STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Champlain VT, LLC d/b/a TDI New England for a Certificate of Public Good, pursuant to 30 V.S.A. §248, authorizing the installation and operation of a high voltage direct current (HVDC) underwater and underground electric transmission line with a capacity of 1,000 MW, a converter station, and other associated facilities, to be located in Lake Champlain and in the Counties of Grand Isle, Chittenden, Addison, Rutland, and Windsor, Vermont, and to be known as the New England Clean Power Link Project ("NECPL")	)	Docket No. _____

PREFILED DIRECT TESTIMONY OF DONALD JESSOME, EUGENE MARTIN AND JOSHUA BAGNATO

ON BEHALF OF CHAMPLAIN VT, LLC

December 8, 2014

Summary:

Messrs. Jessome, Bagnato, and Martin provide an overview of the New England Clean Power Link, a proposed transmission line project. They discuss the resources and siting of the Project, construction and operation, and the Project's compliance with the criteria of 30 V.S.A. § 248.

Exhibit Number	Name of Exhibit
TDI-JMB-1a-c	Resumes of Donald Jessome, Eugene Martin and Joshua Bagnato
TDI-JMB-2 (Oversized)	Project Maps – Overview, Lake, and Land (TRC)
TDI-JMB-3	Representative Photos of Project Locations
TDI-JMB-4 (Oversized)	Project Plans – Lake Route (TRC)
TDI-JMB-5 (Oversized)	Construction Typicals – Lake (TRC)
TDI-JMB-6	NECPL Summary of Economic and Public Good Benefits (TDI-NE)
TDI-JMB-7	TDI-NE – VELCO Agreement
TDI-JMB-8a-d (Oversized)	Converter Station Context Map, Civil Plan, Electrical Plan, and Elevation Plan (TRC)
TDI-JMB-9	Converter Station Equipment Description
TDI-JMB-10	Blasting Plan (MDB)

Exhibit Number	Name of Exhibit
TDI-JMB-11	Construction and Permitting Schedule
TDI-JMB-12	Summary of Outreach Activities
TDI-JMB-13a-b	VTrans Letter of Intent: § 1111 Permit Letter from Vermont Rail System
TDI-JMB-14	Mitigation Summary Table (TDI-NE)
TDI-JMB-15	45 Day Notice Package
TDI-JMB-16a-b	Letter from Ludlow Letter from Alburgh
TDI-JMB-17	Ludlow Municipal Impact Questionnaire
TDI-JMB-18	§ 202(f) Letter to DPS

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General Background

Q1. Please state your names, occupations, and business addresses.

A1. Response:

My name is Donald Jessome. I am co-founder and chief executive officer of Transmission Developers Inc. and TDI-USA Holdings Corp. ("TDI"). My business address is 600 Broadway, Albany, NY 12207. TDI and its parent company the Blackstone Group are developing the Project through an affiliate, Champlain VT, LLC, d/b/a TDI New England ("TDI-NE").

My name is Gene Martin. I am president and chief operating officer of TDI. My business address is 1301 Avenue of the Americas, New York, NY 10019.

My name is Josh Bagnato. I am employed by TDI-NE as the project manager for the New England Clean Power Link ("NECPL") transmission project. My business address is P.O. Box 155, Charlotte, Vermont 05445.

Q2. Please describe your qualifications and expertise.

A2. Response:

Donald Jessome: My education includes an undergraduate degree in Electrical Engineering from the Technical University of Nova Scotia (currently referred to as Dalhousie University) in 1987, and a Masters of Business Administration, with Distinction, from Saint Mary's University in 1999. I have spent my entire career in the energy field, starting with 22 years at Emera Inc., a publicly-traded company in Canada with $5.3 billion in energy infrastructure assets centered on power and natural gas. I worked in a broad range

of areas while at Emera, including transmission & distribution operations and construction, integrated system planning, system operations, generation operations and fuel procurement, marketing and sales, and most recently Director of Asset Optimization and Power Trading for Emera Energy Inc. a wholly-owned non-regulated trading and asset optimization company of Emera Inc. Through my marketing and trading experience with both the regulated and non-regulated business at Emera, I developed extensive knowledge of the power markets in the Northeast including ISO-NE, NYISO, IESO, TransEnergie, NBSO, and PJM.

I joined Riverbank Power in 2008 as Vice President of Marketing and Trading, to help the company develop its commercialization strategy for its 1,000 MW underground pump-storage technology, referred to as Aquabank™. This strategy included the development of economic models and programs for the sale of energy, capacity and renewable attributes for both the regulated and market-based energy markets. In addition, I was responsible, along with the CEO, for raising equity financing for Riverbank's development plans.

In 2008, I co-founded TDI and currently serve as its Chief Executive Officer and as a member of the board. TDI was created to meet the growing need to develop innovative transmission projects in the deregulated power markets. TDI's innovation was to combine the FERC-encouraged merchant transmission model, shipper not ratepayer customers, with all buried HVDC technology to bridge the gap between constrained load centers with remotely-sourced renewable power facilities such as hydroelectric and wind.

Josh Bagnato: My education includes a Master's Degree in business administration from Boston University and a Bachelor of Arts from Hamilton College. From 2007-2013 I was employed at First Wind, an independent North American renewable energy company, where I managed a wide array of tasks during the development, construction and operational phases of utility-scale wind and solar projects throughout the United States—particularly in New England. While at First Wind, I assisted with development and construction/operational compliance of the Sheffield Wind Project in Sheffield, VT. Before joining First Wind, I held several positions with the Massachusetts Office of Environmental Affairs, including as its Director of Renewable Energy Policy.

Gene Martin: My education includes a Master's in Business Administration and a Bachelor of Science in Mechanical Engineering from the University of South Carolina. I have 30 years of experience in general and executive management with six New York Stock Exchange listed companies in the energy, engineering, construction and private equity sectors. My professional background includes divisional CEO roles with EMCOR Group (NYSE:EME), KeySpan Energy (NYSE:KSE), and UtiliCorp United (NYSE:UCU), as well as various management roles for SCANA Corporation (NYSE:SCG) and AECOM (NYSE:ACM), where I built several life cycle service companies focused on energy infrastructure to over $5 billion, serving some of the world's largest commercial, industrial and institutional companies across their global operations.

Over the past 30 years, I led turnkey operations focused on developing, building and operating power, thermal, transmission and distribution and commodity opportunities/assets in both domestic and international markets. I was the leader and

management spokesperson for utility, contracting and engineering investments in excess of $3 billion, including the $1.15 billion acquisition of United Energy in Melbourne, Australia.

I also sit on the State University of New York's Advanced Energy and Research Technology Center Advisory Board and Heath Consultant's Board of Directors.

Our resumes are attached as ***Exhibits (Exh.) TDI-JMB-1a, 1b, and 1c.***

Q3. Have you previously testified before the Public Service Board or in other judicial or administrative proceedings?

A3. Response:

Josh Bagnato: I have not testified before the Vermont Public Service Board. I have testified in front of the Vermont Environmental Court as well as Vermont Legislative Committees on energy and siting issues.

Donald Jessome: I have not testified before the Public Service Board. I have testified before the New York State Department Public Service in case 10-T-0139, Application of Champlain Hudson Power Express, for a Certificate of Environmental Compatibility and Public Need Pursuant to Article VII of the PSI, for the Construction, Operation and Maintenance of a High Voltage Direct Current Circuit from the Canadian Border to New York City.

Gene Martin: I have not testified before the Vermont Public Service Board, but I have testified on integrated resource planning, long-term renewable Power Purchase Agreements (PPAs), on the siting of new generation and in support of operational issues related to international acquisitions. Specifically, (i) in 1993 I testified before the South

Carolina Public Service Commission regarding integrated resource planning and in support of the 430 MW Cope generating plant commissioned in 1996; (ii) in 1995, before the Colorado Public Utilities Commission concerning the repowering of the Comanche coal facility; (iii) in 2009, before the Connecticut Department of Public Utility Control regarding a PPA for a 39 MW landfill gas-fired turbine project; and (iv) in 1994, before the regulatory commission in Victoria, Australia on operational issues associated with the $1.15 billion purchase of United Energy.

Q4. What is the purpose of your testimony?

A4. Response: The purpose of our testimony and exhibits is to provide a detailed description of the NECPL that TDI-NE is proposing to build and operate (the "Project"). Our testimony discusses the layout and route of the NECPL; details concerning construction and operation; the financial structure of the NECPL; public benefits of the NECPL; decommissioning; outreach conducted to date and the NECPL's compliance with the criteria under Title 30 section 248.

Q5. Please describe the Petitioner.

A5. Response: Champlain VT, LLC d/b/a TDI New England ("TDI-NE") is a limited liability company organized and existing pursuant to the laws of the state of Delaware. TDI-NE is authorized to do business in Vermont and is in good standing.

The TDI-NE team, through its affiliate TDI, is made up of the same leadership team currently developing the Champlain Hudson Power Express ("CHPE") Project in New York

State. TDI-NE and TDI are both owned by The Blackstone Group, a publicly-traded global investment and advisory firm with $284 billion (as of September 2014) currently under management.

Project Overview

Q6. What is the proposed NECPL Project?

A6. Response: NECPL is a proposed electric transmission line that will run from the Canadian border to Ludlow, VT along underwater and underground routes. The electricity shipped through NECPL will be generated by renewable energy sources in Canada, and will be delivered to Vermont and the New England electric grid. The transmission line will utilize high voltage direct current (HVDC) technology, capable of transmitting 1,000 megawatts (MW) of electricity.

The underwater portions of the transmission line, approximately 98 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 self-bury. The overland (terrestrial) portions of the transmission line, approximately 56 miles in length, will be buried underground within existing public road rights-of-way ("ROWs").[1]

The transmission line will begin at a converter station in the Province of Québec, Canada and transmit electricity as described above from Alburgh, Vermont to Ludlow Vermont, where it will tie into TDI-NE's proposed converter station. The Ludlow Converter Station will convert the electrical power from direct current ("DC") to alternating

[1] As shown on ***Exh. TDI-AW-2***, sheets 64-70, one portion of the route will be on a railroad right-of-way.

current ("AC") and then connect to the 345 kV Coolidge Substation in Cavendish, Vermont that is owned by the Vermont Electric Power Company ("VELCO").

Overview Maps, Route Plans (Lake and Overland), and Converter Station Plans are provided as ***Exhs. TDI-JMB-2, JMB-4, JMB-8, and AW-2***. Representative photographs depicting the Project locations are provided as ***Exh. TDI-JMB-3*** (additional photographs detailing the overland route are provided in the testimony of Jeffrey Nelson and Kristin Heitert). We would note that all of the Project's plans referenced above and others discussed later in our testimony (and in the testimony of others) represent preliminary design plans. Consistent with TDI-NE's understanding of how the Board has reviewed other projects, after the route plans, Converter Station plans, and other Project plans are finalized, they will be submitted to the Board for approval as part of a post-CPG certification process.

Q7. You mention the Champlain Hudson Power Express Project. What is that project, and how does it relate to the NECPL?

A7. Response: The CHPE is a proposed 1,000 MW transmission line, being developed by a different affiliate of TDI, which will run from the Canadian border to New York City. It has received its State of New York Article VII Certificate of Environmental Compatibility and Public Need in April 2013, its Department of Energy Presidential Permit in October 2014, and should have its Army Corps of Engineers section 404 & section 10 permits in December 2014. In order to start construction, currently planned in 2015, CHPE must complete its commercialization, engineering procurement and construction agreement along with finalizing the financing. The CHPE is expected to be in service in late 2018.

Whereas the CHPE will serve the New York City area as part of the NYISO electric system, the NECPL will serve the New England states as part of the ISO-NE system. As such, the two projects are physically and electrically separate and will serve two distinct markets.

Q8. Why is the NECPL being pursued, and why in Vermont?

A8. Response: TDI is in the business of providing independent transmission to serve the North American market. TDI believes 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. In today's market, acute transmission bottlenecks are causing prices to rise, hindering renewable generation projects and impeding the efficient operation of AC systems. TDI focuses on using HVDC technology to develop projects that deliver, safe, reliable renewable power in an environmentally and aesthetically responsible manner. TDI'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/underwater infrastructure is less susceptible to damage from natural disasters.

With respect to why Vermont and New England, 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 these 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. See http://www.mass.gov/eea/pr-2013/ne-hydro.html.
4. TDI had extensive knowledge of Lake Champlain and how to install cables efficiently and environmentally responsibly through its work on the Champlain Hudson Power Express Project.

As a result, TDI determined that there was an opportunity for a new transmission line project to import Canadian renewable power (hydro and/or wind) to serve the New England market, and 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.

Q9. What are the components of the NECPL that will need to be built in Canada?

A9. Response: TDI-NE currently has interconnection requests filed with TransEnergie, the transmission subsidiary of Hydro-Quebec, to determine the location and equipment required

to safely and securely connect to the NECPL.[2] At a minimum, it would be expected that a small amount of HVAC equipment, a new HVAC-HVDC converter station and an HVDC cable system would be needed to connect to the NECPL at or near the Quebec-Vermont border.

Q10. Please provide more details on HVDC technology and why TDI-NE is proposing to utilize it for the NECPL.

A10. Response: HVDC technology was chosen by TDI as its preferred technology primarily due to its ability to be developed in compact cable format, two approximately 5-inch diameter cables, so it can be buried with minimal disruption to the communities it will traverse. The two HVDC cables will be connected to a HVDC Voltage Source Converter (VSC) station which uses the latest in high voltage semi-conductor technology to provide both enhanced system stability and precise power flow. In addition to these superior characteristics, the power losses on HVDC technology are very low over long distances. See also the prefiled direct testimony of Larry Eng and ***Exh. TDI-LE-3*** (Description of HVDC technology).

Q11. Is HVDC technology new? Is it proven, safe and reliable?

