

Liberty Review of the Public Service Company of New Hampshire Petition for License to Construct and Maintain Electric Lines and a Fiber Optic Communications Cable Over and Across the Public Waters of the Merrimack River in Bow, Concord, Franklin, and Northfield, the Soucook River in Concord and Pembroke, Turtle Town Pond in Concord, and Chance Pond in Franklin

April 29, 2008

Review Summary

On April 24, 2008, Public Service Company of New Hampshire (PSNH) filed a petition with the New Hampshire Public Utilities Commission (Commission) pursuant to RSA 371:17 for a license to construct and maintain electric and fiber optic communications (OPGW) lines at six¹ locations for the purpose of rebuilding a 115 kilovolt (kV) line depicted as V-182 to increase its capacity. PSNH states that the new crossings are required to relieve an overload on the V-182 115kV line between the Garvins Substation in Bow, New Hampshire and the Webster Substation in Franklin, New Hampshire caused by the loss of the larger and parallel 115kV line between the Merrimack Generating Plant and Webster Substation with full generation at Merrimack Station and increased customer demand in the central portion of New Hampshire. The combination of the contingency and load growth results in PSNH's inability to meet its system design guidelines. The rebuild of the V-182 115kV line and the six new crossings will allow PSNH to meet the reasonable requirements of service to the public in the central region of New Hampshire.

In support of its petition, PSNH submitted related figures, tables, and exhibits as follows: construction detail drawing depicting the construction specifications of the proposed dead end structures (Figure 1), construction detail drawing depicting the construction specifications of the proposed tangent structures (Figure 2), a table which correlates crossing locations, waters crossed, previous Commission approval Order Numbers and Docket Numbers for these crossing locations, and current petition crossing identification (Table 1), appendices describing the design conditions of the six proposed crossings (Appendices, A, B, C, D, E, F, and G), geographic maps depicting the locations of the six proposed crossings (Exhibits 1, 3, 5, 7, 10, and 12 respectively), plan and profile drawings depicting the locations and projected elevations of the seven proposed crossings (Exhibits 2, 4, 6, 8, 9, 11, and 13 respectively). Table 1, related exhibit identification for the current petition, and previous crossing licence information is shown in Attachment A to this report.

PSNH states that with the exception of the both sides of the Merrimack River in Bow and Concord, New Hampshire (Appendix A), which is land owned by PSNH, PSNH owns easements that are a minimum of 225 feet in width for its lines and facilities on both sides of the public water bodies at all of the other proposed crossing locations and that each of

¹ PSNH has split the Turtle Town Pond crossing into two appendices because of its length.

the crossings will be constructed within the limits of those easements or on PSNH property. The new crossings will be constructed at locations described in Attachment B to this report.

The construction of the crossings will consist of either three pole laminated wood dead-end angle structures (Type DA) depicted in Figure 1, or single pole laminated wood tangent structures (Type WT1) shown in Figure 2. As designed by PSNH and depicted in Figure 1, the three poles of the dead-end angle structures will be X braced and spaced 14-foot 0-inches apart with each of the phase conductors terminating with an insulator string on each of the poles 8-foot 6-inches from the top of the pole resulting in a 14-foot 0-inch conductor spacing in the horizontal plane. The static wire and the OPGW communications cable will be mounted on their own cross arm 7-foot 0-inches horizontally offset from the phase conductors (centered between them) and 7-foot 6-inches above them. As designed by PSNH and as depicted in Figure 2, the single pole tangent structures will be davit arm construction. The phase conductors will be vertically configured and offset resulting with the highest and lowest conductors on one side of the pole and the middle conductor on the other. The highest conductor will be 15 feet 0-inches from the top of the pole and 6-foot 0-inches offset from the pole. The lowest conductor will be 15-feet 0-inches below the highest conductor and 7-foot 0-inches offset from the pole. On the other side of the pole, the middle conductor will be 22-feet 0-inches from the top of the pole and 6-foot 0-inches offset from the pole. The OPGW communications cable will be mounted on the pole 6-inches from the top of the pole. The structure number, structure type and height, crossing span length, and geographic placement relative to the crossing are shown in Attachment C to this report.

PSNH investigated a multitude of weather and loading conditions for its design. The conditions investigated were the National Electrical Safety Code (NESC), ANSI C2-2007 Heavy Load Conditions (0 degrees F, 4 pounds per square foot wind loading, and ½ inch radial ice), minus 20 degrees F ambient temperature, and 285 degrees F conductor temperature. PSNH used these design conditions to determine the minimum clearance of the conductors to the water surfaces of the crossings and to land surfaces. To determine the minimum distances between the phase conductors and the static wire conductor and the OPGW communication cable, PSNH assumed the phase conductors were at 30 degrees F with no ice while the static wire and the fiber optic conductors above were at 30 degrees F and an extreme ice loading of one inch radial ice.

