MUNICIPAL CONSULTATION FILING

CONCERNING THE CONNECTICUT PORTION

OF THE INTERSTATE RELIABILITY PROJECT

BY

THE CONNECTICUT LIGHT & POWER COMPANY

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TABLE OF CONTENTS

VOLUME 1 **PAGE**

Table of Figures

List of Tables

EXHIBITS, SUPPLEMENTAL REPORTS AND ILLUSTRATIONS

VOLUME 2: ENVIRONMENTAL EXHIBITS

VOLUME 3: EXHIBITS

VOLUME 4: SUPPLEMENTAL DOCUMENTS BY OTHER AGENCIES

VOLUME 5: ROUTE ILLUSTRATIONS [Based on Preliminary Design]

Glossary

115-kV: 115 kilovolts or 115,000 volts
345-kV: 345 kilovolts or 345,000 volts
AC (alternating current): An electric current which reverses its direction of flow periodically. (In the United States this occurs 60 times a second-60 cycles or 60 Hertz.) This is the type of current supplied to homes and business.
ACSR: Aluminum Conductor, Steel Reinforced, a common type of overhead conductor.
AIS: Air-insulated Substation
Ampere: (Amp): A unit measure for the flow (current) of electricity. A typical home service capability (i.e., size) is 100 amps; 200 amps is required for homes with electric heat.
Arrester: Protects lines, transformers and equipment from lightning and other voltage surges by carrying the charge to ground. Arresters serve the same purpose as a safety valve on a steam boiler.
Auxiliary Transformers: Equipment installed at substations to provide voltage or current information for relaying and/or metering purposes.
BLSF: Bordering Land Subject to Flooding.
Bundle (circuit): Two or more parallel 3-conductor circuits joined together to operate as one single circuit.
Bundle (conductor): Two or more phase conductors or cables joined together to operate as a single phase of a circuit.
Cable: A fully insulated conductor usually installed underground but in some circumstances can be installed overhead.
CELT: ISO-NE, Forecast Report of Capacity, Energy, Loads and Transmission
Certificate: Certificate of Environmental Compatibility and Public Need
Circuit: A system of conductors (three conductors or three bundles of conductors) through which an electrical current is intended to flow and which may be supported above ground by transmission structures or placed underground.
Circuit Breaker: A switch that automatically disconnects power to the circuit in the event of a fault condition. Located in substations. Performs the same function as a circuit breaker in a home.
C&LM: Conservation and Load Management.
Conductor: A metallic wire, busbar, rod, tube or cable which serves as a path for electric current flow.
Conduit: Pipes, usually PVC plastic, typically encased in concrete, for housing underground power cables.
CEAB: Connecticut Energy Advisory Board
Contingency: The unexpected failure or outage of a system component, such as a generator, transmission line, circuit breaker, switch or other electrical element
Conversion: Change made to an existing transmission line for use at a higher voltage, sometimes requiring the installation of more insulators. (Lines are sometimes pre-built for future operation at the higher voltage.)
Council: Connecticut Siting Council
dBA: Decibel, on the A-weighted scale.
DC: (direct current): Electricity that flows continuously in one direction. A battery produces DC power.
DBH: Diameter breast height
Deadend Structure: is a line structure that is designed to have the capacity to hold the lateral strain of the conductor in one direction
Demand: The total amount of electricity required at any given time by an electric supplier's customers.
DEP: Department of Environmental Protection
DG: Distributed Generation. Refers to modular electric generation or storage, located near the point of electric use, and generally involves the use of small generators located close to electric demand sources, to decrease end-users' electric purchases and to reduce the

need for electricity generated by large, centrally-located power plants and power transport to load centers on transmission lines.
Distribution: Line, system. The facilities that transport electrical energy from the transmission system to the customer.
Disconnect Switch: Equipment installed to isolate circuit breakers, transmission lines or other equipment for maintenance or sectionalizing purposes.
DRP: Demand-response program.
DRSP: Demand-response service provider
Duct: Pipe or tubular runway for underground power cables (see also Conduit).
Duct Bank: A group of ducts or conduit usually encased in concrete in a trench.
EIR: Environmental Impact Report
Electric Field: Result of voltages applied to electrical conductors and equipment.
Electric Transmission: The facilities (69 kV+) that transport electrical energy from generating plants to distribution substations.
EMF: Electric and magnetic fields.
ENE: Eastern New England
EOT: Executive Office of Transportation and Public Works
EPA: United States Environmental Protection Agency
Fault: A failure or interruption in an electrical circuit (short circuit).
FCM: Forward Capacity Market
FEMA: Federal Emergency Management Agency
FERC: Federal Energy Regulatory Commission
G: Gauss; 1G = 1,000 mG (milligauss); the unit of measure for magnetic fields.
GIL: Gas-Insulated Transmission Line using sulfur hexafluoride gas (SF_6).
GIS: Gas-Insulated Substation
Ground Wire: Cable/wire used to connect wires and metallic structure parts to the earth. Sometimes used to describe the lightning shield wire.
HDD: Horizontal directional drill
H-frame Structure: A wood or steel structure constructed of two upright poles with a horizontal cross-arm and bracings.
HPFF Pipe Cable System: High-pressure fluid-filled; a type of underground transmission line.
HPGF Pipe Cable System: High-pressure gas-filled, a type of underground transmission line.
Hz: Hertz, a measure of alternating current frequency; one cycle/second.
Impedance: The combined resistance and reactance of line or piece of electrical equipment which determines the current flow when an alternating voltage is applied
ISO-NE: Independent System Operator New England, Inc. New England's independent system operator.
kcmil: 1,000 circular mils, approximately 0.0008 sq. in.
kV: kilovolt, equals 1,000 volts
kV/m: Electric field unit of measurement (kilovolts/meter)
Lattice-type Structure: Transmission or substation structure constructed of lightweight steel members.
Lightning Shield Wire: Electric cable located to prevent lightning from striking transmission circuit conductors.
Line: A series of overhead transmission structures which support one or more circuits; or in the case of underground construction, a duct bank housing one or more cable circuits.
LMP: locational marginal pricing
Load: Amount of power delivered as required at any point or points in the system. Load is created by the power demands of customers' equipment (residential, commercial, industrial).
Load Pocket: A load area that has insufficient transmission import capacity and must rely on out-of-merit order local generation.
LOLE: Loss of Load Expectation; a measure of bulk power system reliability.
LPFF: Low-pressure fluid-filled; a type of self-contained fluid filled (SCFF) underground transmission line.
LPP: Laminated paper-polypropylene; a type of cable insulation.
Magnetic Field: Produced by the flow of electric current; level measured as

magnetic flux density in units called gauss (G) or milligauss (mG).

Magnetic Flux Density: See Magnetic Field

Manhole: See Splice Vault

MHG: Material Handling Guidelines

mG: milligauss (see Magnetic Field)

MVA: (Megavolt Ampere) Measure of electrical capacity equal to the product of the voltage times the current times the square root of 3. Electrical equipment capacities are sometimes stated in MVA.

