NEW ENGLAND CLEAN POWER LINK

Lake Champlain, Vermont

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1.0 Introduction and Regulatory Background

On behalf of Champlain VT, LLC d/b/a TDI New England ("TDI-NE"), VHB has prepared this Lake Encroachment Permit Application for the aquatic portion of the proposed the New England Clean Power Link Project ("NECPL" or "Project"). The aquatic portion of the transmission line, approximately 97 miles in length, will be buried in the bed of Lake Champlain, except at water depths of greater than 150 feet where the cables will be placed on the bottom and allowed to self-bury. The cables will enter the Lake in Alburgh, Vermont and emerge in Benson, Vermont. The Project Overview Map, Lake Segment Overview Map, Lake Route Plans, and Lake Segment Details and Profiles are provided in Appendix 1.

According to Vermont Statutes Title 29, Chapter 11 Management of Lakes and Ponds §402(3), the alteration of the lands underlying any waters, or the placement of a cable or similar structure beyond the shoreline is considered to be an encroachment, and is prohibited without obtaining a Lake Encroachment Permit. In addition, a shoreline is further delineated as the mean water level of a lake, which in the case of Lake Champlain is established to be at elevation 95.5 feet. Therefore, this application has been prepared to demonstrate how the proposed Lake installation will meet the applicable permitting criteria. The following documents, in addition to the Statute, have been referenced in preparation of the application materials:

- Vermont Department of Environmental Conservation ("VT DEC") *Interim Procedures for the Issuance or Denial of Encroachment Permits*, dated October 6, 1989 ("Interim Procedures").
- VT DEC *Explanation of Public Trust Review of Encroachment Permit Applications*, undated, accessed on VT DEC WWMD web site January 2015 ("Explanation").
- VT DEC *Instruction Sheet – Application for Permit Management of Lakes and Ponds,* undated, accessed on VT DEC WWMD web site January 2015.
- VT Natural Resources Board, Water Resources Panel, *Rules Determining Mean Water Levels*, as amended, effective December 30, 2011.

The completed VT DEC Lake Encroachment Permit Application Form is enclosed, and this report serves to provide supplemental information to that included on the Application Form. Sections 2.0 through 7.0 of this report provide information directly requested by the form (Lines 4 through 10). Section 8.0 of this report describes how the Project meets the Public Trust Doctrine and can therefore be permitted. Conclusions are presented as Section 9.0. Additional supporting materials, such as maps, plans, and technical reports, are provided in the Appendices, as referenced by the attached Document Tracking Table.

The Applicant submitted a Petition for a Certificate of Public Good ("CPG") and prefiled testimony ("PFT") and exhibits to the Vermont Public Service Board ("VT PSB") on December 8, 2014. The majority of this report, as well as application and supporting materials, are a compilation of text and supporting documents from relevant PFT and exhibits. Additional Project information and details can be found in materials associated with that preceding. References are provided at the end of the report.

2.0 NECPL Project Overview and Route Development

The NECPL high voltage direct current ("HVDC") electric transmission line will provide electricity generated by renewable energy sources in Canada to the New England electric grid. The line will run from the Canadian border at Alburgh, Vermont to Ludlow, Vermont along aquatic and underground routes. The nominal operating voltage of the line will be approximately 300 to 320 kV, and the system will be capable of delivering 1,000 megawatts ("MW") of electricity.

The proposed aquatic portion of the transmission line, approximately 97 miles in length, will be buried to a target depth of 3-4 feet in the bed of Lake Champlain except at water depths of greater than 150 feet where the cables will be placed on the bottom and self-burial of the cables in sediment will occur. In areas where there are obstacles to burial (e.g. existing infrastructure, bedrock), protective coverings will be installed except in the deeper waters of the lake (i.e. greater than 150 feet).

The overland portion of the transmission line, approximately 57 miles in length, will be buried approximately four feet underground within existing public (state and town) road rights-of-way (ROWs) or on land controlled by TDI-NE.[1] In Castleton, the transmission line will be installed beneath the southern end of Lake Bomoseen within the U.S. Route 4 ROW via Horizontal Directional Drill ("HDD") methodology, which is addressed in a separate Lake Encroachment Permit Application.

In Ludlow, the HVDC line will terminate at a converter station that will convert the electrical power from direct current ("DC") to alternating current ("AC"). An underground AC transmission line will then run to the existing 345 kV Coolidge Substation in Cavendish, Vermont located approximately 0.6 miles to the south that is owned and operated by the Vermont Electric Power Company ("VELCO").

TDI-NE conducted feasibility studies resulting in the selection of the Point of Interconnection and the proposed transmission line route in Vermont. The studies found that of the substations considered,

[1] The only potential areas where underground burial will not occur is at two stream/river crossings in Ludlow where the cables will be placed in conduit and attached to a bridge or culvert headwall.

only the VELCO Coolidge Substation has the infrastructure necessary to reliably interconnect the NECPL without significant upgrades to the New England Independent System Operator ("ISO-NE") transmission system. After determining that the NECPL could reliably interconnect to the Coolidge Substation, TDI-NE evaluated a number of alternative routes from the Canadian border to the substation. Based on TDI's experience with a similar project (the Champlain Hudson Power Express), TDI-NE focused on alternatives that utilized Lake Champlain as the primary route, utilized buried HVDC technologies, and utilized public ROWs. Installing cables in the Lake is less costly, less disruptive to communities and less impactful when using environmentally-sensitive lake installation measures. TDI-NE also evaluated several above-ground and underground routes that did not utilize Lake Champlain as part of its alternatives analysis for its Section 404 application to the US Army Corps of Engineers. The non-lake or overhead alternatives were deemed impracticable due to cost, logistics, and/or technological constraints.

Once an approximate route using the Lake and public ROWs was developed, TDI-NE evaluated numerous route segments. TDI-NE developers and engineers evaluated numerous entry/exit points along Lake Champlain and road, railroad and utility ROW corridors from Lake Champlain to Ludlow. Meetings were held with the owners of these corridors to evaluate the feasibility of installing an HVDC cable. Once a preliminary route was selected by TDI-NE, it was previewed with state and federal regulators per their request and then through many meetings with town representatives and abutters along the route. Through feedback received at these meetings, several adjustments to the original route were made in Alburgh, Benson, Shrewsbury, Wallingford and Ludlow. The final proposed Alburgh to Benson Lake Route was selected based on the following criteria:

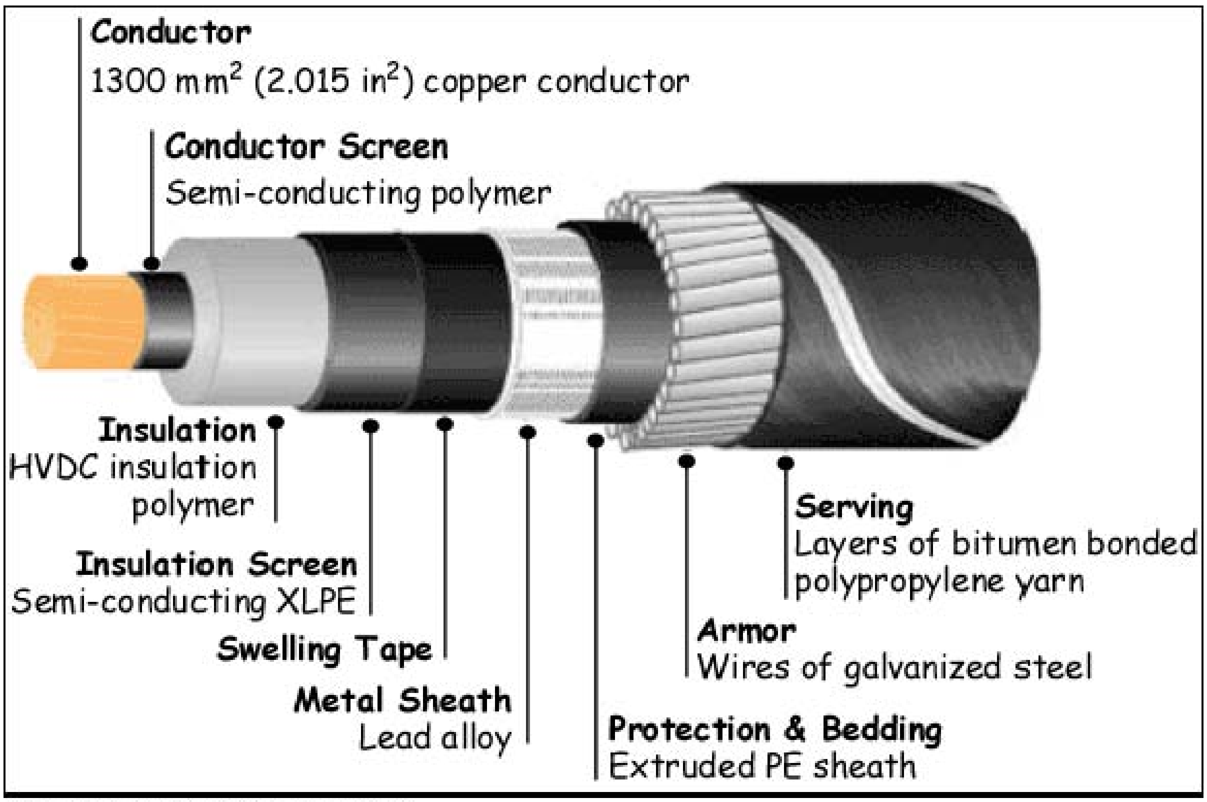
- Begin route near the U.S – Canadian border and maintain route entirely within the State of Vermont
- Avoid water depths less than 20 feet to the extent practical to allow for the typical draft of installation vessels
- Avoid areas with known geological obstacles, such as bedrock outcrops, to the extent feasible
- Avoid the sensitive section of Lake Champlain on the east side of the 4 Champlain Islands (Missisquoi National Wildlife Refuge)
- Avoid the rocky reefs and shoals where water depth ranged from 10 to 40 feet in order to reduce potential impacts on these fishery areas
- Avoid the Narrows of Lake Champlain by exiting the Lake in the Town of Benson
- Avoid known archaeological resources

The following Sections follow the format of the Lake Encroachment Permit Application form, and the Line numbers provided correspond to the line numbers on that form.

