

TRF

**FROM:** Tom Frantz – Director, Electric Division

April 7, 2009

**SUBJECT:** DE 08-003: Petition by National Grid for a License to Construct and Maintain Electric Lines and a Communication Line Over and Across the Public Waters of the Connecticut River and Cold River in Walpole, New Hampshire and the Ashuelot River in Surry, New Hampshire

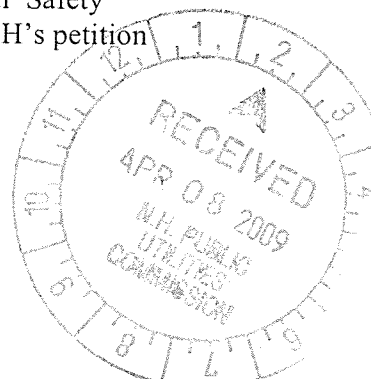
**TO:** Chairman Getz, Commissioners Morrison and Below  
Executive Director Howland

On January 16, 2009, National Grid filed a petition with the Commission under RSA 371:17 for a license to construct and maintain electric lines and a communication line over and across public waters. Those public waters are the Connecticut River and Cold River in the Town of Walpole, New Hampshire and the Ashuelot River in the Town of Surry, New Hampshire. The crossings are part of a significant reinforcement of the transmission system in western New Hampshire.

Staff employed the Liberty Consulting Group (Liberty) to review National Grid's petition. On January 30, 2008 Staff and Liberty met with National Grid to discuss the petition. At that meeting, Staff expressed its concerns about the petition. Those concerns and the long history of this petition are detailed in the attached review filed electronically by Liberty on March 20, 2009. Staff also has included the various attachments filed by Liberty in this proceeding. It is clear from the Liberty review that major disagreements were present from the beginning in National Grid's petition. Some of those disagreements, including the question of whether National Grid needed or ever received licenses for its proposed water crossings, remain unsettled. Staff believes National Grid should submit documentation of its licenses that the NHPUC has approved for its water crossings and/or state land crossings and for those crossings that are not licensed, National Grid should petition for Commission approval in a reasonable timeframe. In regard to this specific petition, Staff recommends that the Commission approve the crossings as soon as possible in order for National Grid to meet its construction deadlines. Staff makes this recommendation based on its review of the petition, its field work conducted with Liberty and National Grid, the meetings it conducted with National Grid and Liberty over the past year and the conclusions and recommendations of Liberty that are attached hereto.

Liberty, after extensive review, stated that "[G]rid has provided sufficient information and data to justify construction of new electric lines and a communication cable across public waters at these locations" and that National Grid "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 also stated that "If the proposed facilities are constructed, operated, and maintained as proposed in its filing, Grid 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 further recommended to Staff that it recommend approval of PSNH's petition to the Commission.

Please contact me if you have any questions or would like to discuss this matter.



**Review by The Liberty Consulting Group of the National Grid Petition for License to Construct and Maintain Electric Lines and a Communication Line Over and Across the Public Waters of the Connecticut and Cold Rivers in Walpole and the Ashuelot River in Surry, New Hampshire**

**March 30, 2009**

**Petition Summary**

On January 16, 2009 National Grid (Grid) filed a petition with the Commission under RSA 371:17 for a license to construct and maintain electric lines and a communications line over and across public waters of the Connecticut and Cold Rivers in Walpole and the Ashuelot River in Surry and to license previously unlicensed crossings also at those locations. The facilities in question are a double circuit tower on the Vermont side and 2 single circuit towers on the new Hampshire side of the Connecticut River crossings and double circuit towers across the Cold and Ashuelot Rivers that support the I-135N and J-136N 115 kV lines. These lines connect the Bellows Falls No. 14 substation in Rockingham, VT and the Flagg Pond station in Fitchburg, Massachusetts. These lines are currently unlicensed<sup>1</sup>. Grid filed its petition at this time as the three I-135N crossings need to be reconstructed as part of a transmission reinforcement project for the western portion of New Hampshire. Specifically, a low voltage situation results from the loss of the I-135S and J-136S double circuit towers between Flagg Pond and Pratt's Junction substations in Massachusetts and requires the use of load shedding to correct. In addition, voltage and thermal issues can result from the outages of 345/115kV transformer at Vermont Yankee, the K-186 115kV line from Vermont Yankee to Public Service Company of New Hampshire, or the 345kV line between the Vermont Yankee and the Coolidge substations in Vermont. The J-136N lines crossings will remain as constructed. The rebuild of the I-135N 115kV line will allow Grid to meet the reasonable requirements of service to the public in the southwestern region of New Hampshire.