MVAR: (Megavolt Ampere Reactive) Measure of reactive power.

MW(s): (Megawatt(s)) Megawatt equals 1 million watts, measure of the work electricity can do.

MWh: per megawatt hour

NEEWS: New England East – West Solution

NEPOOL: New England Power Pool

NERC: North American Electric Reliability Council

NESC: National Electrical Safety Code

NPCC: Northeast Power Coordinating Council

NRCS: Natural Resources Conservation Service (United States Department of Agriculture)

NRHP: National Register of Historic Places

OH (Overhead): Electrical facilities installed above the surface of the earth.

Phases: Transmission (and some distribution) AC circuits are comprised of three phases that have a voltage differential between them.

Pothead: See Terminator

Project: Interstate Reliability Project

Protection/Control Equipment: Devices used to detect faults, transients and other disturbances in the electrical system in the shortest possible time. They are customized or controlled per an entity's operational requirements.

PSI: Pounds per square inch

Reactive Power: The portion of electricity that establishes and sustains the electric and magnetic fields of alternating-current lines and equipment owing to their inductive and capacitive characteristics. Reactive power is provided by generators, synchronous condensers, and capacitors, absorbed by reactive loads, and directly influences electric system voltage. Shunt capacitor and reactor capacities are usually stated in MVAR.

Rebuild: Replacement of an existing overhead transmission line with new structures and conductors generally along the same route as the replaced line.

Reconductor: Replacement of existing conductors with new conductors, but with little if any replacement or modification of existing structures.

RGGI: Regional Greenhouse Gas Initiative

Reinforcement: Any of a number of approaches to improve the capacity of the transmission system, including rebuild, reconductor, conversion and bundling methods.

Right-of-way: ROW; corridor

RFP: Request for Proposal

RPS: Renewable Portfolio Standards

RSP: Regional System Plan prepared annually by ISO-NE.

RTE: Rare, threatened and endangered.

RTEP03: 2003 Regional Transmission Expansion Plan

SCADA: Supervisory Control and Data Acquisition

SCFF Cable System: Self-contained fluid-filled hollow-core cable; a type of underground transmission line used primarily for submarine installations.

Series Reactor: A device used for introducing impedance into an electrical circuit, the principal element of which is inductive reactance.

SEMA/RI: Southeastern Massachusetts and Rhode Island area

SF_6: Sulfur hexafluoride, an insulating gas used in GIS substations and circuit breakers.

Shield Wire: See Lightning Shield Wire

SHPO: State Historic Preservation Office

Shunt Reactor: An electrical reactive power device primarily used to compensate for reactive power demands by high voltage underground transmission cables.

Splice: A device to connect together the ends of bare conductor or insulated cable.

Splice Vault: A buried concrete enclosure where underground cable ends are spliced and cable-sheath bonding and grounding is installed.

SNE: Southern New England

S/S (Substation): A fenced-in yard containing switches, transformers, line-terminal structures, and other equipment enclosures and structures. Adjustments of voltage, monitoring of circuits and other service functions take place in this installation.

Steel Lattice Tower: See Lattice-Type Structure

Steel Monopole Structure: Transmission structure consisting of a single tubular steel column with horizontal arms to support insulators and conductors.

Step-down Transformer: See Transformer

Step-up Transformer: See Transformer

Switchgear: General term covering electrical switching and interrupting devices. Device used to close or open, or both, one or more electric circuits.

Stormwater Pollution Control Plan: Is a sediment and erosion control plan that also describes all the construction site operator's activities to prevent stormwater contamination, control sedimentation and erosion, and comply with the requirements of the Clean Water Act

SWCT: southwest quadrant of the state

Terminal Points: The substation or switching station at which a transmission line terminates.

Terminal Structure: Structure typically within a substation that ends a section of transmission line.

Terminator: A flared pot-shaped insulated fitting used to connect underground cables to overhead lines.

Transformer: A device used to transform voltage levels to facilitate the efficient transfer of power from the generating plant to the customer. A step-up transformer increases the voltage while a step-down transformer decreases it.

Transmission Line: Any line operating at 69,000 or more volts.

UG (Underground): Electrical facilities installed below the surface of the earth.

Upgrade: See Reinforcement

USACE: United States Army Corps of Engineers (New England District)

USFWS: United States Fish and Wildlife Service

USGS: United States Geological Survey (U.S. Department of the Interior).

VAR: Volt-ampere reactive power. The unit of measure for reactive power.

Vault: See Splice Vault.

V/m: volts per meter, kilovolt per meter: 1,000 V/m = 1 kVm; electric field measurement

Voltage: A measure of the push or force that transmits energy.

VSC: Voltage source converter

Watercourse: Rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial, public or private.

Wetland: is an area of land consisting of soil that is saturated with moisture, such as a swamp, marsh, or bog

WMA: Wildlife Management Area

XLPE: Cross-linked polyethylene (solid dielectric) insulation for transmission cables

EXECUTIVE SUMMARY

ES-1 Introduction and Purpose of the Project

What is the Interstate Reliability Project and why is it needed?

The Interstate Reliability Project (Project) is a set of improvements to the electric transmission systems of Connecticut, Rhode Island, and Massachusetts that will help provide safe, reliable, and economic transmission service to these states, and, in particular, will increase the systems' ability to meet growing demand for power and comply with mandatory federal and regional reliability standards and criteria. At the same time, the Project improvements will advance a comprehensive regional plan for improving electric transmission reliability in New England. This comprehensive plan is known as the New England East – West Solution (NEEWS).

What Companies would construct the Interstate Reliability Project?

The Connecticut Light and Power Company (CL&P) would construct, own, and operate the Project facilities that would be located in Connecticut. CL&P is a wholly-owned subsidiary of Northeast Utilities (NU), as is its affiliate, Northeast Utilities Service Company (NUSCO), which provides services to CL&P, including the transmission planning, design, and permitting work described in this document. The facilities in Rhode Island would be owned by the Narragansett Electric Company and those in Massachusetts would be owned by The New England Power Company. The latter two companies are wholly-owned subsidiaries of National Grid USA (National Grid).

What are the deficiencies of the existing system that this Project is designed to address?

The Project addresses deficiencies that limit the transmission system's capacity to move power into Connecticut from Massachusetts and Rhode Island, and to move power across Connecticut, and across Southern New England from east to west. Southern New England (SNE) is defined as Connecticut, Massachusetts and Rhode Island.

What is the deficiency in Connecticut's import capacity?