A11. Response: HVDC technology in buried cable format has been used both in America and abroad. In numerous applications (i.e. underground, underwater), HVDC has a track record of being safe and reliable. There are approximately 145 HVDC links in operation around the world, representing over 140,000 MW. Recently, within the United States, three HVDC

[2] See page 14 of the HQT Impact Study Queue, items 171T and 177T, at http://www.oatioasis.com/HQT/HQTdocs/List_Impact_Studies.pdf.

projects similar to NECPL have been built and are operational. These include: (1) The 660 MW Neptune Project which extends 65 miles from New Jersey to Long Island in both marine and land environments. This project has been operational since 2007. (2) The 400 MW Trans Bay Project which extends 53 miles across the San Francisco Bay and has been operational since 2010; (3) The 660 MW Hudson Transmission Partners which extends 7.5 miles from New Jersey to New York City in both marine and land environments. This project has been operational since 2013.

Q12. You mentioned that the power to be shipped over the line will be renewable energy from Canada. Please explain further.

A12. Response: TDI-NE anticipates contracts with Canadian suppliers of renewable energy, principally hydroelectric power. This power could come from many suppliers in Quebec, Ontario and Atlantic Canada. It is possible that electricity from wind generation plans could also be shipped over the line. TDI-NE has not yet entered into any contracts, so the specific contractual details have not yet been determined. Assuming those contracts come to fruition as TDI-NE anticipates, the NECPL will be able to transmit Canadian hydro or wind power, and thereby achieve its business plan of making renewable energy available to the New England region.

Q13. How was the specific Point of Interconnection within Vermont chosen?

A13. Response: In order to construct and operate an HVDC transmission system within Vermont, TDI-NE conducted feasibility studies to determine where the NECPL could

safely interconnect to the ISO-NE transmission system without jeopardizing grid reliability. To evaluate potential points of interconnection, TDI-NE retained Siemens PTI to study the following three existing backbone 345kV substations owned by VELCO: the New Haven 345 kV Substation located in Addison County, Vermont (New Haven Substation); the West Rutland 345 kV Substation located in Rutland County, Vermont (West Rutland Substation); and the Coolidge 345 kV Substation in Windsor County, Vermont (Coolidge Substation). To assess the suitability of interconnecting 1,000 MW of new generation at each of these interconnection points, TDI-NE analyzed each substation to determine whether:

- There were sufficient interconnection points (or whether the substation had the capability to add sufficient interconnection points);
- The ISO-NE transmission system could accommodate the additional generation supply at these locations without requiring significant additional transmission system upgrades;
- Whether a DC-to-AC Converter Station could be sited in close proximity to the substation; and
- Whether the AC transmission cables from the Converter Station could access the substation without encountering significant constraints.

After concluding its technical analyses, TDI-NE determined that the New Haven Substation and West Rutland Substation presented substantial issues because both of these substations interconnect to only *one* existing 345-kV transmission line. Without significant upgrades to the ISO-NE transmission system, it would not be possible to reliably deliver 1,000 MW of new capacity to these substations. In contrast, the Coolidge Substation is

interconnected to *two* existing 345-kV transmission lines, thereby providing the infrastructure necessary to reliably interconnect the NECPL. Further, TDI-NE was able to secure site control on three adjacent properties for the Converter Station that are located in close proximity to the Coolidge Substation. Siting a converter station on a portion of those properties is consistent with existing land uses, and will minimize environmental impacts and disruptions to the community as the AC cables from the Converter Station will only need to run for 0.3 miles in an unpaved town road to the VELCO substation.

Q14. How was the specific transmission line route within Vermont chosen?

A14. Response: After making a determination that the NECPL could reliably interconnect to the Coolidge Substation, TDI-NE evaluated a number of route alternatives from the Canadian border to the substation. Based on TDI's experience with the CHPE, TDI-NE focused on alternatives that utilized Lake Champlain as the primary route, utilized buried HVDC technologies and utilized public right of ways. Installing cables in the Lake is less costly, less disruptive to communities and less impactful when using environmentally-sensitive lake installation measures. Further, installing the cables within public right of ways also reduces impacts to the community and environment and is a consistent land use. However, TDI-NE also evaluated several above-ground and underground routes that did not utilize Lake Champlain as part of its alternatives analysis for the US Army Corps Application. The non-lake or overhead alternatives were deemed impracticable due to cost, logistics or technological constraints.

Once an approximate route using the Lake and public right of ways was developed, TDI-NE evaluated numerous route segments. The east/west route from the Lake to Benson and then overland to Ludlow was selected based on the following criteria:

- Avoid the sensitive section of Lake Champlain on the east side of the Champlain Islands
- Avoid the Narrows of Lake Champlain
- Avoid Green Mountain National Forest lands
- Find a route over the Green Mountains that was as flat as possible
- Stay on existing public rights of way to avoid the use of private property and the attendant potential impacts
- Find the most direct route possible

Based on this criteria, 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 along the overland route (see our testimony concerning outreach activities). Through feedback received at these meetings, several adjustments to the original route were made in Alburgh, Benson, Shrewsbury, Wallingford and Ludlow.

Because the overland route was proposed primarily within the Vermont Agency of Transportation's ("VTrans") ROW, regular meetings were scheduled with VTrans'

representatives and a memorandum of understanding ("MOU") was executed with VTrans to reimburse it for their review of the proposed Project route. Further, multiple meetings occurred in the Towns of Alburgh, Benson and Ludlow where the cable is proposed within town roads. Based on meetings and feedback received through approximately one year of outreach with regulators, town officials, abutters, nonprofits, regional planning commissions and consultants working for TDI-NE, the proposed route was advanced.

Q15. How was the Converter Station site within Vermont chosen?

A15. Response: In conjunction with identifying the Coolidge Substation as a feasible POI, TDI-NE identified possible sites for construction of the Converter Station in proximity to the substation. Considerations in the selection of a converter site include:

- Sufficient land available for the Converter Station facility -- approximately 12 acres in total to allow for the Converter Station and associated buffers.
- Proximity to the cable route ROW minimizes off-road environmental impacts.
- Consistency with, and minimizing potential impacts on, land uses in proximity to the Converter Station site.
- Minimizing potential environmental impacts associated with the transmission cable installation and the construction of the Converter Station.

Initially, TDI-NE identified and secured control over two adjacent properties on Nelson Road in Ludlow near the Coolidge substation as suitable sites for the Converter Station. After consulting with engineering, sound and visual experts, TDI-NE determined that additional space would be beneficial for the Converter Station, so an adjacent 27 acres

was secured by TDI-NE. This additional land enabled the Converter Station to be sited further away from a nearby residence and within a mature pine forest which provides excellent screening of the station from public roads (see the prefiled testimony of Michael Buscher). These three properties are in close proximity to the Coolidge Substation and the existing cleared VELCO ROW, and when utilized together have more than adequate acreage for the converter site and for accommodation of aesthetic and noise design considerations. Additionally, they allow for the avoidance of environmental resources, reduce the need for excessive excavation, and provide good visual screening due to existing vegetation and topography.

Q16. What is the cost of the NECPL and how will it be financed?

A16. Response: The cost of constructing the NECPL is estimated to be $1.185 billion. The general breakdown of construction-related costs is as follows:

(All figures in nominal $USD millions, unless otherwise noted)

Construction Expenses	
NECPL Equipment & Install Costs	$848.7
Taxes and Fees	$109.9
ISO-New England Transmission Upgrades(1)	$100.0
Interest on debt and debt service reserve funding	$91.1
Development and operating expenses	$34.8
Total	**$1,184.5**

Annual Operating Expenses(2)	
Taxes and Fees	$16.7
Public Good Benefits	$7.5
Operations, Maintenance, and Administration	$5.7
Total	**$29.9**

(1) The studies for full capacity deliverability rights have not been completed, however, based on preliminary technical studies, this is TDI-NE's estimate.

(2) Figures do not incorporate debt service, depreciation, or corporate income taxes.

The prefiled direct testimony of Todd Singer provides additional information on the costs of constructing and operating the Project.

The NECPL will be a privately-financed, or "merchant" plant. That is, TDI-NE does not intend to seek to recover the costs of the Project through charges paid by retail electric ratepayers. Rather, it will recoup its costs of construction and operation though the payments it will receive from Canadian power suppliers who will contract to utilize capacity on the NECPL transmission line.

This same model is being utilized by TDI and Blackstone to privately develop and finance the CHPE transmission line project.

Q17. What electric system initiatives, if any, are occurring on the regional level that could affect how the NECPL would be built and paid for?

A17. Response: In a December 5, 2013 joint statement, the New England Governors stated their commitment "to work together, in coordination with ISO New England and through the New England States Committee on Electricity (NESCOE), to advance a regional energy infrastructure initiative that diversifies our energy supply portfolio while ensuring that the benefits and costs of transmission and pipeline investments are shared appropriately among the New England States." NESCOE represents the collective perspective of the six New England Governors in regional electricity matters and, in its own words, "advances the New

England states' common interest in the provision of electricity to consumers at the lowest possible price over the long-term, consistent with maintaining reliable service and environmental quality."

The New England States, through NESCOE, have agreed that one or more requests for proposals may be issued to advance the development of transmission infrastructure that would enable delivery of at least 1200 MW and as much as 3600 MW of energy into the New England electric system from no- and/or low-carbon emissions resources.

The status of the Governors' Transmission Initiative is currently unclear as to when or if this initiative will proceed beyond the policy status.

Q18. If the New England Governors' Transmission Initiative were to move forward, wouldn't that result in the NECPL being paid for by ratepayers?

A18. Response: As noted above, the NESCOE process is currently still at the policy level and it would be premature to consider it as a viable alternative to the current commercial strategy of the NECPL. Should the initiative ultimately go forward, and RFPs issued, depending upon the circumstances at the time TDI-NE *may* submit a bid. *If* TDI-NE were to be awarded a contract, the costs of the Project may, subject to FERC approval, be recovered pursuant to an ISO-NE tariff that could allocate costs among the New England States. Vermont's, and all of the New England states' share of those costs have to the best of our knowledge not been determined as the process is still at the policy stage. However, even if the process advances to an RFP stage, it is not likely that any Vermont share of such a project would ever exceed its regional load share percentage, 4%, given Vermont's

transmission and energy utilization profile.[3] Whatever percentage that might be attributable to Vermont in such a process would likely be paid through the distribution utilities and their respective ratepayers. It is important to note that the NESCOE process has not yet resulted in an agreed-upon formula; the above is offered for illustrative purposes only, and the State of Vermont will ultimately need to negotiate its own share.

As discussed below and in the prefiled testimonies of Todd Singer, Thomas Kavet, and Seth Parker, a need exists for the NECPL in the New England region and in Vermont, and its construction and operation will result in substantial economic and environmental benefits to the State of Vermont and will promote the general good of the State. As a result, even if the NECPL was a successful bidder in a regional cost-sharing process, the overall benefits of the NECPL would clearly outweigh Vermont's regional cost-share.

Q19. What is the regulatory role of the Federal Energy Regulatory Commission ("FERC") concerning the NECPL, and how will the power output of the Project be sold?

A19. Response: The NECPL is subject to regulation by FERC under the Federal Power Act (FPA). On March 10, 2014, FERC issued an order conditionally authorizing TDI-NE to sell transmission rights for the Project at negotiated rates. 146 FERC ¶ 61,167 (2014). Pursuant to this order, TDI-NE must turn over operational control of the Project to the New England Independent System Operator (ISO-NE) and ISO-NE will operate the transmission line pursuant to ISO-NE's FERC-approved open access transmission tariff.

As made clear in TDI-NE's application to FERC: (i) TDI-NE will assume all market risks for the Project and there will be no captive customers; (ii) TDI-NE is a new market

[3] It is also possible that the State may achieve a more beneficial negotiated outcome in the NESCOE process.

entrant that does not own or operate any existing facilities in ISO-NE; and (iii) no affiliate of TDI-NE owns or operates facilities in these markets. Because incumbent transmission owners have an obligation under the ISO-NE OATT to expand their transmission capacity, upon request, at cost-based rates, no entity will purchase transmission service from TDI-NE unless it is cost-effective to do so when compared to the incumbent transmission owners' cost of expanding capacity.

FERC has recognized that negotiated rates for service over merchant transmission lines are effectively capped at the differential in power prices between markets, in this case the markets operated in Canada and ISO-NE. The anchor customers likely to subscribe to the Project are sophisticated utilities that would only secure transmission service at competitive rates.

Thus, pursuant to its authority from FERC, TDI-NE will sell the transmission rights for the power to the power generators or other Canadian suppliers/marketers. They will, in turn, sell the actual power output that is transmitted via the Project to New England area utilities who will deliver that output to retail customers.

Q20. Please state the Project's capacity and anticipated power output.

A20. Response: The Project will be capable of delivering 1,000 MW of electricity into New England, at a nominal operating voltage of 300 to 320 kV. We anticipate that the line will operate up to 95% of its capacity due to the combination of the expected high availability of the transmission system, estimated to be 98%, the relative economics of the supply, and the New England market's desire to maximize low CO2 energy sources to meet climate change

objectives.[4] As a result, the NECPL is expected to deliver 8,322 gigawatt hours ("GWh") per year, which is equivalent to the energy used by approximately 1 million homes.

Q21. What benefits will the NECPL create for Vermont and the New England region?

A21. Response: During construction and operation of the NECPL, which has an expected life of at least 40 years, significant economic, environmental, and electric system benefits will be created. These will include the following:

ENVIRONMENTAL BENEFITS

- Supports the goals of the New England states to import low-cost, renewable energy.
- Millions of tons/year in reduced greenhouse gas emissions by replacing existing electricity generated by fossil fuels with renewable energy from Canada.
- Supports Lake Champlain cleanup and restoration efforts and in-state renewable programs through ongoing financial contributions.
- Provides a major source of electricity without the need for any above-ground transmission lines and their attendant aesthetic impacts.

ELECTRIC SYSTEM BENEFITS

- Enhances the region's fuel diversity by bringing hydroelectric power to New England
- Strengthens and diversifies the Vermont electric grid
- Buried infrastructure will protect the line from natural disasters
- "Black Start" capability can quickly restart the electric grid in case of a blackout.

[4] For instance, a bill before the Massachusetts Legislature in 2104 sought 18.9 TWh of electricity from "clean energy generation sources." See https://malegislature.gov/Bills/188/House/H4187.