3.0 Lake Specific Project Description (Line 4)

3.1 Proposed Aquatic Cable Specifications

The transmission cables proposed for installation in the Lake Champlain segment will be XLPE HVDC cables rated at +/- 300 to 320 kV (depending upon the manufacturer). The polyethylene insulation in the XLPE cable eliminates the need for fluid insulation, enables the cable to operate at higher temperatures with lower dielectric losses, improves transmission reliability, and reduces risk of network failure. In general, aquatic transmission cables include a polyethylene sheath extruded over a lead-alloy sheath to provide superior mechanical and corrosion protection. An armored layer of galvanized steel wires embedded in bitumen provides additional protection for the aquatic transmission cables. The outer layer of the aquatic transmission cable will consist of an asphaltic compound with polypropylene reinforcement. The diameter of each aquatic cable will be approximately 5 inches (135 millimeters ("mm")) and the cable will weigh approximately 25 pounds per foot ("lb/ft") in water. An example aquatic HVDC transmission cable cross-section is provided in Figure 1 below.



Source: Cross-Sound Cable Company 2012

Figure 1: Example Aquatic HVDC Transmission Cable Cross-Section (Cross-Sound Cable Company, 2012)

3.2 Aquatic Cable Route

The Lake route, generally, is proposed in deeper sections of the Lake away from the shoreline. As discussed in the Project Overview section, certain areas, such as known fisheries, steep slopes, and archaeological resources, have been avoided to the extent possible during route design. The proposed aquatic portions of the transmission line, will enter the Lake in Alburgh and exit the Lake in Benson via transitional HDD's) on TDI-NE controlled properties:

- 55 Bay Road, Alburgh, VT (Alburgh Parcel ID: BY055)
- 229 Stoney Point Road, Benson, VT (Benson Parcel ID: 4-31.5)

The proposed entrance route involves an approximate 0.6-mile HDD from the launch site in a southwesterly direction where the boring would emerge on land in a receiving pit at the Fish and Wildlife Department ("FWD") Korean War Veterans Access Area ("FWD Access Area") off of US Route 2 in Alburgh, Vermont. TDI-NE has secured a license agreement with the FWD for used of this area (provided in Appendix 2). A manhole and fiber optic hand hole will be constructed on the FWD Access Area for cable splicing and future access. A second HDD would extend from the manhole area approximately 0.2 miles in a southwesterly direction to an exit point in the Lake where water is deep enough for alternative installation methods. A receiver casing or temporary cofferdam would be used at the exit point to receive the drilling fluid and serve as the point where the reamer and high-density polyethylene ("HDPE") conduit are attached and pulled back through the borehole. The proposed exit route involves an approximate 0.2-mile HDD from the HDD launch area on TDI_NE owned land in Benson to a receiver casing or coffer dam located within the Lake. The HDD launch area is setback over 400 feet from the shoreline of the Lake.

While the entry and exit points to the Lake will remain fixed, the aquatic routing as shown in the Lake Route Plans, provided in Appendix 1, represents a proposed general alignment of the Project, which may be adjusted in places following more detailed design work necessary for the final construction-level plans. Construction level engineering will not be initiated until after all state and federal approvals have been received, so that any final site specific analysis completed will ensure compliance with the regulatory requirements that come with those authorizations. TDI-NE also has not as of this point selected an Engineering, Procurement, and Construction ("EPC") contractor, whose expertise may also further enhance the design of the Project so as to better ensure its reliability. The routing depicted in the plans in Appendix 1 is offered for the purposes of understanding the potential impacts associated with the construction, operation, and maintenance of the Project. However, TDI-NE is seeking the flexibility to adjust this route during final design with the understanding that any changes in routing would have the same or less impacts than the current route proposed.

As discussed with ANR, TDI-NE proposes the following four step approach of communicating and seeking approval for route modifications:

1. Permit application materials provided herein depict the proposed linear aquatic route

2. After permits are issued and more detailed surveys are completed, but prior to construction, TDI-NE will submit final confirmatory construction route plans to appropriate agencies
3. The final cable location will ultimately be determined during construction based on actual conditions
4. TDI-NE will submit as-built construction plans to the ANR following construction

3.3 Installation Methods and Equipment

Prior to installing the aquatic transmission line, TDI-NE will conduct a debris-clearing run along NECPL's aquatic route. Using a tug and barge equipped with a grapnel system and crane, and followed by support vessels to transport crew members and collected debris, the route will be cleared of objects along the lakebed that could obstruct the burial of the line during installation.

In addition to the use of HDD at the entrance and exit points of the Lake, the cable will be installed using one of four methods, depending on water depths and conditions: jet-plow trenching, shear-plow trenching, hand trenching assisted by divers (as necessary), and laid on the bottom (no trenching) where water depths are greater than 150 feet. The cables will be stacked vertically in plow trenches and strapped together horizontally for bottom laid burial.

When buried, the aquatic transmission cables in Lake Champlain will be installed to a target depth of between 3 and 4 feet. The actual depth of burial that will be achieved will depend on available aquatic construction equipment, soil types and depth to bedrock and existing utilities. Cables that are laid on the Lake bed are anticipated to settle an average of one foot below the surface over time. Table 1 below summarizes the proposed installation method by mile, and descriptions of each installation method are provided below, and HDD Profiles and Lake Construction typicals, including Cofferdam and HDD Receiver Casing Installation typicals are provided in Appendix 1.

Table 1: Anticipated Mile by Mile Installation Method Summary

Approximate Mile Points	Installation Method	Installation Depth	Notes
MP 0.5 to MP 1.4 (entrance)	HDD	20 feet (min)	TDI controlled land to FWD access area to receiver casing/cofferdam
MP 1.4 to MP 22	Jet-Plow	3-4 feet	Waters are generally less than 150 feet deep
MP 22 to MP 66	Bottom Lay/ Self Burial	Approximately 1 foot	Assumes cables will self-bury an average of approximately 1 foot due to weight of cable, where cables are not crossing utilities or bedrock.
MP 66 to MP 74	Jet-Plow	3-4 feet	Waters are generally less than 150 feet deep
MP 74 to MP 98	Shear-Plow	3-4 feet	Proposed to help reduce disturbance of sediments in southern Lake Champlain, including where historic anthropogenic

Table 1: Anticipated Mile by Mile Installation Method Summary			
Approximate Mile Points	**Installation Method**	**Installation Depth**	**Notes**
			activities may have affected the quality of lake sediments
MP 97.6 to 97.8 (exit)	HDD	20 feet (min)	Cofferdam/Casing to TDI controlled land

The cables will be transported from the manufacturer by a special cable transport vessel and transferred onto the cable installation vessel. The linear cable machines onboard the installation vessel will pull the cables from coils on the transport vessel onto the installation vessel and into prefabricated tubs. After the cable has been transferred, the installation vessel will travel to the construction commencement location. It is anticipated that there will be a total of six barges and tugs performing round trips to transport the cable to Lake Champlain.

<u>Horizontal Directional Drill</u>

The aquatic transmission line will enter and exit Lake Champlain using HDD, a trenchless construction technique, to avoid impacts to the Lake shoreline and nearshore habitat. HDD is a method of installing underground utilities in a shallow arc along a prescribed path by using a surface-launched drilling rig. The use of HDD also benefits the Project for installation in areas where the use of a barge is not practical.

The main equipment used for HDD include:

1. a directional drill rig sized for the Project;
2. drill rods linked together to form a drill string for advancing the drill bit and for pulling back reamers and products, i.e., high density polyethylene pipe (HDPE) conduit;
3. a transmitter/receiver or wire line for tracking and recording the location of the drill and product;
4. a tank for mixing and holding drilling fluid; and,
5. a pump for circulating the drilling fluid and various pumping and centrifugal pumps/cyclones to recycle the drilling fluid and remove cuttings.

An HDD includes a launch site where the rig is set up and positioned to drill a pilot bore along a planned path to an exit pit where first a reamer (to open the bore to the required dimensions) and then the HDPE conduit are attached and pulled back through the hole. The rig is secured and positioned at a distance behind the entry point to allow the drill to enter the ground at the planned location at a typical entry angle of 8 to 16 degrees. A pit for capturing drilling fluids (returns) is dug at the point of entry and at the planned exit point in terrestrial HDD's and a cofferdam or receiver casing is used in aquatic transitions. To minimize turbidity in Lake Champlain associated with the HDD operation, TDI-NE proposes to have the HDD boring enter into a receiver casing, which is driven into the lake bottom at sufficient depth to contain drilled mud. In lieu of the receiver casing, a temporary cofferdam would be constructed at the offshore exit-hole location. A cofferdam would be approximately 16 feet by 30 feet with a dredged entry/exit pit typically 6 to 8 feet deep and constructed using steel sheet piles driven by a barge-mounted crane. The cofferdam would be rectangular in shape and open at the end facing away from shore to allow for pull back of the conduits and the cables. Accepted industry practices for inadvertent return management and spill prevention and control, to be implemented during Project construction, are discussed in Section 9.1.