Power transfers into Connecticut are limited and will eventually result in the inability to serve the load under many contingencies that the system must withstand in order to comply with national and regional reliability standards. To serve load reliably, an electric supply system must be able to access multiple generation sources so that the unavailability of some generation by reason of planned or unplanned outages or retirement, or the loss of access to some generation by reason of the loss of one or more transmission lines, will not interrupt the supply of power. In New England, the bulk-power supply system integrates load and generation on a regional basis so that any given area within the region can import generation from outside of that area if needed to maintain continuity of service (particularly during peak load periods and/or when local generation is unavailable); for economic reasons (such as when lower cost power is available from remote sources); or for other reasons (such as to meet obligations to supply power from low-emission or renewable sources when such power is not available in sufficient quantity from local generation). Of all the New England states, Connecticut is the least able to import power to supplement its internal supply resources. For example, New Hampshire, Vermont, and Rhode Island have enough import capacity to serve 100 percent of their peak load. Massachusetts and Maine can import slightly less than 50 percent of their peak load. Currently, Connecticut can only import approximately 30 percent of its peak load. In order to reliably serve its peak load in the future, Connecticut must increase its capacity to import power. The Independent System Operator, New England (ISO-NE)[1], which is responsible for planning the New England electric system, has determined that Connecticut area power-transfer capabilities may not meet the area's import needs as early as 2009 and that if improvements are not made by 2016, the import deficiency for this area under generator unavailability and loss of a single power-system element conditions is expected to be greater than 1,500 Megawatts (MWs) assuming no additional capacity is added.

What are the deficiencies related to East-West power flows across New England?

Much of the generation that serves the peak load in the SNE area, particularly the load in western portions of the area, is located outside of the area, to the north and east. Moreover, much of the generation within SNE is not proximate to the load that it must serve. This is particularly true of the newer, more efficient, and less costly generating units. Accordingly, in order to serve peak loads in SNE, large transfers across New England from north to south and from east to west are required. However, east-west power flows across Connecticut are limited by the potential overloading of existing 345-kV lines that traverse Rhode Island, Massachusetts, and Connecticut from east to west and by potential voltage violations at substations served by those lines.

[1] ISO-NE is a not-for-profit corporation that is responsible for operating New England bulk power generation and transmission system, overseeing and administering the region's wholesale electricity markets, and managing the regional bulk power stem planning process.

What construction is proposed to fix these problems?

To alleviate these problems, CL&P and National Grid are proposing to construct and operate new 345-kV transmission lines and associated facilities that would extend from CL&P's Card Street Substation in Lebanon, Connecticut, to CL&P's Lake Road Substation in Killingly, Connecticut, and from the Lake Road Substation to National Grid's West Farnum Substation in North Smithfield, Rhode Island (crossing the Connecticut/Rhode Island state border in Thompson, Connecticut), before continuing on to terminate at National Grid's Millbury Switching Station in Millbury, Massachusetts. These new 345-kV transmission lines would be developed together with related improvements to existing 345-kV and 115-kV facilities, some of which are being implemented as separate projects. Figure ES-1 shows the substations in each state that would be connected by the proposed new 345-kV line.

Figure ES-1: Interstate Reliability Project: 345-kV Electrical Path

How will the proposed Project address this deficiency in Connecticut's import capacity?

The Project will provide new 345-kV transmission lines for the transfer of bulk power between Connecticut, Rhode Island, and southeastern Massachusetts, supplementing the existing high-capacity 345-kV network that presently serves these areas. Providing more lines for transferring large blocks of power into Connecticut from southeastern Massachusetts and Rhode Island will increase Connecticut's import capacity. Construction of the Project will also strengthen part of a path for power flowing from east to west across New England, thus contributing to the relief of the regional east-to-west transfer constraint.

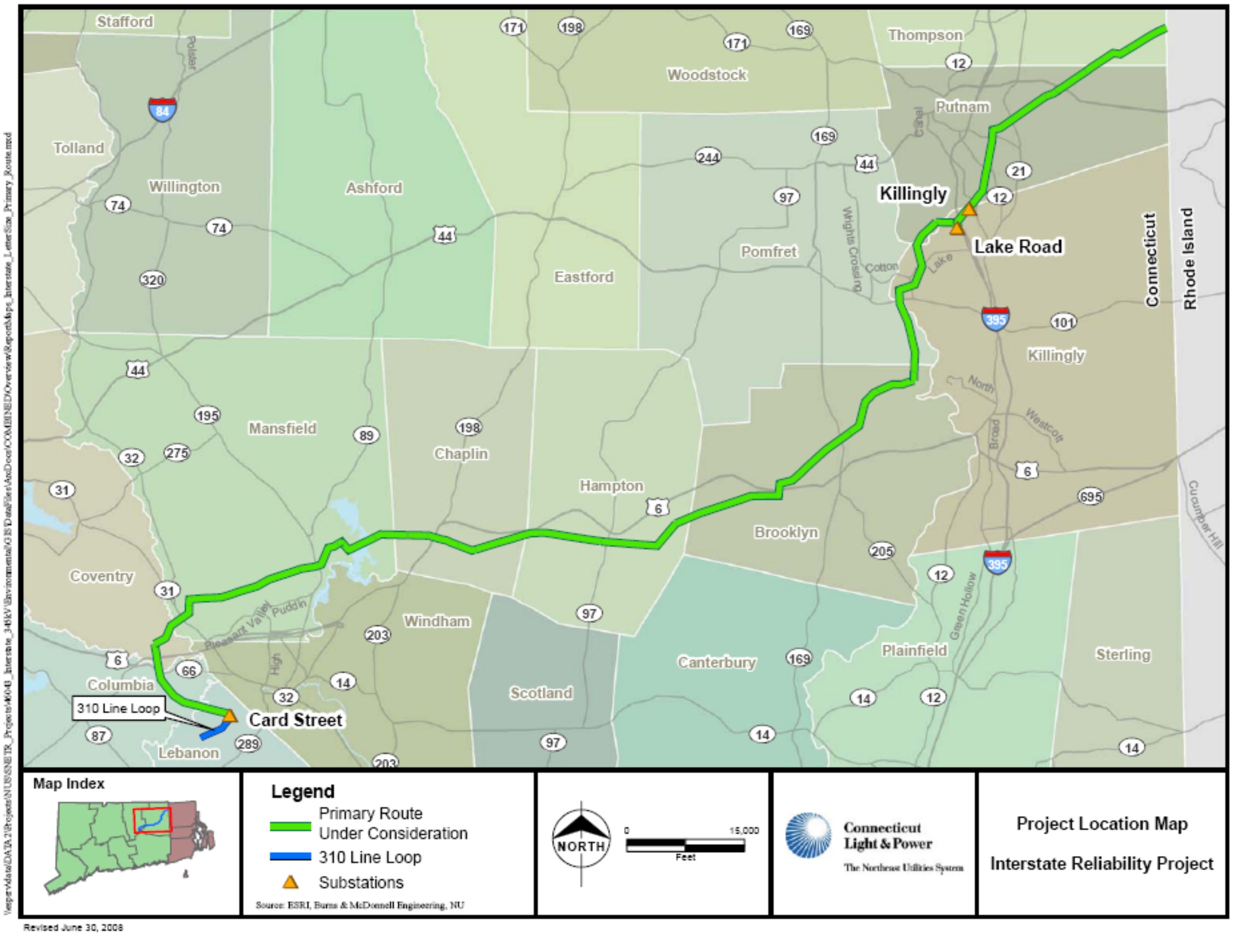
What siting approvals are necessary for the Project?