The three phase conductors will be 1590 MCM 45/7 ACSR conductors, constructed in either a vertical or horizontal configuration as described above. The static wire will be a single 7#8 Alumoweld conductor and will be bracket mounted on the structures and poles. The OPGW communication cable will be bracket mounted on the structures and poles in the same manner as the static wire. The phase conductors will be tensioned to 10,000 pounds except for the crossings in Appendix A and C which will be 13,500 pounds and 14,000 pounds respectively. Similarly, the static wire and OPGW communication cable will be tensioned to 4,500 pounds except for the crossings in Appendix A and C which will be 6,500 pounds and 5,200 pounds respectively. All conductors, static wires, and OPGW communication cables will be sagged to NESC,

ANSI C2-2007 Heavy Load Conditions.

PSNH used the 100-year flood levels contained in the Federal Emergency Management Agency (FEMA) flood insurance rate maps at all locations in its design except for Turtle Town Pond (Appendices D and E) as no FEMA flood insurance maps exist for this water body. PSNH stated that it used the 100-year flood for water elevations as the normal flood level or 10-year flood levels required by the NESC were not available and that the 100-year flood level will be well above the 10-year flood elevation. To determine the flood elevation for the two Turtle Pond crossings, PSNH performed a hydrological analysis of Turtle Town Pond and the surrounding area assuming a 10-year storm event of 4.2 inches of rain within a 24-hour period per U. S. Department of Agriculture maps and calculated an expected water level rise of 2.5 feet for Turtle Town Pond. For conservatism, PSNH used a 5.0 foot water level rise for this crossing.

PSNH further states that the maximum sag for the phase conductors occurs when they are at their maximum operating temperature of 285 degrees F. Water surface areas, whose size determines NESC minimum clearance requirements were calculated according to NESC Table 232-1, Note 19, using the surface area of a one mile section of the water body. The resultant water surface areas ranged from 45 acres to 239 acres. Table 232-1 requires a minimum water surface clearance of 30.1 feet for water surface areas of 20 acres to 200 acres and 36.1 feet for water surface areas of 200 acres to 2,000 acres when adjusted by NESC Rule 232.C.1.a. for circuits operating at 115kV.

For static wires and OPGW communication cables that meet Rule 230C1, the minimum clearance required by Table 232-1 to the water surface is 25.5 feet for water surface areas of 20 acres to 200 acres and 31.5 feet for water surface areas of 200 acres to 2,000 acres. The maximum sag of the static wire and the OPGW communication cable will never exceed these clearance requirements as they are located well above and offset from the phase conductors and will never sag to levels near the phase conductors. The 100-year flood elevations, calculated water surface areas, water surface clearance requirements, and minimum water surface clearance for the phase conductors are shown in Attachment D to this report.

For phase conductors adjusted to a 115kV operating voltage by NESC Rule 232.C.1.a, the minimum clearance required by Table 232-1 to the land surface where truck traffic is present is 20.1 feet. For static wires and OPGW communication cables that meet Rule 230C1, the minimum clearance required by Table 232-1 to the land surface is 17.5 feet. The maximum sag of the static wire and the OPGW communication cable will never exceed these clearance requirements as they are located well above and offset from the phase conductors and will never sag to levels near the phase conductors. The land surface clearance requirements, and minimum land surface clearance for the phase conductors are shown in Attachment E to this report.

PSNH determined that the minimum distance between the static wire or the OPGW fiber optic cable and the phase conductors occurs when the phase conductors are at a temperature of 30 degrees F and have no ice while the static wire or OPGW fiber optic

cable is at 30 degrees F with an extreme ice loading of 1 inch radial ice. NESC Table 235-6, Section 2a requires that the minimum distance between the phase conductors and the static wire or OPGW fiber optic cable be 54.3 inches or 4.8 feet for circuits operating at 115kV when adjusted by NESC Rule 235C.2.a.1. The minimum expected vertical and horizontal clearances between the phase conductors and the static wire or the OPGW communication cable are depicted in Attachment F to this report.

According to PSNH, There are no abutters to either side of the crossings because PSNH either owns the property on each side of the structure location on both sides of the river or has at least 225 foot wide easements on both sides of the public water bodies at all of the crossing locations.

PSNH states that with the exception of the crossing of the Turtle Town Pond in Concord, New Hampshire, none of the other crossing structures will be set within jurisdictional wetlands or other areas that will require New Hampshire Department of Environmental Services (NHDES) permitting. PSNH further states that the appropriate NHDES wetlands permits will be applied for and obtained by PSNH prior to the installation of any of the new structures associated with the crossing at this location. Additionally, PSNH states that in the event that NHDES wetlands permits are required to gain access to any of the other new crossing structures, such permits will be obtained prior to construction.