The drilling fluid is an absorbent clay composed of aluminum phyllosilicate, which facilitates the HDD function by suspension of drill cuttings allowing removal, reducing friction forces, and stabilizing the bore hole. The drill string, composed of a series of drill rods, is advanced using rotational torque and thrust until the drill string has enough downhole stability to allow the operator to change the direction that the string will advance along the drill path. The operator navigates the drill by manipulating the drill string. Drilling fluids, pumped down through the hollow drill rods and holes in the drill bit, keep the system cool, stabilize the hole and extract the returns (cuttings). Material Safety Data Sheets for the drilling mud and anticipated additive are provided in Appendix 3.

Once the bore hole reaches the exit area, the reaming and installation of the HDPE conduit phase begins. The hole is reamed in one or more passes to the required diameter. When the bore is large enough to accept the HDPE conduit (approximately 1.5 times the size of the conduit), the HDPE conduit is attached to the drill string with a pulling head and swivel and pulled back to the rig.

For each proposed NECPL HDD location, separate drill holes for each cable will be required. Each cable will be installed within a 10-inch (64-cm)-diameter, or larger, HDPE conduit. To maintain appropriate separation between the two cables, approximately 6 feet (1.8 meters) will be maintained between each drill path. After the HDPE conduits are in place, the transmission cables, and the fiber optic line, which will be attached to one of the cables, will be pulled through these conduits. The conduits will remain in place to protect the transmission cables and fiber optic line.

<u>Jet-Plow Trenching</u>

In the northern portion of Lake Champlain, TDI-NE will bury the sediment cables in water depths under 150 feet using a jet-plow trenching method, which uses pressurized water to “fluidize” the sediments to create an approximately 4-foot deep by 1.5 to 2-foot wide trench. The water jet-plow is fitted with hydraulic pressure nozzles that create a downward and backward flow within the trench, allowing the transmission cables to settle into the trench under its own weight before the sediments settle back into the trench. Sediments quickly fill in due to the narrowness of the trench, the loose sediment and the installation of the cables on the trench bottom.

The skid-mounted jet-plow will be towed by a barge, because the plow has no propulsion system. For burial, the barge will tow the plow at a safe distance as the laying and burial operation proceeds (refer to Lake Construction Typicals (L-TD-1 and -2) provided in Appendix 1). The transmission cables will be deployed from the vessel to a funnel device on the plow. The plow will be lowered to the lake floor, and the plow blade cuts into the lake bed while it is towed along the pre-cleared route to carry out a simultaneous lay-and-burial operation. The plow will then bury both cables in the same trench.

The cable system location and burial depth will be recorded during installation for use in the preparation of as-built location plans. The water jetting device is equipped with horizontal and vertical positioning equipment that records the laying and burial conditions, position, and burial depth. This information is monitored continually on the installation vessel and will be forwarded to appropriate agencies and organizations as required for inclusion on future navigation charts.

In addition to continuous closed circuit video monitoring, divers will make regularly scheduled dives in order to monitor the cable installation operation and inspect the condition of the cable trench and jet sled. Occasionally, the jet-plow may require maintenance during cable burial operations due to nozzle wear or loss. During these maintenance periods, the jet leg roller load cells, suction piping, and hose connections are checked, and hydraulic fluid is replenished as required. All routine maintenance required to be performed on submarine equipment shall be performed while the equipment is on the barge deck. A Spill Prevention, Countermeasure, and Control ("SPCC") Plan or its equivalent will be developed pursuant to federal and/or state regulations and will be followed during construction equipment maintenance and repair activities.

Shear-Plow Trenching

In the southern portion of Lake Champlain, a shear-plow installation method will be used to reduce sedimentation impacts. For this installation technique, the plow is tethered to a surface support vessel, which tows the plow along the lakebed, opening up a trench of somewhat smaller size and depth than that created with the jet-plow technique. This method requires certain sediment and water level conditions to be present, as compared to the jet-plow which can be done in most environments. The use of the shear-plow installation method will also help minimize disturbance of any areas in southern Lake Champlain where historic anthropogenic activities may have affected the quality of lake sediments.

Hand Trenching

If necessary, a diver-operated hand jet or Remotely-Operated Vehicle ("ROV") may be used to bury the cable. In this process, a support vessel provides pressurized water through a hose with a nozzle that is maneuvered by a diver or ROV. The jet of water works the sediment under the cable to create a trench into which the cable settles.

Use of Protective Mattresses

Where prevailing conditions make burial impractical, additional protection beyond the cable armoring itself is needed. The most common challenges to burial are addressing existing infrastructure or geological features such as exposed bedrock. When confronted by these conditions, protective concrete mattress systems will be deployed to achieve maximum protection. For example, where the transmission cables cross existing utility infrastructure such as a pipeline or another cable that are located near the lake bed surface, mattresses may be laid over the existing utility and protective articulated concrete mats (generally 40' x 8' x 12") would be installed over the cable crossing. A representative schematic of such protection measures is provided in the Lake Construction Typical sheet (LTD-1), provided in Appendix 1. Known utility crossings are depicted on the Lake Route Plans provided in Appendix 1.

3.4 Operational Description

With the exception of system monitoring, the NECPL Project will be largely unmanned after commissioning. Controls will be automated, with power delivered as "base load" with remote operations being managed by TDI-NE. ISO-NE will have operational control of the NECPL. Field support of system operations will be provided in consultation with the manufacturer through a contracted specialty transmission services provider.

The Project has an expected life span of at least 40 years. During this period, it is expected that the transmission system will maintain an energy availability factor of 95 percent, meaning that the transmission system will be delivering electricity 95 percent of the time, with the remaining five percent allocated for scheduled and unscheduled maintenance and lower throughput on the cables.

The HVDC transmission cables themselves will be virtually maintenance free, as they will be installed within specified design and field condition parameters. Although no components of the transmission system will require regular replacement, regular inspections, in accordance with the manufacturer's specifications, will be performed during scheduled outages to ensure equipment integrity is maintained.

<u>Transmission Cable Inspection</u>

The aquatic portion of the NECPL will be surveyed at least once every 5 years, and inspections will focus on verifying the depth of cable burial, condition of infrastructure protection measures, and identifying areas where protection of the transmission system or the environment could be compromised. Aquatic transmission cables will be inspected by remotely-operated vehicles ("ROVs") and magnetometers to ensure that cables remain in their installed positions and that protection and co-location schemes are in place with full integrity.

While not anticipated, it is possible that over the expected 40-year lifespan of the proposed NECPL Project the transmission cables may require repair. The proposed cable installation design and techniques identified by TDI-NE will minimize the potential for mechanical damage to the cable system and ensure operational safety and reliability of the cables. If a cable is damaged, a protection system in place will detect the fault and the Ludlow and Quebec HVDC Converter Station switching systems will de-energize the transmission system in approximately five milliseconds.

Before operation of the proposed NECPL Project begins, an Emergency Repair and Response Plan ("ERRP") will be prepared to identify procedures and contractors necessary to perform maintenance and emergency repairs. The ERRP will detail the activities, methods, and equipment involved in repair and maintenance work for the transmission system. Although the scope of work for each situation will be adjusted to fit the conditions of the problem, the typical procedures for repair of a failure within the aquatic portion of the proposed NECPL Project route are described as follows:

Aquatic Transmission Cable Repair

Direct burial of the aquatic transmission cables to an average depth of at least three feet below the Lake bottom in waters less than 150' deep provides a margin of safety and reliability against cable damage by vessels or anchors. The transmission cables will have protective steel armoring wires to protect against damage. At the landfall locations, the aquatic transmission cables will be encased within an HDPE conduit to provide protection against mechanical damage. The steel wire armored cables will be tightly sealed to prevent the ingress of water and contain no circulating fluids or reservoirs.

The location of the problem will be identified by the fault detection system and crews of qualified repair personnel will be dispatched to the fault area. Depending on the location of the problem, a variety of equipment will be used to perform the necessary work. As part of the ERRP, appropriate vessels and qualified personnel will be pre-selected to minimize the response time. Once the failure location is identified, a portion of the transmission cable, equal to approximately 2.5 times the water depth, will be excavated in preparation for cable replacement. The damaged portion of the cable will be cut and a new cable section will be spliced in place by specialized personnel. Once repairs are completed, the transmission cable will be reburied using an ROV jetting device.

End of Cable Life

The NECPL has an expected useful life of 40 years. TDI-NE will evaluate the continued viability of the NECPL's existing infrastructure prior to the end of its useful life, to determine whether it can continue to operate, and/or whether the NECPL should be upgraded (subject to any necessary VT PSB approvals).

Presuming that the Project will not continue to operate, TDI-NE currently proposes to de-energize the line but leave the cable in place. As necessary, TDI-NE will provide state and local officials with accurate and detailed information on the location of the line. Otherwise, because the aquatic/underground line will have no ongoing impacts, decommissioning the line in place will have a much lower impact to the environment, and will be much less disruptive to the public, than mobilizing the equipment and crews necessary to deconstruct and remove it from the lakebed, roads and railroad ROWs.

