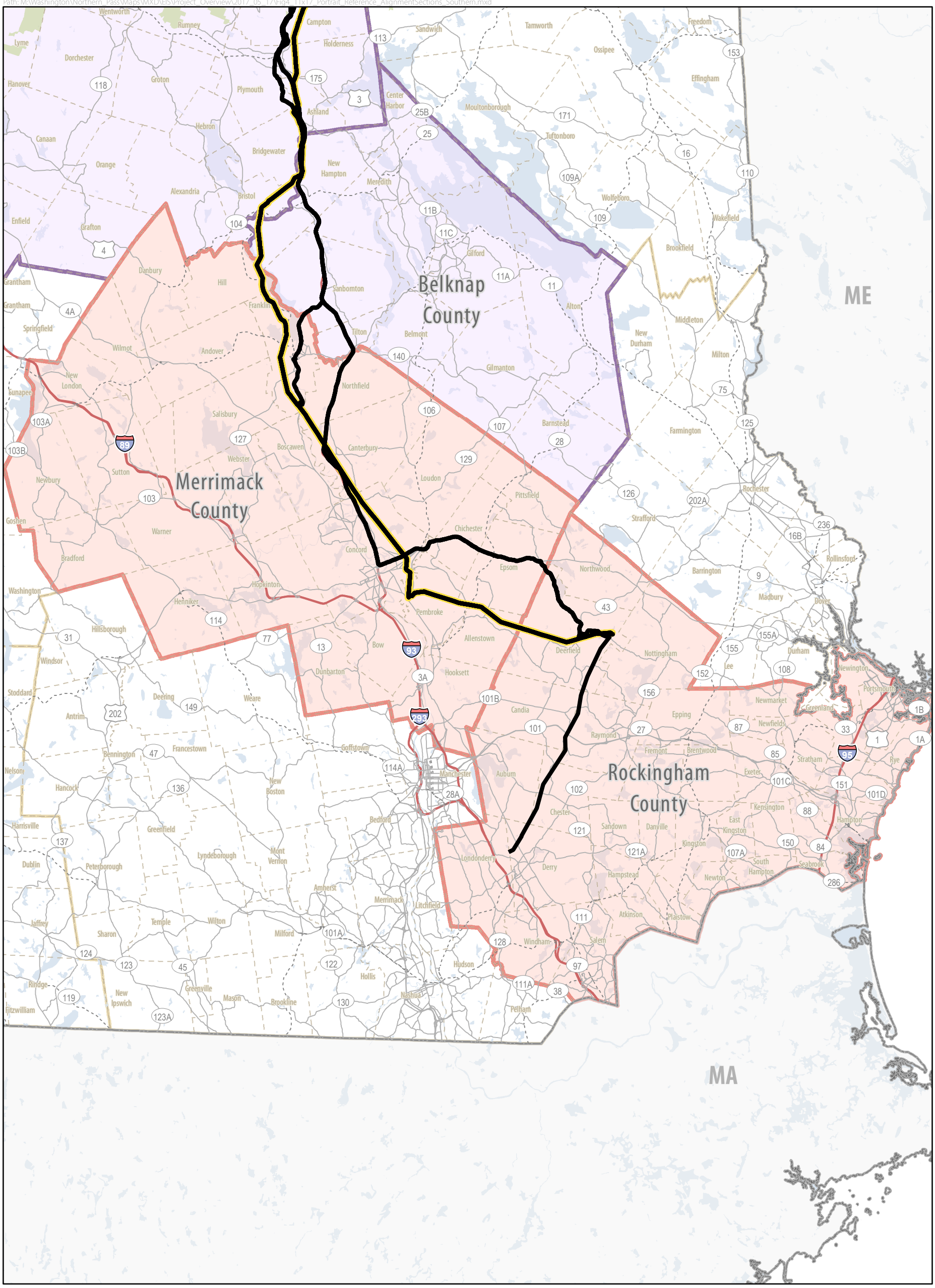

Legend

- State Boundary
- Political Boundary
- County Boundary
- Alternative Project Alignments
- Waterbody
- White Mountain National Forest

Section Boundaries

- Northern Section
- Central Section
- Southern Section
- Existing PSNH Transmission Route

SOURCE: ESRI 2011; Ecology and Environment 2014.

Map 4:
Southern Section
Northern Pass Transmission Line Project
Environmental Impact Statement

N

SCALE

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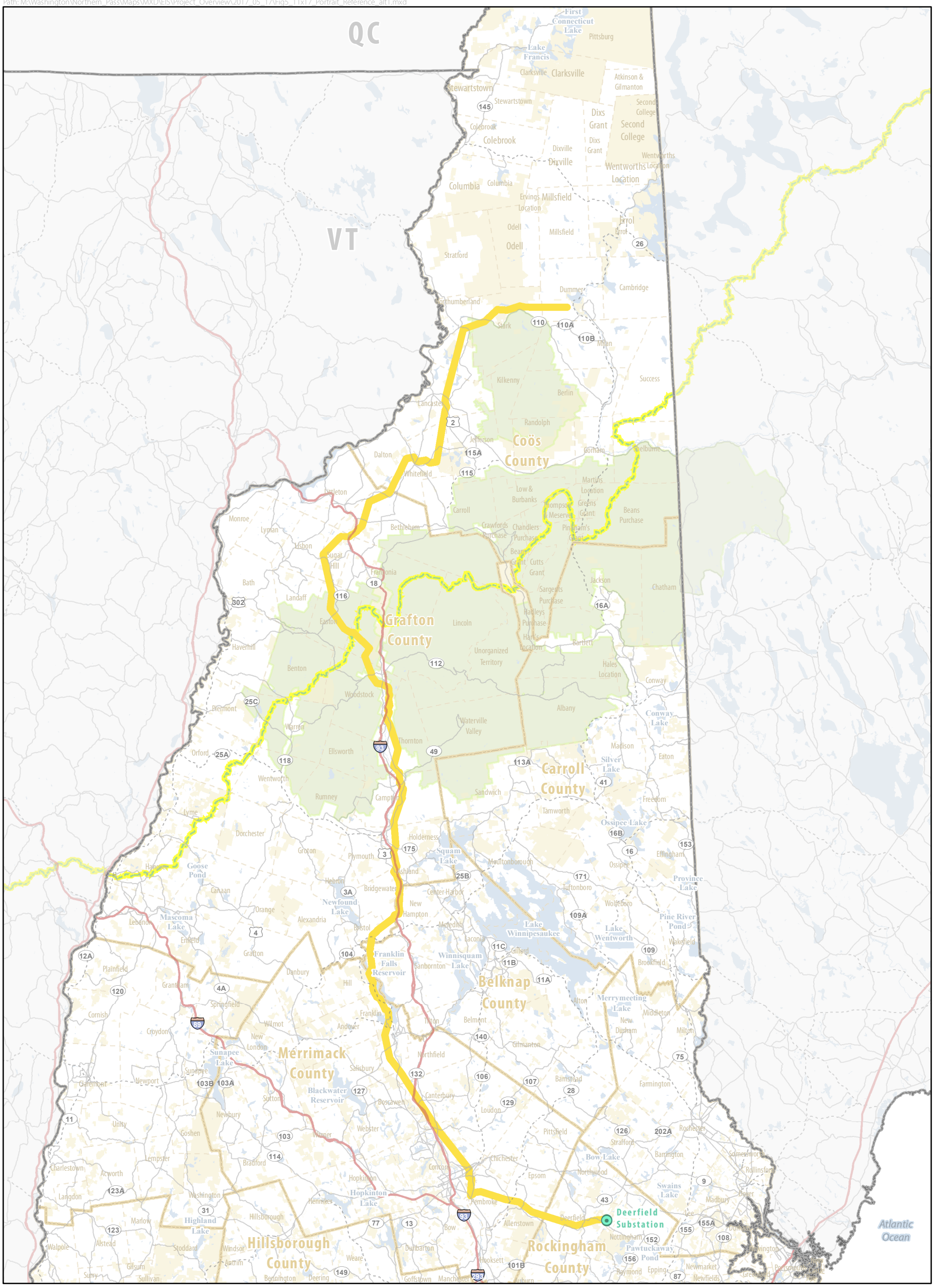

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road

- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012

Map 5:
Alternative 1 - No Action
Northern Pass Transmission Line Project
New Hampshire