ECONOMIC AND PUBLIC GOOD BENEFITS[5]

VERMONT PUBLIC GOOD BENEFITS	ANNUAL	LIFE OF PROJECT
▪ VT Electric Ratepayer Benefit	$3.4 million (avg.)	$135.7 million
▪ VT Renewable Programs	$1.0 million	$40.0 million
▪ Lake Champlain Phosphorous Cleanup	$2.0 million	$82.0 million
▪ Lake Champlain Trust Fund	$1.0 million	$40.0 million
		$297.7 million
TAXES AND REQUIRED LEASE PAYMENTS		
▪ VT Property Taxes	$7.0 million (avg.)	$301.2 million
▪ VT Corporate Income Taxes	$8.2 million (avg.)	$328.3 million
▪ VTrans ROW Lease Payments	$0.5 million (avg.)	$21.9 million
		$651.4 million
DIRECT SPEND DURING CONSTRUCTION (2016-2019)		
▪ VT Sales Tax	$10.5 million (avg.)	$31.4 million
▪ NECPL VT Employment	$27.8 million (avg.)	$88.3 million
▪ NECPL VT Non-Employment Expenditures	$33.6 million (avg.)	$100.7 million
		$215.3 million
DIRECT SPEND DURING OPERATION (2019-2059)		
▪ NECPL VT Employment	$4.0 million (avg.)	$158.3 million
▪ NECPL VT Non-Employment Expenditures	$3.8 million (avg.)	$151.6 million
		$309.9 million
	TOTAL	**$1.474 billion**

OTHER ECONOMIC BENEFITS

- Vermont Ratepayer Savings (first 10 years of Operations) $294.0 million
- Increase in Vermont GSP (Construction Period) $116.6 million
- Increase in Vermont GSP (first 10 years of Operations) $316.4 million

[5] See Notes in ***Exh. TDI-JMB-6***.

A summary of the public good and economic benefits, with explanatory notes, is provided in ***Exh. TDI-JMB-6***. The prefiled direct testimonies of Todd Singer, Thomas Kavet, and Seth Parker provide more discussion and details on the economic and environmental benefits of the NECPL. The prefiled direct testimony of Larry Eng addresses the electric system attributes of an HVDC transmission line.

Q22. You reference a number of "Public Good Benefits" above. Please explain these in more detail.

A22. Response: TDI-NE recognizes that the NECPL will create certain temporary burdens and impacts on Vermont during construction of the Project. In addition, the use of Lake Champlain -- a public waterbody -- carries with it special responsibilities to ensure that the Lake is protected during construction and operation of the NECPL and at the same time, that discernible public benefits are created for granting TDI-NE the right to use the Lake. Thus, the purpose of the NECPL's Public Good package is to provide benefits to Vermont and its citizens for serving as the host state for the NECPL Project. TDI-NE's proposed benefit package is intended to supplement the substantial direct economic, electric, and environmental benefits already specified. TDI-NE is proposing to establish four categories of Public Good benefits:

- VT Electric Ratepayer Benefit – in addition to the ratepayer savings that will occur due to NECPL's effect of lowering wholesale energy prices in the region (see prefiled direct testimony of Seth Parker), TDI-NE is proposing to provide ratepayers

with $2.5 million per year, escalated annually at 1.5%. These funds would be administered by VELCO, as discussed further below.

- VT Renewable Programs – contributions of $1 million per year to the Clean Energy Development Fund to enhance in-state renewable energy programs for average income Vermonters.
- Lake Champlain Phosphorous Cleanup – contributions of $2 million per year to the newly-announced Clean Water Fund to be directed towards addressing excess phosphorous in Lake Champlain.
- Lake Champlain Enhancement/Restoration Trust Fund – contributions of $1 million per year to a fund to be created to restore and enhance aquatic habitat, and improve recreational access to, or opportunities in, Lake Champlain. The Fund will be administered by a diverse group of Lake-based stakeholders in the public, private, and non-profit sectors.

Q23. What role is VELCO playing with respect to the NECPL and the Vermont Electric Ratepayer Benefit discussed above?

A23. Response: VELCO is the sole electric transmission service provider in the State of Vermont, and is the owner of the Coolidge Substation in Cavendish, Vermont, the NECPL's proposed point of interconnection. Given VELCO's role, it is participating in the ISO-NE's I-39 process under which a System Impact Study is being prepared for the Project.

TDI-NE recognized early on that for the NECPL to be successful, close coordination with VELCO would be an important element. In that regard, it has engaged

VELCO from the time the Project was first announced in October 2013, keeping VELCO apprised of developments and seeking its counsel. And, as noted above, TDI-NE sought a mechanism to provide a direct benefit to ratepayers. TDI-NE and VELCO have thus entered into an agreement under which VELCO will facilitate the disbursement of the TDI-NE annual payments to the benefit of Vermont ratepayers. The Agreement is attached as *Exh. TDI-JBM-7*. TDI-NE and VELCO have further agreed that the Agreement should be submitted in this proceeding for approval by the Board, and to be a condition of any Certificate of Public Good issued for the Project.

Q24. What are the VTrans lease payments mentioned above?

A24. Response: The Vermont Agency of Transportation ("VTrans") has agreed to allow TDI-NE to utilize state highway and railroad rights-of-way ("ROW") for approximately 84% of the overland portion of the cable route, subject to the Agency issuing a ROW "Section 1111" permit. VTrans has informed TDI-NE that it will require annual lease payments for use of the ROW, as it has recently done for Vermont Gas System's use of a state highway. This lease payment is discussed further in the prefiled testimony of Todd Singer.

Q25. What is the scope of the property tax payments mentioned above?

A25. Response: The property tax payments noted above are the combined municipal and education taxes that will be due in each of the towns that will host the overland portion of the Project –Alburgh, Benson, Castleton, Cavendish, Clarendon, Fair Haven, Ira, Ludlow, Mount Holly, Rutland, Shrewsbury, Wallingford, West Haven, and West Rutland.

Q26. What about property taxes with respect to the underwater portion of the NECPL from Alburgh to Benson?

A26. Response: After consulting with the Vermont Department of Taxes and reviewing the tax statutes, TDI-NE believes that the water-based portions of the NECPL route are not taxable; therefore, the tax payments and proposed public benefit funds described above reflect this status.

Q27. What major federal and state permits are needed for the Project?

A27. Response: On the federal side, the Department of Energy ("DOE") must issue a Presidential Permit for any electric transmission facilities that connect at the international border. The Army Corps of Engineers issues permits for activities in navigable waters of the United States and related infrastructure. And as noted above, FERC has conditionally granted TDI-NE the authority to sell transmission rights at negotiated rates. The Federal Highway Administration must concur with the Vermont Agency of Transportation's decision to grant a Section 1111 permit for use of the Route 4 right-of-way. Review by all of these agencies will be informed by and predicated on a full review of the Project's environmental impacts pursuant to the National Environmental Policy Act ("NEPA"). The DOE is the federal lead agency for purposes of conducting the NEPA review.

In terms of state permits, in addition to Board review under Sections 231 and 248, ANR and its departments will play a central role in reviewing the Project's potential effects on key environmental resources — Lake Champlain, wetlands and streams, threatened and

endangered species, and possibly others — prior to issuing any permit decisions. A list of major permits and their status is provided below:

PERMIT	RESPONSIBLE AGENCY	EXPECTED SUBMITTAL DATE
401 Water Quality Certificate	VT Agency of Natural Resources	Jan.-Feb., 2015
Lake Encroachment Permit	VT Agency of Natural Resources	Jan.-Feb., 2015
Discharge Permit	VT Agency of Natural Resources	Jan.-Feb., 2015
Stream Alteration Permit	VT Agency of Natural Resources	Feb.-March, 2015
Wetland Permit	VT Agency of Natural Resources	Feb.-March, 2015
Construction Stormwater Permit	VT Agency of Natural Resources	Feb.-March, 2015
Operational Stormwater Permit	VT Agency of Natural Resources	Feb.-March 2015
Right of Way Permit	VT Agency of Transp. and certain Towns	Submitted May, 2014
Sections 404/10 Permits	U.S. Army Corps of Engineers	Submitted Oct., 2014
Presidential Permit & NEPA	U.S. Department of Energy	Submitted May, 2014

Project Equipment

Q28. Please provide additional details on the elements of the Project and its construction and operation.

A28. Response: As noted above, the NECPL will consist of the construction, operation, and maintenance of an HVDC electric power transmission system in Vermont that will have both aquatic (underwater) and overland (underground) segments. *See Exhs. TDI-JMB-2 (Overview Maps), JMB-4 (Lake Route Plans), and AW-2 (Overland Route Plans)*. The transmission line will be an HVDC design, comprised of two cables – one positively charged and the other negatively charged – and will be solid dielectric and thus contain no fluids or gases. The nominal operating voltage of the line will be approximately 300 to 320 kV, and will be capable of delivering 1,000 MW of electricity.

The NECPL will also include a fiber optic system which will consist of a separate armored multi-strand fiber optic single mode cable, approximately one inch in diameter, that will be installed over the total distance of the NECPL from the Converter Station in Canada to the Ludlow Converter Station. The fiber optic cable will facilitate HVDC control. In addition, given the demand for increased bandwidth in Vermont and to potentially accommodate VTrans' expected communication requirements along certain roads, TDI-NE may enhance the capacity of the fiber optic system within the NECPL permitted ROW to include a long haul dark fiber network along with the HVDC cable installation. TDI has had preliminary conversations with VTrans about utilizing these dark fibers in support of its operations, but no agreement has been reached yet.

Aquatic Cables. 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) (38 kilograms/meter (kg/m)) in water. 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, 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. ***See Exh. TDI-JMB-5 (Lake Construction Typicals)***. See also the prefiled testimony of Sean Murphy.

Overland Cables. For the underground transmission cables, the outer sheathing insulation will be composed of an ultraviolet-stabilized, extruded polyethylene layer. The underground transmission cables will have a diameter of approximately 4.6 inches (117 mrm), and each cable will weigh approximately 20.2 lb/ft (30.1 kg/m). The two cables within the bipole system will be laid side-by-side, approximately 12 to 18 inches (30 to 45 cm) apart, in a trench approximately 4 to 5 feet (1.2 to 1.5 meters) deep to provide for at least 3 feet (0.9 meters) of cover over the cables including thermal and native fills depending on soil resistivity. See the prefiled testimony of Alan Wironen and ***Exh. TDI-AW-3 (Overland Construction Methods)***.

Figures depicting typical cross sections for the aquatic and overland cables are provided in ***Exh.TDI-LE-4***.

Transmission Line Route -- Lake. The proposed underwater portions of the transmission line, approximately 98 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. The line will enter the Lake in Alburgh and exit the Lake in Benson via transitional HDD's on TDI-controlled properties. The Lake route, generally, is proposed in deeper sections of the Lake away from the shoreline. Certain areas,

such as known fisheries, steep slopes and archaeological resources have been avoided to the extent possible during route design. See the prefiled direct testimony of Sean Murphy and *Exh. TDI-JMB-4*.

Transmission Line Route – Land. The overland portions of the transmission line, approximately 56 miles in length, will be buried approximately four feet underground within existing public (state and town) roads and rail rights-of-way (ROWs). The only potential areas where underground burial may not occur is at two stream/river crossings in Ludlow where the cables are proposed to be placed in conduits and attached to a bridge or culvert headwall. Very short sections of the route at the Lake Champlain entry and exit points, as well as at the converter site in Ludlow, will be located on private land that is controlled by TDI-NE.

From the U.S.-Canada border, the transmission line will be installed underground within a town road in Alburgh, and then underground through TDI-NE-owned land where it will enter Lake Champlain for a total distance of approximately 0.5 miles.

From the Lake Champlain exit point in Benson, the transmission line will be buried in public rights-of-way or private property controlled by TDI-NE for approximately 56 miles, as follows:

- TDI-NE land to Benson town roads east to VT Route 22A (4.4 miles)
- VT Route 22A south to US Route 4 in Fair Haven (~8.1 miles)
- US Route 4 east to US Route 7 in Rutland (~17.2 miles)
- US Route 7 south to VT Route 103 in North Clarendon (~2.6 miles)
- VT Route 103 south/southeast to VT Route 100 in Ludlow (~14.3 miles)

- Excursion off Route 103 onto railroad ROW in Shrewsbury (3.5 miles)
- VT Route 100 north to Ludlow town roads (~0.8 miles)
- Ludlow town roads to the proposed Converter Station (~4.8 miles)
- Converter Station to VELCO Coolidge substation (~ 0.3 miles)

As with the transmission line segment in Alburgh, the cables will be located below ground along existing public road and rail ROWs from Benson to the Converter Station in Ludlow. Manhole covers placed at ground level may be required in locations where the cable is placed in a duct system or where access to cable splices is needed.

Converter Station

The Ludlow Converter Station will convert the electrical power from direct current (DC) to alternating current (AC) and then connect to the 345 kV Coolidge Substation in Cavendish, Vermont that is owned and operated by VELCO. The Converter Station will utilize voltage source converter (VSC) technology which includes converter valves with transistors, developed for electric transmission over the past 15 years to lower system losses, increase stability, and improve power transfer and voltage control capabilities. The layout of the VSC station of an HVDC Converter Station utilizes a modular design that incorporates factory-assembled converter valves modules, cooling systems and controls which minimizes required footprint. The DC components of the Converter Station are enclosed in the building, keeping noise emissions low while maintaining a secure facility. VSC converters typically utilize much less space than traditional HVDC substation layouts, which require significant areas for filtering equipment.

The NECPL Converter Station will be located on a TDI-controlled property of 27 acres. The total post-construction site area (i.e., building and associated areas and equipment) will be approximately 4.5 acres. The total amount of land to be cleared for construction will be approximately 10 acres due to required grading and facility access needs. The Converter Station's building will have a footprint of approximately 165 feet by 325 feet (1.2 acres). The entire station will be surrounded by secure fencing that will be compliant with the National Electrical Safety Code and other applicable industry standards.

