STATE OF NEW HAMPSHIRE

Inter-Department Communication

DATE: February 27, 2017
AT (OFFICE): NHPUC

FROM: Randy Knepper
Director – Safety Division

SUBJECT: Docket No. DE 15-460, DE 15-461, DE 15-462 and DE 15-463
Northern Pass Transmission Project
Northern Pass Transmission, LLC (NPT) and
Public Service Company of New Hampshire d/b/a Eversource Energy (ESE)
Staff Recommendation #2 regarding
5 Licenses to Cross Public Waters and Lands

TO: Debra Howland, Executive Director
Thomas Frantz, Director, Electric Division
Leszek Stachow, Assistant Director, Electric Division
Suzanne Amidon, Staff Attorney

cc: Robert Wyatt, Assistant Director, Safety Division

Public waters and lands crossings included in this recommendation

Table 1 Zone 2 - List of NPT and ESE Crossings

Staff Zone-Map #	Water/ Land Name	DE 15-460 NPT Water Crossing/ License	DE 15-461 NPT Land Crossing/ License	DE 15-462 ESE Water Crossing/ License	DE 15-463 ESE Land Crossing/ License	Totals
2-9	NHDOT RR	--	Bethlehem	--	--	1
2-9	Ammonoosuc River	Bethlehem	--	--	--	1
2-10	Gale River	Franconia	--	--	--	1
2-11	Moosilauke Brook	Woodstock	--	--	--	1
2-12	Baker River	Plymouth	--	--	--	1
Zone 2	Total Licenses	4 NPT Water	1 NPT Land	0 ESE Water	0 ESE Land	5

Staff Recommendation #2 for Zone 2 crossings

NPT filed petitions pursuant to RSA 371:17 in docket no. DE 15-460, DE 15-461, DE 15-462 and DE 15-463, for licenses to construct and maintain electric lines over, under and across public waters, lands and rails at 5 locations along the proposed path between Bethlehem and Plymouth, New Hampshire (Zone 2). The proposed 320kV direct current high-voltage electric transmission line is referenced in the petitions as the DC Line. Other existing Eversource circuits along the project path that will require

licenses to cross public waters or lands are identified by their assigned circuit numbers and operate at alternating current (AC).

The methodology used by Staff to determine how the analysis was performed is presented in the Overall Recommendation memorandum.

This Recommendation #2 is to provide the details examined that apply to Zone 2.

Within Zone 2 there are three underground proposed installation of the public water crossings of the Gale River in Franconia, Moosilauke Brook in Woodstock and Baker River in Plymouth. The two remaining crossings are overhead for public waters, and rails. The 5 crossings are sequentially labeled from, north to south. All mapping and data collection tables are presented in and follow the same sequence.

Table 2 gives pertinent information tables provided in this Staff Recommendation regarding overhead crossing information that has been reviewed or otherwise analyzed as appropriate.

TABLE 2 ZONE 2 AERIAL CROSSINGS

Staff Zone-Map #	Water/Land Name	Town	Type Crossing: Land / Rail / Water	Voltage /Type	NPT/ESE	Circuit	Staff Calculated Clearance SAG 10	Clearance Shown on Petition Profile	Calculated Difference	Required Clearance NESC	Span ft	Verification
2-9	NHDOT RR Groveton Branch	Bethlehem	Rail	320kV/DC	NPT	3270 3271	63	63	0	**33.7**	548.98	Excellent

Refer to 4 detailed PUC generated single-page maps using its GIS mapping software specific to each crossing location. Each detailed map depicted all circuits, (proposed and existing including those that will be relocated and those that will remain in place). Support structures, Support structure identifications, support structure heights, ROW widths, proper orientation of circuits, dimensions of spans, parcel information known as line lists (which emanated from NPT and ESE's petitions) are all depicted. Typical elevation views within the Right of Way are shown including cross sections within the ROW are taken from Forward NH Plans located at w*ww.northernpass.us/towns.htm*. In addition to the above geographical information was also depicted such as roads, buildings, rivers, trees, neighborhoods, bridges, and town lines.

Refer to Appendix A for single-page tables of information specific to each crossing, with a comments, conclusions, conditions and recommendations. Staff designated Zone 2 has identified 5 public waters and rail crossings that will require licenses. Specific technical and information relevant to the crossing are identified in each Appendix A table.