**Review Summary and Chronology**

New Hampshire Public Utilities Commission Staff (Staff) and The Liberty Consulting Group (Liberty) met on January 30, 2008 to discuss the petition. At that technical conference, Staff pointed out to Grid that its petition was flawed in that water elevations used to calculate clearances under the National Electrical safety Code (NESC) were 2003 August flows<sup>2</sup> that significantly overstated clearances, assumed that all rivers were not navigable and therefore not subject the increased clearance requirements of the NESC, and other deficiencies in the petition. Liberty reviewed the format and types of data that Grid needs to file so that a determination can be made that the crossings meet the requirements of the NESC. At this meeting, Grid also stated

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<sup>1</sup> Grid claims that the Commission licensed these crossings in the 1930s. Commission Staff reviewed previous Commission documents and determined that the Commission did not license these crossings, but merely granted Grid, then New England Power (NEP) permission to do business in New Hampshire. NEP's original position at the time of construction of the facilities was that NEP did not need permission to do business or construct facilities in New Hampshire as the facilities were part of a federal power project.

<sup>2</sup> August is the lowest flow period and lowest water level of the year.

that they believed that they had other unlicensed crossings and would submit them for Commission review.<sup>3</sup> Staff and Liberty agreed to meet with Grid again after the required information was obtained.

Staff and Liberty again met with Grid on February 25, 2008 as Grid stated that the required information had been obtained. Grid presented water elevations used in the design of the water crossings that were permutations of the NESC 10 year flood requirement such as the 10 year average water elevation and the 10 year high water elevation. Liberty again told Grid that these values were not the same as required by the NESC. Liberty reminded Grid that the navigation requirement in the NESC also existed at the 10 year flood level. Each crossing was discussed and Liberty also questioned the use of 550' as the design water level at Surry Mountain Lake Dam as that elevation was the spillway elevation<sup>4</sup> and not the design high water level. Prior to this meeting, Grid also presented information that the I-135N 115kV line rebuild would also cross an old state owned railroad bed in Rindge and that the petition would be amended to include that crossing of public lands.

Because Grid had continuously presented information which it should have known was not in conformance with the NESC, misrepresented the Commission's previous actions with regards to these crossings, and created confusion over the proper water design level at Surry Mountain Lake Dam, Liberty asked data requests concerning the contract with the US Government regarding the Surry Mountain Lake Dam, original line design drawings, and operating procedures at Surry Dam regarding public use. Subsequently, Liberty contacted the Core of Engineers in Waltham, MA and was told by the project engineer that the Surry Lake maximum design water level was 563'.

An additional meeting was held with Grid on October 27, 2008 to discuss the information requested by Staff and Liberty. Grid presented photos of each location at water level conditions as they existed at the time the photos were taken to show that the areas under the crossings were not navigable. At this point, Grid had determined what the 10 year flood levels were at the Cold and Connecticut River locations and had incorporated that information into their designs. The information requested by Liberty was supplied except for any information pertaining to the I-135N and J-136N lines' original design parameters and clearance and any information to the increase in the operating temperature of the lines to 100°C in the 1970s. Grid stated that all information for those lines was "lost".

With regard to navigable conditions at the crossings, Grid presented photos and calculations of bridge height impairments to boating showing that the Cold River crossing should not be considered navigable. Liberty agreed. The operating procedure at the Surry Dam was also discussed. It clearly showed that as the Surry Mountain Lake impoundment begins to fill that the facility is closed to the public at an early point in the fill cycle and that the public facilities and roads would be inundated. Liberty agreed that Surry Mountain Lake is not navigable when full. In addition, the issue of navigation at normal level conditions is moot due to the significant

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<sup>3</sup> Grid later claimed that it had no unlicensed crossings.