Since the Project will involve construction in Connecticut, Massachusetts, and Rhode Island, the transmission elements to be constructed in each state will require the approval of that state's siting agency – in Connecticut, the Connecticut Siting Council (Council); in Massachusetts, the Energy Facilities Siting Board; and in Rhode Island, the Energy Facility Siting Board. The approvals of these agencies must be coordinated so that the permitted construction in each state is integrated into a single technically, environmentally, and economically practical and consistent project.

Where in Connecticut would new 345-kV facilities of the Project be located?

The Connecticut portion of the Project would consist primarily of the proposed new 345-kV line sections between the Card Street Substation, the Lake Road Substation and the Rhode Island state border in Thompson, Connecticut. The proposed route for this line, the Primary Route Under Consideration, would extend from the Card Street Substation in Lebanon, through the towns of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam, and Thompson. The length of the Primary Route Under Consideration within Connecticut would be approximately 37 miles. All but two short segments could be constructed within CL&P's existing right-of-way (ROW) that is already occupied by transmission lines and therefore dedicated for use as an energy corridor. Another part of the Project will include the construction of four 345-kV line segments in a one-mile corridor (where two 345-kV line segments now exist and would be removed) to make a loop of the Manchester to Millstone 310 Line from Village Hill Road Junction into Card Street Substation), referred to as the 310 Line Loop. The Project is depicted on Figure ES-2. The Project would also entail the modification of three existing substations: Card Street Substation in the Town of Lebanon, and Lake Road and Killingly Substations, both in the Town of Killingly. Approval of the modifications to the Card Street, Lake Road, and Killingly Substations will be sought in the application to the Council for approval of the Project, and are described in this document.

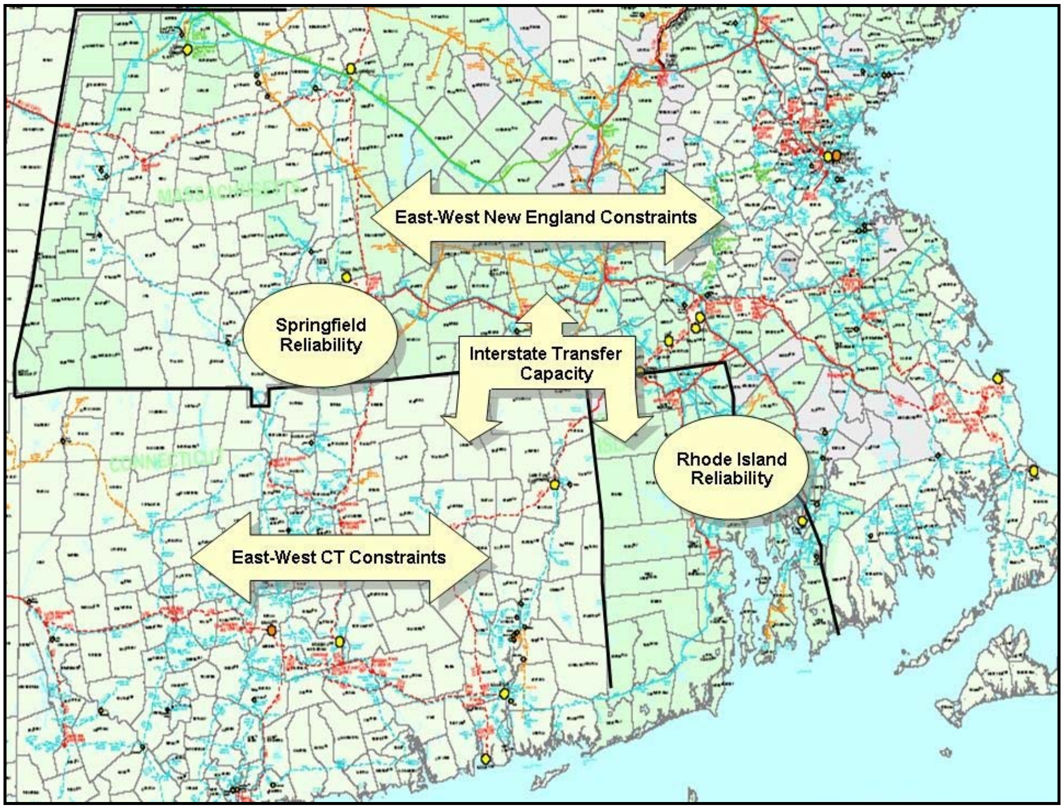
Figure ES-2: Project – Connecticut Segment



What is NEEWS and how does the Project fit into it?

NEEWS is a comprehensive long-term electric transmission construction plan that addresses multiple related electrical reliability issues arising in Connecticut, Massachusetts, and Rhode Island. The NEEWS Plan involves improvements to portions of the interconnected bulk-power transmission system owned and operated by CL&P, National Grid, and by Western Massachusetts Electric Company (WMECO), which is, like CL&P, a subsidiary of Northeast Utilities. These coordinated improvements will address five primary deficiencies with respect to the SNE electric transmission system, which are illustrated in Figure ES-3.

Figure ES-3: Reliability Concerns in the Southern New England Region



These five deficiencies are addressed by a combination of four separate NEEWS projects, each of which provides needed reliability improvements in its own right, but all of which are designed to work together to provide unconstrained and reliable transmission of electric power within and across New England under both normal conditions and following contingency events such as the unplanned outage of one or more transmission lines or generating plants. The four NEEWS projects are described below in general term.

- **The Interstate Reliability Project**, which is the subject of this municipal consultation document, includes the construction of 345-kV line along existing overhead line ROW extending 15 miles in Massachusetts, 22 miles in Rhode Island, and 38 miles in Connecticut, together with related improvements to existing 345-kV and 115-kV facilities, including substations.

- **The Greater Springfield Reliability Project**, which includes the construction of new 345-kV lines along approximately 35 miles of overhead line ROW (23 miles in Massachusetts and 12 miles in Connecticut); the construction, reconstruction and upgrade of 115-kV lines along approximately 27 miles of existing and new overhead line ROW in Massachusetts; and related substation improvements in both Massachusetts and Connecticut. A separate but related project, the separation of a 345-kV circuit and a 115-kV circuit between Manchester Substation and Meekville Junction in Manchester, Connecticut for a distance of 2.7 miles, will be proposed in the same application as the Greater Springfield Reliability Project.

- **The Rhode Island Reliability Project**, which, as proposed by National Grid, would include the construction of a 345-kV line along 21 miles of existing overhead line ROW, extending from its West Farnum Substation in North Smithfield, Rhode Island to its Kent County Substation in Warwick, Rhode Island, together with related improvements to existing 115-kV and 345-kV facilities.
- **The Central Connecticut Reliability Project**, which, as currently under consideration, would include the construction of a new 345-kV line along 38 miles of existing overhead line ROW, extending from CL&P's North Bloomfield Substation in the Town of Bloomfield to its Frost Bridge Substation in the Town of Watertown, together with related improvements to existing 345-kV and 115-kV facilities.