Existing license(s) and permissions previously granted by the PUC for these locations

See Attachments A1, A2 or A3 of the Overall Recommendation for licenses previously granted. NPT and ESE petitions were for the new DC transmission line and only for relocated ESE transmission lines. ESE did not include licenses for those existing transmission lines that were not being altered.

Existing Circuits where ESE does not have a license.

In examining the eight locations Staff found 3 locations where existing licenses were never issued:

1. Ammonoosuc River, Bethlehem, - X178 Circuit 115kV - PUC detailed map 9
2. Ammonoosuc River, Bethlehem, - 348 Circuit 34.5kV - PUC detailed map 9
3. Gale River, Franconia - 348X1 Circuit 34.5 kV - PUC detailed map 10

Staff recommends ESE be required to submit petitions for granting of these licenses.

Safety Division Specific Recommendations with any applicable conditions:

See individual crossing details listed within Tables A.2.9a.1, A.2.9b.1, A.2.10.1, A.2.11.1, A.2.12.1, located in Appendix A of Recommendation #2.

Public Water/Land Crossing Name: NH Central Rail-Groveton Branch in Bethlehem, NH for NPT

General Information			Technical Information	
PUC Docket Number	DE 15-461		Voltage	320 kV, DC
PUC Zone	2		Circuit	3720/3731
PUC Map Number	9		Conductor Type	AAAC
Petitioner (NPT, ESE)	NPT		Code Name	None
Petitioner Line List # (for Parcels traversed)	3109		Conductor Size	2933 kcmil
Crossing Circuit Configuration	Overhead		Stranding	91
Public Crossing Type (Water/Land)	Land		Conductor Horizontal Separation	28
Previous Public Crossing License Issued by PUC (Yes/No)	No		Conductor Vertical Separation	NA
Relocated ESE Crossing (Yes/No)	No		Cable Weight (Lbs/Ft)	2,769
Right of Way Width	265 feet		Back Pole Number	DC-662
Number of Circuits within ROW	1 new (DC), 2 existing		Back Structure Height	90
Foreign Utilities within ROW	None		Back Ground Elevation (Ft)	1018.34
Total Structures/Poles/Manholes this circuit crossing	2		Back Conductor Height	60.5
First Structure Identification	DC-662		Back Conductor Elev. at Pole	1078.84
State Listed Public Waters (Yes/No/Not Applicable)	Not Applicable		Forward Pole Number	DC-663
Last Structure Identification	DC-663		Forward Structure Height	95
PUC Approximate Length of crossing for License (Land only) [Does Not apply to Water or Rail]	Not Applicable		Forward Ground Elevation	981.45
			Forward Conductor Height	70.5
			Forward Conductor Elev. at Pole	1051.95
			Span (Feet)	548.98
			Max Tension NESC Heavy lbs.	20,000
			Max Operating Temp (^{o}F)	130
			Calc'd Horiz.Tension@MaxTemp	
			Calc'd. Clearance (SAG 10)	63
			Clearance Shown on Profile	63
			Req'd Clearance (NESC)	33.7

Crossing Comments, Conclusions, Conditions, and Staff Recommendation	
Comments	The NH Central Rail-Groveton Branch in Bethlehem is a State-owned railroad parcel managed by the NH Department of Transportation (NH DOT). This public land crossing will require a license from the NH PUC for the utility rights to cross the parcel.
	The NH DOT describes this railroad as an active, year-round freight line. NH DOT does not anticipate any negative impact from the proposed NPT project, notes a positive relationship with Eversource maintenance practices, and has no concerns with the relocation of the existing Eversource circuit within the ROW.
	NH DOT does not foresee any negative impacts of this project on the rights to the public in using this land. The NH DOT does not foresee any negative impact to the NH Central Rail-Groveton Branch in Bethleham related to the proposed NPT project.
Conclusions	Based on the comments received from the NH DOT, Staff believes the proposed license petitioned for may be exercised without substantially affecting the public rights in these public lands, nor will the proposed crossing substantially affect the fuctional use and safety in these public lands.
	The petition, appendices and other documents filed by the Company provide sufficient support showing that the design meets or exceeds the requirements of the 2012 National Electric Safety Code (NESC) C2-2012, consistent with Puc 306.01(b)(1).
Staff Recommendation	That the Commission grant the license to construct, maintain and operate the electric and communications lines over and across the public land identified in the petition.
Staff Reccommended Conditions applied to License	The license for this public land crossing is contingent upon the Northern Pass Project receiving a Certificate of Site and Facility from the SEC.