<sup>4</sup> The spillway elevation is the elevation at which water can no longer be impounded but is allowed to flow downstream. It is not the maximum design level of the facility as water can further rise behind the impoundment because of constriction of flow at the spillway.

clearances that exist at those times. Upon reviewing the information and photos supplied regarding the Connecticut River crossing, Liberty did not agree with the Grid conclusion that the Connecticut River location was not navigable. If anything, the photos made the area under the subject lines appear navigable especially if 10 year flood levels were considered. Liberty agreed to do a field audit before making a final determination at this location.

With regard to clearances at the crossings, Liberty concluded that the Cold River crossing met NESC requirements for non navigable location requirements, that the Connecticut River crossing did not meet NESC requirements if the location was navigable, but did meet NESC requirements if it was not. With regard to Surry Mountain Lake clearance requirements to water, the contract stated that it required the then New England Power Company (NEP) to relocate its facilities to allow for continuous operation of its facilities at an elevation of 560'. NEP performed the relocation and was fully compensated to do so. Since that time, the maximum operating temperature of the lines was increased from 49°C to 100°C when they were re-rated in the 1970s. Grid stated that their engineers determined that NESC requirements are met if the J-136N line is operated at 100°C and the rebuilt I-135N line is operated at 140°C if non navigable clearances are applied at the 550' spillway water level and that those clearances would be reduced to approximately 5' if Surry Mountain Lake fills to its 560' design level. Grid also stated that the 560' requirement only references the elevation of the tower footings so they would not be eroded with a full pond. Liberty totally disagrees with the Grid positions. It is Liberty's position that when the US government required relocation of the NEP facilities for the construction of Surry Dam to allow continuous operation of their facilities at a level of 560' that NEP was required to rebuild its facilities to the NESC that was in existence at time by contract and in order to be in compliance with Commission rules. Liberty believes that NEP did so using 60°F and 49°C maximum conductor temperature which were the commonly used values at that time. When the lines were re-rated in the 1970's to operate at 100°C and operate with greater sag, Liberty suspects either that this section of line was not looked at due to the large clearance that exists under most actual conditions and that no consideration was given to contractual obligations or that the spillway elevation was incorrectly used in the review.

At the October 27, 2008 meeting, Grid also requested that the I-135N and J-136N lines be separated, that Staff only consider the I-135N line in this petition, and that the J-136N line would be considered in a later petition. Staff agreed to do so.

Liberty conducted a field visit of the Connecticut River crossing on November 5, 2008 at Bellows Falls to ascertain whether the Connecticut River location is navigable. Liberty was accompanied by Staff and Grid. During that visit, Liberty concluded that the location is not navigable and has filed a separate field report substantiating its conclusion (Attachment A to this report). The original Grid photos were taken from a vantage position that did not allow a proper visual determination of navigable conditions to be made.

A further meeting was held between Staff, Liberty, and Grid on January 30, 2009. At that meeting, Grid agreed to alter its operating procedures for the I-135N 115kV line such that if the impoundment level of the Surry Mountain Lake Dam reaches 556' (the level at which NESC clearances are at the allowed minimum while at maximum conductor temperature), that a procedure would be in place to ensure that NESC required clearances are maintained to a level of

560' by reducing the maximum allowable current flowing over the line as required. Liberty agreed that such a procedure meets the requirements of the NESC.

On February 13, 2009, Grid filed a revised petition with the information required; however, the information for the crossing of State of New Hampshire land in Rindge was not included. Grid committed to file the petition for crossing of public lands as a separate petition. Staff agreed to the NEP request.

### **Review Findings**

In support of its petition, Grid supplied locational geographic maps and plan and profile drawings for the Connecticut, Cold, and Ashuelot River crossings as Appendices A through C respectively, site review findings and clearance issues identified as Appendix D, and construction detail of the structure and foundation modifications necessary as Figures 1 and 2 respectively. Related appendix identification for the current petition, and previous crossing licence information is shown in Attachment B to this report.

Grid states that owns easements that for its lines and facilities on both sides of the public water bodies at all of the proposed crossing locations and that each of the crossings will be constructed within the limits of those easements. The existing crossing and new crossings that will be constructed are at locations described in Attachment C to this report.