The Converter Station will be designed to minimize visual impacts to the local environment and surroundings. The indoor design of the Converter Station will limit the need for exterior switchyards and will reduce audible sound. It is anticipated that transformers, cooling equipment, and power line carrier filters will be the major equipment installed outside of the building. The Converter Station will be powered by electricity taken directly from the NECPL transmission line. In the unlikely event that this is not possible, electric power from a local utility or a back-up diesel generator will be used. A context site plan, civil plan, elevation plan, and electrical plan of the Converter Station are provided in ***Exh.TDI-JMB-8a-d***. A summary description of Converter Station equipment is provided as ***Exh. TDI-JMB-9***. Note that these plans are conceptual only; final design plans will be completed after permit approvals have been issued and Project contractors selected.

From the Converter Station, a 345 kV (AC) transmission line will be installed underground within a duct bank for approximately 0.3 miles on public roads to connect the Converter Station with the VELCO Coolidge Substation in Cavendish.

Construction

Q29. Please describe in greater detail the construction plans.

A29. Response: There are five broad components to the construction of the transmission line that include: (1) overland construction; (2) Lake construction; (3) construction to connect the overland and Lake segments; (4) Converter Station construction; and (5) construction staging. These components are addressed in detail below.

Overland Construction

Typically, the two cables will be laid side-by-side (approx. 12 to 18 inches apart) in a trench approximately 4-5 feet deep. Subsequent to laying the cables in the open trench, the trenches will be backfilled with native materials, if appropriate, or low thermal resistivity material, such as well-graded sand to fine gravel, stone dust, or crushed stone. A protective cover will be placed directly above the low thermal resistive backfill material and marker tape placed above the cover. A typical overland trench cross section is shown in ***Exh. TDI-AW-3***. In certain areas that present particular engineering or environmental challenges, horizontal direction drilling (HDD) or Jack and Bore will be utilized in lieu of trenching.

The general sequence for installing the underground transmission cables along the road and railroad ROWs will be as follows: (i) survey, borings and schedule/impact notifications; (ii) environmental controls and clearing; (iii) trench excavation, removal or storage of spoils for backfill; (iv) lay cable; (v) backfill, install protection plate and warning tape; (vi) compact and resurface; and (vii) site restoration.

Although we will be exploring with our selected contractors the most efficient equipment available, such as wheel trenchers, in general, standard excavation equipment will

be used to dig the trench (e.g., excavators, backhoes, loaders, etc.). Typical cable segment lengths range from 0.2 to 0.4 miles; cable lengths will be spliced together utilizing specialized teams provided by the cable manufacturer in pre-excavated pits that will house the modular splice enclosures that create the clean room conditions that are needed. Any excavated soils will be temporarily stockpiled adjacent to the worksite or transported off site if onsite storage is not possible. Where soil is stockpiled on site, it will be temporarily stabilized with EPSC measures. The width of the temporary construction areas will be approximately 20 feet to 50 feet depending on existing constraints and available right of way.

Once construction is complete along the overland route, an approximately-12-foot-wide area along the transmission line route will be kept clear of deep-rooted trees for the life of the Project.

Overland Route - temporary storage and work areas

Temporary staging areas to support overland installation activities will be located in proximity to the roads in areas that require minimal alterations (i.e., flat fields). Additional temporary workspace will also be required at HDD and Jack and Bore staging areas. If additional workspace outside the road ROW is required, previously-disturbed areas or undeveloped areas will be utilized where feasible in order to minimize impacts. The Project will utilize two types of staging areas, construction staging areas and storage staging areas.

Construction staging areas are work areas adjacent to the trenching Jack and Bore or HDD installations where work will occur. A typical construction staging area in a roadway ROW would be approximately 20 to 50 feet wide along one side of the roadway. Staging areas for Jack and Bore and HDD operations will vary in area based on the size of the

equipment and topography. If necessary, TDI-NE will seek landowner consent through short-term agreements to utilize private property for temporary construction staging areas. These agreements would identify the limitations of what could be constructed within the private lands (e.g., temporary work space associated with an HDD). TDI-NE would also restore the property area utilized to its original condition. TDI-NE has already secured six agreements to allow for these temporary off-ROW construction staging areas at eight locations.

Temporary storage-staging locations are designated areas where vehicles, supplies, and construction equipment are positioned for access and use in support of construction activities. Several properties controlled by TDI-NE have been designated as storage-staging locations, described as follows:

- Alburgh: TDI-NE controls the property at 55 Bay Road in Alburgh, Vermont. The property is approximately four acres, with a single building on it. Approximately three acres of this property can be utilized as the only temporary staging area for the northernmost portion of the transmission line routing.
- Benson: TDI-NE controls the properties at 113 and 148 Stony Point Road, Benson, Vermont. These properties have approximately two acres of land available for a staging area. TDI-NE also has secured a storage area of approximately five acres in size on Mill Pond Road near Route 22A in Benson, pursuant to an option and lease agreement.
- Ludlow: TDI-NE has control over three adjacent properties in Ludlow, Vermont. The combined land on these properties is approximately 40 acres,

with a single building on one of the parcels. Sections of this land will be used for temporary storage areas in support of general construction and erection of the proposed Converter Station.

TDI-NE is working to identify other potential temporary staging areas for construction of the overland portion. These sites will be screened for existing cleared, relatively flat, land with few or no environmental resources. TDI-NE's priority is focused on commercial land options or available commercial property in the interest of minimizing impacts to private property interests.

Aquatic Construction

Depending on depth, the line will be installed beneath or on the lake bed on the Vermont side of Lake Champlain for a distance of approximately 98 miles, to the Town of Benson. In locations where the water depth is greater than 150 feet, the transmission line will be installed on the top of the lake bed where it will sink into the sediment approximately one foot over time.

General construction typicals for the Lake route are provided in ***Exh. TDI-JMB-5.***

Prior to installing the aquatic 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. Further details are provided in the prefiled testimony of Sean Murphy.

The cable will be buried in the Lake bottom using either a water-jet plow or a shear plow or laid on the surface of the lake bottom in depths greater than 150 feet. In any

aquatic installation, protection of the submarine cable is vitally important. The two most common methods of protection of a submarine cable are internal armoring and burial. The cable specified by TDI-NE has surface layers of steel strands which provide both tension stability and mechanical protection. See cable cross section depicted in ***Exh. TDI-LE-4***.

To further protect the system in the northern portion of Lake Champlain, TDI-NE will bury the submarine cables in waters under 150 feet with a water-jetting process which uses pressurized water to "fluidize" the sediments to create an approximately 4 foot deep by 8 to 18 inch 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.

In the southern portion of Lake Champlain, where sediment stiffness is low and the waterway is narrow, a shear plow installation will be used. 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.

A diagram depicting the jet/shear plow installation processes is provided in ***Exh. TDI-JMB-5***.

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 bedrock. When confronted by these conditions, protective concrete mattress systems are deployed to achieve maximum protection. For example, where the transmission cables would cross existing utility infrastructure such as a pipeline or another cable, depending on how deep the utility infrastructure is buried, 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 ***Exh. TDI-JBM-5***.

TDI has surveyed and located utilities and other lake bottom infrastructure which will be confirmed by owners and by diver visual inspection. The known utility crossings are depicted on the Lake route plans, shown in ***Exh. TDI-JMB-4***.

Generally, where the infrastructure is buried to a significant depth in the lakebed, the jet or shear plow will be configured to provide at least one foot of sediment between the utility infrastructure and the NECPL cables. Once past the utility line, the plow will be reconfigured to the prescribed burial depth for that section of the route, and it will be decided whether protective covering is required for that utility crossing location based on good engineering principles. Where the utility infrastructure is not deeply buried, the shear or jet plow will be lifted off the bottom, moved across the utility infrastructure, and then re-deployed on the bottom past the infrastructure. Mattresses would be laid over the existing utility infrastructure, and the NECPL cables would cross then be covered with concrete mats. In the instances where protective mattress systems are required, inspection and placement by divers and coordination with utility owners, guided by standard utility crossing procedures, will occur to prevent damage to pre-existing utilities. A representative

schematic of such protection measures is provided in *Exh. TDI-JMB-5 (Lake Construction Typicals)*.

Q30. Please further describe how the transmission cables will be installed when entering and exiting Lake Champlain, and in portions of the overland route where trenching cannot be used.

A30. Response: The transmission line will enter and exit Lake Champlain using a trenchless construction technique known as a horizontal directional drill (HDD) to minimize impacts to the Lake and shoreline. HDD is a method of installing underground utilities in a shallow arc along a prescribed path by using a surface-launched drilling rig.

HDD will also be used to install cables under roadway or railway crossings where trenching is not possible, or under environmentally-sensitive areas such as rivers.

The equipment used and scale of the HDD operation will vary depending on the length and depth of the installation. It is anticipated that the largest, most complex, HDD operation will occur at the two land-to-water transitions that are planned in Alburgh and Benson. An overview of the HDD process is described below.

The main components of the HDD are: (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 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 is used in aquatic transitions. The drilling fluid is an absorbent clay composed of aluminum phyllosilicate which facilitates 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 down hole 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).

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 – about 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, high-density polyethylene (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 will be pulled through these pipes, which will remain in place to protect the transmission cable.

TDI-NE is currently planning on 29 HDDs along the entire route, representing approximately 5.4 miles of drills. This HDD activity includes the management of excavated soils, which will be temporarily stored on site during construction, and will be used to restore the site to its previous grade once the drilling process has been completed, or removed and disposed of at an approved location. TDI-NE estimates that approximately 100 cubic yards (76 cubic meters) of drill cuttings (used bentonite and excess soil) will be generated at the HDD installations which will require appropriate disposal. ***Exh. TDI-AW-3*** shows an example of an HDD drill rig operation staging area for landfall locations. HDD staging areas in entirely terrestrial locations (i.e., roadway crossings) will likely be smaller in size and less complex due to smaller equipment requirements.

Q31. Please describe any necessary land-based staging areas for the aquatic portion of the Project.

A31. Response: Minimal land-based support will be required for installation of the aquatic transmission cables in Lake Champlain. The land-based port facility for supporting transmission cable installation will be located at a suitable facility on Lake Champlain with

capabilities to support crew, installation and dive operations. A small (approximately 60,000 square feet) temporary storage area at the port facility may also be required to support the cable installation activities. TDI-NE's marine contractor will identify site specifics including necessary mechanical, sanitary, provisions, supplies and hoist requirements.

Q32. Will the overland portion of the Project require bedrock or ledge removal, and if so, what methods of rock removal will be utilized?

A32. Response:

Yes, given the anticipated subsurface conditions in some trench locations, bedrock or ledge is expected. If bedrock or ledge is encountered, it will be removed by the most suitable technique, to be determined in the field, with preference for mechanical removal if cost effective, i.e., excavating the rock with an excavator bucket, cutting device and/or pneumatic hammer. If mechanical removal is not possible, then TDI-NE will evaluate alternatives, including a more shallow cable installation with enhanced concrete or steel cover protection, an increase in the amount of cover (if the changed topography is not problematic), or blasting, to achieve the standard depth. Blasting, if needed, would be conducted only to the extent necessary to remove rock to allow the cables to be buried.

Although TDI-NE has not performed the detailed geo-technical activities that occur in the final design stage after the Project receives its CPG, TDI-NE discussions with contractors, consulting engineers and state officials familiar with route geology strongly suggests that we should be prepared to blast if necessary in support of excavations. TDI-

NE sought out a company with experience in Vermont -- Maine Drilling and Blasting -- to assist with preparation of a blasting plan.

Blasting could occur at any point in the 56 mile terrestrial portion of the NECPL Project, including site preparations for the Ludlow Converter Station. Blasting is utilized as a safe and efficient means to remove rock from the NECPL installation areas, with a long history of effectiveness in Vermont. Along with rock removal, appropriately conducted blasting should result in no impacts to surrounding structures, wells and roadways. Blasting requirements and procedures will follow federal, state and VTrans guidelines regarding:

- Pre- and post-survey blast notifications – property owners will be notified by certified mail and via public meeting about planned blasting, and any property owners within 500 feet of a blast site will be offered water quality/flow testing which will be documented before and after blasting. Blasting will be seismically monitored with the goal of ensuring minimal ground vibrations.
- Blasting procedures – all blasting will be scheduled during days and will include warning and all clear signals. Blasting areas will be restricted from unauthorized entry and blasting procedures shall be best practices (blast direction; stemming character; use of mats; dust and noise control). All blast vibrations shall be monitored and will not exceed federal guidelines as dictated by the USBM.
- Delivery and Storage of Explosives – all explosives will be delivered daily and will not be stored on site.

- Blaster qualifications – the blasting contractor in charge will be licensed in the State of Vermont and insured for use and transportation of explosives, and all blasting will be performed in accordance with all applicable laws and regulations.

These and other elements of the blasting program are described NECPL's Blasting Plan, attached as *Exh. TDI-JMB-10*.

Q33. Will construction of the overland portion of the NECPL require the removal of trees along the roads, and if so, how will potential impacts be addressed?

A33. Response: One of the key design criteria for the terrestrial portion was minimizing tree clearing. TDI-NE's proposed route design largely avoids tree clearing, since the cable is proposed adjacent to or in roads. However, there are stretches along the route, primarily within the VTrans ROW, where tree clearing is unavoidable. In these cases, clearing is primarily restricted to areas where the cleared ROW is too narrow to accommodate the installation of the cable. Hedge rows or mature trees in front of houses were avoided to the extent possible. In certain cases, tree clearing avoids other resources, such as rare plant areas, wetlands or cliffs close to the roads. Where trees are close to the road or railroad, there may be added public safety benefits of removing trees.

In sum, tree clearing primarily occurs in forested areas and will have the result of increasing the cleared zone of the road ROW without unduly impacting property owners. If trees are removed that impact landowners, TDI-NE will consider replanting trees off the ROW with property owner consent. TDI-NE is willing to engage with any affected landowner prior to construction to discuss replanting.

Traffic and Transport of Equipment and Materials

Q34. Please discuss traffic-related issues during construction, and how construction materials and equipment needed for the aquatic portion of the NECPL will be transported to the work sites.