Public Water/Land Crossing Name: Ammonoosuc River, Bethlehem, NH for NPT

General Information			Technical Information	
PUC Docket Number	DE 15-460		Voltage	320 kV, DC
PUC Zone	2		Circuit	3720/3731
PUC Map Number	9		Conductor Type	AAAC
Petitioner (NPT, ESE)	NPT		Code Name	None
Petitioner Line List # (for Parcels traversed)	3109		Conductor Size	2933 kcmil
Crossing Circuit Configuration	Overhead		Stranding	91
Public Crossing Type (Water/Land)	Water		Conductor Horizontal Separation	28
Previous Public Crossing License Issued by PUC (Yes/No)	No		Conductor Vertical Separation	NA
Relocated ESE Crossing (Yes/No)	No		Cable Weight (Lbs/Ft)	2,769
Right of Way Width	265 feet		Back Pole Number	DC-662
Number of Circuits within ROW	1 new (DC), 2 existing		Back Structure Height	90
Foreign Utilities within ROW	None		Back Ground Elevation (Ft)	1018.34
Total Structures/Poles/Manholes this circuit crossing	2		Back Conductor Height	60.5
First Structure Identification	DC-662		Back Conductor Elev. at Pole	1078.84
State Listed Public Waters (Yes/No/Not Applicable)	Yes		Forward Pole Number	DC-663
Last Structure Identification	DC-663		Forward Structure Height	95
PUC Approximate Length of crossing for License (Land only) [Does Not apply to Water or Rail]	Not Applicable		Forward Ground Elevation	981.45
			Forward Conductor Height	70.5
			Forward Conductor Elev. at Pole	1051.95
			Span (Feet)	548.98
			Max Tension NESC Heavy lbs.	20,000
			Max Operating Temp (^{o}F)	130
			Calc'd Horiz.Tension@MaxTemp	
			Calc'd. Clearance (SAG 10)	66
			Clearance Shown on Profile	67
			Req'd Clearance (NESC)	35.7

Crossing Comments, Conclusions, Conditions, and Staff Recommendation	
Comments	The proposed public water crossing will not substantially affect the public rights in these waters, nor will the proposed crossing substantiall affect the fuctional use and safety in these public waters.
	Staff calculations of clearance above water exceeds NESC Code requirements.
	Staff calculations of clearance above water exceeds NESC Code requirements.
Conclusions	The proposed public water crossing will not substantially affect the public rights in these waters, nor will the proposed crossing substantiall affect the fuctional use and safety in these public waters.
	Staff calculations of clearance above water exceeds NESC Code requirements.
Staff Recommendation	That the Commission grant the license to construct, maintain and operate the electric and communication lines over and across the public waters identified in the petition. Staff recommends ESE file a petition for granting a license for Circuits X178 115kV and 348 (34.5kv) for Upper Ammoonosuc River
Staff Reccommended Conditions applied to License	The license for this public water crossing is contingent upon the Northern Pass Project receiving a Certificate of Site and Facility from the SEC.

Public Water/Land Crossing Name: Gale River, Franconia, NH for NPT

General Information			Technical Information	
PUC Docket Number	DE 15-460		Voltage	320 kV, DC
PUC Zone	2		Circuit	3720/3731
PUC Map Number	10		Conductor diameter (cross sect)	2.25 in
Petitioner (NPT, ESE)	NPT		Manufacturer	ABB
Petitioner Line List # (for Parcels traversed)	3645.01 (river only)		Conductor Size	2500 sq mm
Crossing Circuit Configuration	Underground, Trenchless		Insulation	XLPE
Public Crossing Type (Water/Land)	Water		Conduit Diameter	8" SCH40
Previous Public Crossing License Issued by PUC	No		Conductor Dia with Insulation	4.72 in
Relocated ESE Crossing (Yes/No/NA)	NA		Cable Weight (Lbs/Ft)	20.900
Right of Way Width	DOT ROW		Back Structure Receiver	Microtunnel 13 Receiver
Number of Circuits within ROW	2		Steel Casing Diameter	36 in
Foreign Utilities within ROW	None		Back Ground Elevation (Ft)	NA
Total Structures/Poles/Manholes this circuit crossing	2		Back Conductor Height	NA
First Structure Identification	Microtunnel 13 Launch		Back Conductor Elev. at Pole	NA
State Listed Public Waters (Yes/No/Not Applicable)	Yes		First Structure Receiver	Microtunnel 13 Launcher
Last Structure Identification	Microtunnel 13 Receiver		Estimated Depth below River	15 ft
PUC Approximate Length of crossing for License (Land only) [Does Not apply to Water or Rail]	Not Applicable (but 450 feet including DOT ROW)		Forward Ground Elevation	NA
			Forward Conductor Height	NA
			Forward Conductor Elev. at Pole	NA
			Span (Feet)	349
			Max Tension NESC Heavy lbs.	NA
			Max Operating Temp (^{o}F)	130
			Calc'd Horiz.Tension@MaxTemp	NA
			Calc'd. Clearance (SAG 10)	NA
			Clearance Shown on Profile	5 feet
			Req'd Clearance (NESC)	No Engineering Standard