4.0 Purpose of the Project (Line 5)

The purpose of the NECPL Project is to import Canadian renewable power to serve the New England market using buried HVDC lines to deliver safe, reliable renewable power in an environmentally and aesthetically responsible manner. A number of factors over the last few years have led TDI-NE to propose the development of new infrastructure to connect renewable energy sources to the Vermont and New England energy markets, including:

1. ISO-NE identified three core challenges in its 2013 Regional Electricity Outlook:
   - Increasing reliance on natural gas as a fuel source for power plants and the potential for reduced operational performance during stressed system conditions.
   - The large number of aging, economically challenged oil- and coal-fired generators that provide fuel diversity to the resource mix.
   - Greater future needs for flexible supply resources to balance variable, renewable resources that have operating characteristics markedly different from those of traditional generating resources.
2. The announcement on August 28th, 2013 that Vermont Yankee would close opened transmission capacity on the Vermont transmission grid.
3. The Governors' regional initiative to expand large hydro imports into New England, May 17th, 2013.

TDI-NE determined that such a project could be logically and efficiently located in Vermont due to its proximity to Canada and the availability of transmission interconnection points.

According to TDI-NE, they are in the business of providing independent transmission to serve the North American market, and they believe that in order for power markets to work efficiently and effectively, there must be sufficient transmission to allow the lowest-cost generation to flow to meet the needs of consumers. Also according to TDI-NE, acute transmission bottlenecks are causing prices to rise, hindering renewable generation projects and impeding the efficient operation of AC systems. TDI-NE's business model is centered on the use of buried HVDC lines, which avoids aesthetic concerns and the attendant impacts on communities. It also increases the electric grid's safety and reliability because underground/aquatic infrastructure is less susceptible to damage from natural disasters.

5.0 Public Benefits of the Project (Line 6)

The proposed project will provide numerous lake-specific and other broader public benefits, the majority of which are outlined below. These benefits have been proposed by TDI-NE as part of its petition for a CPG under 30 VSA § 248, submitted on December 8, 2014, and are described in further detail in the supporting testimony and exhibits in that proceeding. TDI-NE expects that the proposed benefits will be included as conditions in the final CPG for the project, when and if a CPG is issued.

5.1 Lake-Specific and Other Environmental Benefits

The Project will result in the following Lake Champlain specific and environmental benefits:

1. TDI-NE has committed to contribute $2 million in annual funding for Lake Champlain phosphorous cleanup for 40 years. An additional $1 million will be paid at financial close and $1 million will be paid at the start of operations. The precise mechanism for allocating this funding over the life of the Project will be identified as part of the §248 process.
2. TDI-NE has committed to contribute $1 million in annual funding for Lake Champlain enhancement through a Trust Fund for 40 years. The precise mechanism for allocating this funding over the life of the Project will be identified as part of the §248 process.
3. The Project is expected to reduce CO_2 emissions by up to 3.3 million tons annually within New England. Significant annual CO_2 reductions are anticipated, because the Project is expected to import new low-carbon resources such as hydroelectricity and wind power. These new, clean resources will displace fossil fuel generating resources within New England, which will have the impact of reducing CO_2 emissions throughout the region. In addition, the Project supports the Vermont 2011 Comprehensive Energy Plan which sets a vision to have the State secure 90% of its energy from renewables by 2050. The Vermont Energy Plan specifically supports large-scale hydroelectric generation and renewable resources from out-of-state sources.
4. The Project will provide funding in the amount of $350,000 to the State for use of the FWD Access Area. This funding will enable the design, permitting and construction by FWD of a new double-lane boat ramp at the State-owned Korean War Veterans Access located in Alburgh, VT. A boat ramp in this section of the Lake will help alleviate congestion at other nearby ramps.
5. TDI-NE proposes to complete re-vegetation and stabilization of a severely eroded bank on Lake Champlain on their property in Benson, Vermont.
6. The project proposes to replace and upgrade selected culverts to meet to meet the design requirements of the Vermont Stream Alteration General Permit in Benson that convey perennial streams. These upgrades require temporary private property easements, which TDI-NE is working to secure.
7. As part of construction, the Project is anticipated to enable improvements to existing roadside ditches along Routes 22A and 103. These improvements are expected, because excavation will

need to occur within roadside ditches to install the cables and TDI-NE will be obligated by VTrans to restore the ditches.

5.2 Electric Benefits

The Project will result in the following Electric benefits:

1. TDI-NE has reached an agreement that requires $3.4 million in average annual payments to VELCO for 40 years. These payments will be distributed to Vermont ratepayers by VELCO through reductions in their electric bills. The details of this agreement are contained in exhibit TDI-JMB-7 of the 248 filing.
2. TDI-NE has committed to contribute $1 million in annually to the Vermont Clean Energy Development Fund to support Vermont Renewable Programs for 40 years. These funds are administered and distributed by the VT PSB and Clean Energy Development Board.
3. TDI-NE estimates that the Project will create $294 million in Vermont ratepayer savings for the first ten years due to the decline in retail energy and capacity prices.
4. The HVDC technology proposed has electrical reliability benefits for Vermont. First, this technology has "black start" capability, which could enable the Project to materially contribute to the restoration of electric services within Vermont and the region in the event of a major regional power outage. Second, HVDC technology is more controllable compared to HVAC technology. Third, because of its capacity to inject reactive power into the adjacent AC network, it not only improves the voltage performance response of the transmission network at the point of interconnection, but also to the adjacent AC network.

5.3 Infrastructure Benefits

The Project will result in the following infrastructure benefits:

1. TDI-NE has proposed $0.5 million in average annual payments to Vermont Agency of Transportation ("VTrans") for the use of their right-of-way for 40 years. These payments would likely be a condition of any VTrans permit.
2. TDI-NE will install a new fiber network for the Project to ensure seamless communications between a Converter Station in Canada and the Converter Station proposed in Ludlow. There is an opportunity for VTrans, Green Mountain Railway, and VELCO to access this fiber network to enhance their own communication systems. These communication systems benefit Vermont through economic efficiencies and enhanced safety.
3. Within Ludlow and Benson there is a potential to replace in-kind deteriorating culverts with new culverts.

5.4 Economic Benefits

The Project will result in the following economic benefits:

1. Based on input from the Vermont Tax Department, TDI-NE expects to pay an estimated $7.2 million in average annual property tax payments for 40 years. These payments would flow to the municipal budgets of 14 Towns and the State Education Fund.
2. As part of Project operations, TDI-NE estimates it will pay $8.2 million in average annual corporate income taxes to Vermont for 40 years.
3. TDI-NE estimates it will pay $31.4 million in sales tax payments to Vermont during three years of project construction.
4. An economic analysis estimates that the Project will create 140 jobs annually during construction and 22 jobs annually during operation within Vermont. The cumulative value of these jobs is estimated at $158.3 million.
5. These jobs are estimated to spur an additional $3.8 million in VT expenditures annually during construction and operation.
6. Vermont ratepayers are protected financially because the risk associated with the development and construction are solely the Applicants.

6.0 Planned Work Schedule (Line 7)

The permitting phase of the proposed NECPL Project is expected to continue through 2015 into early 2016. Pre-construction activities will commence in 2016 related to the qualification and selection of contractors. Construction-related engineering activities are expected to commence in 2016 and continue through early 2019 with performance testing and commissioning. TDI-NE anticipates that the commercial operation date for the proposed NECPL Project will be April 2019. A schedule of Project permits and milestones is provided in Appendix 1.

TDI-NE is seeking the maximum flexibility permissible for the construction work hours, without causing unreasonable inconvenience to others or undue environmental effects. Within the Lake, TDI-NE proposes that construction be allowed 24 hours per day, 7 days per week to enable the lake installation to occur as quickly as possible and during a single work season. The in-lake work will generally be very distant from private property and will not involve activities that generate undue levels of noise. TDI-NE is proposing the above schedule because it expects there will be certain seasonal restrictions placed on construction which include restrictions on Lake installation from May 1 to September 15 (Alburgh to Chimney Point) and September 15 to December 31 (Chimney Point to Benson) to avoid certain fisheries and complications resulting from cold weather.

7.0 Abutting Landowners (Line 9)

Properties that directly abut the entrance and exit parcels of Lake Champlain, as well as parcels that abut the US Route 2 causeway and the Lake are depicted in the Abutting Parcel Maps in Appendix 2. Landowner contact information for these abutting parcels are provided in the Table of Property Owners Adjacent to HDD, provided in Appendix 2.

8.0 Public Trust Determination

In addition to the material presented above to complete the VT DEC Lake Encroachment Permit Application Form, the following additional information has been prepared to assist in the consideration of this application in the context of the Public Trust Doctrine. As described by the VT DEC Explanation document, in order to find that an LEP application meets the Public Trust Doctrine and can therefore be permitted, the VT DEC must find that the public purpose and benefits outweigh adverse effects on the public good. In making this determination, VT DEC applies a three part test, as described in the Interim Procedures. Information relevant to each of these parts is presented below.

8.1 Part 1: Extent of Encroachment

Part 1 of the Public Trust Determination assesses the effect of the Encroachment, with consideration of the extent of the encroachment, less intrusive alternatives, measures taken to reduce impacts on the public resources, and the placement of fill beyond the Lake's mean water level that could potentially impact the public use of the state's natural resource. This section demonstrates how the Project and Project components were developed in accordance with these considerations.