The deficiencies illustrated in Figure ES-3 will be addressed by the four NEEWS projects as follows:

- **Regional East–West Power Flows.** Regional east-west power flows across New England are limited due to the potential overloading of existing 345-kV lines that traverse southern Massachusetts from east to west and by potential voltage violations at substations served by those lines. Construction of the Interstate Reliability Project, the Central Connecticut Reliability Project, and the Greater Springfield Reliability Project will provide another path for power flowing from east to west, and will allow higher flows in these directions.
- **Connecticut Import Limitations.** Power transfers into Connecticut are limited and will eventually result in the inability to serve load under many contingencies that the system must withstand in order to comply with national and regional reliability standards. The construction of additional 345-kV ties to Rhode Island and Massachusetts will greatly improve the system's ability to serve the load by providing additional paths on which power may flow in the event of a planned or unplanned loss of a system element, such as a transmission line or generating unit, and thus significantly increase power-transfer limits into and out of Connecticut. In addition to improving the security of supply, this increase in import capacity will also yield economic benefits to Connecticut consumers by providing access to lower cost, remote sources of power to the north. The Project is also likely to provide environmental and statutory compliance benefits by enabling access to remote renewable and/or low emission sources.
- **Connecticut East-West Transfers.** Load in Connecticut is heavily concentrated in the southwest quadrant of the state (SWCT), whereas Connecticut's generation resources are concentrated in the eastern part of the state. The anticipated completion of a 345-kV loop serving SWCT in 2009 will enable power to move freely through SWCT, and the construction of the Interstate Reliability Project and the GSRP will enable the import of sufficient power to provide reliable service to the entire state, including SWCT. However, the increased power flows across central Connecticut necessary to serve the growing load will result in overloads on existing transmission lines following contingency conditions. This "bottleneck" between eastern Connecticut and western Connecticut will be eliminated by the addition of another 345-kV connection between these areas. Providing a less constricted path to western Connecticut for power generated in eastern Connecticut and imported from central/eastern Massachusetts and Rhode Island will also reduce the amount of existing power forced to flow through the Springfield 115-kV system.
- **Rhode Island Reliability.** Transmission system reliability and dependence on local generation are the major concerns for the Rhode Island system. System modeling has demonstrated that a number of overload and voltage violations can occur on the Rhode Island transmission facilities following contingency conditions. These problems are caused by a number of contributing factors, both independently and in combination, including: high load growth (especially in southwestern Rhode Island and the coastal communities), generating unit unavailability, and transmission outages (planned or unplanned). The addition of the new 345-kV line from West

Farnum Substation to Kent County Substation and other associated improvements will both greatly improve the reliability of the state's transmission system and reduce dependence on local generation. The new 345-kV lines from Millbury Switching Station to West Farnum Substation and from West Farnum Substation to Lake Road Substation would serve a dual role of both improving Rhode Island Reliability and providing an essential component of the new 345-kV Interstate Reliability Project, discussed above.

- **Greater Springfield Reliability.** The Greater Springfield Reliability Project will address overloads and voltage violations on the existing Greater Springfield 115-kV system. Together with the existing 345-kV line between the North Bloomfield, Barbour Hill and Ludlow Substations, the new North Bloomfield – Agawam – Ludlow 345-kV line will complete a 345-kV "loop" through north-central Connecticut and western Massachusetts. This new high-capacity loop will relieve congestion on the 115-kV system that currently both serves the Springfield area and supports interstate power transfers between the North Bloomfield, Barbour Hill and Ludlow Substations. At the same time, the new lines will increase the power-transfer capacity between Connecticut and western Massachusetts. The completed high-capacity electrical loop will serve a function analogous to that of a multi-lane circumferential highway constructed around an urban area where previously all highways had terminated at the edges of the city, requiring that traffic traverse congested city streets to gain access to the next section of highway.

How was NEEWS developed?

The NEEWS Plan emerged from a coordinated series of studies of the deficiencies in the SNE electric supply system, which began in 2004, and were collectively called the Southern New England Transmission Reliability (SNETR) study. Both the SNETR study and the NEEWS Plan were developed by ISO-NE, and by the transmission system planning staffs of NUSCO and National Grid, with the assistance of outside consultants (the Working Group). ISO-NE is a not-for-profit corporation that is responsible for operating the New England bulk-power generation and transmission system, overseeing and administering the region's wholesale electricity markets, and managing the regional bulk-power system planning process. When the SNETR study effort was undertaken, several major SNE transmission projects were in the process of being approved or were under construction, and were expected to be in service by 2009. Under the leadership of ISO-NE, the Working Group undertook a study of further improvements that would be needed thereafter to address transmission system problems expected to arise through 2016, assuming the completion of the projects already underway and projected peak-load growth. Initially, these studies considered limitations on east-west power transfers across SNE and transfers between Connecticut and southeast Massachusetts and Rhode Island.[2] These limitations had been identified as interdependent (that is, as affecting one another) in ISO-NE's 2003 Regional Transmission Expansion Plan (RTEP03). In the course of studying these interstate transfer limitations, the Working Group determined that previously identified reliability problems in Greater Springfield and

[2] These studies also included issues in the Boston and Southeastern Massachusetts areas, which are outside the scope of the NEEWS Plan.

Rhode Island were not simply local issues, but also affected interstate transfer capabilities. In addition, the Working Group identified constraints in transferring power generated in – or imported into – eastern Connecticut across central Connecticut to the concentrated load in SWCT. A comprehensive plan to address all of these interrelated problems was then developed, including the identification of the four components of the NEEWS Plan described above, along with other system improvements to address local reliability issues.

Figure ES-4 provides a conceptual illustration of the four elements of NEEWS.

Figure ES-4: NEEWS Project Elements

How will the proposed Project improvements affect electric transmission service in Connecticut?

The proposed Project will improve the reliability of Connecticut's electric service by reducing constraints on the existing transmission system over which power is imported into Connecticut from Rhode Island and southeast Massachusetts. This improvement will both increase the reliability of electric supply to Connecticut customers, and provide them with better access to lower-cost, low-emission, and renewable remote power sources. Similarly, the NEEWS projects as a whole will enhance these benefits, as the other NEEWS projects combine with the Project to greatly improve the capacity of the Connecticut transmission system to import power and to move it across the state. The flow of electric power over electric transmission systems is not limited by state borders. Thus, improvements to interstate electric transmission systems cannot be fairly evaluated according to the benefit they provide to a single state at any one time. The Project will provide significant reliability and economic benefits to electric customers in Rhode Island, Massachusetts and Connecticut, and, with the construction of the other components of NEEWS, throughout the New England Region.

ES-2 Objectives of this Municipal Consultation Filing

What is a Municipal Consultation?