Crossing Comments, Conclusions, Conditions, and Staff Recommendation	
Comments	This underground crossing will entend approximately 450 feet under the public water and NH DOT ROW.
	There is no NESC standard for this type of underground, trenchless crossing.
Conclusions	The proposed public water crossing will not substantially affect the public rights in these waters, nor will the proposed crossing substantially affect the functional use and safety in these public waters.
Staff Recommendation	That the Commission grant the license to construct, maintain and operate the electric and communications lines under the public waters identified in the petition. Staff recommends ESE file a petition for 348X1 (34.5 kV) for granting a liscense to cross the Gale River.
Staff Reccommended Conditions applied to License	The license for this public water crossing is contingent upon the Northern Pass Project receiving a Certificate of Site and Facility from the SEC.

Public Water/Land Crossing Name: Moosilauke Brook Crossing (Lost River), Woodstock, NH for NPT

General Information		Technical Information	
PUC Docket Number	DE 15-460	Voltage	320 kV, DC
PUC Zone	2	Circuit	3720/3731
PUC Map Number	11	Conductor diameter (cross sect)	2.25 in
Petitioner (NPT, ESE)	NPT	Manufacturer	ABB
Petitioner Line List # (for Parcels traversed)	4123.01	Conductor Size	2500 sq mm
Crossing Circuit Configuration	Underground	Insulation	XLPE
Public Crossing Type (Water/Land)	Water	Conduit Diameter	8" HDPE
Previous Public Crossing License Issued by PUC (Yes/No)	No	Conductor Dia with Insulation	4.72 in
Relocated ESE Crossing (Yes/No)	No	Cable Weight (Lbs/Ft)	20.900
Right of Way Width	DOT ROW	Back Structure Receiver	HDD 039 Exit Points (a +b)
Number of Circuits within ROW	1 new (DC)	Estimated Depth Max	65 feet at max arc
Foreign Utilities within ROW	Water Pipe	Radius of Directional Drill	1200 ft
Total Structures/Poles/Manholes this circuit crossing	2	Back Conductor Height	NA
First Structure Identification	HDD 039 Entry Points (a +b)	Back Conductor Elev. at Pole	NA
State Listed Public Waters (Yes/No/Not Applicable)	Yes	First Structure Receiver	HDD 039 Entry Points (a +b)
Last Structure Identification	HDD 039 Exit Points (a +b)	Estimated Depth Arc	varies
PUC Approximate Length of crossing for License (Land only) [Does Not apply to Water or Rail]	Not Applicable (but 1118 feet including DOT ROW)	Forward Ground Elevation	NA
		Forward Conductor Height	NA
		Forward Conductor Elev. at Pole	NA
		Span (Feet)	1118
		Max Tension NESC Heavy lbs.	NA
		Max Operating Temp (^{o}F)	130
		Calc'd Horiz.Tension@MaxTemp	NA
		Calc'd. Clearance (SAG 10)	NA
		Clearance Shown on Profile	10 feet
		Req'd Clearance (NESC)	No Engineering Standard