A34. Response: For the in-water portion of the Project, transport of the transmission cables will occur via supply barges. Other equipment, materials, and supplies will be transported to the work site by local barges and support vessels. A small (approximately 60,000 square feet) temporary storage area on land might also be required to support installation of the cables in Lake Champlain. If this storage area is needed, it is anticipated that an existing commercial marine facility within Vermont with docking, hoist capacity and storage space can be utilized.

During installation activities, the presence and operation of the transmission cable installation vessels will result in additional vessel traffic on Lake Champlain. Installation vessels will include a 100 x 300 foot sectional lay barge and six 165 x 44 foot supply barges purposely built to transit the Lake Champlain locks. These supply barges will transport 1,270 tons of cable in static tanks in support of installation from a freighter in Port Elizabeth, NJ and will make approximately 12 trips to and from the Lake over the course of the installation. Given the limited traffic associated with the Lake installation, and the slow speeds of the supply and installation vessels, it is expected that the Project will not prohibit any water-dependent commercial or recreational activities, including boating, angling, water sports or commercial sightseeing, because vessels could easily transit around the limited area of the work site. Additional vessel traffic will be temporary (i.e., for the duration of construction while vessels and equipment will be present) and localized to the work site.

Depending on the installation technique deployed, approximately 1.4 (shear plow / jet plow) to 7.8 miles (bottom lay) of transmission cables can be installed per 24-hour day in an aquatic environment. As a result, the immediate work site, which will be off limits to other vessels, will remain at any given location for a reasonably short period of time due to installation vessel speed.

All transmission cable installation activities will be closely coordinated with the commercial ferry operator, with the goal of scheduling cable installation around planned maintenance cycles, if possible. TDI-NE will also closely coordinate lake installation activities with the U.S. Army Corps of Engineers (USACE); U.S. Coast Guard (USCG); harbor masters, commercial vessels, local maritime associations; marinas; and other local, state, and federal agencies, as necessary, to minimize or avoid impacts to the extent practical. Additionally, an Aquatic Safety and Communications Plan will be provided to the USCG which includes notifications to local waterway users regarding timing of the transmission cable installation activities.

Q35. Please discuss traffic-related issues during construction, and how construction materials and equipment for the <u>overland</u> portion of the NECPL will be transported to the work sites.

A35. <u>Response</u>: While some of the roads along the route are primarily used for thru-traffic, other roads have residences adjoining the ROW. Installation of the transmission line and the presence of construction work areas and equipment will result in temporary disturbances to surrounding land uses during the construction period, including lane closures and other

traffic management measures. At any given location, the active construction zone is expected to last for a maximum period of five days except where we encounter very significant rock formations, in the case of HDDs, or other unexpected delays.

The proposed Project route will cross various paved municipal and state roads. Where crossings are required, TDI-NE will be deploying trenchless technologies to pass under these roads including HDD and/or Jack and Bore.

Jack and Bore is a technique for forming a horizontal bore hole through the ground (i.e. under a paved road in support of culverts) from a drive shaft to a reception shaft by means of a rotating cutting head. The augur boring equipment creates an unsupported hole, so the common practice is to jack the steel casing with the boring operation, hence Jack and Bore. Jack and Bore is the primary method utilized to span a road; if it is not used, lane restrictions could result. These traffic disturbances will be temporary, lasting only for the duration of construction of that particular crossing.

The construction schedule will be developed in conjunction with the selected upland general contractor to minimize inconvenience to the travelling public and surrounding residences, to the extent practicable. TDI-NE will provide timely information to affected residents regarding construction activities, and coordinate with VTrans and local officials. Impacts will be minimized by installing construction signs, utilizing plating for temporary access and use of barriers in accordance with applicable State of Vermont highway regulations and design standards. Restoration of the roadway ROW, driveways, and landscaped areas will include consultation with the same entities noted above.

Constructions workers will be dispersed throughout the Project area where work is ongoing. Therefore, the number of construction vehicles at any one location will not add noticeably to overall traffic. Construction-related vehicles parked within roadway ROWs will not affect any existing parking resources in the vicinity of the Project. Construction vehicles supporting transmission line installation activities in roadway ROWs will be parked within construction zones, but the construction zones will be managed in accordance with a Maintenance and Protection of Traffic (MPT) Plan, which will identify procedures to be used to maintain traffic and provide a safe construction zone for those activities within the roadway ROW. The MPT Plan will also maintain sufficient parking and access at all times.

Transport of Oversized Equipment

TDI-NE will establish a logistics plan with the responsible manufacturer to address transport of the large power transformers ("LPTs") for the Converter Station and cable reels for the transmission line. Although final details and routing plans need to be completed, we are confident that we can find an effective means to get the transformers and all related equipment to site.

Cable will be manufactured in Huntersville, NC and transported over roads to installation sites on specially-designed low boy trailers that can properly distribute and move the weight while minimizing vertical height. The cable will be approximately 2,300 feet in length, mounted on a standard ST-36 steel drum. The combined weight of the drum and cable will be 26.4 US tons. Approximate vertical height will be 15½ feet.

The transport of the LPTs is the most challenging part of the logistics plan, due to weight, dimensions and shipping distances. The four 383.3 MVA single phase transformers

specified for the Converter Station each weigh 305,000 lbs. The LPT's will be sourced in Europe and shipped by freighter to a US. East Coast port. Options to ship to Vermont include rail and barge, with the final leg to the Project site being addressed with over-the-road transport. TDI-NE is considering a rail option that would have the transformer units arrive at Port Newark in New Jersey and be routed out of Newark to Palmer, Massachusetts, forwarded on to the New England Central, and on to the Vermont Railway. TDI-NE is also considering a barge option which would transport the transformers from Port Elizabeth, NJ to Albany, transfer to rail to Vermont, and complete the final route via truck. TDI-NE will also seek VELCO's input on the local road segment, as it previously transported large power transformers to the same area for the Coolidge substation. LPT and cable reel transport will also require special permits and routes from the transportation agencies of each state on the route, including VTrans (through the Department of Motor Vehicles). Bridges need to be checked, traffic lights and utilities raised or removed and replaced. In addition, transporting large power transformers and cable reels on the road can require temporary road closures due to traffic issues as well as coordination with local officials and police to redirect traffic.

Although oversized loads are anticipated for certain items as depicted above, TDI-NE anticipates that all construction equipment and materials, and all Converter Station equipment, can be transported to the Project locations on local and state roads without requiring special road or bridge modifications.

See also the prefiled direct testimony of Alan Wironen.

Operation and Maintenance

Q36. What will operation of the NECPL consist of, who will operate it, and where will the operations of the NECPL be controlled from?

A36. Response: 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.

Q37. Please describe the ongoing operation and maintenance of the Project.

A37. Response: The proposed NECPL 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 5 percent allocated for scheduled and unscheduled maintenance and lower throughput on the cables.

The HVDC and HVAC 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.

Transmission Cable Inspection

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. The overland cable will be inspected approximately every 3 years to ensure that adequate cover exists. In addition, following installation of the transmission cable, annual walk-down inspections will be conducted of the transmission cable ROWs, transitional splice vaults and duct banks to ensure that cables are fully secure and that there is no potential intrusion or activity that could impact cable operation. More specifically, on-the-ground inspectors will survey the terrestrial ROW periodically for:

- Vegetation on the ROW that might be capable of disrupting (i.e., damaging) the cables below;
- Line exposures at areas with steep slopes and stream banks;
- Unauthorized encroachments;
- Vandalism.

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.

Converter Station

Throughout normal operations, the Ludlow HVDC Converter Station would require minimal-to-no on-site personnel. Maintenance activities at the Converter Station, including

inspections, testing and preventative maintenance, would be expected to occur regularly throughout the life of the transmission line, focused on inspection and repair of balance of plant components, optimizing and annual testing of the system and general maintenance/cleaning of components such as transformers and coolers. For example, insulators at the Converter Station will be inspected and cleaned if there are excess deposits of industrial contaminants and soot. Additionally, metal parts (i.e., nuts, bolts, cable cleats, and grounding scraps) will be inspected for corrosion and tightness and cooling water chemistry and levels in the cooling stations maintained. The permanent stormwater features at the Converter Station will also be inspected and maintained as required by the applicable permits.

ROW Maintenance

During operation of the proposed NECPL Project, vegetation clearing in the transmission line ROW will be performed on an as-needed basis. This clearing will likely only occur in segments of the ROW that are not receiving ongoing clearing by VTrans or the Railroad. Vegetation management will include mowing, selective cutting to prevent the establishment of trees directly over the transmission line, and vegetation clearing on an as-needed basis to conduct repairs. Vegetation along the transmission line ROW will primarily be managed by mechanical means including such mechanisms as brush hogging, mowing, or hand cutting.

Any vegetation management activities currently conducted by VTrans or the Railroad within the ROWs will continue following the construction and operation of the transmission cable. A vegetation management plan for the transmission system has been

developed. The goal of the vegetation management plan will be to establish stable low-growing vegetation with shallow root systems that will not interfere with the cables. See *Exh. TDI-JAN-12*.

Transmission Cable Repairs

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 5 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 procedure for repair of a failure within the aquatic and terrestrial portions of the proposed NECPL Project route is described as follows:

Aquatic Transmission Cable Repair

Direct burial of the aquatic transmission cables to an average depth of at least 3 feet below the Lake bottom 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.

As discussed in the testimony of Sean Murphy, in the event of aquatic cable repair, the location of the problem will be identified by the fault detection system and crews of qualified repair personnel will be dispatched to the work location. 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.

Terrestrial Transmission Cable Repair.

Underground terrestrial transmission cables will be buried to an approximate depth of 4 feet (1.2 meters) below ground surface with a pre-cast concrete cap placed on top of the trench above the cables where they are installed by trenching. The Ludlow HVDC Converter Station will be designed, manufactured, installed, and tested by a reputable equipment vendor with international HVDC transmission experience.

In the event of terrestrial transmission cable repair, pre-selected local contractors identified during the development of the ERRP will excavate around the location of the

problem and along the transmission cable for the extent of cable to be repaired or replaced. Once the portion of the transmission cable is excavated, specialized OEM personnel will remove the damaged cable and install new cable. Once complete, the transmission cable trench will be backfilled and the work area restored using the same methods as described for the original installation.

Q38. Please describe the permitting and overall construction schedule for the Project, and the proposed work hours during construction.

A38. Response: The permitting phase of the proposed NECPL Project is expected to continue through 2015 into early 2016. Pre-construction activities will commence in 2015 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 as *Exh. TDI-JMB-11*.

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.
- Restrictions on working in the VTrans ROW from December 1 to April 15.
- Restrictions on works hours and prohibitions from working on Sundays and Holidays.

The hours of construction on land are generally Monday through Friday, 7 AM to 7 PM, and Saturdays from 8 AM to 5 PM for areas near homes. Where TDI-NE is working in close proximity to residences, consideration in planning and executing the construction work will attempt to minimize the overall duration of the impact on the residences, and TDI-NE will provide residents with reasonable advance notice of 24-hour HDD operations.

For work in non-sensitive areas, such as the Route 4 corridor, TDI-NE proposes extended hours into the evening.

No work will take place on Sundays or state or federal holidays.

Blasting operations will be limited to 9 AM to 5 PM, Monday through Friday. Where TDI-NE is conducting HDD, it may continue the drill up to 24 hours per day, including weekends and holidays, as necessary to complete a drill.

Q39. What are the plans for decommissioning the NECPL at the end of its useful life?

A39. Response: 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 PSB approvals).

When the NECPL ceases to operate, TDI-NE proposes the following general scope of decommissioning activities:

Converter station – as discussed previously, the station will be located on private property controlled by TDI-NE, well-screened from public visibility and with substantial buffers from nearby residences and public roads. At the same time, the station is in close proximity to the VELCO substation and thus may retain intrinsic value to other transmission service providers or other commercial entities in the future. As a result, TDI-NE proposes to limit decommissioning to the disconnection of the Project from the VELCO substation, the removal of any equipment or materials from the station that could present a hazard if left unattended, the removal of equipment that TDI-NE may choose to reuse elsewhere or sell, and then the securing of the facility with locked gates and enclosures. Given that the station would not pose any ongoing visual, noise, environmental, or other impacts, there would be no need to conduct further activities such as completely dismantling and removing the Station.

Lake and terrestrial cables – TDI-NE will de-energize the line but otherwise proposes to 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 underwater/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. Simply put, there is no societal benefit that outweighs the substantial financial and environmental costs of removing a transmission line that is completely inert and out of public view.

Public Outreach Activities

Q40. What activities has TDI-NE undertaken to inform the public and potential stakeholders of the Project?

A40. Response: Since announcing the Project in late October, 2013, TDI-NE has made a concerted effort to initiate outreach with interested and potentially impacted stakeholders -- local landowners, town leaders, local businesses, state elected officials, state and federal agencies, Vermont utilities, non-governmental (not-for-profit) organizations ("NGOs"), trade associations, regional commissions, and Vermont citizens. TDI-NE has engaged with hundreds of people in Vermont and New England at more than one hundred meetings or briefings over the past year. All selectboards along the overland segment have been briefed on the Project,[6] six open house informational meetings were held along the overland segment, a Lake Symposium which provided details on the lake segment was held in Burlington, and numerous individual meetings have been held with interested people along the proposed route.

[6] TDI-NE is scheduled to meet with Cavendish on December 8th, the final selectboard it has not yet met with.