The construction of the crossings will consist of reinforced dead end structures and foundations as depicted in Figures 1 and 2. As designed by Grid and depicted in Appendices A through C, the phase conductors will be horizontally configured with a single optical ground wire (OPGW) acting as a static conductor positioned above and centered between two of the phase conductors. The OPGW is equivalent to 3/8 inch extra high strength galvanized steel. Dimensions between the phase conductors and the OPGW are also depicted in Appendices A through C. The structure number, structure type and height, crossing span length, and geographic placement relative to the crossing are shown in Attachment D to this report.

Grid investigated a multitude of weather and loading conditions for its design. The design condition that produced the maximum sag for the phase conductors was operation at 284 degrees F. The design condition that produced the maximum sag for the OPGW cable was the 105 degree F condition. Grid used these design conditions to determine the minimum clearance of the phase conductors and the OPGW cable to the water surfaces of the crossings and to land surfaces. To determine the minimum distances between the phase conductors and the OPGW communication cable, Grid assumed the phase conductors were at 30 degrees F without ice and that the static wires were at 30 degrees F with 3/4 inch of radial ice and 4 pounds per square foot of wind.

The three phase conductors are 795 MCM 26/7 ACSR conductors, constructed in a horizontal configuration as described in Appendices A through C. The static wires will be a single OPGW cable equivalent to 3/8 inch extra high strength galvanized steel, constructed as described in Appendices A through C. The phase conductors of the Connecticut, Cold and Ashuelot River crossings will be tensioned to 8,800 pounds, 8,000 pounds, and 8,500 pounds respectively at NESC, ANSI C2-2007 Heavy Load Conditions (0 degrees F, 4 psf wind, and 1/2 inch radial ice). Similarly, the OPGW communications cable at the Connecticut, Cold, and Ashuelot River

crossings will be tensioned to 4,900 pounds, 4,500 pounds, and 4,500 pounds respectively at NESC, ANSI C2-2007 Heavy Load Conditions.

Grid used the 10-year flood levels contained in the Federal Emergency Management Agency (FEMA) flood data in its design at the Connecticut and Cold River crossing locations. For the Surry Mountain Lake Dam crossing, Grid used the design high water elevation of the US Army Core of Engineers.

Water surface areas, whose size determines NESC minimum clearance requirements where sail boating is permitted is not at issue in this petition as all crossings are over waters not suitable for sail boating.

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 water bodies not suitable for sail boating is 18.6 feet. For the OPGW communication cable which meets Rule 230C1, the minimum clearance required by Table 232-1 to the water surface is 14.0 feet for water bodies not suitable for sail boating. The maximum sag of the OPGW cable will never exceed their 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 10-year flood elevations, water surface clearance requirements, and minimum water surface clearance for the phase conductors and the OPGW communications cable are shown in Attachment E 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 the OPGW communication cable that meets Rule 230C1, the minimum clearance required by Table 232-1 to the land surface is 15.5 feet. The maximum sag of the static wires 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 and OPGW communications cable are shown in Attachment F to this report.

Grid determined that the minimum distance between the OPGW cable and the phase conductors occurs when the phase conductors are at a temperature of 30 degrees F and have no ice while the OPGW cable is at 30 degrees F with a loading of 3/4 inch radial ice and a wind loading of 4 psf. NESC Table 235-6, Section 2a requires that the minimum distance between the phase conductors and the static wires 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 clearances between the phase conductors and the static wires are depicted in Attachment G to this report.

The proposed crossings in this petition are in an area that is considered a special wind region as depicted in Figure 250-2(e) of the NESC. Such designation requires that the proposed facility locations be analyzed for unusual local wind conditions. Grid states that no special local conditions were found.

Grid states that all technical requirements are based on the NESC, ANSI C2-2007 and those resultant clearances and designs meet or exceed NESC, ANSI C2-2007 requirements.

Grid also states that only the licenses petitioned for in this proceeding are required to construct the subject crossings. As such impacts to jurisdictional wetlands in the areas of the crossings will be avoided and no wetland permits will be required from the New Hampshire Department of Environmental Services.