N

SCALE

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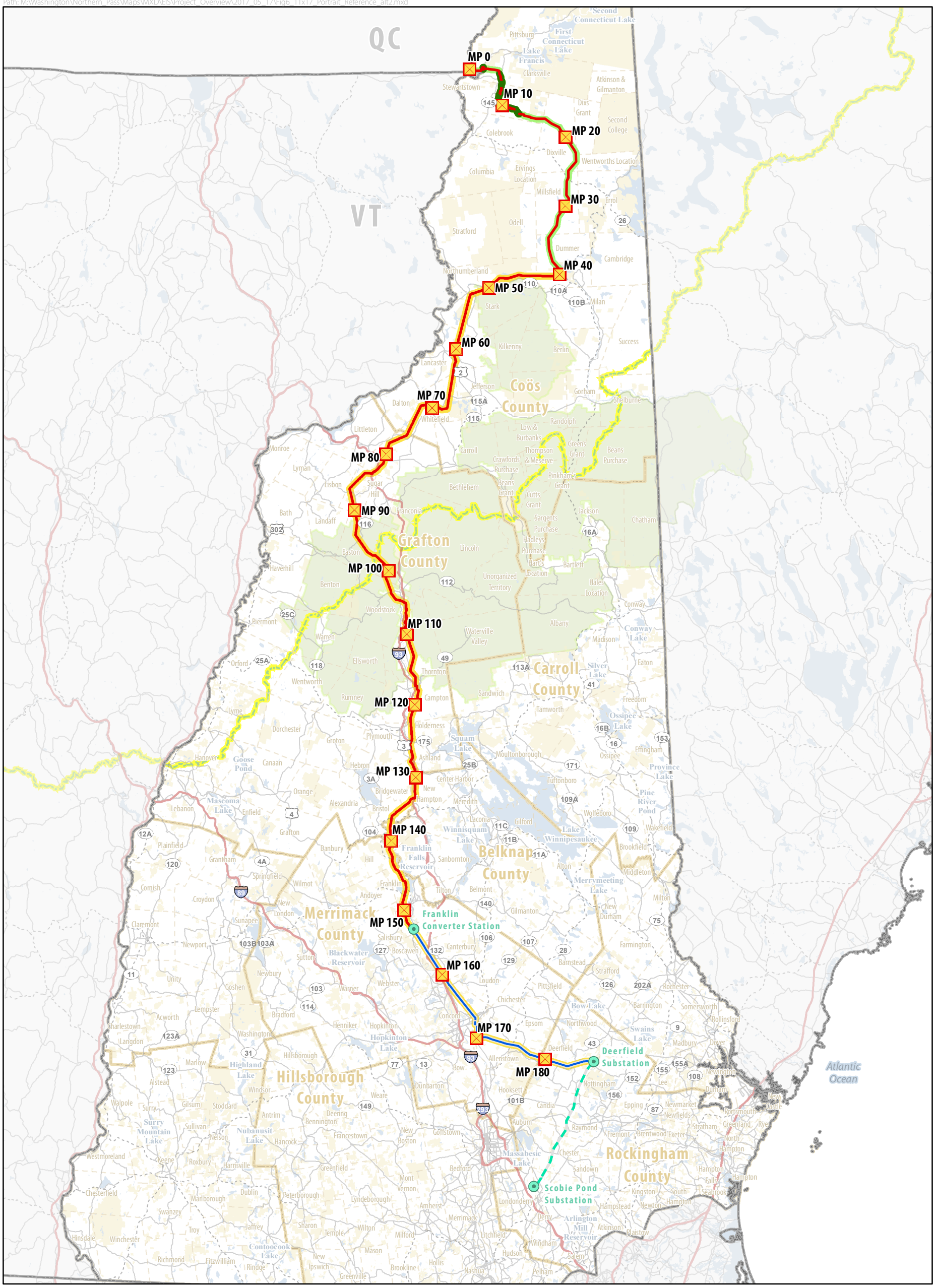

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 2 Components

- New Transmission Route
- Project in Roadway Corridor
- Overhead High-Voltage Direct Current Centerline
- Overhead High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012

Map 6:
Alternative 2
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
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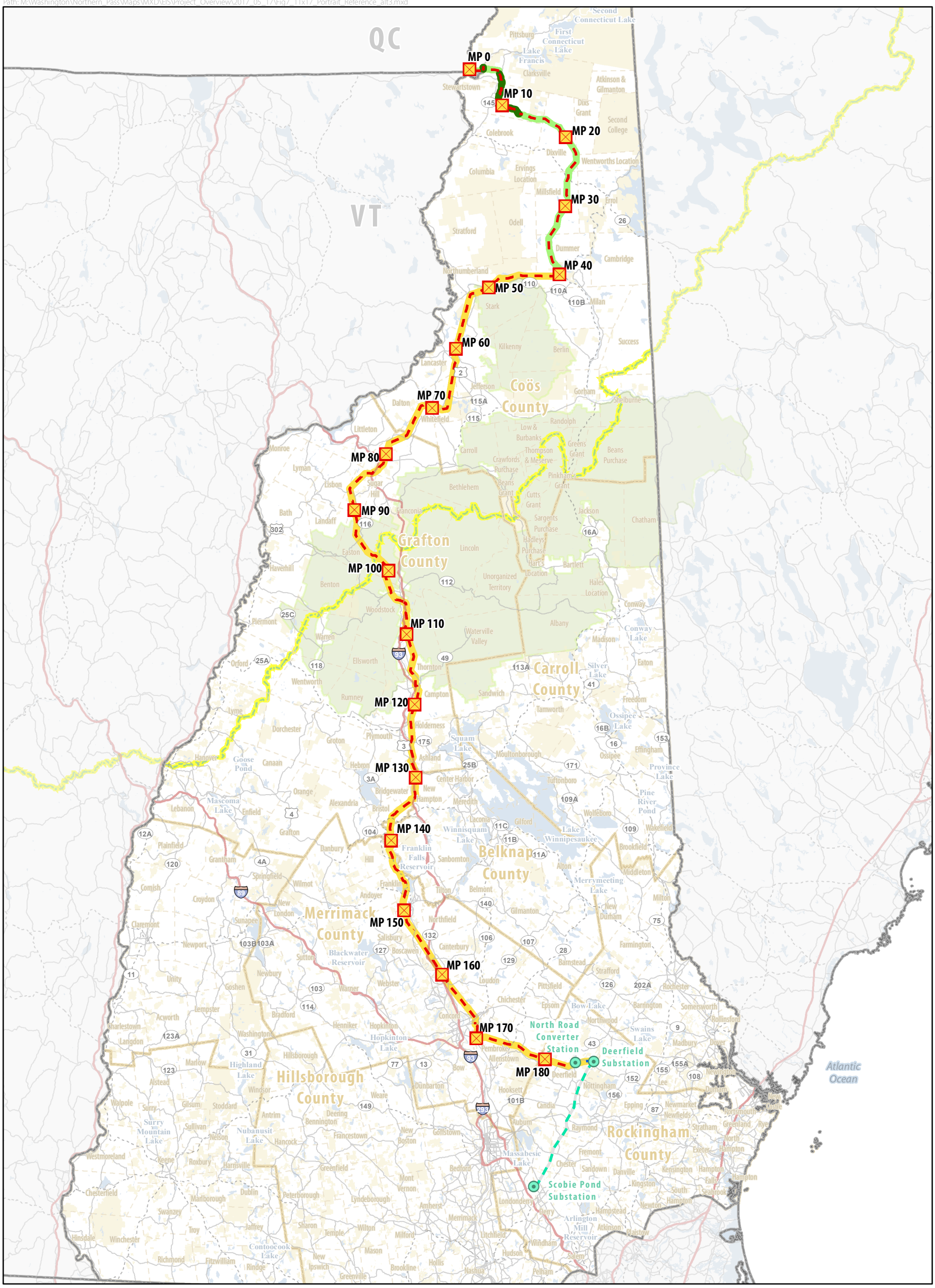

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 3 Components

- New Transmission Route
- Project in Roadway Corridor
- Underground High-Voltage Direct Current Centerline
- Underground High-Voltage Alternating Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

Map 7:
Alternative 3 - Underground Transmission Cable in Alternative 2 Alignment
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
0 5 10 Miles