CL&P is preparing an application for submission to the Council for a Certificate of Environmental Compatibility and Public Need (Certificate) for the construction and operation of the Project facilities that would be located in Connecticut. This Municipal Consultation Filing is designed to solicit comments on the Project from the leadership and public of the municipalities that would host parts of the Project, before the application is submitted to the Council. Such comments may prove useful in developing the application, and will in any case be summarized and reported to the Council.

What information is CL&P providing about the Project?

In accordance with the Council's requirements, CL&P has compiled detailed technical reports and information concerning the need, site selection, and potential environmental effects of the Project. These reports include the results of studies and analyses that the ISO-NE and CL&P and its consultants have performed to date, as well as CL&P's identification and evaluation of alternatives, including alternative transmission solutions, general environmental characteristics of the Project area, and the Project's potential environmental impacts and mitigation measures.

Based on the results of these studies, as well as on their considerable experience in providing electric transmission service throughout Connecticut and in Massachusetts and Rhode Island, the NUSCO and National Grid engineering and planning staffs and their consultants have proposed the improvements to the transmission system described in this document, which they concluded best address the interstate transfer limitations and best meet the objectives of the overall NEEWS Plan. The NUSCO system planners and environmental and land planning staff, together with their consultants, also have identified a transmission route for the Connecticut portion of these improvements; the Primary Route Under Consideration and several potential overhead and underground line-alignment variations to the Primary Route Under Consideration.

During the municipal consultation process, CL&P hopes to acquire information and recommendations from each municipality and/or the affected public that will be useful in refining the Project and in developing a final proposed route, which will be presented in the application to the Council.

What municipalities are involved in the consultation process?

Pursuant to the Council's requirements, CL&P is seeking input from the public and local government representatives in each of the Connecticut municipalities in which the Primary Route Under Consideration or variations of the proposed transmission facilities are located, and any municipalities within 2,500 feet of such alignment. These municipalities are: Lebanon, Columbia, Windham, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam, and Thompson.

How can the Connecticut public obtain information about the Project?

The public can obtain information about the Project in several ways, as follows:

- At the municipal offices of each of the potentially affected towns
- At Project "Open Houses" sponsored by CL&P
- On CL&P's web site: www.interstatereliability.com

In accordance with the Council's requirements, a copy of the Municipal Consultation Filing will be provided to the chief elected official of each potentially affected municipality. In addition, to allow the public further opportunities to learn about the Project and the Project siting process, CL&P has offered to hold "open houses." At these "open houses," experts will be available to provide information regarding Project need, alternatives, electric transmission technology, environmental issues, and electric and magnetic fields. CL&P's objective is to use the "open houses" not only to provide information to residents and businesses regarding the Primary Route Under Consideration, but also to receive feedback from the public concerning routes, transmission line configurations, and other matters. The schedule for the "open houses" will be determined in consultation with local officials.

ES-3 Configuration of Project Facilities

What transmission facilities are contemplated along the route from the Card Street Substation to the Connecticut/Rhode Island state border?

CL&P currently expects to propose that the Connecticut portion of the Project 345-kV line be constructed overhead, along CL&P's existing ROWs depicted in Figure ES-2. Except along a 5,175-foot segment crossing the Mansfield Hollow Reservoir and a 2,745-foot segment crossing Mansfield Hollow State Park, a new 345-kV line can be constructed entirely within existing CL&P transmission line ROWs, which vary in width from approximately 150 to 400 feet. The Mansfield Hollow segments currently have a 150-foot ROW width with one existing 345-kV transmission line. Up to an additional 150 feet of width adjacent to the existing ROW may be required for segments of the ROW through the Mansfield Hollow area. As currently proposed, a new line would be supported primarily by wood- or steel-pole H-frame structures averaging 90 feet above ground, which would be similar in configuration, spacing, and appearance to those that support the existing 345-kV line on the same ROW. Taller steel monopoles supporting various arrangements of the line conductors would be considered where required to minimize ROW width or to reduce magnetic fields. The primary characteristics of each type of structure, and the typical ROW configuration for each, are depicted on the cross-section drawings found in Volume 5.

The Project also includes associated modifications to the Card Street, Lake Road, and Killingly Substations. All of these modifications would occur on existing CL&P property.

Pursuant to the Council guidelines, CL&P also has identified several alternate overhead and underground line "route variations," each of which could potentially be developed to replace a segment of the Primary Route Under Consideration.

Why is the Primary Route Under Consideration an all-overhead line route?

Except for two short segments (in the Mansfield Hollow area), the proposed 345-kV line can be constructed overhead, within the established CL&P ROW, without the need to acquire additional private land or easement rights, at a fraction of the cost of underground line construction. Furthermore, this overhead line will provide better reliability than an underground line, or a hybrid overhead and underground line, and will result in generally marginal environmental effects that are consistent with the addition of a new line within an established energy corridor.

In contrast, underground transmission cable installation within the ROW is not practical. Since much of the existing transmission line ROW is not suitable for underground transmission cable construction, underground route variations would have to be constructed off the ROW, within or adjacent to roadways, thus increasing the length and cost of the line and affecting the local transportation network.

Please describe the modification of existing lines along approximately one mile of ROW near the Card Street Substation in Lebanon that will be done as part of the Interstate Reliability Project.

There is an existing ROW between the Manchester Substation in Manchester and the Millstone Switching Station in Waterford. One of the lines on that ROW is the 310 line, an overhead 345-kV line. At present, the 310 line is a single continuous circuit between the Manchester Substation and the Millstone Switching Station. CL&P proposes to divide the 310 line into two shorter circuits, each of which would terminate at Card Street Substation in Lebanon, which is about one mile east of the Manchester to Millstone ROW, and is between the Manchester Substation and the Millstone Switching Station (south of Manchester and north of Millstone). When that construction is complete, an interruption of one of the two new circuits (Manchester to Card Street or Millstone to Card Street) would still leave the other intact and connected to the other 345-kV line at Card Street Substation. This configuration will then be the same as now exists for two other 345-kV circuits between Millstone and Manchester, and will provide two direct 345-kV circuit paths between the Card Street and Manchester Substations.

How does CL&P reconcile all-overhead lines?

Section 16-50(p)(i) of the General Statutes establishes a rebuttable presumption that electric transmission lines at 345 kV and above shall be constructed underground where they are "adjacent to" certain land uses, described as: "residential areas, private or public schools, licensed child daycare facilities, licensed youth camps [and] public playgrounds." For convenience, these land uses are sometimes referred to collectively as "Statutory Facilities." One purpose of this provision is to avoid or minimize increases in magnetic field levels at such facilities. The presumption is overcome by proof that underground line construction is "infeasible," by reason of technical limitations, reliability considerations, or an unreasonable economic impact on customers. The Council has determined that the term "residential areas," as used in this statute, refers to developed "neighborhoods," not to undeveloped or sparsely developed land that is residentially zoned. The Council applies this presumption while considering its electric and magnetic field (EMF) Best Management Practices.

Although there are some Statutory Facilities that would be adjacent to the proposed 345-kV line, it is likely that, in accordance with the Council's EMF Best Management Practices, a different line configuration could be implemented to reduce magnetic field levels as compared to those that would be produced by the new horizontally configured line which is contemplated as the baseline design of the Project.