More specifically, as summarized in *Exh. TDI-JMB-12 (Outreach Table)*, TDI-NE proceeded on a deliberate outreach program based on previous developments in Vermont as explained below:

- Stage 1 – Statewide Outreach (October, 2013 – February, 2014): This stage primarily consisted of an overview of the Project to a wide variety of stakeholders including, state and federal regulators, NGOs, elected officials, business/trade groups and utilities. Vermont ANR specifically requested that TDI-NE preview the proposed route with their resource experts prior to sharing with the local communities.
- Stage 2 – Local Outreach (March, 2014 – December, 2014): This stage consisted of Project overview meetings with the selectboards of all fourteen towns along the overland route and numerous meetings with other town officials and adjacent landowners. In addition, the five regional planning commissions along the proposed route have been briefed on the Project. This local outreach culminated with open houses held in six locations along the overland route in August and September. These two-hour open houses were staffed by TDI-NE personnel as well as its outside experts and were attended by approximately 150 people. These open houses were widely advertised and allowed TDI-NE to understand specific concerns from local citizens. These concerns have been, and will continue to be, addressed in the Project design to the extent practicable.
- On October 9, 2014, TDI-NE held a Lake Symposium at the ECHO Center in Burlington, which was attended by approximately 30 people representing NGOs, state and federal agencies, members of the Vermont legislature, regional planning

commissions, watershed associations, commercial vessel owners, and other interested citizens. TDI-NE and its consultants presented preliminary information on installing the cables in the Lake and associated water quality, magnetic and thermal impacts. During this meeting, attendees asked questions and provided feedback that TDI-NE has utilized to improve its assessment of Lake impacts. These presentations were made available on the NECPL website.

- In August 2014, TDI-NE sent letters to15 towns who have shoreline on Lake Champlain, providing an overview of the Project. This letter was supplemented roughly two months later with the 45-day notice letter.
- As part of the NEPA process, the U.S. Department of Energy held two scoping meetings for the Project on September 16th (Burlington) and 17th (Rutland). These public meetings were lightly attended.

Q41. Please provide further detail on TDI-NE's consultations with Vermont state agencies.

A41. Response: TDI-NE has been meeting regularly with VTrans and VT ANR since late 2013. VTrans has been involved in the development of the proposed routing along state roads and the railroad, reviewing draft plans and providing feedback on the proposed design which relates to state roads and railroads and that has been submitted as part of this petition. VTrans will need to issue a Section 1111 permit for the use of state road rights-of-way and execute a license agreement along with Green Mountain Railroad ("GMR") (owned by

Vermont Rail System) for use of the railroad right-of-way.[7] VTrans has provided a Letter of Intent to issue the Section 1111 permit. ***See Exh. TDI-JMB-13a***. In addition, TDI-NE has received a conditional letter of support from Vermont Rail System. ***See Exh. TDI-JMB-13b.***

Likewise, various experts from throughout VTANR (including its Departments of Environmental Conservation and Fish and Wildlife) have been involved in reviewing and approving TDI-NE's and its consultants' study plans, providing guidance on required studies, reviewing and providing feedback on draft reports and raising concerns that need to be addressed during the permitting process. TDI-NE believes that VTANR has been aware of Project development activities that relate to their jurisdiction during the last year. In addition, TDI-NE has met with the VT Tax Department, VT Department of Public Service, and VT Agency of Commerce & Community Development.

Q42. Before turning to the specific section 248 Criteria, can you summarize the steps that TDI-NE has taken to avoid, minimize and/or mitigate potential impacts of the Project?

A42. Response: Yes. TDI-NE has payed a great deal of attention and effort to site selection, Project design, routing, construction techniques, and equipment selection, to avoid, minimize and/or mitigate potential impacts of the NECPL. This information is generally referenced in the testimony of specific witnesses. To provide the Board with a broad overview, we have prepared a summary table that enumerates these efforts to date. See ***Exh.TDI-JMB-14***.

[7] This railroad ROW is owned by the State of Vermont, managed by VTrans, and leased to GMR.

Section 248 Criteria

Q43. Have you considered the Project's compliance with the criteria of 30 V.S.A. § 248?

A43. Response: Yes, we have considered the Project's compliance with 30 V.S.A. § 248(b) based on input from all of the other witnesses who are providing testimony. The Project complies with all relevant criteria. Our specific responses are noted below.

30 V.S.A. § 248(b)(1) – Orderly Development of the Region

Q44. Will the Project unduly interfere with the orderly development of the region?

A44. Response: No, as discussed below the Project will not unduly interfere with the orderly development of the region, and will not cause any direct impacts on the capacity of the region to develop. See also the prefiled direct testimony and supporting exhibits of Michael Buscher with respect to the town and regional plans for the overland route.

As discussed elsewhere in our testimony and in the testimony of Alan Wironen and Sean Murphy, the Project will implement construction techniques and traffic control methods to ensure that it will not cause an undue burden on public roadways or the Lake (for swimming, boating, etc.), or on other types of municipal or state services or infrastructure. The Project will be developed in a linear fashion, so construction impacts will be limited to discrete areas for limited periods of time. In addition, NECPL has and will continue to closely coordinate the Project design with VTrans, GMR and the towns along the route.

By locating the transmission line in the Lake and within public rights of way, the NECPL will not utilize land or resources that are otherwise needed or planned for other

forms of development within the region. In addition, construction access to these rights of way requires minimal upgrades. Likewise, the Converter Station will be located on a forested parcel and will be sited such that it avoids impacts to sensitive natural resources.

Q45. Please describe any input or recommendations received from any municipality or regional planning commissions.

A45. Response: As discussed previously, TDI-NE has engaged in significant outreach before preparing and filing its Section 248 application and supporting materials. TDI-NE has taken into consideration the comments it has received in discussions with town officials, regional planning commission officials, and local residents, in designing the Project and compiling the petition and supporting materials for the Section 248 process. TDI-NE also issued its 45-Day Notice letter to all towns along the Project route. *See Exh. TDI-JMB-12 (Outreach Summary) and TDI–JMB-15 (45 Day Notice Package)*.

For example, citizens and business owners within the Village of Cuttingsville (in the Town of Shrewsbury) expressed some concern regarding disruption to their community during construction and requested that TDI-NE evaluate avoiding the village by using a 3.5 mile stretch of railroad right-of-way. TDI-NE recognized the unique challenges posed by the road route in that village, given the number and proximity of homes and width of available work spaces. In response, TDI-NE evaluated this stretch of track and after much analysis and field work determined it was a preferred route to avoid the village.

Similarly, within Benson, TDI-NE developed the proposed route based upon a review of several routes along town roads. We have discussed and toured the proposed

route with the Town. Within Alburgh, the location of the cable was moved to a different portion of land owned by TDI-NE, per the request of the adjoining landowner. And, as explained earlier, additional land was secured by TDI-NE in Ludlow to improve the siting of the Converter Station.

Finally, TDI-NE will continue to meet with adjoining landowners to ensure that their concerns related to impacts on their property are addressed and memorialized in the Project design. As mentioned earlier, TDI-NE has received supportive feedback from these Towns as evidenced by the attached letters from Ludlow and Alburgh. ***See Exhs. TDI-JMB-16a and 16b***.

Q46. Are there any other aspects of the Project that will have a positive impact on the development of the region?

A46. Response: Yes. As noted earlier in our testimony, the Project will generate over $7 million per year, on average, over the life of the Project in taxes to the State of Vermont and host towns. Roughly 1/3 of that amount goes to municipal property taxes. The Project will also generate construction jobs and operational jobs that will have a positive impact locally and for Vermont as a whole. See also the prefiled direct testimony of Todd Singer and Thomas Kavet.

Additionally, the Project will significantly reduce the reliance on fossil fuels in the New England region, which will lead to enhanced environmental benefits to the region over time. As noted above, TDI-NE has committed to establishing "Public Good" funds in conjunction with the development of the Project, which will be used in part to benefit Lake

Champlain, an immensely important resource to the towns and regions. The Project will overall have a very positive impact on the regions where it is being developed, and in Vermont generally.

30 V.S.A. § 248 (b)(2) – Need for the Project

Q47. Is the Project required to meet the need for present and future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measure and energy efficiency and load management measure?

A47. Response: Yes, there is a clear need for the NECPL for Vermont and the New England Region as a whole.

As an initial matter, The NECPL will not be owned by a Vermont electric distribution utility and will not provide retail service, but rather is a merchant project offering transmission services on the wholesale market. In several prior cases, the Board has addressed the applicability of the Need criterion in the context of merchant power plants, concluding that: "'the general good of the state' standard includes a recognition of the value to Vermont of the benefits to the entire New England Power Pool, from which Vermont purchases much of its power and upon which Vermont depends for reliability."[8] The Board further found that, "due to the regional nature of the power pool, a merchant project that addresses the regional need for power would comply with the statutory standard. This

[8] See Docket 6545, *In re Vermont Yankee Nuclear Power Corp.*, Order of 6/13/02 at 106; Docket 6812, *Petition of Entergy Nuclear Vermont Yankee, LLC*, Order of 3/15/04 at 21; Docket 7156, *Petition of UPC Vermont Wind*, Order of 8/8/07 at 29.

standard recognized the fact that the developer of a merchant plant had no obligation to provide energy efficiency and load-management services."[9]

There is ample evidence that the Project is required to meet the need for present and future demand in Vermont and regionally. As explained in great detail in the testimony and report of economist Seth Parker, the need for this Project is driven by several factors: (i) the renewable energy and environmental policy goals and mandates of Vermont and other New England States; (ii) forecasted load growth in Vermont and New England; (iii) the impending retirement of power plants in the New England region; and (iv) the need to diversify fuel supply in the ISO-NE region due to over dependence on natural gas.

30 V.S.A. § 248 (b)(3) – System Stability and Reliability

Q48. Will the Project adversely affect system stability and reliability?

A48. Response: The Project will not adversely affect system stability and reliability. The Project will deliver transmission to the grid through interconnection with the VELCO Coolidge substation in Cavendish, Vermont. The Project will utilize a number of systems to isolate the Project from the power grid in the unlikely event of equipment failure within the Project. The interconnection with VELCO is subject to review and approval by ISO-NE, and TDI-NE will be responsible for system modifications or upgrades that are necessary to interconnect the NECPL in a manner that does not adversely affect system stability and reliability. TDI-NE has submitted an application for interconnect and the System Impact

[9] Docket 7508, *Petition of Georgia Mountain Community Wind, LLC*, Order of 6/11/10 at 20-21 (citing Docket 6812, *Petition of Entergy Nuclear Vermont Yankee, LLC*, Order of 3/15/04 at 21–22.

Study ("SIS") is ongoing. We presently expect the SIS to be available in the first quarter of 2015.

Additional testimony supporting the conclusion that the Project will not adversely affect system stability and reliability is provided in the prefiled direct testimony of Larry Eng, an engineer with Siemens PT who is currently performing the SIS.

30 V.S.A. § 248 (b)(4) – Economic Benefit to the State

Q49. Will the Project result in an economic benefit to the state and its residents?

A49. Response: Yes, in a number of substantial ways as enumerated previously in our testimony -- through the creation of jobs, State lease payments, State and local tax payments, the Public Good Funds (VELCO/ratepayer payments, CEDF, and Lake Champlain Funds, and other direct and indirect economic benefits). The prefiled direct testimony and supporting materials of Todd Singer, Seth Parker and Thomas Kavet provide details on the specific economic benefits of the Project relative to the state of Vermont.

30 V.S.A. § 248 (b)(5) and (8) – Environmental Considerations

Q50. Will the NECPL have an undue adverse effect on aesthetics, historic sites, air and water purity, the natural environment, and the public health and safety, with due consideration being given to the criteria specified in 10 V.S.A. § 1424a(d) and § 6086(8a)(1) through (8) and (9)(K)?

A50. Response: As discussed below and as supported in the prefiled direct testimony of Jeffrey Nelson, Sean Murphy, Alan Wironen, Seth Parker, William Bailey, Andrew Thuman, Galen

Guerrero-Murphy, Kenneth Kaliski, Michael Buscher, Kristin Heitert**.** Stephen Olausen**,** and Chris Sabick**,** the NECPL will not have an undue adverse effect on those enumerated resources. For the sake of completeness, all of the section 248(b)(5) subcriteria will be summarily covered below, although many of the issues are substantively addressed in the testimony of the other TDI-NE witnesses.

Public Health and Safety

Q51. Please describe how public health and safety will be addressed in the construction and operation of the NECPL.

A51. Response: The Converter Station will be constructed to meet all applicable national and state safety and electrical codes. The Converter Station will be a secure facility fully enclosed by fencing, alarm and camera security systems and a locked enclosed building. The cable protection system is designed to react virtually instantaneously to any cable breaks, preventing any discharge of harmful currents or voltage, preventing injury to humans or animals.

TDI-NE will minimize highway safety concerns by keeping cable installations in the highway shoulder and clear zone whenever possible, observing road and lane closure industry standards, restricting highway construction in winter periods (per VTrans requirements) and delivering oversize/overweight equipment in off-peak hours. In addition, TDI's consulting engineers have prepared a number of typical construction methods and traffic control scenarios to address the different scenarios that can be expected on the state and local roads. *See Exh. TDI-AW-3*.

TDI's aquatic construction operations will have minimal impact on public safety given the limited traffic of the Lake installation and the slow speeds of the supply and installation vessels, which are anticipated to be 1.5 knots and 12 knots, respectively, or less. It is expected that the NECPL will not impede any water-dependent commercial or recreational activities, including boating, angling, water sports or commercial sightseeing, because vessels could easily transit around the limited area of the work site. Additional vessel traffic will be temporary (i.e., for the duration of construction while vessels and equipment will be present) and localized to the work site. Depending on the installation technique deployed, approximately 1.4 (jet plow/shear plow) to 7.8 (bottom lay) miles (2.25 to 12.55 km) of transmission cables can be installed per 24- hour day in an aquatic environment, so the immediate work site, which will be off-limits to other vessels, will remain at any given location for a reasonably long period of time, essentially eliminating any safety concerns.

TDI-NE has also conducted analyses of the potential for electric and magnetic impacts of both the overland and Lake portions of the NECPL, and all impacts are minimal and well below established international standards. *See Exhs. TDI-WHB-3 and 4.*

Based on the above, the NECPL Project will not have an undue adverse effect on public health and safety. See also the prefiled direct testimony of Al Wironen (overland construction) Sean Murphy (Lake Champlain navigational safety), and Dr. William Bailey (magnetic fields).

Outstanding Resource Waters

Q52. Will the NECPL have an undue adverse effect on any Outstanding Resource Waters?

A52. Response: No, the NECPL route and Converter Station will not be in or near any ORW waters. See the prefiled direct testimony of Jeff Nelson.