Grid 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. Grid 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**

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

Liberty found that Grid 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 Grid 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, Grid 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.

### **Recommendations**

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

Liberty further recommends that Staff recommend that the Commission include the following conditions on Grid in its order.

Require that all 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 Grid maintains and operates these crossings in conformance with the National Electrical Safety Code.

Require that Grid review its records and submit a list of all former New England Power, New England Electric, New England Electric Transmission, or other affiliates operating in the New Hampshire jurisdiction showing the individual water crossing or state land crossing, the location, the line number used for dispatching, and Commission approved license number information including the Docket Number as appropriate.

Require that Grid submit petitions for crossings of state water or lands not duly licensed by the Commission and identified on the above list within a reasonable time as prescribed by the Commission.

Require that Grid submit a petition to cross the state lands in Rindge by the I-135N 115kV line forthwith.



**Docket No. DE 08-003**

**Attachment A**

**FIELD REPORT**

**I-135N CROSSING OF CONNECTICUT RIVER**

**SOUTH OF BELLOWS FALLS HYDRO STATION**

**THE LIBERTY CONSULTING GROUP**

**NOVEMBER 5, 2008**

On November 5, 2008, The Liberty Consulting Group (Liberty) inspected the I-135N 115kV crossing of the Connecticut River just south of the Bellows Falls Hydroelectric Station. Thomas C. Frantz, the Director of the Electric Division of the New Hampshire Public Utilities Commission (Commission) and Richard Olsen of Vanderweil Engineers accompanied Liberty on its inspection. The purpose of the field inspection was to determine if the water under the crossing was suitable for sail boating and hence subject to greater clearance between the water body at its 10-year flood level and the conductors at maximum operating temperature according to the National Electrical Safety Code.

**Photo 11-5-08 #1**

This photo was taken on the Vermont side of the river looking north to the station and the takeoff structure of the I-135N and J-136N 115kV lines. Note that the lines cross over the tailrace of the station.

**Photo 11-5-08 #2**

This photo was taken at the approximated location of Photo 11-5-08 #1 but farther the fog had lifted to some degree. Notes are the same as that photo.

**Photo 11-5-08 #3**

This photo was taken on the New Hampshire side of the river looking south at a location at the rock outcrop between the tail race of the station to the right. Note the I-135N and J-136N take off structure at the station is directly over the tail race of the station.

**Photo 11-5-08 #4**

This photo was taken a little further out on the rock outcrop and depicts the full view of the outcrop between the station and the spillway canal.

**Photo 11-5-08 #5**

This photo was taken a little further out on the rock out crop and shows the take off structure of the I-135N and J-136N 115kV lines looking across the tail race of the station.

**Photo 11-5-08 #6**

This photo was taken at the same location as Photo 11-5-08 #5 and depicts the spillway canal to the left of the out crop looking towards the New Hampshire river bank. Note that the I-135N and J-136N line crossings are inside the definition of the spillway canal rock out crop and the river bank.

**Photo 11-5-08 #7**

This photo was taken at the same location as Photo 11-5-08 #5 and shows what the tail race of the station looks like directly under the I-135N and J-136N take off structure.

**Photo 11-5-08 #8**

This photo was taken a little further out on the rock out crop and directly under the I-135N and J-136N lines looking south to New Hampshire across the spill way canal. Note that the lines cross over the spillway canal itself.

**Photo 11-5-08 #9**

This photo was taken at the same approximate location as Photo 11-5-08 #8 and depicts what the spill way canal looks like a little further north of the line crossings.

**Photo 11-5-08 #10**

This photo is essentially the same as Photos 11-5-08 #6 and #8.

**Photo 11-5-08 #11**

This photo was taken from the New Hampshire side of the river on New Hampshire Route 12 looking west towards the station and directly under another unidentified 115kV river crossing. The photo shows that there is a large rock mound under the line

**Analysis**

Liberty found that the I-135N and J-136N 115kV crossings of the Connecticut River at this location are within the physical confines of the tail race and the spill way canal.

While the tail race appears accessible to sail boating, it is so confined that sail boat turning requirements cannot be met and that the current of the tail race would impede boating activities. During high water conditions the units would be expected to be in operation.