8.1.1 Construction Considerations and Precautions

A series of complementary measures will be used to limit the Project's potential impact on the natural environment during installation. These include the route design, strategic use of installation methods, proposed installation inspection and monitoring, seasonal construction windows, monitoring and spill prevention during installation, and spill prevention planning for hazardous materials.

<u>Route Design</u>

As discussed in the Project Overview Section, TDI-NE carefully considered and designed the proposed project route based on cost efficiency and overall environmental impact. A complete Alternatives Analysis is presented in the Applicant's U.S. Army Corps of Engineers Section 404/Section 10 Permit Application, dated November 7, 2014, which demonstrates that the Lake Route described herein satisfies the requirements of Section 404(b)(1) of the Clean Water Act as the least environmentally damaging practicable alternative. Further refinement of the Lake Route was developed based on several discussions with federal and state regulators and town representatives, and the following considerations have been implemented in the Lake Route design:

- Avoid the sensitive section of Lake Champlain on the east side of the 4 Champlain Islands (Missisquoi National Wildlife Refuge)
- Avoid the rocky reefs and shoals where water depth ranged from 10 to 40 feet in order to reduce potential impacts on these fishery areas
- Avoid the Narrows of Lake Champlain by exiting the Lake in the Town of Benson

Additionally, TDI-NE consulted the Lake Champlain Maritime Museum ("LCMM") when selecting a route through Lake Champlain that avoids impacting known cultural resources located on the bottom lands of Lake Champlain. The LCMM completed an Archaeological Assessment Report for the Lake portion of the NECPL Route, which is provided in Appendix 3. The proposed NECPL route reflects recommendations made by the LCMM to reduce or avoid impacts to cultural resources located within Lake Champlain; however, as indicated in the report, three known cultural resources that stretch across Lake Champlain exist in the NECPL corridor: The Rouses Point Train Trestle Bridge, the Larrabees Point-Willow Point Train Trestle, and the Revolutionary War Great Bridge between Mount Independence, VT and Ticonderoga, NY. The assessment also identified three unverified sonar targets that lay within 40m of the NECPL Route. TDI-NE will continue to work with cultural resource professionals to identify appropriate routes through or around these known and potential resources in order to minimize or avoid impacts.

In terms of specific sensitive areas, public concern has been raised regarding the historic and current discharges from the International Paper facilities in southern Lake Champlain. TDI-NE has reviewed readily available studies related to these two locations, the results of which are presented in the *Review of Historic Studies of Paper Mill Sedimentation in Ares in Southern Lake Champlain in Relation to the Proposed NECPL Route* Memorandum, provided in Appendix 3. Based on available information, TDI-NE believes that with the use of the shear plow in southern Lake Champlain, there will be no significant impacts on water quality.

<u>Installation Methodology</u>

TDI-NE plans to implement the use of HDD technology to enter and exit the Lake in order to avoid impacts to shoreline and near shore habitats. HDD equipment and laydown area will be set back at least 50 feet from any natural resource features, such as wetlands. The current design of the HDD staging areas is 200 feet or greater from the shoreline at the entry parcel in Alburgh, and 400 feet or greater from the shoreline at the exit parcel in Benson. The staging area on the FWD Access Area would be in close proximity to the shoreline of the Lake, but appropriate EPSC and borehole fluid containment measures would be implemented, as depicted on the HDD Plan and Profile Sheets provided in Appendix 1.

Additionally, TDI-NE will bury the cable in 3 to 4 feet of sediment to water depths of 150 feet or less in order to prevent navigational or recreational impacts (see relevant discussion below) using state of the art installation technology as described in Section 3.3. The use of jet-plow embedment methods for aquatic cable installations are considered to be the most effective and least environmentally damaging when compared to traditional mechanical dredging and trenching operations. This method of laying and burying the cables simultaneously ensures the placement of the aquatic cable system at the target burial depth and minimizes bottom disturbance, with much fluidized sediment settling back into the trench. As previously stated, TDI-NE proposes to use the shear-plow installation method from MP 74 to MP 98 to help reduce disturbance of any areas in southern Lake Champlain where historic anthropogenic activities may have affected the quality of lake sediments.

Drilling Mud and Inadvertent Returns

Drilling mud would consist of non-hazardous bentonite slurry (a combination of bentonite clay, water, and drilling additives). Material Safety Data Sheets ("MSDSs") for typical drilling mud additives are provided in Appendix 3. Additional or alternative additives may be determined necessary by the selected contractor, and although TDI-NE anticipates they would likely also be non-toxic, MSDSs would be provided to the VT DEC for review prior to construction. Prior to construction of the NECPL, TDI-NE would complete a geotechnical study of the sediments along the proposed HDD routes to determine the appropriate composition and density of the drilling mud to reduce the risk of inadvertent returns. Although considered unlikely, TDI-NE has prepared a Horizontal Directional Drilling Inadvertent Return Contingency Plan for managing inadvertent returns, which would serve as a guide for the selected contractor to develop their own plan that contains similar or more stringent provisions (provided in Appendix 3).

Hazardous Materials

The installation of the aquatic portion of the transmission line would require the transport, handling, use, and onsite storage of hazardous materials and petroleum products, primarily associated with the operation of the vessels. To minimize potential impacts from hazardous materials and wastes, TDI-NE would require all contractors to follow certain TDI-NE-proposed measures, which would include but not be limited to establishing a Spill Prevention, Control, and Countermeasure ("SPCC") Plan or its equivalent to prevent, control, and minimize impacts from a spill of hazardous materials, hazardous wastes, or petroleum products. Potential measures to be included in this Plan include but are not limited to: keeping appropriate spill control equipment such as containment booms, water skimmers, and sorbents on site and ready for use; using secondary containment when practical; and following all appropriate Federal and State of Vermont regulations regarding management of hazardous materials and wastes. TDI-NE's Overall Oil and Hazardous Materials Spill Prevention and Contingency Plan stipulates the minimum requirements and components of a Contingency plan to be developed by the selected Contractor, and is provided in Appendix 3.

Installation Inspection/Monitoring

During installation, a qualified Environmental Inspector will be on-board the installation vessel and responsible for monitoring compliance with all applicable permit and approval requirements. Total Suspended Solids ("TSS") levels associated with the shear plow and jet plow installation will be monitored in real time at two route-perpendicular transects. The first transect will be conducted approximately 500 feet up-current of the operating jet plow/shear plow (or at reasonable safe survey distance up-current of the plow) to measure ambient or background TSS conditions. The down-current transect will be conducted 500 feet down-current of the installation device. If elevated levels of TSS are reported, the installer will employ such measures such as changing the rate of advancement of the jet plow or shear plow, modifying hydraulic pressures, or implementing other reasonable operational controls that may reduce suspension of in-situ sediments.

Aquatic Invasive Species Management

TDI-NE has developed an Aquatic Invasive Species Management and Control Plan to describe the specific protocols to be taken during the construction, operation and maintenance of the Project to manage aquatic invasive species ("AIS") (provided in Appendix 3). The goal of this plan is to prevent the introduction and spread of invasive species potentially associated with Project-related operations and activities. To achieve this goal, the plan:

1. identifies potential plant and animal AIS concerns in the Project area or within the broader vicinity (e.g., Lake Champlain);
2. identifies potential pathways for AIS introduction in the Project area; and
3. establishes measures to prevent and control AIS during Project construction, operation, and maintenance.

Schedule

As previously discussed, TDI-NE proposes construction work windows to avoid impacts to fish species during the most sensitive portions of their life cycle. These windows were initially developed in consultation with the New York State Department of Environmental Conservation ("NYS DEC") and the NYS Department of Public Service ("DPS") as part of the Champlain Hudson Power Express Project. In the northern portion of the Lake from Alburgh to Chimney Point (MP 0.5 to MP 74), TDI-NE proposes that in-water construction activities occur from May 1 through September 15th. South of Chimney Point to Benson, VT (MP 74 to 98), construction activities would occur from September 15th through December 31st. TDI-NE is open to reasonable modifications of these timeframes so long as there is no need to have two construction seasons.

8.1.2 Operational Phase

As previously discussed, once constructed, the HVDC transmission cables themselves will be virtually maintenance free, as they will be installed within specified design and field condition parameters. Although no components of the transmission system will require regular replacement, regular inspections, in accordance with the manufacturer's specifications, will be performed during scheduled outages to ensure equipment integrity is maintained, as described in Section 3.4.

The primary operational impacts are the magnetic and thermal fields associated with the operation of the transmission system. TDI-NE retained Exponent, Inc. to complete models in order to quantify these impacts, and the PFT submitted by Dr. William Bailey of Exponent, Inc. ("Exponent") describes these modeling efforts. His testimony indicates that, based on the calculated values for these two parameters, ambient conditions, and an assessment of likely biological responses, the operation of the transmission line would not be expected to have an undue adverse impact to aquatic resources over the lifespan of the Project. The thermal and magnetic modeling studies are discussed in Sections 8.2.1 (thermal) and Sections 8.2.3 (magnetic) below.

8.2 Public Trust Determination Part 2: Effect of Statutory Criteria

Part 2 of the Public Trust Determination examines the effect of the encroachment on statutory criteria including water quality, fish and wildlife habitat, aquatic and shoreline vegetation, navigation, and other recreational and public uses, including fishing and swimming. In addition, the Department will examine the proposed encroachment's consistency with the natural surroundings, any applicable municipal shoreland zoning ordinances, and any applicable state plans.