PSNH states that the use and enjoyment by the public of these waters will not be diminished in any material respect as a result of the proposed electric and communication line crossings. PSNH further attests that the construction of the crossing will be constructed, maintained, and operated in accordance with the requirements of the National Electrical Safety Code, American National Standards Institute (ANSI) C2-2007.

Conclusions and Recommendations

Liberty reviewed the petition and associated technical information filed by PSNH in support of its petition.

Liberty found that PSNH has provided sufficient information and data to justify construction of new electric lines and a communications cable across public waters at these locations.

Liberty found that PSNH assures the Commission that the new overhead facilities will be properly constructed, operated, and maintained in accordance with the requirements of the NESC, ANSI C2-2007.

Liberty concluded that if the proposed facilities are constructed, operated, and maintained as proposed in its filing, PSNH will provide safe and reliable service to the public based on sound engineering standards and that construction will be in accordance with the 2007 edition of the National Electrical Safety Code.

Liberty recommends that Staff recommend approval of PSNH's petition to the Commission.

Liberty further recommends that Staff recommend that the Commission include the following conditions on PSNH.

- Require that PSNH shall conform to all requirements of the New Hampshire Department of Environmental Services related to these approved crossings
- Require that PSNH file copies of all required New Hampshire Department of Environmental Services wetland permits required for these crossings with the Commission
- Require that all construction and future reconstruction to these approved crossings shall conform to the requirements of the National Electrical Safety Code and all other applicable safety standards in existence at that time
- Require that PSNH maintains and operates these crossings in conformance with the National Electrical Safety Code.

Docket No. DE 08-064

Attachment A

Correlation of Existing and Current Petition Information

Town	Water Body	Former NHPUC Order No.	Former NHPUC Docket No.	Current Petition Appendix #	Current Petition Location Exhibit #	Current Petition Plan & Profile Exhibit #
Bow/Concord	Merrimack River	12,219	DE 76-22	A	1	2
Concord/Pembroke	Soucook River	N/A ¹	N/A ¹	B	3	4
	Soucook River	N/A ¹	N/A ¹	C	5	6
Concord	Turtle Town pond ²	21,817	DE 94-272	D	7	8
	Turtle Town Pond ²	21,817	DE 94-272	E	7	9
Franklin/Northfield	Merrimack River	12,219	DE 76-22	F	10	11
Franklin	Chance Pond	18,782	DE 87-131	G	12	13

1 – These crossings were not previously licensed.

2 – PSNH submitted this crossing as two appendices.

Docket No. DE 08-064

Attachment B

Location Descriptions of Crossings

Current Petition Appendix #	Town	Water Body	Current Petition Location Ex. #	Location Description
A	Bow/Concord	Merrimack River	1	Just South of the Garvins Falls Dam
B	Concord/Pembroke	Soucook River	3	West of NH Route 3 and East of the Merrimack River
C		Soucook River	5	West of the intersection of Pembroke Road and NH route 106 and North of NH Route 106
D	Concord	Turtle Town Pond ¹	7	West of Oak Hill Road and East of Appleton Street.
E		Turtle Town Pond ¹	7	Same as above.
F	Franklin/ Northfield	Merrimack River	10	North of the Confluence of the Merrimack River and Stirrup Iron Brook and South of South Main Street
G	Franklin	Chance Pond	12	Just South of Garneau Road and just North of Chance Pond Road

1 – PSNH submitted this crossing as two appendices.

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Attachment C

Structure and Span Information

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Exhibit #	Structure # & Location	Structure Type & Height (feet)	Span Length (feet)
A	Bow/Concord	Merrimack River	2	#2 – South #3 – North	DA – 85 DA – 85	827.5
B	Concord/Pembroke	Soucook River	4	#11 – South #12 - North	WT1 – 85 WT1 - 95	424.4
C		Soucook River	6	#31 – South #32 - North	DA – 85 DA - 55	1167.3
D	Concord	Turtle Town Pond ¹	8	#79 – South #80 – North	WT1 – 110 WT1 – 110	519
				#80 – South #81 – North	WT1 – 110 WT1 – 110	534
				#81 – South #82 – North	WT1 – 110 WT1 – 95	457
				#82 – South #83 - North	WT1 – 95 WT1 - 100	329
E		Turtle Town Pond ¹	9	#83 – South #84 – North	WT1 – 100 WT1 – 105	442

				#84 – South #85 – North	WT1 – 105 WT1 – 105	476
				#85 – South #86 – North	WT1 – 105 WT1 – 105	469
				#86 – South #87 - North	WT1 – 105 WT1 - 75	518
F	Franklin/Northfield	Merrimack River	11	#208 – South #209 - North	WT1 – 95 WT1 - 100	570.9
G	Franklin	Chance Pond	13	#267 – South #268 - North	WT1 – 95 WT1 - 95	506.8

1 – PSNH submitted this crossing as two appendices.