The spill way canal is more accessible than the tail race to boating activities, but turning requirements are restricted by the rock out crop and the New Hampshire river bank. In addition river current is a large concern here. When the units are operating, the current in the tail race is fairly constant regardless of river flow conditions as only a finite amount of water can be passed by the turbines. As the river flows escalate, the additional water must pass through the spill way canal so that the current in the spill way increases as the water level rises.

**Conclusion**

Liberty concluded that the water area under the I-135N and J-136N 115kV line crossings of the Connecticut River are not suitable for sail boating.

### **Recommendations**

Liberty recommends that National Electrical safety Code clearance requirements for sail boating should not be applied at this location.

Liberty further recommends that the applicant check the clearance of the rock mound under the unidentified 115kV line depicted in Photo 11-5-08 #11 at maximum operating temperature of the line to assure that National Electrical Safety Code requirements are met.

### **Photographs**



Photo 11-5-08 #1



Photo 11-5-08 #2

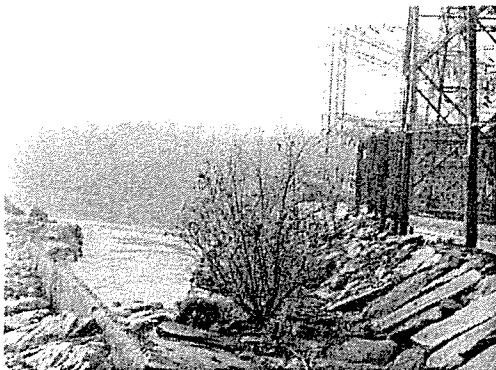


Photo 11-5-08 #3



Photo 11-5-08 #4

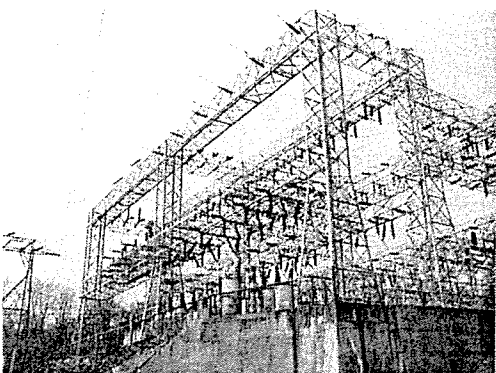


Photo 11-5-08 #5



Photo 11-5-08 #6

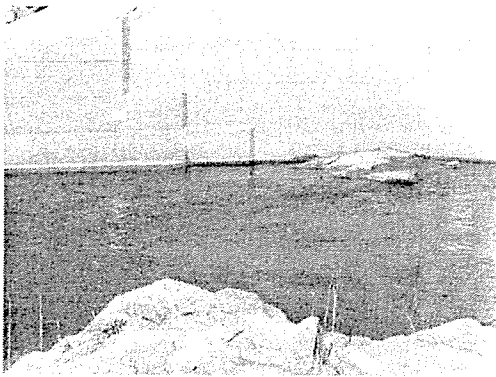


Photo 11-5-08 #7



Photo 11-5-08 #8



Photo 11-5-08 #9



Photo 11-5-08 #10

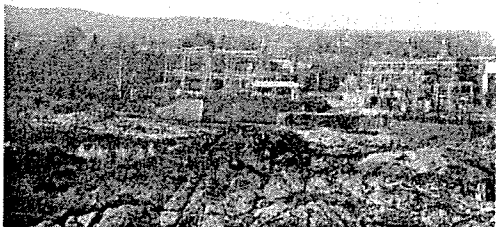


Photo 11-5-08 #11

**Docket No. DE 08-003**

**Attachment B**

**Correlation of Existing and Current Petition Information**

<b>Town</b>	<b>Water Body/State Lands</b>	<b>Former NHPUC Order No.</b>	<b>Former NHPUC Docket No.</b>	<b>Current Petition Appendix #</b>	<b>Current Petition Location Appendix #</b>	<b>Current Petition Plan &amp; Profile Appendix #</b>
<b>Walpole</b>	Connecticut River	N/A <sup>1</sup>	N/A <sup>1</sup>	A	A	A
<b>Walpole</b>	Cold River	N/A <sup>1</sup>	N/A <sup>1</sup>	B	B	B
<b>Surry</b>	Ashuelot River	N/A <sup>1</sup>	N/A <sup>1</sup>	C	C	C

1 – These crossings were not previously licensed.