8.2.1 Water Quality

Construction activities along aquatic portions of the Project route could result, on a temporary basis, in the disturbance and resuspension of sediments, increased water turbidity, and disturbances to aquatic species and habitat. TDI-NE completed a series of studies to characterize Lake conditions and assess the Project's potential impacts on natural resources in the Lake during construction. In order to better understand sediment conditions in the Project area, the Project team retained Drs. Tom and Patricia Manley, of Marine Research, Corp. to conduct an analysis of acoustic sub-bottom profiles along the proposed Vermont route and use that analysis to compare conditions on the Vermont side of the lake with acoustic sub-bottom profiling and core sediment samples collected in the New York waters of the lake for the Champlain Hudson Power Express in 2010 and 2012. The methodology and results of the Manleys' analysis are discussed in more detail in their report, which is provided in Appendix 4. As a result of this analysis, the Manleys were able to classify the majority of the Vermont route (99%) into one of three basic sediment types (recent Lake Champlain ("LC"), Champlain Sea ("CS") and Lake Vermont ("LV"), which provided sufficient sediment property information for the water quality modeling completed by HDR.

Based on this sediment analysis, TDI-NE worked with HDR to analyze and model the Project's potential impact of resuspended sediment on water quality during installation. This modeling effort and its results are described in HDR's Lake Champlain Water Quality Monitoring Report, provided in Appendix 4. In general, the analysis consisted of detailed water quality modeling to estimate the potential dispersion of sediment and other constituents during the cable installation process for the Project for each installation type (jet plow and shear plow). The water quality constituents considered in the model included: total suspended solids ("TSS"), total phosphorus ("TP"), dissolved phosphorus ("DP"), arsenic, cadmium, copper, lead, nickel, zinc, silver, and mercury. HDR modeled five representative locations along the cable route that are indicative of the water quality changes expected along the entire cable route due to the sediment characteristics and bottom lake current. The locations include shallow northern and shallow southern lake locations (approximately 20 feet deep), and three deeper mid-lake locations (depths ranging from approximately 60 to 300 feet deep).

Overall, the modeling results at each of the five locations demonstrate that the water quality impacts associated with cable installation are short-term and geographically limited to areas adjacent to the cable installation location. The calculated increases in TSS and TP are a one-time event of short duration (on the order of a few hours) and of limited spatial and vertical extent. Within 200 feet from the point of installation, and within 3-10 feet from the lake bottom, TSS, TP and DP concentrations temporarily increase along the Lake bottom but return to less than 3 mg/L TSS above background levels and less than 0.01 mg/L TP or DP above background levels in one to four hours after cable installation. All of the constituent concentrations from project related activities are less than the relevant VWQS criteria at all times, including the calculated dissolved metals concentrations and existing sediment dissolved concentrations, which are less than the applicable acute and chronic VWQS criteria. For TP, the VWQS criteria vary in the Lake along the cable installation route from 0.010-0.025 mg/L and are applied as an annual mean in the euphotic zone. Because the calculated TP increases are of short duration (on the order of hours), it is not expected that the one-time, short term TP increases will meaningfully contribute to the annual mean TP concentrations in the lake. Therefore, the Project will not significantly contribute to existing exceedances of the VWQS for TP in Lake

Champlain. There is no specific VWQS for TSS but calculated TSS concentration increases are less than mg/L above background levels at 200 feet from the point of installation and within one to four hours from the time of cable installation. Based on the model results, HDR concludes that the water quality impacts associated with the cable installation would be quite limited, with no adverse impact on designated or existing uses in Lake Champlain.

<u>Thermal Impacts</u>

TDI-NE also retained Exponent to model the thermal effects of the cables on the Lake, and Exponent's temperature gradient modeling report is provided in Appendix 4. In summary, Exponent modeled three thermal cases based on representative and conservative cable configurations, as follows:

- <u>Case T (Trench):</u> The cables are installed in a trench via shear plow or jet plow in a vertical or stacked profile (one cable above the other). Trench installation is expected to occur for approximately 53 miles or 54% of the route of the cables in Lake Champlain.
- <u>Case S (Self-Burial):</u> Where the route is in depths greater than 150 feet, the cables are proposed to be laid on the bottom of Lake Champlain. The cables are expected to self-bury in a horizontal (or side-by-side) profile in the sediment due to their weight. Self-burial is expected for approximately 42 miles or 43% of the lake route.
- <u>Case B (Bedrock):</u> In depths greater than 150 feet where bedrock or other obstacles to self-burial (such as pre-existing infrastructure) are encountered, the cables may lay in a horizontal profile on top of the bedrock. The bedrock configuration is expected for approximately 2 miles or 2% of the Lake route. In shallow waters or in certain special situations in deep waters, concrete mattresses may be placed over the cables. This scenario, however, was not modeled in this report because the thermal impact in the water outside of the concrete mats over the cables will likely be smaller than Case B based on the 1-foot thickness of the concrete mat and because the cables will have little or no direct contact with water.

In cold water fish habitat, such as the majority of locations where the Project is proposed, VWQS Section 3-01(B)(1)(b) establishes a one degree Fahrenheit ("F") threshold for temperature changes above ambient temperature. VWQS Section 2-04(A) provides for the ability to establish mixing zones of a limited size (200 feet) where temperature increases are otherwise minor, and Section 3-01(B)(1)(d) provides greater flexibility to permit assimilation of thermal effects in zones larger than 200 feet, where thermal effects will otherwise still allow for the full support of existing aquatic uses. For the majority of the cable route in the Lake, the maximum temperature increases associated with the Project will be below the 1 degree F threshold, and for the remainder of the cable route the areas of temperature increases above 1 degree F are extremely limited, as summarized in Table 2 below. Based on Exponent's analysis and as reported in Dr. Bailey's testimony, the Project's thermal effects are not expected to have an undue adverse impact on water quality under the applicable criteria found in the VWQS.

Table 2: Summary of Thermal Impacts along NECPL Cable Route

Mile Posts	Water Depth	Burial Depth into Lake Bottom	Thermal Case	Expected Water Temperature Increase
MP 1-22	<150 feet	3 to 4 feet	Case T (Trench)	< 1° F
MP 22-66	>150 feet	1 foot (self-burial)	Case S (Self-burial)	>1° F for 2.8 feet horizontally, 0.3 inches vertically
MP 66 – 98	<150 feet	3 to 4 feet	Case T (Trench)	< 1° F
Crossing of existing utilities / bedrock in shallow water	<150 feet	On Lake bottom, covered in Mattress	Case B (Bedrock)*	>1° F for 1.0 feet horizontally, 5.5 inches vertically*
Crossing of existing utilities / bedrock in deep water	>150 feet	On Lake bottom	Case B (Bedrock)	>1° F for 1.0 feet horizontally, 5.5 inches vertically

* Thermal temperatures in the water outside of the concrete mats over the cables will likely be smaller than Case B based on the 1-foot thickness of the concrete mat and because the cables will have little or no direct contact with water.

8.2.2 Aquatic and Shoreline Vegetation and Biota

As previously discussed, TDI-NE proposes to use HDD methodology at the entry and exit points of the Lake to avoid impacts to the shoreline vegetation and nearshore habitat. Furthermore, TDI-NE has developed an AIS Management and Control Plan to describe the specific protocols to be taken during the construction, operation and maintenance of the Project (provided in Appendix 3*)*. The goal of this plan is to prevent the introduction and spread of invasive species potentially associated with Project-related operations and activities.

TDI-NE also evaluated potential impacts or rare threatened or endangered species in Lake Champlain. Based on the recommendation of Mark Ferguson of the VT FWD, surveys for sensitive mussel species were completed by HDR for five RTE freshwater mussel species suspected to occur in the northern section of the Project route. Diver surveys were conducted every one-half mile along the cable route until water depths increased to greater than 30 feet. No live Vermont RTE mussel species were observed, and the live common mussels found at only three of the 24 sites surveyed were sufficiently covered in zebra mussels that field staff did not believe that they would survive the year. The full results are included in a report entitled *New England Clean Power Link, Lake Champlain Freshwater Mussel Survey Report*, which is provided in Appendix 4. Based on these results, the VT FWD concurred in September of 2014 that these species are not likely to be persisting within the Project area and that no further work was required.

The primary operational impacts of the Project are the magnetic and thermal fields associated with the operation of the transmission system. Thermal and magnetic modeling completed by Exponent and PFT submitted by Dr. William Bailey of Exponent, indicates that, based on the calculated values for these two parameters, ambient conditions, and an assessment of likely biological responses, the operation of the transmission line would not be expected to have an undue adverse impact to aquatic resources over the lifespan of the Project. The magnetic modeling report prepared by Exponent is provided in Appendix 4.

8.2.3 Navigation

Impacts on navigation during construction could occur due to the additional vessel traffic generated by site preparation for and installation of the transmission cables along the proposed route. In general, construction will be continuously moving along the cable installation route and would therefore not impact navigation in one specific section of the Lake for an extended period of time.

During installation via jet plow, shear plow or cable laying, TDI-NE would employ a fleet of approximately four vessels, including the tugboat or tow boat, cable-laying vessel, crew boat, and survey boat which would be used to coordinate the laying of cable. TDI-NE anticipates that crew boats will likely make multiple daily trips from a nearby marina to transport personnel and supplies to the installation barge (estimating about 3-6 trips/daily). The speed of the installation vessel would be comparable to the debris removal barge, and the support vessels would also generally be no faster than 8 to 12 knots.

Both pre-and post-construction, TDI-NE will be completing surveys of the route. Potential surveys could include bathymetry, magnetometer, side scan sonar and core sampling. It is expected that the average speed of the survey vessels would be about 3 to 4 knots, with any support vessels traveling at around 8 to 10 knots while transiting.