What Statutory Facilities are adjacent to the existing ROW?

- There are no youth camps or public playgrounds adjacent to the Connecticut ROW where the 345-kV line would be constructed.
- There are two licensed daycare facilities that would be adjacent to the proposed new line: a home-based daycare facility in Brooklyn, and the Mount Hope Montessori School in Mansfield, which is both a licensed daycare facility and a school.
- Although the area surrounding the ROW is predominantly rural and sparsely settled, there are several groups of homes at widely spaced intervals along the ROW. The Council will need to determine whether any of these groups of homes are sufficiently densely developed and integral to qualify as a statutory "residential area."

Will CL&P identify for the Council route variations that would avoid adjacency to these facilities?

Yes. CL&P has identified both underground and overhead line-route variations that would avoid adjacency of the new 345-kV line to the facilities described above. These potential variations are described and evaluated in this document, and will be presented to the Council for its consideration.

Were any of the route variations developed for reasons other than avoiding possible Statutory Facilities?

Yes. One of the variations was developed in part in case it is not possible to acquire the additional rights needed to construct the new line on certain federal and state property. The Mansfield Hollow Reservoir is owned by the federal government, administered by the U.S. Army Corps of Engineers (USACE) and leased to the Connecticut Department of Environmental Protection (DEP). The area was originally acquired by the federal government in conjunction with the construction of a dam to control flooding in the Thames River Basin. Mansfield Hollow State Park and Wildlife Management Area (WMA), which is located in Chaplin, is owned by the USACE and is leased by DEP. Both properties are managed by DEP for public recreation and wildlife.

An existing 345-kV transmission line passes through these federal and state properties, on a 150-foot-wide ROW. Additional easements would have to be acquired in order to expand the width of the ROW to accommodate a new 345-kV line. This would require a voluntary conveyance of additional easement rights from the USACE, with the consent of the DEP. In case it is not able to reach an agreement with these entities concerning the construction of the new line on this property, CL&P identified route variations that would avoid the need to acquire additional land in these areas, and would not require the expansion of the existing overhead line ROW.

Why does CL&P prefer the Primary Route Under Consideration to a route that would incorporate the variations?

A 345-kV overhead line incorporating the route variations would be more costly and have more environmental impact than the available all-overhead line route on existing ROWs. Similarly, an overhead 345-kV line incorporating underground variations and transition stations would cost far more, take longer to construct, have greater social and environmental impacts, and be somewhat less reliable than the all-overhead line.

What Project environmental issues are addressed in the Municipal Consultation Filing?

The Municipal Consultation Filing presents an overview discussion of the general environmental resources along, and in the vicinity of, the Primary Route Under Consideration and the route variations identified to date. The Volume 5 maps, which are derived from aerial photography, illustrate the Primary Route Under Consideration and the nearby principal land-use features (e.g., residential, commercial, and industrial uses; wetlands; streams and rivers; recreational areas; schools and community facilities; and roads).

The environmental issues commonly associated with transmission line projects include potential effects on soils, wetlands, watercourses, biological resources (vegetation, wildlife, threatened and endangered species, fisheries), land use, aesthetic/visual resources, and cultural resources. Construction-related nuisance effects such as localized noise and traffic congestion also are considerations. In addition, EMF levels also are typically of concern.

The Municipal Consultation Filing presents a summary of general information about these issues in this volume (Volume 1). More detailed information is provided in Volume 2. However, the purpose of the discussion is not to identify all specific environmental resources in the Project area, but rather to provide baseline data concerning the Project's environmental setting. This information is intended to facilitate an understanding of the Project's potential environmental impacts and the measures that CL&P has identified, to date, to mitigate such impacts. CL&P anticipates that the municipal consultation process will serve to identify more specific environmental concerns or issues.

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I. STATUTORY REQUIREMENTS FOR MUNICIPAL FILING

The Connecticut Light and Power Company (CL&P) plans to file an application with the Connecticut Siting Council (Council) on or about December 1, 2008 for the approval of the Connecticut portion of the 345-kilovolt (kV) Interstate Reliability Project (Project) facilities proposed to be constructed between the Card Street Substation in the Town of Lebanon and National Grid's electric transmission system at the Connecticut/Rhode Island state border in Thompson. The formal designation of this approval is a Certificate of Environmental Compatibility and Public Need (Certificate). Pursuant to the Public Utility Environmental Standards Act, Conn. Gen. Stat. § 16-50g et seq., CL&P has a statutory obligation to consult with any municipalities in which the primary or alternate routes of a facility for which it seeks a Certificate are located (and any municipalities within 2,500 feet of such routes). Specifically, Conn. Gen. Stat. § 16-50*l*(e) requires that:

> [a]t least sixty days prior to the filing of any application with the council, the applicant shall consult with the municipality in which the facility may be located, and with any other municipality required to be served with a copy of the application under subdivision (1) of subsection (b) of this section concerning the proposed and alternative sites of the facility… Such consultation with the municipality shall include, but not be limited to good faith efforts to meet with the chief elected official of the municipality. At the time of the consultation, the applicant shall provide the chief elected official with any technical reports concerning the public need, the site selection process and the environmental effects of the proposed facility. Conn. Gen. Stat. § 16-50*l*(e)

This municipal consultation package provides interested municipalities with technical reports and information concerning need, site selection, and potential environmental effects as required by § 16-50*l*(e). CL&P hopes to acquire information and recommendations from each municipality that may assist it in designing and constructing transmission improvements that will provide needed system reliability at the lowest reasonable cost to consumers, while minimizing and appropriately mitigating the environmental impacts of the Project.

This municipal consultation filing will also be evaluated by the Connecticut Energy Advisory Board (CEAB), a statutory body that represents the State of Connecticut in regional energy planning. The CEAB may determine to issue a Request for Proposal (RFP) for alternate solutions to meet the needs served by the Project. In determining whether or not to issue such a request, the CEAB will draw upon, among other things, its own general knowledge of Connecticut's energy needs, information that it has already gathered about this and the other NEEWS Projects, and a Comprehensive Procurement Plan that it developed in accordance with Section 51 of Public Act 07-242, a copy of which is included in Volume 4 of this filing. The CEAB submitted this report to the DPUC on August 1, 2008, and it is subject to review and modification by the DPUC. Should the CEAB determine to issue an RFP for alternate proposals, and should one or more such alternate proposals come forward, the Council could be called upon to evaluate the alternate proposal(s) along with the Project.

II. MUNICIPALITIES' PARTICIPATION DURING MUNICIPAL CONSULTATION PROCESS

Conn. Gen. Stat. § 16-50*l*(e) outlines the role of a municipality during the consultation process preceding an applicant's filing with the Council for a Certificate. Once the applicant provides technical reports concerning public need, the site selection process, and environmental effects:

> [t]he municipality may conduct public hearings and meetings as it deems necessary for it to advise the applicant of its recommendations concerning the primary facility. Within sixty days of the initial consultation, the municipality shall issue its recommendations to the applicant. No later than fifteen days after submitting the application to the council, the applicant shall provide to the council all materials provided to the municipality and a summary of the consultations with the municipality including all recommendations issued by the municipality. Conn. Gen. Stat. § 16-50*l*(e).