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

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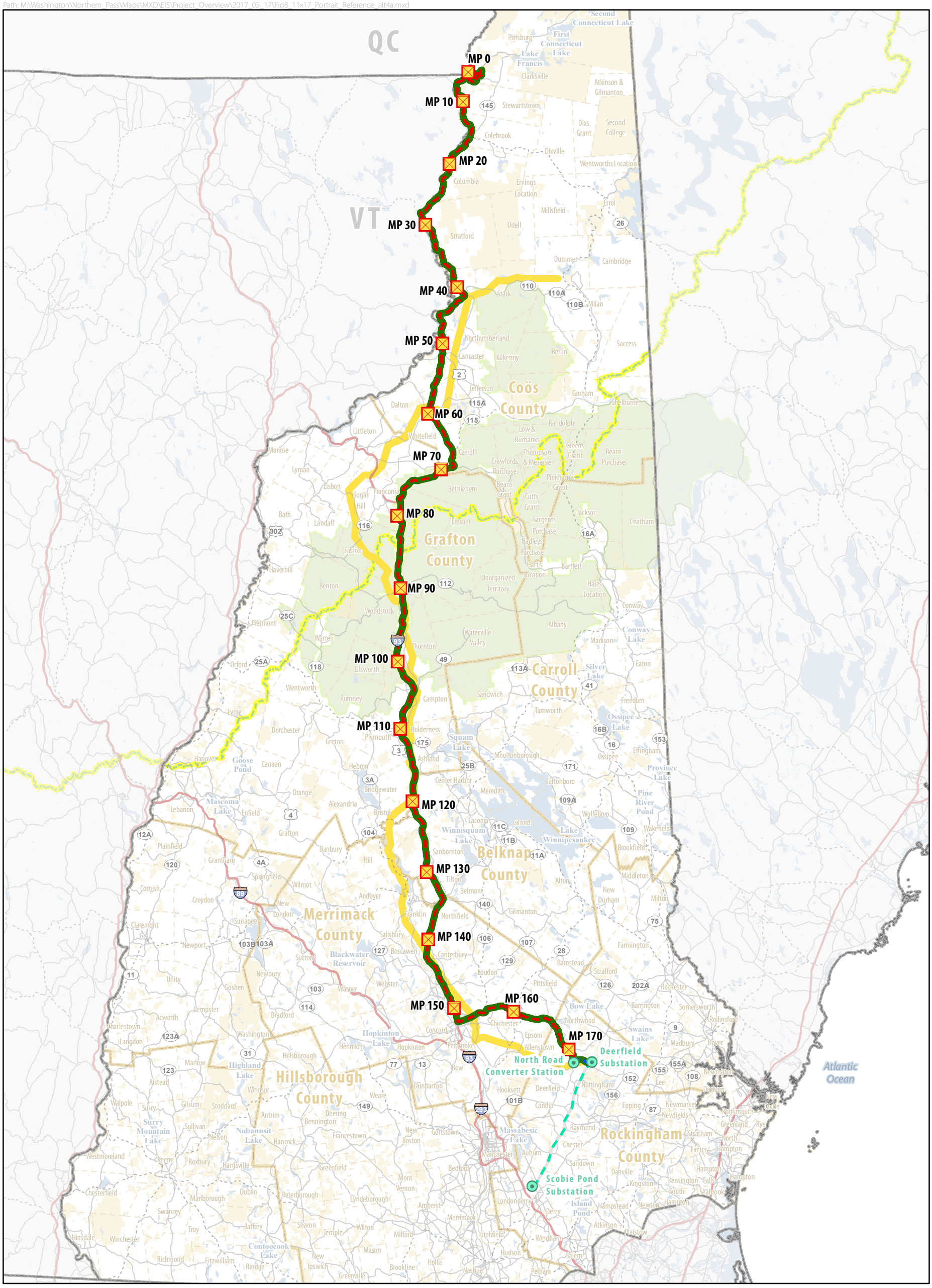

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 4a Components

- New Transmission Route
- Project in Roadway Corridor
- Underground High-Voltage Direct Current Centerline
- Underground High-Voltage Alternating Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 8:
Alternative 4a - Underground Transmission Cable in Roadway Corridors - *I-93 through Franconia Notch*
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
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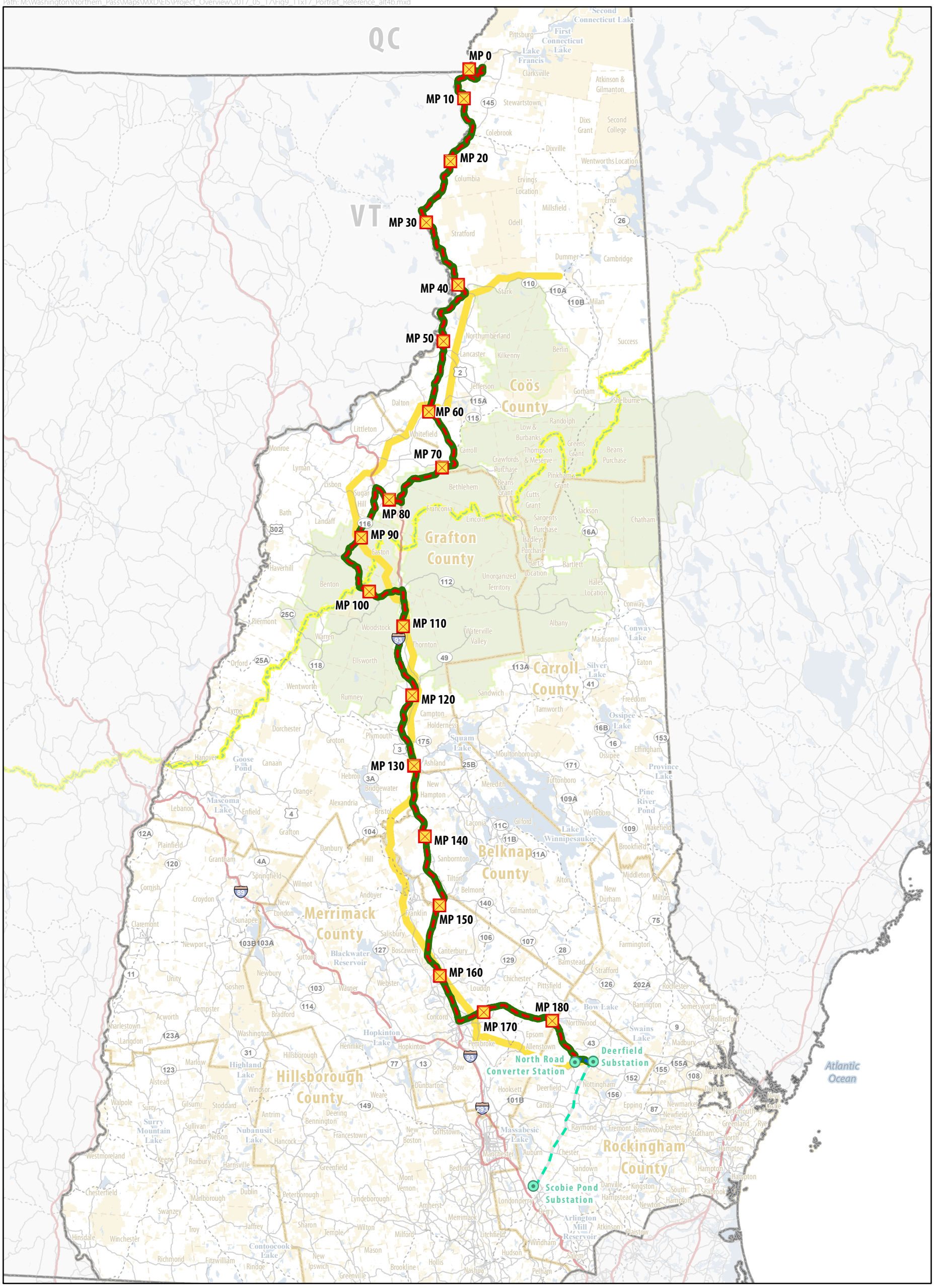

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 4b Components

- New Transmission Route
- Project in Roadway Corridor
- Underground High-Voltage Direct Current Centerline
- Underground High-Voltage Alternating Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 9:
Alternative 4b - Underground Transmission Cable in Roadway Corridors -
NH Routes 112 and 116 through WMNF
Northern Pass Transmission Line Project
New Hampshire