Air Pollution; Greenhouse Gas Emissions ("GHG")

Q53. Will the Project cause undue air pollution?

A53. Response: No, the Project will not "result in undue air pollution."

Construction of the Project: Fugitive dust emissions from earth disturbance during construction of the terrestrial portion of the NECPL will be minimized through the implementation of a site-specific Erosion Prevention and Sediment Control Plan by the Project contractors. While specific Best Management Practices to be employed will be the subject of Construction Phase Stormwater Permit, it is anticipated that dust control measures will include, at a minimum, regular watering of earthwork areas and prompt stabilization/restoration. See the prefiled direct testimony of Jeffrey Nelson.

Construction of the Project will also involve the use of large vehicles and vessels with diesel fuel-powered internal combustion engines that may emit pollutants associated with such engines, but these emissions are not expected to exceed the de minimis thresholds established in 40 CFR 93.153(b) for individual nonattainment pollutants. If at any time it is determined that the equipment used in construction of the Project exceeds these thresholds or otherwise requires permits for any associated air emissions, the appropriate permits will be obtained.

Operation of the Project: The ongoing operation of the NECPL will not generate any air pollutants. Accordingly, operation of the Project will not require an air pollution control permit from ANR, with the possible exception of a permit for the emergency diesel generators to be located at the Converter Station. ***See Exh. TDI-JMB-9 (Converter Station Equipment)***. It is our understanding that the air permit threshold in Vermont for diesel emergency generators is 450 HP, with a limit of limit of 100 hours/year for routine testing and no limit in the event of a true emergency. The final selection of equipment for the Project will not occur until the final design stage (post-CPG). At that time, if required, TDI-NE will apply for and obtain any air permits for the generators.

Reduction of air pollutants in New England: The NECPL's provision of 1,000 MW of energy from Canadian hydro or wind into the ISO-NE system is expected to result in significant reductions in air emissions. As explained in the prefiled direct testimony of Seth Parker, the energy to be shipped over the NECPL will displace the generation of equivalent energy from fossil fuel-fired plants in New England. Mr. Parker found the following:

Table 3. Forecast Reduction in ISO-NE Power Plant Emissions over 10 years

	CO_2 (million tons)		NO_x (thousand tons)		SO_2 (thousand tons)	
Without NECPL	383.5		234.5		118.0	
With NECPL	350.6		220.9		111.6	
Reduction	32.9	*8.6%*	13.6	*5.8%*	6.4	*5.4%*

Mr. Parker also found that the CO2 reductions due to the NECPL could be partially offset by CO2 emissions caused by hydroelectric projects. He noted, however that there is no single "correct" value that should be used to calculate the GHG contribution of Canadian hydropower projects. Mr. Parker does not specifically calculate the emissions

ascribable to the energy delivered via the NECPL, because the exact energy mix has not yet been determined, and due to the site-specific factors in determining the specific GHG footprint of a hydroelectric project. See prefiled testimony of Seth Parker.

Q54. Why is it important to address these potential GHG offsets?

A54. Response: TDI has taken great care to ensure that all information in its 248 Petition has been fully studied for accuracy. The issue of GHG emissions from hydroelectric projects has been brought to our attention by a regional stakeholder group. In turn, TDI-NE felt it was important to understand the current state of the science related to this issue, particularly because it does not appear there is consensus among policymakers in the New England States on how to account for GHG from hydro. TDI-NE will continue to monitor the science and policy developments as the NECPL advances.

Water Purity and Water Pollution

Q55. Will the NECPL have an undue adverse impact on water purity or cause undue water pollution?

A55. Response: No, as discussed in detail in the prefiled testimony and exhibits of Jeffrey Nelson, Sean Murphy, and Andrew Thuman, the NECPL will not have an undue adverse impact on water purity or result in undue water pollution.

With respect to land-based Project activities, the NECPL is being designed in close coordination with VTrans and VTANR to identify resources and develop construction practices that will prevent undue adverse impacts to water resources. For example, where

necessary, HDD construction techniques will be used in lieu of open trenching to avoid impacting water bodies. Detailed site-specific erosion prevention and sediment control measures will be implemented through an Individual Permit for Stormwater Runoff from Construction Sites. In addition, jurisdictional stream crossings will be regulated by VTANR's stream alteration permit program. The Converter Station will be covered under both the Stormwater Construction permit, and a Stormwater Operational Phase permit.

With respect to installation of the NECPL in Lake Champlain, HDD will be used at both the Lake entry and exit point in order to completely avoid impacts to the Lake's shoreline. To assess the potential water quality impacts of laying the cable within or on the lakebed, TDI-NE's consultants have reviewed relevant data and where necessary performed modeling (again, in close coordination with VTANR) with respect to turbidity, phosphorous, other existing contaminants, thermal changes and magnetic fields. Their analyses demonstrate that the NECPL can be installed in the Lake in a manner that complies with the Vermont Water Quality Standards. *See Exhs. TDI-WHB-2, WHB-3 and AT-2.*

The aquatic transmission cables do not contain any hazardous fluids, thereby eliminating any potential for sediment contamination from the cables themselves. During construction, installation barges would contain small amounts of hazardous wastes, primarily used oils, solvents, and lubricants. To minimize potential impacts from hazardous materials and wastes, TDI-NE would require that all contractors follow appropriate hazardous material and waste handling protocols and additional TDI-NE-proposed measures.

Installation and operation of the Lake portion of the NECPL will also require a U.S. Army Corps of Engineers Section 404 permit, a Vermont ANR Section 401 Water Quality

Certification, a Vermont ANR Lake Encroachment permit and, if required, a Vermont ANR Discharge Permit.

Headwaters

Q56. Please describe whether the NECPL route or Converter Station will be in or adjacent to any headwaters, and if so any potential impacts to those resources.

A56. Response: The NECPL will not result in any undue adverse impacts to headwaters. Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Jeffrey Nelson.

Waste Disposal

Q57. Please describe the NECPL's generation of waste and any potential impacts.

A57. Response: As discussed above, the native ground material removed for trenching the terrestrial portions of the NECPL will be stockpiled nearby and reused as backfill after installing the transmission line. Any material that is not suitable as backfill will be properly disposed of at an off-site location.

Solid waste from the terrestrial portion of the NECPL may consist of unusable excavation material, gravel and other materials typically found in trench excavation activities. There is minimal solid waste expected from the lake installation since no materials are being added or removed from the lake bottom with the exception of concrete mats. Any solid waste that is generated will be disposed of in accordance with relevant solid waste regulations through private haulers, and will create no burden on local government.

Stormwater management is discussed above and in more detail in the prefiled direct testimony and exhibits of Jeffrey Nelson, including *Exh. TDI-JAN-7*.

Water Conservation

Q58. Please describe the Project's use of water and consideration of water conservation.

A58. Response: Use of water during construction will be primarily for earthwork compaction and dust control during the terrestrial stages of the Project. This water will be brought on site by the contractor if sufficient quantities are not found to be available locally. The volume of water will be dictated, in part, by on-site conditions during the construction efforts. No water use will be required for installing the aquatic portions of the Project, other than water from the Lake itself for the jet plow, which will be recirculated back into the Lake.

Operation of the NECPL will not require the use of water other than for sanitary facilities to be located on TDI-NE property at or near the Converter Station, if required. A wastewater/water supply permit is not anticipated for this Project.

For additional details on water conservation, please see the prefiled direct testimony of Jeffrey Nelson.

Floodways

Q59. Please describe whether the NECPL route or Converter Station will be in or adjacent to any floodways or floodway fringes, and if so any potential impacts to those resources.

A59. Response: The NECPL will not result in any undue adverse impacts to floodways. The Project does run through several floodways, but since it is proposed within the road or

railroad ROWs with restoration of existing topography following construction, no hydrological impacts are expected to these floodways. Moreover, the construction area will be revegetated and returned to the existing contours to the extent feasible.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Jeffrey Nelson, including *Exh. TDI-JAN-3.*

Streams

Q60. Please describe whether the NECPL's route or Converter Station will be in or adjacent to streams and if any potential impacts to those resources.

A60. Response: The NECPL will not result in any undue adverse impacts to streams.

Approximately 170 streams of varying flow regimes (perennial, intermittent, ephemeral) will be traversed by this Project within the right of ways. The majority of these streams will be crossed at an existing culvert, or for smaller streams via an open trench near the culvert inlet/outlet. Larger streams and rivers will be crossed via HDD, so impacts to the bed and banks of the channel will be entirely avoided. In addition, there will likely be opportunities to improve stream connectivity and hydrology through replacement of existing deteriorated or undersized culverts in certain locations. There are no streams adjacent to the Converter Station that will be impacted.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Jeffrey Nelson, including *Exh. TDI-JAN-5 and JAN-8.*

Shorelines

Q61. Please describe whether the NECPL's route or Converter Station will be in or adjacent to shorelines, and if so any potential impacts to those resources.

A61. Response: The Project has been designed to completely avoid crossing or otherwise physically impacting the shorelines of Lake Champlain or Lake Bomoseen through the use of HDD at the entry and exit points. As a result, no land will be disturbed and no vegetation cut within the shoreline or shoreline buffer. In addition, TDI-NE has committed to revegetating a heavily eroded bank near the Benson HDD location that existed prior to TDI-NE's purchase of the property.

Additional detail regarding this criterion is provided in the prefiled direct testimony of Jeffrey Nelson and Sean Murphy.

Wetlands

Q62. Please describe whether the NECPL's route or Converter Station will be in or near wetlands and if so any potential impacts to those resources.

A62. Response: The NECPL will not result in any undue adverse impacts to wetlands. Approximately 3.7 acres of wetlands of varying classifications (Class II and Class III) will be traversed by this Project within the right of ways. Impacts to these wetlands will primarily be temporary, due to the nature of trench construction, but permanent impacts will occur to a much lesser extent due to conversion of vegetation from forested to open (e.g. grassed). Many of the impacted wetlands are already compromised due to their proximity to built-up

road and railroad infrastructure. There will be no wetland impacts associated with the Converter Station.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Jeffrey Nelson, including *Exh. TDI-JAN-10*.

Sufficiency of Water and Burden on Existing Water Supply

Q63. Please describe the Project's potential impacts on existing water supplies, as well as the sufficiency of existing water supplies to meet the needs of the Project.

A63. Response: As discussed above, construction and operation of the NECPL will not involve a substantial use of water, and thus there is sufficient water available for the reasonably-foreseeable needs of the Project.

The Project will not have an undue adverse impact or burden on existing water supplies. Regulated water systems that have been identified along the route, such as water intakes in Lake Champlain, will be avoided during construction and not impacted during operation.

As discussed in the Overview section, the Blasting Plan will require pre-blast and post-blast surveys of any potentially-affected water wells, and TDI-NE will be responsible for any unlikely damage caused to wells. TDI-NE will continue to consult with abutters and Towns to understand water systems in proximity to the route that could be impacted. These systems will be avoided to the extent possible or replaced in kind. *See Exh. TDI-JMB-10*.

For additional detail regarding this criterion, see the prefiled testimony and exhibits of Jeffrey Nelson, including *Exhs.TDI-JAN-11a, b* and prefiled testimony of Sean Murphy.

Soil Erosion

Q64. Will the NECPL cause undue adverse impacts with respect to soil erosion?

A64. Response: The Project will not "cause unreasonable soil erosion or a reduction in the capacity of the land to hold water so that a dangerous or unhealthy condition may result." See the responses above concerning water pollution and waste disposal, which indicate that the NECPL's terrestrial construction activities will be governed by an individual stormwater construction permit and site–specific erosion prevention and sediment control plan.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Jeffrey Nelson, including *Exh. TDI-JAN-7*.

Transportation Systems

Q65. Will the NECPL cause unreasonable congestion or unsafe conditions with respect to transportation systems?

A65. Response: No, the Project will not cause unreasonable congestion or unsafe conditions with respect to the use of the highways, waterways, railways, airports and airways, and other means of existing transportation. All public roads can handle the expected volume of construction traffic. TDI-NE will develop traffic management plans and continue to closely coordinate with VTrans, Green Mountain Railroad and local officials to minimize traffic delays and ensure safe working conditions in the public right-of-way. Additionally, Project construction is concentrated in discrete areas for relatively short durations during construction, minimizing disruptions and potential for safety concerns.

In the aquatic portion of the Project, relatively minor portions of the Lake will be designated as off-limits to the public for short periods of time since the installation will occur at a rate of 1.4 to 7.8 miles per day; boaters and other recreational Lake-users will not be prohibited from Lake use due to vessels' operations required for construction of the Project in the Lake.

See our prior discussion in the Overview section on transport and traffic issues, and the prefiled direct testimony of Alan Wironen (overland) and Sean Murphy (Lake).

Educational Services

Q66. Will the Project cause an unreasonable burden on municipalities to provide educational services?

A66. Response: The Project will not cause an unreasonable burden on municipalities to provide educational services. The construction phase of the Project is expected to last three years. Few, if any, of the temporary construction workers and their families are likely to move to the area due to the Project, especially because the Project is linear, and involves the installation of a transmission line across 154 miles of the State.

Once operational, on average 22 FTEs will be needed each year to operate, inspect, and maintain the Project and ensure compliance with the myriad of permits and other regulatory requirements. This number of employees, even if they were all new to Vermont and located in one town such as Ludlow, would not be expected to appreciably change the number of students in the public schools system over existing levels.

As noted above, TDI-NE has notified the towns along the Project route of the Project and there have been no concerns expressed regarding an unreasonable burden on educational services. On the contrary, due to the millions of dollars in annual property taxes that will flow to the Vermont education fund, the Project will be a net benefit to the Vermont education system.

Municipal Services

Q67. Will the Project cause an unreasonable burden on municipalities to provide municipal services?

A67. Response: The Project will not place an unreasonably burden on local governments to provide municipal or governmental services. The transmission line will require no unusual or extra municipal services in any of the towns along the Project route.

Construction of the cable will be similar to other road projects and will not place a burden on municipalities due to its transient nature.