Overall, impacts to navigation during installation are expected to be temporary and insignificant. Transmission cable installation activities would not prohibit water-dependent commercial activities because vessels could either transit around the work site or use a different area of the waterway. If conditions do not allow other vessels to transit around the work site, TDI-NE would ensure that aquatic construction does not interfere with routine navigation by making adjustments to the installation schedule based on consultation with commercial operators on Lake Champlain as required. For example, installation of the transmission cables would be coordinated with ferry operators to minimize impacts on ferry operations.

TDI-NE has consulted with the US Coast Guard, who is a Cooperating Agency with the Department of Energy on the Presidential Permit review. In addition, TDI-NE has spoken with representatives from the relevant commercial vessels that operate on the Lake, including the Lake Champlain Transportation Co., Spirit of Ethan Allen III, Fort Ticonderoga II, Melosira, and the David Folger. Although additional coordination is required with some of these vessels prior to construction, no significant concerns were raised by the operators. If required, prior to construction TDI-NE will complete a Navigation Risk Assessment to quantify (and mitigate for) the potential risk of external damage to the cables as well as potential impacts to navigational safety.

Once operational, the magnetic field produced by the cables during operation could impact the readings on mechanical navigational compass readings. Modeling completed by Exponent Inc. indicates that for cables bundled and buried at 3 feet the maximum deviance from magnetic north at 19 feet directly above lakebed would be an estimated 2.9 degrees from the 14.35° W geomagnetic declination (the difference from magnetic north relative to geographic north). Compass deflection falls off rapidly with distance from the cables, so that within 25 feet of the cables the deflection is almost zero. The expected deviation is greater when the cables are not buried, but this would only occur in those limited instances of a bedrock or utility crossing in shallow waters or when bedrock is crossed in deeper waters (where the water depth will be sufficient so that there will be no impacts on the compass system). There will be no impacts on navigational systems that rely on GPS. Based on modeling conducted by Exponent, compass deviation is not expected to have a significant impact on navigation.

The other potential operational risk associated with the transmission system is the potential for anchor snags. In shallower waters, protection against physical damage will be provided by burial to a depth of three to four feet. When there are obstacles to burial (e.g. bedrock, existing utilities) in these shallower areas, the industry standard is to install a protective covering such as articulated concrete mats over the cables. These types of mattresses have been shown to be an effective measure to reduce the risk to infrastructure by a dropped or dragged anchor. Many established concrete mattress products are shaped so as to deflect an anchor being dragged across the surface. In an instance of a penetrating drag, an individual mat section could serve as a sacrificial element, rather than the underlying cable. In locations in Lake Champlain where the water depth is 150 feet or greater (approximately MP 22 to 66), the cables will be laid on the lake bed as there are no known or planned commercial vessels on the lake that are likely to impact the cables at these depths.

In terms of maintenance activities, regular inspections and possibly emergency repairs of the transmission line will occur. Regular inspections of aquatic portions of the transmission line will be completed using vessel-mounted instruments. Emergency repair activities would be similar to those associated with the installation of the transmission system, although in a more localized area. For these activities, the impacts would be insignificant and temporary.

8.2.4 Other Recreation and Public Uses

During construction, the area around the HDD staging areas would be restricted in terms of public access. As the Alburgh and Benson HDD staging areas are located on private property, the HDD would not interfere with public access to the Lake in these locations. Use of the VT FWD Access Area will result in a temporary disruption (approximately 16 weeks) in public use of this area during construction. After completion of the HDD installations, the parking area will be restored and can be re-opened to the general public. In addition, the Project will result in funding to vastly improve FWD Access Area with a new two lane boat ramp and associated dock. The VT FWD Kelly Bay public Lake access area is located nearby on the mainland shore just south of the US Route 2 causeway, and would be available as an alternative public access area during this time.

Construction activities associated with the installation of the aquatic portions of the proposed Project would result in additional vessel traffic in areas that are likely used for recreational boating / fishing. The expected level of vessel traffic is described in the Navigation section. As with commercial vessels, the aquatic installation activities would not prohibit any water-dependent recreational uses of adjacent areas and the overall impacts would be temporary in nature. TDI-NE anticipates that in-Lake construction would take place between May and October.

In terms of operational impacts, there would be no significant or measurable impacts on recreation and public uses other than the magnetic field deviation and maintenance activities described in the Navigation section.

8.2.5 Consistency with Natural Surroundings

Once installed, the NECPL will not be visible and its presence is therefore consistent with the natural surroundings.

8.2.6 Consistency with Applicable Municipal Plans and Shoreland Zoning Ordinances

As previously stated, TDI-NE has held several meetings with Towns where the Project Route would be located to obtain their input on the route design and overall Project. The Project team also reviewed the Town Plans for Alburgh and Benson to ensure the Project would be consistent with these Plans. The Project team also reviewed zoning ordinances for Benson, but Alburgh does not have zoning regulations. Relevant policies ("P#") from the 2011 Alburgh Town Plan and the Project's conformance with these provisions are as follows:

- P8, Land Use Policies include: "*Protect Lake Champlain water quality by discouraging development along the lakeshore closer than 50 feet from the high water mark of 99 feet above sea level.*"

  <u>Project Response:</u> The transmission line will enter the Lake via HDD methodology, and temporary construction related components will be set up at least 50 feet from the high water mark of the Lake. If the FWD access is used, utility manways would be installed within 50 feet of the high water mark of the Lake, however, since the access is considered a developed area, the utility manways would not violate this Land Use policy.

- P48, Proposed Land Use includes: "*Shoreland – This land use category includes all land within 300' of mean high water that is not either in the Village/High Density category or either Conservation Land A or B. The intended land uses in this category are residential, recreation, conservation uses. Protection of Lake Champlain water quality is a high priority and development should seek to minimize impact on the lake. Existing land uses in these areas are grandfathered. To protect lake water quality a 50 foot undeveloped and vegetated buffer strip is required for new development, measured from the high water mark of 99 feet above sea level. The minimum lot width is 100 feet.*"

  <u>Project Response</u>: Once constructed, the TDI-controlled access parcel in Alburgh will remain undeveloped. Vegetation will be controlled in order to maintain the ROW access to the cable splice at the HDD entrance. Existing vegetation along the shoreline would be undisturbed by the Project.

Relevant Provisions from the 2013 Benson Town Plan and the Project's conformance with these provisions are as follows:

- P20, Natural Resources Goals, Policies and Programs; Water Resources: "*Encourage landowners to create buffer zones between waterways and agricultural and silvicultural land" and "Limit development along waterways, lakes and ponds*."

- P37, Land Use Districts, Lake Champlain Shoreline District: "*The purpose of this district is to protect water quality, public access, and natural ecosystems. The land in this district is within 500 feet of the mean water level of lakes in the sections indicated on the land use map. The purpose of this district is to protect water quality, while balancing the desire for development with the need for protecting public access, the shoreline and wildlife habitat*" and "*must recognize the special circumstances and opportunities presented by Lake Champlain*."

  Project Response: As previously discussed, the Project will improve the buffer zone/slope on the TDI-NE owned parcel where the transmission line will exit the Lake via HDD in Benson. This improvement would help protect water quality from pending slope failure at this location. Vegetation will be managed in order to maintain the permanent Project corridor.

The 2013 Benson Zoning Regulations indicates that "public utility power generating plants and transmission facilities regulated under 30 VSA Section 248" do not require zoning permits (Section 4.1 Allowed Development (No zoning permit required).

In summary, the Project is consistent with applicable policies in the Town Plans for Alburgh and Benson. The Town of Alburgh does not currently have zoning regulations, and a zoning permit would not be required by the Town of Benson.

8.2.7 Consistency with Applicable State Plans

State Plans that are potentially applicable to the NECPL route is the Lake Champlain Phosphorus Total Maximum Daily Load ("TMDL") Plan, and relevant Tactical Basin Plans.

TMDL Plan

A final TMDL plan has not been issued by the U.S. Environmental Protection Agency at this time. As previously discussed, the Project will not significantly contribute to existing exceedances of the VWQS for TP in Lake Champlain. Furthermore, the cable installation does not represent a new source of phosphorous contribution to the lake but rather represents a one-time resuspension of phosphorus associated with existing lake sediments into the water column on a short term basis (one to four hours). For additional perspective, HDR compared the expected one-time phosphorus resuspension associated with cable installation activities to the total estimated annual external phosphorus sources to the Lake, and also calculated the potential increase in the euphotic zone and mixed layer depth DP concentrations in the Lake. In summary:

- The one-time DP mass re-suspension to the lake due to the cable installation represents 0.01 percent of the total annual external phosphorus input based on external loading data to Lake Champlain from 1991-2008. DP was used for this calculation because the resuspended particulate phosphorus fraction settles quickly back to the sediment and does not contribute significantly to the one-time phosphorus source from the cable installation

- The total potential one-time DP increase in both the euphotic zone and surface mixed layer is less than 0.009 µg/L (or less than 0.1 percent of existing DP levels in the lake). This analysis could be considered conservative because it assumes that the DP mass re-introduced from the sediments into the bottom of the lake as a result of the Project can completely transfer into the surface layer of the lake. In reality, the thermocline within the lake represents a barrier to vertical mass transport in the lake, and would therefore significantly limit this transport during periods of temperature stratification (i.e., approximately May through October). Only the DP fraction of TP was considered for this assessment because the particulate phosphorus fraction that is resuspended near the bottom of the lake will settle quickly back to the sediments and will not materially affect concentrations in the water column.