SCALE
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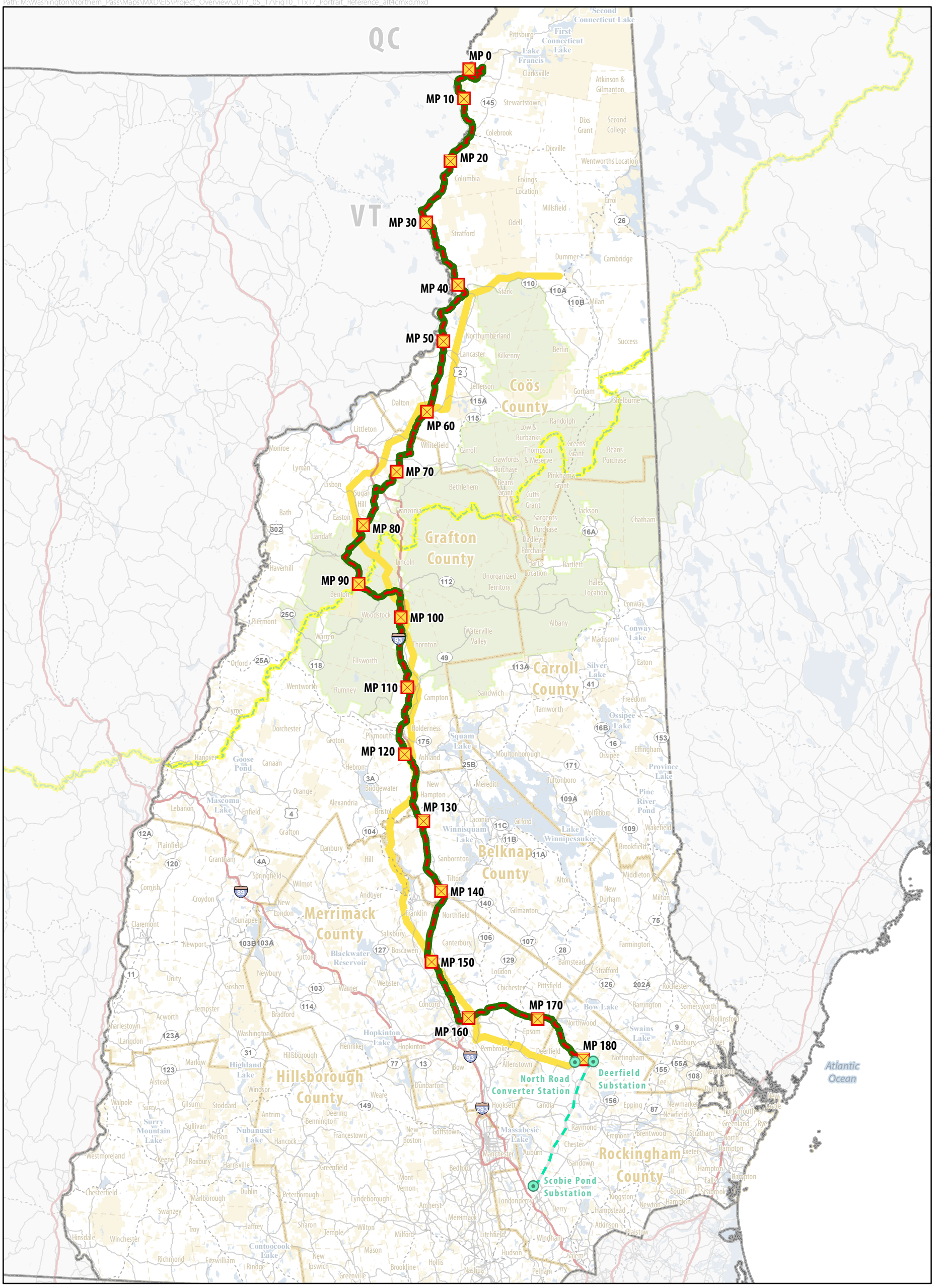

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 4c Components

- New Transmission Route
- Project in Roadway Corridor
- Underground High-Voltage Direct Current Centerline
- Underground High-Voltage Alternating Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 10:

Alternative 4c - Underground Transmission Cable in Roadway Corridors - ***NH Routes 112 and 116 through WMNF and US Route 3 from North Woodstock to Ashland***

Northern Pass Transmission Line Project

New Hampshire

N

SCALE

0 5 10 Miles

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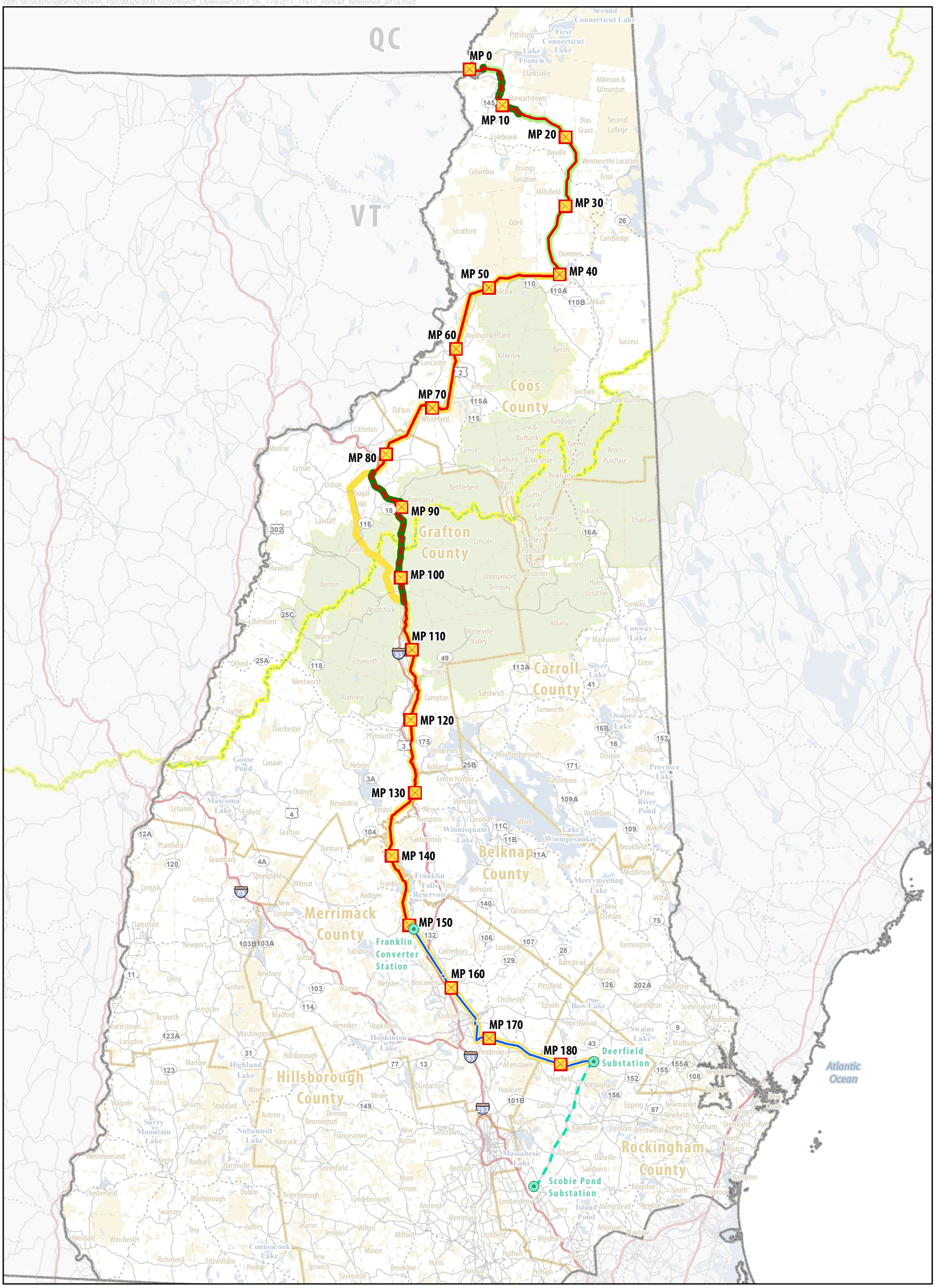

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 5a Components

- New Transmission Route
- Project in Roadway Corridor
- Overhead High-Voltage Direct Current Centerline
- Overhead High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 20102; NH GRANIT 2012; USFS 2012

Map 11:

Alternative 5a - Alternative 2 except Underground Transmission Cable along *I-93 through Franconia Notch*