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Attachment C Continued

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Attachment D

Phase Wire Water Clearance Information¹

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	100 Year FEMA Flood Elevation (feet) ²	Water Acreage (acres)	Phase Wire Water Clearance Required (feet)	Minimum Water Clearance (feet)
A	Bow/Concord	Merrimack River	2	#2 – South #3 - North	204	181	30.1	39.0
B	Concord/Pembroke	Soucook River	4	#11 – South #12 - North	221	121	30.1	42.8
C		Soucook River	6	#31 – South #32 - North	253	121	30.1	41.9
D	Concord	Turtle Town Pond ³	8	#79 – South #80 – North	321	239	36.1	38.3
				#80 - South #81 – North	321	239	36.1	38.8
				#81 – South #82 – North	321	239	36.1	39.8
				#82 – South	321	239	36.1	45.1

				#83 - North				
E		Turtle Town Pond ³	9	#83 - South #84 - North	321	239	36.1	40.3
				#84 - South #85 - North	321	239	36.1	38.8
				#85 - South #86 - North	321	239	36.1	39.4
				#86 - South #87 - North	321	239	36.1	44.9
F	Franklin/Northfield	Merrimack River	11	#208 - South #209 - North	269	181	30.1	38.9
G	Franklin	Chance Pond	13	#267 - South #268 - North	404	45	30.1	42.3

1 - Static wire and OPGW cable clearance requirements are not shown. Clearance requirements for the static wire and the OPGW cable to the water surface are always less than the phase wire under these conditions. The static wire and OPGW cable are installed well above the phase wires and will never sag within the minimum separation requirements of the phase conductors.

2 - Elevations for Appendices D and E are based on PSNH's hydrological study.

3 - PSNH submitted this crossing as two appendices.

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Attachment C Continued

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Attachment E

Phase Wire Land Clearance Information¹

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	Phase Wire Land Clearance Required (feet)	Minimum Land Clearance (feet)
A	Bow/Concord	Merrimack River	2	#2 – South #3 - North	20.1	63.0
B	Concord/Pembroke	Soucook River	4	#11 – South #12 - North	20.1	43.6
C		Soucook River	6	#31 – South #32 - North	20.1	34.8
D	Concord	Turtle Town Pond ²	8	#79 – South #80 – North	N/A	N/A
				#80 - South #81 – North	N/A	N/A
				#81 – South #82 – North	N/A	N/A
				#82 – South #83 - North	20.1	37.6 ³
E		Turtle Town Pond ²	9	#83 – South #84 – North	N/A	N/A

				#84 – South #85 – North	N/A	N/A
				#85 – South #86 – North	N/A	N/A
				#86 – South #87 - North	20.1	33.8 ³
F	Franklin/Northfield	Merrimack River	11	#208 – South #209 - North	20.1	46.7
G	Franklin	Chance Pond	13	#267 – South #268 - North	20.1	43.8

1 - Static wire and OPGW cable clearance requirements are not shown. Clearance requirements for the static wire and the OPGW cable to the land surface are always less than the phase wire under these conditions. The static wire and OPGW cable are installed well above the phase wires and will never sag within the minimum separation requirements of the phase conductors.

2 – PSNH submitted this crossing as two appendices.

3 – Minimum land clearance span for these four spans.

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Attachment E Continued

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Attachment F

Minimum Clearance Between Conductors

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	Minimum Clearance Required (feet)	Vertical Clearance (feet)	Horizontal Clearance (feet)
A	Bow/Concord	Merrimack River	2	#2 – South #3 - North	4.8	4.8	7.0
B	Concord/Pembroke	Soucook River	4	#11 – South #12 - North	4.8	13.0	6.0
C		Soucook River	6	#31 – South #32 - North	4.8	5.4	7.0
D	Concord	Turtle Town Pond ¹	8	#79 – South #80 – North #80 – South #81 – North #81 – South #82 – North #82 - South #83 - North	4.8 4.8 4.8 4.8	13.8 ²	6.0 ²

E		Turtle Town Pond ¹	9	#83 – South #84 – North	4.8		
				#84 – South #85 – North	4.8	12.8 ²	6.0 ²
				#85 – South #86 – North	4.8		
				#86 – South #87 - North	4.8		
F	Franklin/Northfield	Merrimack River	11	#208 – South #209 - North	4.8	11.8	6.0
G	Franklin	Chance Pond	13	#267 – South #268 - North	4.8	12.4	6.0

1 – PSNH submitted this crossing as two appendices.

2 – Minimum distances for all four spans.

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Attachment F Continued