**Docket No. DE 08-003**

**Attachment C**

**Location Descriptions of Crossings**

<b>Town</b>	<b>Water Body/State Lands</b>	<b>Current Petition Location Appendix #</b>	<b>Location Description</b>
<b>Walpole</b>	Connecticut River	A	Approx. 0.3 miles S of the Bridge Street bridge and just N of The Bellows Falls Hydro plant discharge.
<b>Walpole</b>	Cold River	B	Approx. 0.15 miles N of the NH Route 12A bridge.
<b>Surry</b>	Ashuelot River	C	Surry Mountain Lake

Docket No. DE 08-003

Attachment D

Structure and Span Information

Town	Water Body/State Land	Current Petition Plan & Profile Appendix #	Structure # & Location	Structure Type & Height (feet)	Span Length (feet)
Walpole	Connecticut River	A	Hydro Sub.– North #1A– South	Terminal Str. - 60 N-48 DE - 48	2073
Walpole	Cold River	B	#6 – North #7 - South	H-60 DE – 60 H-60 DE - 60	1551
Surry	Ashuelot River	C	#64-1 – North #65-1 – South	H-70 DE – 70 M-46 DE - 46	897

## Attachment E

Phase Wire Water<sup>1</sup> Clearance Information

Town	Water Body/State Land	Current Petition Plan & Profile Ex. #	Structure # & Location	100 Year FEMA Flood Elevation (feet) <sup>2</sup>	Phase Wire Water Clearance Required (feet) <sup>3</sup>	Minimum Water Clearance (feet)
Walpole	Connecticut River	A	Hydro Substation – North 1A South	252.3	18.6	25.6
Walpole	Cold River	B	#6 – North #7 - South	250.6	18.6	177.5
Surry	Ashuelot River	C	#64-1 - North #65-1 - South	560.0 <sup>2</sup>	18.6	14.6 <sup>4</sup>

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

2 - This elevation is based on US Army Core of Engineers requirements.

3 – According to NESC Table 232.1 for 115kV line operation where sail boating will not take place.

4 – This clearance is at the maximum operating conductor temperature of the line (284 degrees F). Clearance requirements are met up to an elevation of 556 feet. At that elevation, Grid will have a protocol in place to maintain the 18.6 foot clearance requirement by reducing line loading.



**Docket No. DE 08-003**

**Attachment F**

**Phase Wire Land<sup>1</sup> Clearance Information**

<b>Town</b>	<b>Water Body/State Land</b>	<b>Current Petition Plan &amp; Profile Ex. #</b>	<b>Structure # &amp; Location</b>	<b>Phase Wire Land Clearance Required (feet)<sup>2</sup></b>	<b>Minimum Land Clearance (feet)</b>
<b>Walpole</b>	Connecticut River	A	Hydro Sub. – North 1A - South	20.1	24.5
<b>Walpole</b>	Cold River	B	#6 – North #7 - South	20.1	52.9
<b>Surry</b>	Ashuelot River	C	#64-1 – North #65-1 - South	20.1	34.8

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

2 – According to NESC Table 232-1.2 (Subject to truck traffic) for 115kV operation.

Docket No. DE 08-003

Attachment G

Minimum Clearance Between Phase and Static Conductors

Town	Water Body State/Land	Current Petition Plan & Profile Appendix #	Structure # & Location	Minimum Clearance Required (feet) <sup>1</sup>	Minimum Clearance (feet) <sup>2</sup>
Walpole	Connecticut River	B	Hydro Sub. – North 1A - South	4.8	8.8
Walpole	Cold River	C	#6 – North #7 - South	4.8	9.3
Surry	Ashuelot River	D	#64-1 - North #65-1 - South	4.8	8.9

1- According to NESC Table 235-6.2a (Parallel conductors).

2- Includes conductor and the OPGW cable lateral offset.

**LINKED**  
4-9-09 Sandy