Northern Pass Transmission Line Project
New Hampshire

N

SCALE

0 5 10 Miles

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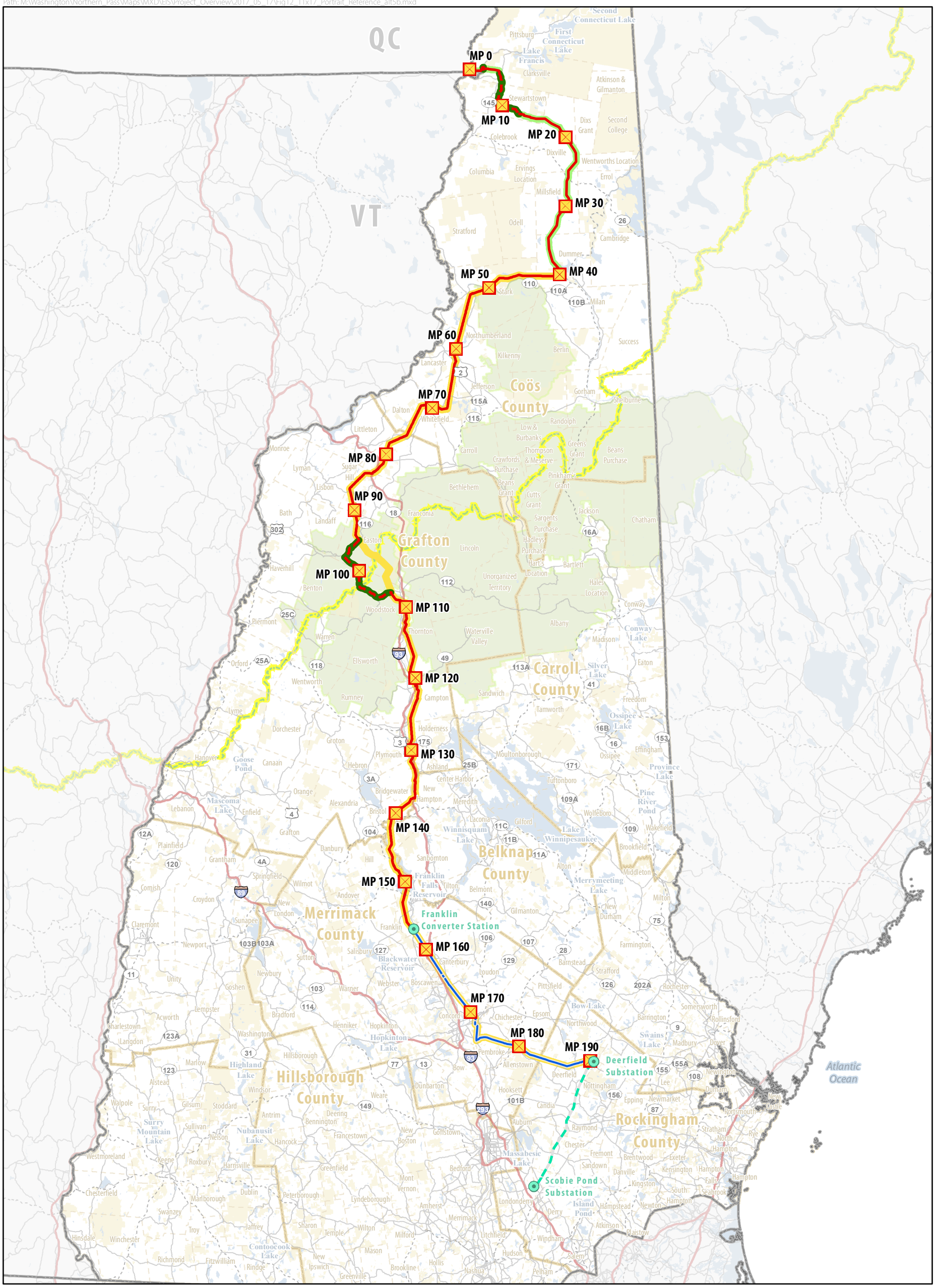

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 5b Components

- New Transmission Route
- Project in Roadway Corridor
- Overhead High-Voltage Direct Current Centerline
- Overhead High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 12:
Alternative 5b - Alternative 2 except Underground Transmission Cable along *NH Routes 112 and 116 through WMNF*
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
0 5 10 Miles

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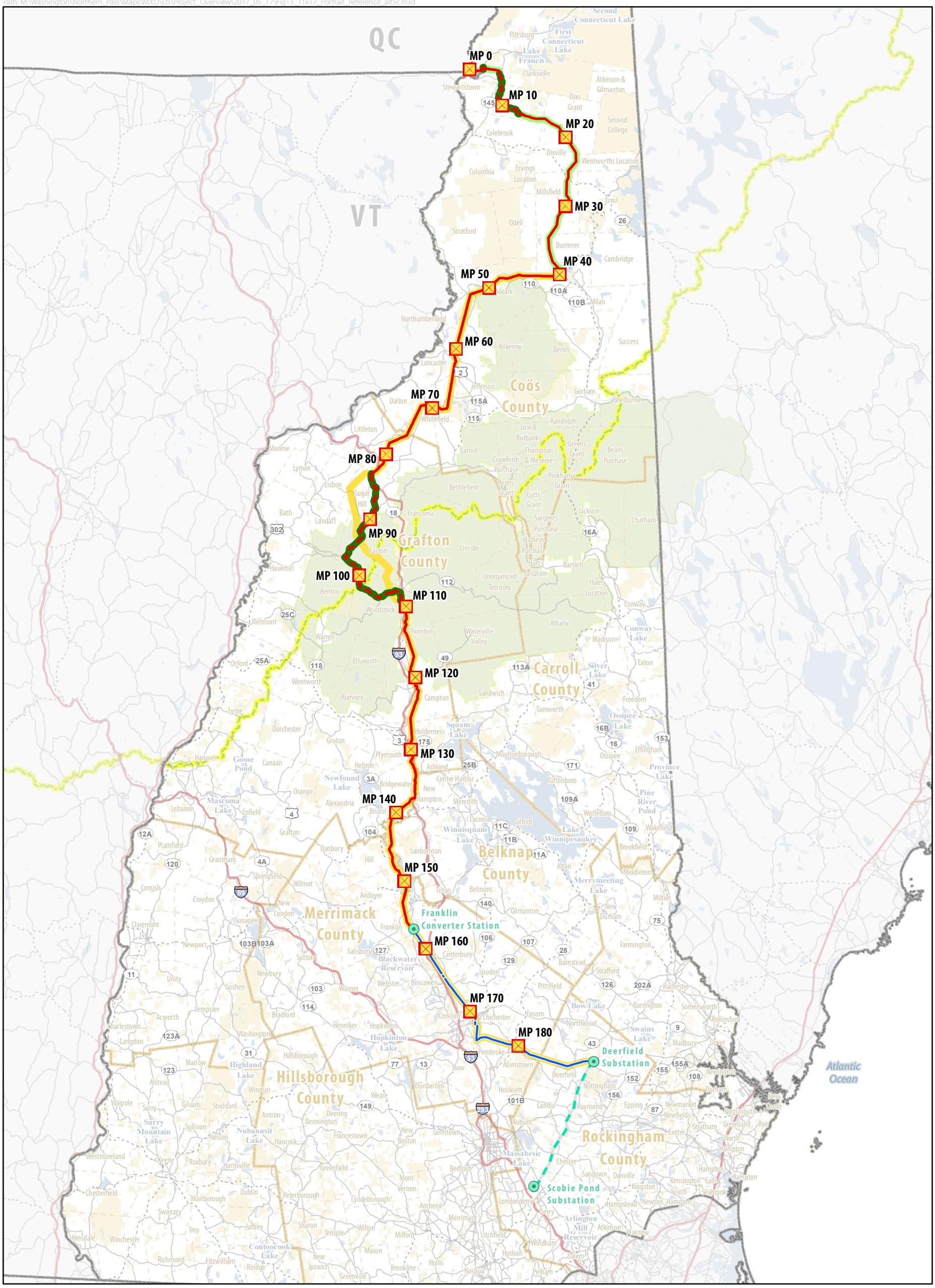

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 5c Components

- New Transmission Route
- Project in Roadway Corridor
- Overhead High-Voltage Direct Current Centerline
- Overhead High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012;USFS 2012

Map 13:

Alternative 5c - Alternative 2 except Underground Transmission Cable along *NH Routes 18, 112 and 116 through Sugar Hill, Franconia, Easton and WMNF*