With respect to the proposed Converter Station, existing fire and emergency services that already cover the VELCO substation should be capable of handling any issues that arise. TDI-NE will consult with local emergency services agencies prior to operation of the Converter Station with instructions and a mechanism for accessing the converter site in the unlikely event of an emergency. The Town of Ludlow indicated via a questionnaire that there would be no impact to the Town's municipal services via the Project's construction or operation. *See Exh. TDI-JMB-17.*

Aesthetics

Q68. Will the NECPL have an undue adverse impact on aesthetics or the scenic or natural beauty of the area?

A68. Response: No, the NECPL will not cause an undue adverse effect on the aesthetics or scenic or natural beauty of the area. A fundamental design principle for the NECPL – to install the transmission line underwater and underground rather than overhead – eliminates any visual impacts of the line itself. There will be minimal above-ground infrastructure associated with the transmission cables, limited to at-grade manhole covers, and the attachment of the cables to a bridge and culvert headwall at two stream crossings. Cleared areas associated with construction have been minimized to the extent possible and will be re-seeded and re-vegetated after construction. New permanent cleared areas that are required to prevent deep rooted trees from impacting Project operations have been avoided to the extent possible.

The Converter Station in Ludlow has been well sited and will be minimally visible from off-site locations due to intervening vegetation, topography, and a setback of approximately 400 feet from the closest public road. In areas where trees or other vegetation are not avoidable, mitigation plantings are proposed to reestablish buffers or other visual benefits provided by the removed trees or vegetation. *See Exhs. TDI-JBM-8a, MB-2.*

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Michael Buscher.

Noise

There are two sources of potential noise impacts for the NECPL: noise during construction and noise form the Converter Station. Construction noise will be temporary and localized to discrete areas along the route at any one time and will be limited to certain work hours. Construction of the Converter Station will not have an undue adverse impact because the activities that make the most noise (land clearing, drilling and blasting, grading, and building shell construction) will be temporary and limited to 7 am to 7 pm weekdays and 8 am to 5 pm on Saturdays, excluding holidays.

Noise from the Converter Station will be generated primarily by the transformers and cooling fans, which is similar to substations. The design of the Converter Station includes setbacks of at least 1,000 feet to the closest residences. TDI-NE has set a noise goal of 35 dBA outside any residence and will design the Converter Station to meet that goal. The noise modeling results demonstrate that the Project can meet the noise goals.

A detailed discussion of noise is provided in the prefiled direct testimony and exhibits of Kenneth Kaliski, including *Exh. TDI-KK-2*.

Historic Sites

Q69. Please describe whether the NECPL's route or Converter Station will be in or near any historic sites, and if so the potential impacts on those resources.

A69. Response: Phase 1A assessments have been performed for potential archaeological resources along the overland route and aquatic route, and for potential extant historic structures along the overland route. This information will be utilized to determine what

additional studies might be needed prior to construction. At the same time, TDI-NE and its consultants are working with the Vermont Division of Historic Preservation and the Lake Champlain Maritime Museum to develop protocols, in the event the NECPL will impact any identified archaeological resources, to avoid, minimize and/or mitigate undue adverse impacts. At a broad level, those protocols will include continued consultation if changes are made to the proposed route to avoid known archaeological resources, additional archaeological investigations on land and in the Lake and the development of any necessary agreements with VTDHP.

Specific findings in the three initial studies conducted by archaeological and architectural consultants were as follows:

Overland Route – Archaeological Phase IA: The survey identified archaeologically sensitive areas along approximately 11.6 linear miles (21%) of the Project and in several of the proposed work parcels in Alburgh, Benson, and Ludlow, Vermont. The survey also identified three previously-recorded pre-contact sites, one previously recorded post-contact site, and four field-identified archaeological resources consisting of nineteenth-century residential and outbuilding foundation remains. A Phase IB archaeological survey is recommended for those locations with moderate–high archaeological sensitivity and subject to Project-related impacts. If any archaeological resources are discovered and determined eligible for listing on the National Register and cannot be avoided during Project construction, measures will be prepared to mitigate any adverse effects. These measures may include, but are not limited to, Phase III (data recovery) excavations.

Overland Route – Extant Historic Structures: Three properties in the Project study area are listed in the National Register, 16 are listed in the State Register and 4 were evaluated as potentially eligible for listing in the State/National Registers. Based on the results of the survey, the construction of the transmission line and the Converter Station will have no adverse direct or indirect effect on any of the historic architectural resources, given that the transmission line will be installed almost entirely within ROWs and the Converter Station will be constructed on an undeveloped wood parcel that has heavy white pine screening on all sides and will not be visible to or from any historic property.

Lake Route - Archaeological Phase IA: There are three known historic resources that stretch across Lake Champlain - 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. It is not certain, based upon available information, whether they can be completely avoided by the Project. However, with additional investigation to inform route selection to identify a safe corridor for the NECPL, impacts to these three resources can be avoided or minimized. In addition, three unverified sonar targets that lay within 40m of the NECPL corridor were found. These targets have not been identified as cultural in nature. If the NECPL cannot be constructed to avoid these three sonar targets, then additional study will be completed to determine if they are, in fact, cultural resources.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Kristen Heitert, Stephen Olausen, and Chris Sabick.

Rare and Irreplaceable Natural Areas

Q70. Please describe the presence of any Rare and Irreplaceable Natural Areas ("RINA") on or near the NECPL route and Converter Station, and any potential impacts to those resources.

A70. Response: The NECPL will not result in any undue adverse impacts to RINA. Several potential and likely significant natural communities were identified along the overland component of the proposed Project that may be considered RINA. The Project design criteria includes carefully-considered protection of potential and likely-significant natural communities. Only one rare (Rank S1) likely-significant natural community was identified during natural resource investigations, which will be avoided. Limited tree removal and construction impacts are proposed within several uncommon (Rank S3) and widespread (Rank S4) potential and likely significant forested natural communities that were identified during natural resource investigations. These impacts will be located along the edge of the existing cleared and actively maintained Route 4 corridor, thereby minimizing impacts to the forest interior and the overall communities. The proposed Project-related impacts situated adjacent to Route 4 will have a negligible effect and will not affect the quality of these natural community occurrences. As such, there will be no undue adverse effect on these natural communities. *See Exhs. TDI-GGM-2, GGM-3, GGM-4, and JAN-3.*

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Galen Guerrero-Murphy.

Necessary Wildlife Habitat

Q71. Please describe the presence of any necessary wildlife habitat on or near the NECPL route and Converter Station, and any potential impacts to those resources.

A71. Response: The Project will not destroy or significantly imperil necessary wildlife habitat. Potential Deer Wintering Areas ("DWA") identified during natural resource investigations will largely be avoided by the Project. Limited tree removal will be required within one potential DWA adjacent to Route 103 (in this and other potential DWAs, no observations of their use by deer as overwintering habitat was evident). No adverse impacts to DWA will occur from this limited tree removal within a potential DWA along an existing highway corridor. One potential bear travel corridor within mapped Bear Production Habitat along Route 103 will be traversed by, but will not be affected by the Project. With regards to cable installation in Lake Champlain, the cable will be installed along a relatively narrow corridor that does not appear to provide necessary wildlife habitat. *See Exhs. TDI-GGM-2, GGM-4, GGM-6, and JAN-3*.

Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Galen Guerrero Murphy and Sean Murphy.

Endangered Species

Q72. Please describe the presence of any rare, threatened or endangered species on or near the NECPL route and Converter Station, and any potential impacts to those species.

A72. Response: The Project will not destroy or significantly imperil necessary wildlife habitat or endangered species. Habitat assessments and surveys for rare, threatened and endangered

("RTE") species were completed in 2014; as a result of these investigations, 53 species of uncommon and RTE plant species were observed, including three state endangered and six state threatened plants. All threatened and endangered plants will be avoided, but six rare plants will be impacted by the Project as currently proposed. TDI-NE's resource experts have developed protection measures to ensure no undue, adverse effects to the rare plant species occur as a result of the Project. With regards to RTE animal species, potential roosting trees for Indiana Bat were identified and will be avoided by the Project. Additionally, TDI-NE's consultants have developed protection measures in consultation with the VT FWD to ensure no undue, adverse effects occur to RTE reptile species as a result of the Project. Finally, RTE mussel surveys requested by VT ANR in Lake Champlain identified no live RTE mussel species. *See Exhs. TDI-GGM-2, GGM-4, GGM-6, and JAN-3*.

Additional detail regarding this criterion is provided in the prefiled direct testimony of Galen Guerrero-Murphy and Sean Murphy.

Development Affecting Public Investments

Q73. Will the Project unnecessarily or unreasonably endanger the public or quasi-public investment in adjacent lands, services, or facilities, or materially jeopardize or interfere with the public's use and enjoyment of those lands, services, or facilities?

A73. Response: The Project will not unnecessarily or unreasonably endanger the public or quasi-public investment in public facilities, services, or lands, or materially jeopardize or interfere

with the function, efficiency, or safety of, or the public's use or enjoyment of or access to public facilities, services, or lands.

The public investments that would be relevant to this Project include Lake Champlain and the public roads where the NECPL will be routed. Our prior testimony and the testimony of other witnesses concerning public health and safety, transportation, aesthetics, historic sites, and other environmental resources explain how the Project can be implemented so that short-term impacts during construction are minimized and meet applicable permitting standards. The public will continue to be able to access, use, and enjoy Lake Champlain and the public roads during construction, with only discrete sections unavailable or modified at any given time. The public will be able to move around the work zones through implementation of the traffic control plans. Water quality impacts due to cable installation in Lake Champlain will be of limited duration and will meet the applicable Vermont Water Quality Standards.

Impacts to the public investments during operation of the NECPL will be either non-existent or very minimal, given the placement of the transmission line underwater and underground, and the design and siting of the Converter Station.

Finally, in some respects the public investments will be enhanced by the NECPL. For example, water quality improvements may be attained via culvert replacement, ditch enhancements and bank stabilization. Town roads are expected to be improved after the cable installation through new material and grading. VTrans will be provided with lease payments that will likely contribute towards the future maintenance of road infrastructure under VTrans' jurisdiction. Further, VTrans has expressed an interest in accessing fiber

from the Project for their own purposes along certain roads. And the proposed Lake Champlain Phosphorus Cleanup Fund and Lake Champlain Trust Fund will provide significant money over a 40-year time period, that can be used to help ameliorate Lake Champlain's phosphorous pollution and conduct habitat restoration or other Lake enhancement projects that are unrelated to the NECPL.

Additional detail regarding this criterion is provided in the prefiled direct testimony of Alan Wironen (overland construction and traffic), Sean Murphy (Lake construction and traffic), and Michael Buscher (aesthetics).

30 V.S.A. § 248 (b)(6) – Integrated Resource Planning

Q74. Is TDI-NE required to have an approved least cost integrated plan, and if so, is the NECPL consistent with "the principles of resource selection" contained in such a plan?

A74. Response: TDI-NE is not an electric distribution utility, and will not directly serve retail or wholesale electric customers in Vermont through the NECPL. Rather, as noted above, TDI-NE will be entering into agreements with suppliers in Canada to transmit power on the NECPL to the interconnection point on the ISO-NE transmission grid at Coolidge station. As a result, TDI-NE is not required to prepare a least cost integrated plan under 30 V.S.A. section 218c, and this criterion is thus not applicable.

30 V.S.A. § 248 (b)(7) – Comprehensive Energy Plan

Q75. Is the Project in compliance with the Department of Public Services approved Electrical Energy Plan?

A75. Response: Yes, the Project is in compliance with the Electrical Energy Plan (2011) approved by the Department of Public Service under 30 V.S.A. § 202, as follows:

As stated by Seth Parker in his prefiled direct testimony, the NECPL complies with section 3, Vermont's Current and Future Electric Sector, because Vermont will require new sources of energy and capacity, and the NECPL will be able to deliver up to 1,000 MW. The NECPL complies with section 4, Electric Energy Efficiency, because it will further the goals identified in the plan: reducing Vermont's share of the Regional Network Service (RNS) charge; reducing the overall cost of purchased electricity; and generating local jobs; reducing the carbon emissions from electricity generation. The NECPL complies with section 5, Vermont's Electric Supply, because (i) Vermont supports large-scale hydroelectric generation, (ii) Vermont supports renewable resources from both in-state and out-of state sources, (iii) the NECPL would take advantage of Vermont's strategic position being interconnected with Canada, (iv) energy flows over the NECPL would lower GHG emissions from power plants, and (v) the price of hydroelectric energy over the NECPL would be more stable compared to gas-fired generation.

In addition to the 2011 Energy Plan, the Department of Public Service published the Total Energy Study in 2013 to inform the Legislature of progress to date in carrying out the State's energy and GHG goals of: (i) meeting 90% of Vermont's overall energy needs from renewable sources by 2050 and (ii) reducing Vermont's GHG emissions by 50% from the 1990 baseline level by 2028 and 75% from the 1990 level by 2050. For all of the reasons discussed throughout our testimony, the NECPL would help achieve those goals.

As required by statute, TDI-NE has requested a 202(f) determination from the Department. *See Exh. TDI-JMB-18*. Additional detail regarding this criterion is provided in the prefiled direct testimony and exhibits of Seth Parker.

30 V.S.A. § 248 (b)(10) – Transmission Facilities

Q76. Can the Project be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers?

A76. Response: Yes, the Project can be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers. First and foremost, any upgrades to the transmission system that are necessitated by the NECPL will be borne entirely by TDI-NE, which does not serve Vermont retail utilities or customers.

TDI-NE is proposing to interconnect at VELCO's Coolidge substation. Given the configuration of that station, with two, 345 kV lines, TDI-NE and its consulting engineers have concluded that interconnection is feasible. At this time, the ISO-NE studies for NECPL are still in progress so no final determinations have been made concerning the precise equipment needed for interconnection at the Coolidge substation or any potential system upgrades of either the VELCO system or transmission facilities owned by other entities in Vermont or elsewhere in New England. For additional detail regarding this criterion, see the prefiled direct testimony and exhibits of Larry Eng.

Q77. Does this conclude your testimony at this time?

A77. Response: Yes.