- Overall, the majority of the one-time, short term duration phosphorus increases near the bottom of the lake due to the cable installation will be confined to water depths deeper than the euphotic zone and the mixed layer depth and, therefore, it is not expected that phosphorus and algal levels in the surface layer of the lake will be impacted due to the Project.

<u>Tactical Basin Plans</u>

The Project is located within the North and South Lake Champlain Drainage Basins, which have established Tactical Basin Plans. According to the VT DEC Watershed Management Division's website, "Tactical Basin Plans focus on the projects or actions needed to protect or restore specific waters and identify appropriate funding sources to complete the work based on monitoring and assessment data." The plans are developed to meet the goals and objectives of the Vermont Surface Water Management Strategy ("VT SWMS") to protect, maintain, enhance, and restore the biological, chemical, and physical integrity, and public use and enjoyment of Vermont's water resources, and to protect public health and safety. As demonstrated herein, the Project will conform to the goals and objectives of the VT SWMS. Furthermore, as outlined in the Public Benefits Section, the Project will result in a significant amount of funding for Lake Champlain phosphorus cleanup and enhancement, which will assist watershed planners in meeting the goals and objectives of the Basin Plans.

8.3 Public Trust Determination Part 3: Potential Cumulative Effect of the Encroachment

Part 3 of the Public Trust Determination determines if the potential cumulative effect of the encroachment, when considered in conjunction with other existing encroachments, is adverse. Other utility encroachments exist within Lake Champlain, and the transmission line will cross these utilities on the Lake bottom in a careful and engineered manner, using industry standard methods. Anticipated utility crossings are depicted on the Lake Route Plans provided in Appendix 1.

Lake Champlain is used as a source of water for various public water systems as well as for private users. VHB completed a preliminary assessment of these water supplies and water supplies along the terrestrial route, which was presented in a memorandum ("VHB Water Supply Memo") for the December 8, 2014 Section 248 filing, and included in Appendix 4 of this report. In summary, the Project will cross through one public water supply intake source protection area ("SPA"), and will pass through the same general portions of the Lake as ten other Vermont public water supply systems that use Lake intakes for raw water, which is subsequently treated for potable usage (See Public Water Supply Map Series, attached to memorandum in Appendix 4). The Project also will pass in the vicinity of some private intakes, such as summer camps that obtain water from the Lake. TDI-NE will notify all public water systems identified in the VHB Water Supply Memo in advance of construction. Notification will include detailed information of the Project schedule, methods, predicted effects (if any) to sediment turbidity, and contact information.

As indicated in VHB's assessment, the only public water intake located in close proximity to the cable route (near MP 24 and 25) is one of the two intakes supplying the Grand Isle Consolidated Water District, which also supplies the Vermont ANR operated Ed Weed Fish Culture Station ("Fish Hatchery"). According to the operator of the Grand Isle Consolidated Water District, the public water system is able to operate exclusively using the shallow intake, which is approximately 2,000 feet from the Project, and would not be affected by Project construction. The Fish Hatchery requires nearly continuous use of water from the deep intake, and elevated turbidity levels would be of concern. As previously discussed, TDI-NE proposes the direct lay installation method between MP 22 and 66, where it will pass in the vicinity of the deep intake. This methodology results in the least amount of sediment disturbance compared to jet-plow or shear-plow installation. As previously stated, TDI-NE plans to complete more detailed surveys prior to construction to evaluate adjustments to the NECPL alignment that would avoid any undue adverse effects to the Fish Hatchery's water supply.

Based on the fact that Project construction activities will be planned to avoid conflicts with the locations of water intakes, will occur only for a short duration, and are not likely to mobilize significant amounts of sediment from the lake bottom in proximity to water intakes, it is not expected that the aquatic portion of the Project will have any undue adverse effect on existing water supplies.

The construction of the cable has been designed so that the cable will not be visible and will not interfere with designated uses of the Lake. Once installed, operation of the transmission line will not result in adverse impact of the statutory criteria. As demonstrated herein, the Project itself meets the criteria of Parts 1 and 2 of the Public Trust Determination, and it is not expect to result in adverse cumulative effects of existing encroachments.

9.0 Conclusions

TDI-NE is seeking a Lake Encroachment Permit for the construction of an HVDC electric transmission line that will run from the Canadian border at Alburgh, Vermont to Ludlow, Vermont along a 97-mile aquatic routes in Lake Champlain. The transmission line will consist of two approximately five-inch diameter cables that will be solid state dielectric and thus will contain no fluids or gases. The NECPL will also include a one-inch diameter, separately armored multi-strand fiber optic cable that will facilitate HVDC control. The aquatic portion of the transmission line will be buried in the bed of Lake Champlain, except at water depths of greater than 150 feet where the cables will be placed on the bottom and allowed to self-bury. The cables will enter the Lake in Alburgh, Vermont and emerge on land in Benson, Vermont.

As presented in this Application Narrative, application of the three part Public Trust Doctrine Procedure demonstrates that the Project conforms to the Public Trust Doctrine, as follows:

<u>Public Trust Doctrine Procedure: Part 1</u>

- The extent of the Project's encroachment in Lake Champlain is not excessive for its stated purpose. The transmission lines will follow a narrow route and will not be visible once installed.
- The Project's route was designed after a thorough and detailed alternatives analysis, and the proposed route represents the best combination of least overall environment impact and cost-efficiency.
- Lake construction methodology and routing have been designed to reduce overall impacts to the Lake.
- The installation of the transmission lines would not create an obstruction to navigation, nor would it result in the permanent elimination of public use of any portion of the Lake.

- The Project will result in numerous Public Benefits:
    - Lake Champlain Specific and Other Environmental Benefits, including significant funding contributions to Lake Champlain clean-up funds, greenhouse gas reductions, State public access improvements, bank stabilization, culvert upgrades, and roadside ditch clean-up
    - Electric Benefits, including cost reductions to Vermont ratepayers, significant funding contributions to VT renewable programs, and increased electrical reliability as a result of system upgrades
    - Infrastructure Benefits, including lease payments to VTrans, creation of a new fiber optic network, and culvert replacements
    - Economic, including annual property, income, and sales tax payments to the State of Vermont, job creation, and construction expenditures

<u>Public Trust Doctrine Procedure: Part 2</u>

- The Project's encroachment in Lake Champlain will not result in adverse impacts of water quality, fish and wildlife habitat, aquatic and shoreline vegetation, navigation, and other recreational and public uses, including fishing and swimming.
- The Project's encroachment is consistent with the natural surroundings, applicable municipal shoreland zoning ordinances, and applicable state plans.

<u>Public Trust Doctrine Procedure: Part 3</u>

- The Project's encroachment in Lake Champlain does not result in an adverse potential cumulative effect when considered in conjunction with other existing utility encroachments.

As presented herein, the Project will bring numerous significant public benefits to the State of Vermont and the region. TDI-NE petitions that these benefits outweigh any potential impacts to the Lake associated with the Project's construction and/or operation, or to any potential cumulative effects of existing encroachments. The Project conforms to the Public Trust Doctrine, and therefore should be permitted in accordance with VSA Title 29, Chapter 11 Management of Lakes and Ponds §402.

References

This permit application relied on the Prefiled Testimon of the following witnesses submitted to the State of Vermont Public Service Board in Docket 8400 on December 8, 2014:

- Prefiled Direct Testimony of Donald Jessome, Eugene Martin & Joshua Bagnato.
- Prefiled Direct Testimony of Sean Murphy
- Prefiled Direct Testimony of Dr. William Bailey
- Prefiled Direct Testimony of Andy Thuman
- Prefiled Direct Testimony of Christopher Sabick

Exponent, Inc. Submarine Cable DC Magnetic Field in Lake Champlain and Marine Assessment. November 29, 2014.

Exponent, Inc. Temperature Gradients in the Vicinity of NECPL Cables and Potential Effects on Water Quality, Bioavailability of Mercury, and Macroinvertebrates. December 1, 2014.

HDR Engineering, Inc. Lake Champlain Water Quality Modeling Report, New England Clean Power Link. December 2014.

HDR Engineering, Inc. New England Clean Power Link Project Lake Champlain Freshwater Mussel Survey Report. September 2014.

Lake Champlain Maritime Museum, Phase I Archaeological Assessment in Support of the New England Clean Power Link Project- Lake Portion. Grand Isle County, Chittenden County, Addison County and Rutland County, Vermont. Sabick, C.R., Tichonuk, S.L., Lehning, A.W. Prepared for TDI-New England and Vermont Department of Historic Preservation. November 2014.

Marine Research Corporation. Final Report on Acoustic Similarity between the NY and VT HVDC Corridors. Prepared for HDR Engineering, Inc. August 15, 2014.

TDI New England. Aquatic Invasive Species Management and Control Plan for the New England Clean Power Link HVDC Transmission Project Management and Control Plan. December, 2014.

TDI New England, New England Clean Power Link Project Horizontal Direction Drilling Inadvertent Return Contingency Plan. February 2015.

TDI New England, New England Clean Power Link Project Overall Oil and Hazardous Materials Spill Prevention and Contingency Plan. February 2015.

VHB, Inc. Criteria 2 & 3 – Water Supply Preliminary Assessment Memorandum to TDI-NE/ New England Clean Power Link Project File. November 26, 2014.

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