Northern Pass Transmission Line Project
New Hampshire

N

SCALE

0 5 10 Miles

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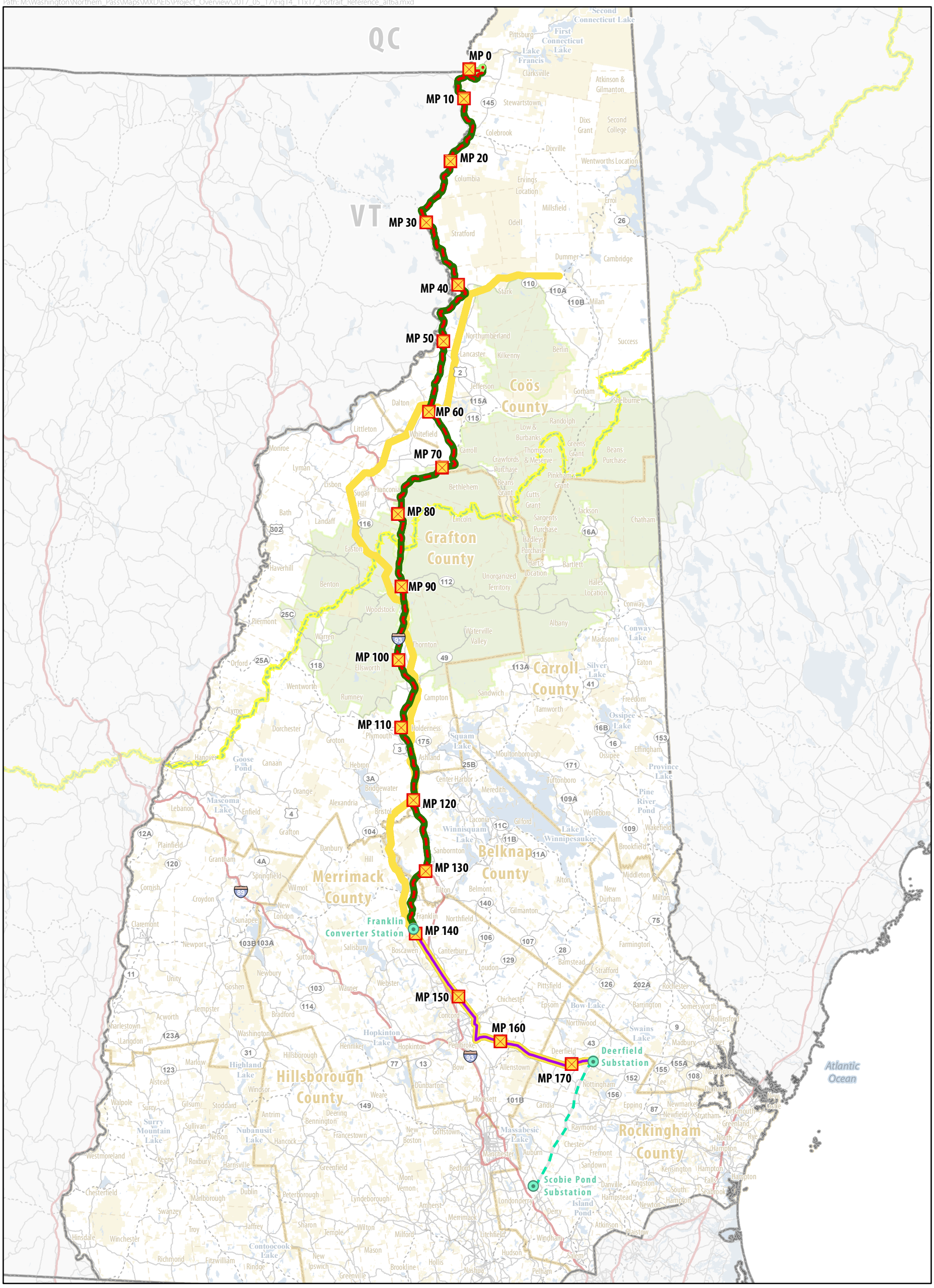


Legend

Existing Conditions
- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 6a Components
- New Transmission Route
- Project in Roadway Corridor
- Overhead Co-located High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

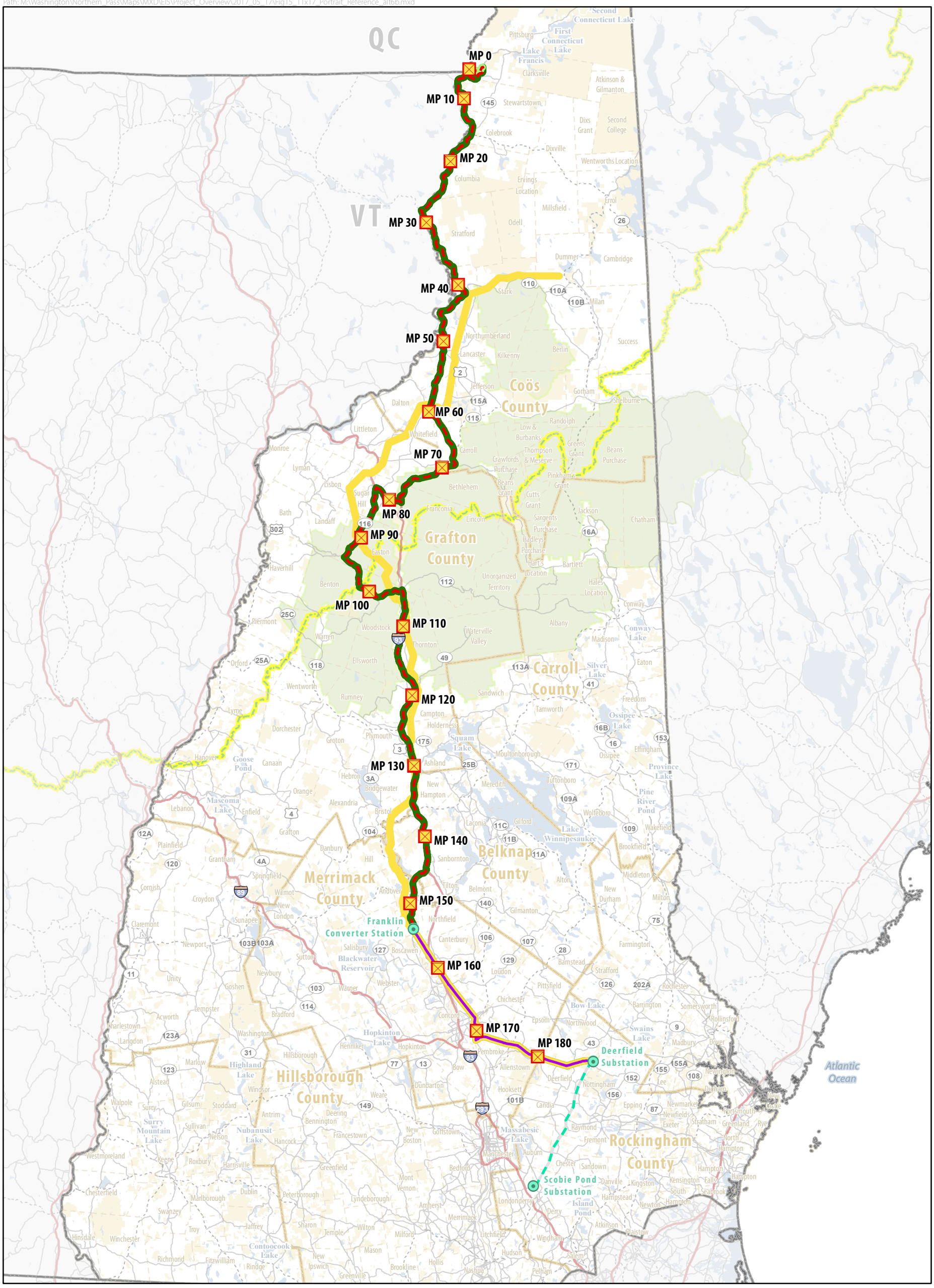
SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 14:
Alternative 6a - Underground Transmission Cable in Roadway Corridors *(I-93 through Franconia Notch)* and Co-located HVAC
Northern Pass Transmission Line Project
New Hampshire

N

SCALE
0 5 10 Miles

Path: M:\Washington\Northern_Pass\Maps\MXD\EIS\Project_Overview\2017_05_17\Fig15_11x17_Portrait_Reference_alt6b.mxd



Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 6b Components

- New Transmission Route
- Project in Roadway Corridor
- Overhead Co-located High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012;USFS 2012

Map 15:

Alternative 6b - Underground Transmission Cable in Roadway Corridors

(NH Routes 112 and 116 through WMNF)

and Co-located Overhead HVAC

Northern Pass Transmission Line Project

New Hampshire

N

SCALE

0 5 10 Miles

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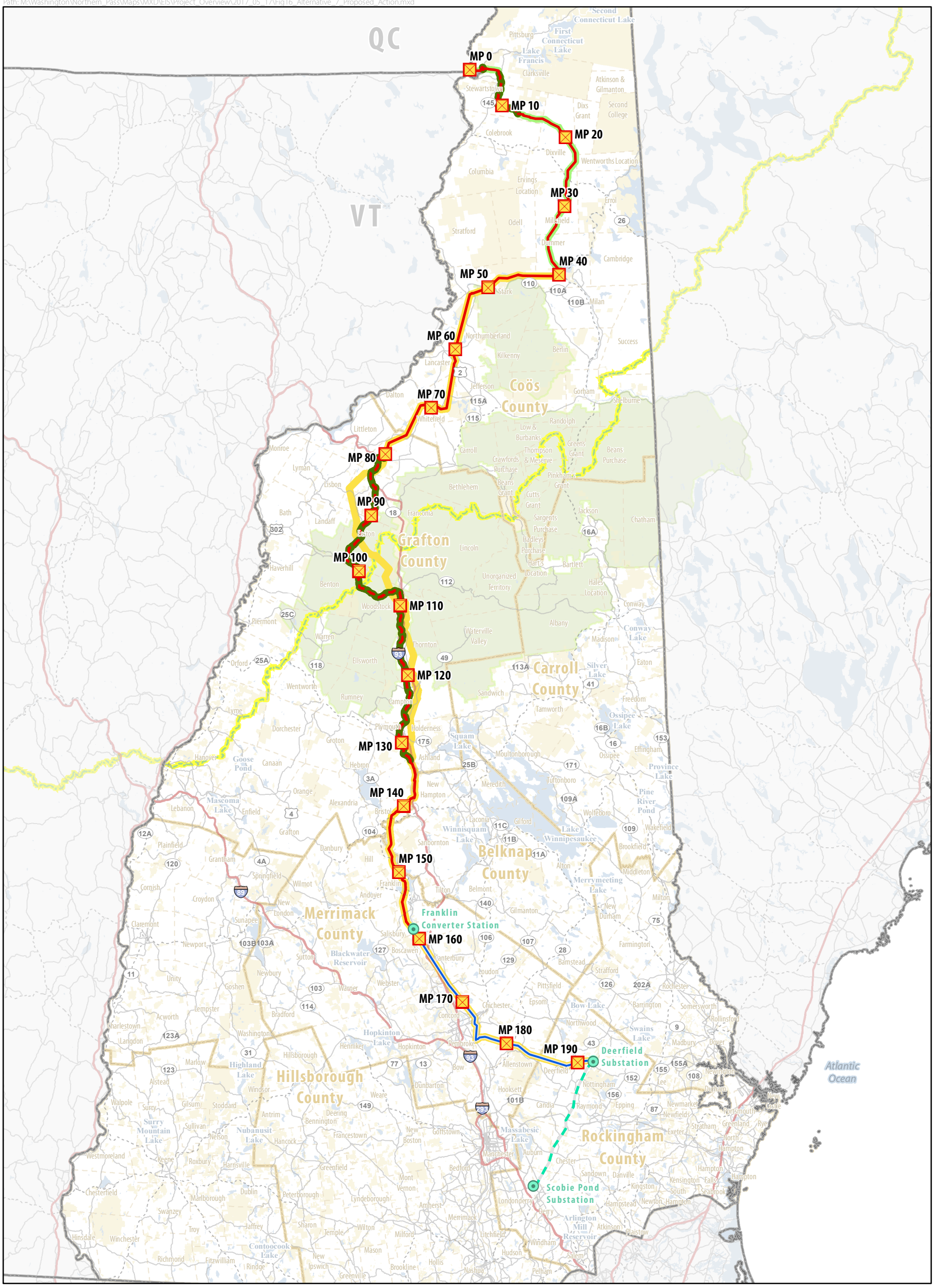


Legend

Existing Conditions
- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Alternative 7 Components
- New Transmission Route
- Project in Roadway Corridor
- Overhead High-Voltage Direct Current Centerline
- Overhead High-Voltage Alternating Current Centerline
- Underground High-Voltage Direct Current Centerline
- Existing Transmission Line Upgrades
- Project Milepost
- Converter/Substation Location

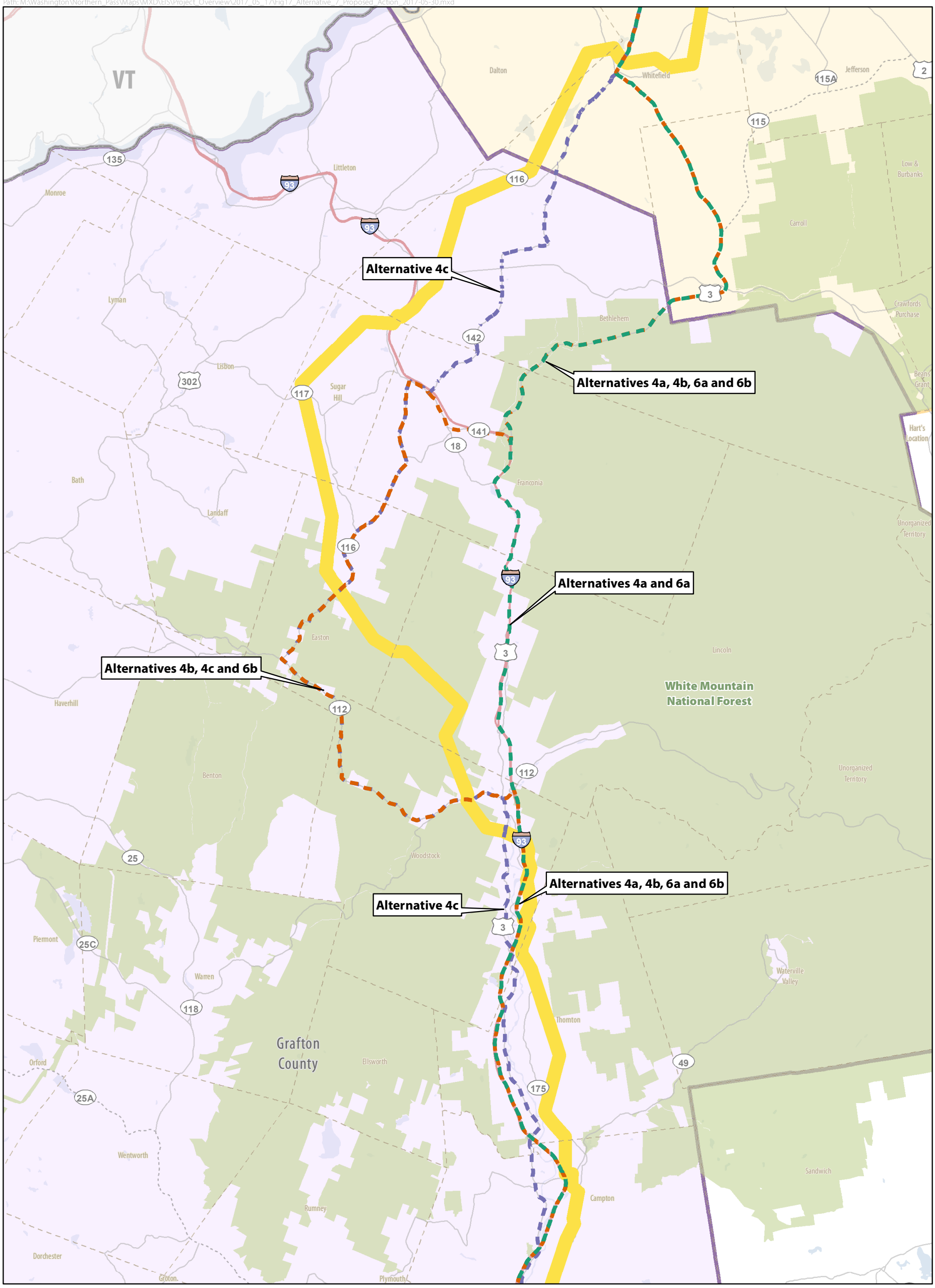
SOURCE: ESRI 2011; GRANIT 2012; Burns and McDonnell 2013; USFS 2012; Ecology and Environment 2013

Map 16:
Alternative 7 - Proposed Action
Northern Pass Transmission Line Project
Environmental Impact Statement

N

SCALE
0 5 10 Miles

Path: M:\Washington\Northern_Pass\Maps\MXD\EIS\Project_Overview\2017_05_17\Fig17_Alternative_7_Proposed_Action_2017-05-30.mxd



Legend

- State Boundary
- Political Boundary
- County Boundary
- Alternatives 4a and 6a
- Alternatives 4b and 6b
- Alternative 4c
- Waterbody
- White Mountain National Forest
- Existing PSNH Transmission Route

Section Boundaries

- Southern Section
- Central Section
- Northern Section

SOURCE: ESRI 2011; Ecology and Environment 2014.