Crossing Comments, Conclusions, Conditions, and Staff Recommendation	
Comments	The original petition portrayed this crossing as a steep underground directional drill with a 10 foot minimum clearance to Moosilauke Brook. The November 2016 submittal changed the design from a tight radius to a larger sweeping radius for the directional drill, resulting in a much greater length.
	There is a town water main, 12 inch diameter, within the NH DOT ROW. Communication cables will be attached to each positive and negative charge cable that have 3 inch diameter HDPE.
	Each cable/conduit is separated by approx 5 ft to 21 ft and will be approximately the same radius. The directional drill will begin at an approximate 12 degree angle at the entry point. The design calls for the use of bentonite annulus fill in the conduits surrounding the conductor and communications cables.
Conclusions	The proposed public water crossing will not substantially affect the public rights in these waters as it will be directionally drilled , nor will the proposed crossing substantially affect the functional use and safety in these public waters.
	There is no engineering standard but the proposed directional drill should be 10 feet below the bottom of the Moosilauke Brook.
Staff Recommendation	That the Commission grant the license to construct, maintain and operate the electric and communication lines under the public waters identified in the petition. Staff recommends NPT coordinate with NHEC in regards to Circuit 500 on sharing ROW for installation of underground to minimize damage occurrence
Staff Reccommended Conditions applied to License	The license for this public water crossing is contingent upon the Northern Pass Project receiving a Certificate of Site and Facility from the SEC.

Public Water/Land Crossing Name: Baker River, Plymouth, NH for NPT

General Information			Technical Information	
PUC Docket Number	DE 15-460		Voltage	320 kV, DC
PUC Zone	2		Circuit	3720/3731
PUC Map Number	12		Conductor diameter (cross sect)	2.25 in
Petitioner (NPT, ESE)	NPT		Manufacturer	ABB
Petitioner Line List # (for Parcels traversed)	5342.01		Conductor Size	2500 sq mm
Crossing Circuit Configuration	Underground		Insulation	XLPE
Public Crossing Type (Water/Land)	Water		Conduit Diameter	8" HDPE
Previous Public Crossing License Issued by PUC	No		Conductor Dia with Insulation	4.72 in
Relocated ESE Crossing (Yes/No)	No		Cable Weight (Lbs/Ft)	20.900
Right of Way Width	DOT ROW		Back Structure Receiver	HDD 050 Exit Point
Number of Circuits within ROW	1 new (DC)		Estimated Depth Max	72 feet at max arc
Foreign Utilities within ROW	Sewer and Drainage		Radius of Directional Drill	1200 ft
Total Structures/Poles/Manholes this circuit crossing	2		Back Conductor Height	NA
First Structure Identification	HDD 050 Entry Points (a +b)		Back Conductor Elev. at Pole	NA
State Listed Public Waters (Yes/No/Not Applicable)	Yes		First Structure Receiver	HDD 050 Entry Point
Last Structure Identification	HDD 050 Exit Point (a + b)		Estimated Depth Arc	varies
PUC Approximate Length of crossing for License (Land only) [Does Not apply to Water or Rail]	Not Applicable (but varies between 948 and 1032 feet including DOT ROW)		Forward Ground Elevation	NA
			Forward Conductor Height	NA
			Forward Conductor Elev. at Pole	NA
			Span (Feet)	1032
			Max Tension NESC Heavy lbs.	NA
			Max Operating Temp (^{O}F)	130
			Calc'd Horiz.Tension@MaxTemp	NA
			Calc'd. Clearance (SAG 10)	NA
			Clearance Shown on Profile	10 feet
			Req'd Clearance (NESC)	No Engineering Standard

Crossing Comments, Conclusions, Conditions, and Staff Recommendation	
Comments	The original petition portrayed this crossing as an underground bore with a 10 foot minimum clearance beneath the Baker River. The November 2016 submittal changed the proposed plan from bore to a directional drill that was considerably longer than the original plan.
	There is a town sewer pipe, 12 inch diameter, and drainage tile within the NH DOT ROW. Each cable conduit is separated by approximately 15 ft to 30 ft and will be approximately the same radius. The conductor and communication cables will be surrounded by bentonite annulus fill within each conduit.
	Communication cables will be attached to each positive and negative charge cable that have 3 inch diameter HDPE.
Conclusions	The proposed public water crossing will not substantially affect the public rights in these waters as it will be directionally drilled , nor will the proposed crossing substantiall affect the functional use and safety in these public waters.
	There is no engineering standard but the proposed directional drill should be 10 feet below the bottom of the Baker River
Staff Recommendation	That the Commission grant the license to construct, maintain and operate the electric and communication lines under the public waters identified in the petition.
Staff Reccommended Conditions applied to License	The license for this public water crossing is contingent upon the Northern Pass Project receiving a Certificate of Site and Facility from the SEC.