Map 17:

Alternative 4 and 6 Variations in Vicinity of WMNF

Northern Pass Transmission Line Project
Environmental Impact Statement

N

SCALE

0 1 2 Miles

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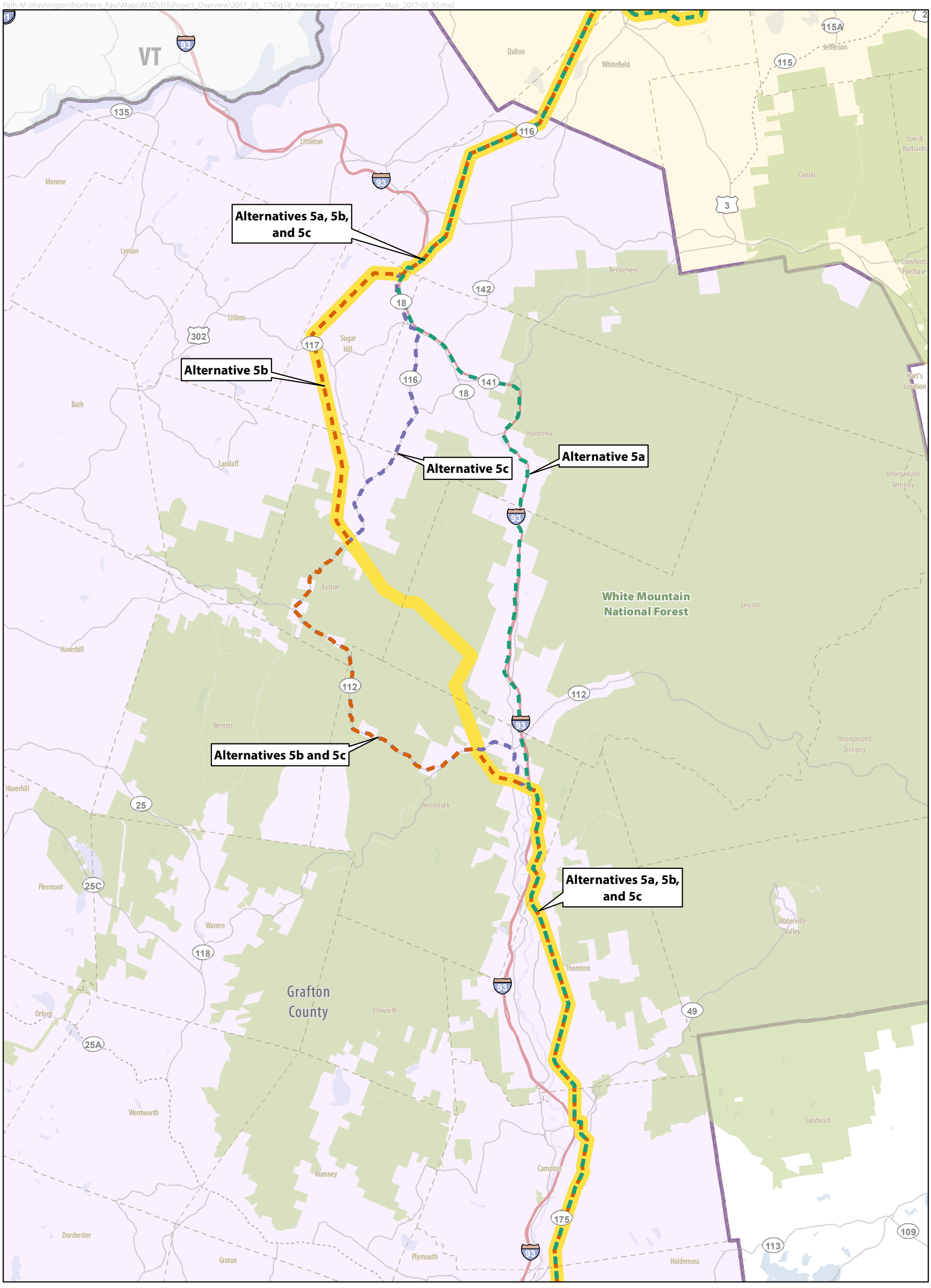

Legend

- State Boundary
- Political Boundary
- County Boundary

Alternative Project Alignment

- Alternative 5a
- Alternative 5b
- Alternative 5c

- Waterbody
- White Mountain National Forest
- Existing PSNH Transmission Route

Section Boundaries

- Southern Section
- Central Section
- Northern Section

SOURCE: ESRI 2011; Ecology and Environment 2014.

Map 18:
Alternative 5 Variations in Vicinity of WMNF
Northern Pass Transmission Line Project
Environmental Impact Statement

N

SCALE
0 1 2 Miles

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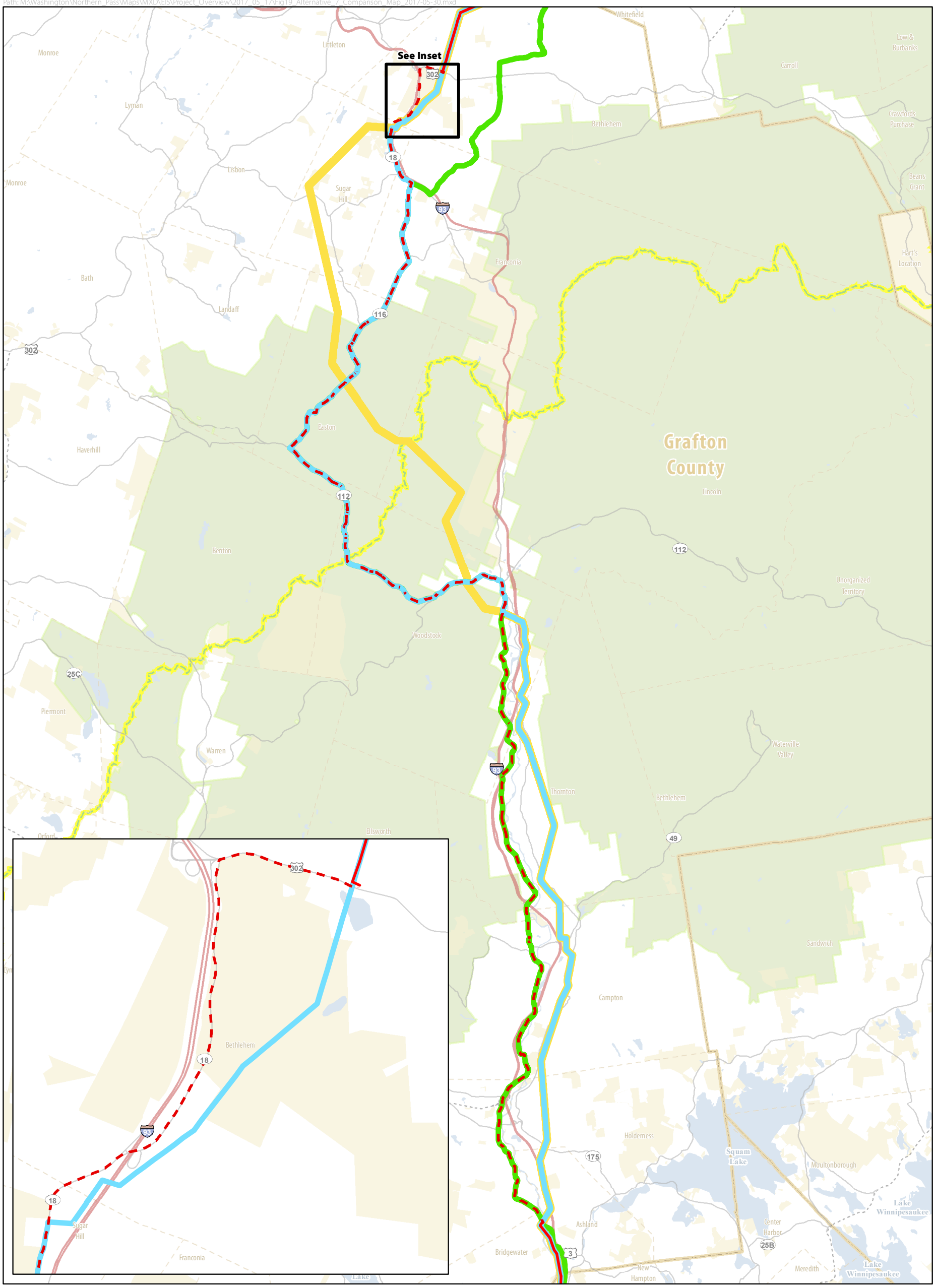

Legend

Existing Conditions

- State Boundary
- County Boundary
- Political Boundary
- Freeway
- Major Road
- Secondary Road
- Appalachian National Scenic Trail
- Waterbody
- NH Conservation Land (WMA, State Forest, Conservation Areas, etc.)
- White Mountain National Forest
- Existing PSNH Transmission Route

Analyzed in the Draft EIS

- Alternative 4c Alignment
- Alternative 5c Alignment

Alternative 7 Projects

- Overhead High-Voltage Direct Current Centerline
- Underground High-Voltage Direct Current Centerline

SOURCE: ESRI 2010; ESRI 2012; NH GRANIT 2012; USFS 2012

Map 19:
Alternative 7 Comparison Map
Northern Pass Transmission Line Project
Environmental Impact Statement

N

SCALE

0 2.5 5 Miles