CL&P has held preliminary meetings with chief elected officials in all of the municipalities along the Primary Route Under Consideration and along the route variations described in this document, and has gathered useful information in the course of these meetings. The delivery of this municipal consultation package initiates the formal municipal consultation process required before an application to the Council may be filed. This package presents information regarding the Primary Route Under Consideration for the proposed 345-kV electric transmission line that CL&P expects to propose to the Council, as well as transmission line configurations that have been considered and variations of the Primary Route Under Consideration.

During this municipal consultation process, CL&P hopes to receive additional input from representatives of each of the municipalities and from the interested public. CL&P expects to consider such information in finalizing the specific route and line configuration to be proposed to the Council. This approach will enable CL&P to take full advantage of the municipalities' views and local knowledge, as well as to have a full understanding of all municipal concerns prior to the submission of a formal application for the Project to the Council.

To facilitate community outreach, in each affected municipality, CL&P has offered to hold "open houses" at which information regarding the Project will be provided. The objective is to use these open house meetings to provide information to residents and businesses regarding the Project and also to receive direct feedback from interested persons concerning routes, structure configurations, and other matters.

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III. DESCRIPTION OF FILING CONTENTS

The contents of this filing are provided in 5 volumes.

- This Volume 1 describes the Primary Route Under Consideration and route variations for the Connecticut portion of the proposed 345-kV electric transmission line. CL&P proposes to develop the new 345-kV facilities as an overhead line, located primarily within an existing transmission line right-of-way (ROW). This volume also summarizes information regarding general engineering, construction, and environmental considerations underlying the route selection process; identifies route variations, describes general construction procedures; and summarizes the existing environment and potential environmental impacts/mitigation measures with respect to overhead and underground transmission line construction. Finally, it identifies additional Connecticut facilities that would require approval by the Council for the Project.
- Volume 2 presents information concerning the existing environment and potential environmental impacts/mitigation measures with respect to overhead and underground transmission line construction, contains copies of agency correspondence, as well as environmental exhibits, including reports that present the results of studies conducted to date concerning wetlands and water resources, amphibians, bird breeding areas, and historical and archaeological resources related to the Primary Route Under Consideration and route variations.
- Volume 3 includes engineering-related reports that focus on describes underground cable technologies, which would apply to the underground route variations.
- Volume 4 provides data concerning the reliability of the electric transmission system in the Project area, and the New England East – West Solution (NEEWS) planning effort. These volumes consist of supplemental reports prepared by entities such as ISO-NE, the Council, the CEAB, and CL&P consultants.
- Volume 5 contains aerial photographs, transmission line cross sections, and plan and profile drawings for Project facilities. Volume 5 also contains simulated photographs, route maps and substation drawings for the Primary Route Under Consideration, and maps for the overhead and underground line-route variations.

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IV. IDENTIFYING THE BEST TRANSMISSION SOLUTION FOR THE ELECTRIC DEFICIENCIES

IV.A SUMMARY OF THE NEED FOR IMPROVEMENTS

The System Planning Process and Electric Reliability Criteria

Electric power transmission systems transport electric energy from generating plants to load centers throughout an operating area. The system operator (Independent System Operator, New England (ISO-NE) for the New England operating area) will dispatch the available generation in the most efficient and cost-effective manner permitted by the limitations of the transmission system. Transmission systems are designed so as to assure continuity of supply paths to load-serving substations.

For many years, New England's transmission owners have voluntarily adopted and complied with common reliability standards. However, pursuant to the Energy Policy Act of 2005, reliability standards for the North American bulk-power system established by the North American Electric Reliability Council (NERC) and approved by the Federal Energy Regulatory Commission (FERC) became mandatory on June 18, 2007, such that FERC can impose financial penalties of up to $1 million per day for an instance of non-compliance. Additional standards and criteria governing transmission planning are set by the Northeast Power Coordinating Council (NPCC), and by ISO-NE, which plans and operates the New England bulk-power supply system. Copies of these standards and criteria, as well as the *Northeast Utilities Transmission Planning Guideline*, are included in Volume 4.

A key element of these reliability standards is the consideration of "contingency" events wherein critical generation and/or transmission facilities are assumed to trip out of service or be unavailable. Such contingency events may include weather, generator outages, transmission line outages, substation equipment failures, seasonal adjustment of transmission and generation capability, and contingencies on other systems connected to the New England transmission system.

If a generating unit or a transmission line is removed from service, instantaneously increased power flows occur on the transmission lines that remain in-service. Thus, the transmission capacity for an area must be designed not only to transmit the imported power required to offset anticipated generating deficits under normal conditions, but also to transmit that imported power reliably following specific contingencies that the system is required to withstand. Otherwise, power flows could exceed emergency transmission line ratings and force the utility to disrupt service to large blocks of customers to prevent permanent damage to elements of the electric system and to prevent an uncontrolled collapse of the electric system which could result in the loss of additional customer load.

To evaluate compliance with applicable reliability standards, planning contingencies are simulated on computer models developed to represent actual and future system conditions. If the simulation shows that transmission lines will overload and/or voltage will not be maintained within acceptable limits under one or more of the contingencies for which the system must be designed, corrective action must be planned and implemented in order to maintain the reliability of the electric grid.

The bulk-power supply system is not only planned, but is also operated so that it can withstand the unplanned loss of system elements. Thus, most transmission lines typically carry currents that are a fraction of those that they could safely carry. Each transmission line is thus available to accept additional current that would instantaneously flow onto it in the event of the sudden loss of a generating unit or other system elements.

Requiring the transmission system to withstand outages of more than one generating unit recognizes that units may be unavailable for many reasons such as economics, equipment failure, fuel supply and maintenance. Also, environmental restrictions on fossil-fueled generating stations in Connecticut could affect continuous operation of generating units at these stations or result in the closure of one or more generating units at a generating station. For instance, in a filing with the CSC on July 8, 2008, the owner of the Norwalk Harbor, Montville and Middletown oil-fired generating units stated, in part, because of these environmental challenges, that the Council should assume for planning purposes, that these units will be retired within ten years, unless they are re-powered under long term contracts or other arrangements which provide certainty of revenue.

It should be recognized that unplanned outages of generating units are common in the electric industry. For example, when ISO-NE set a record for peak winter load on January 21, 2003, eight generating units in SWCT, with a total capacity of approximately 1,038 megawatts (MWs), were unavailable due to problems associated with the extremely cold weather. And for over 12 hours on June 30, 2008 the Milford Power Units 1 and 2 tripped off line during a three-day-long forced outage of Millstone Unit 2, making about 1,470 MWs of Connecticut-based generation unavailable on a summer day. Also, in 1996 three nuclear-powered generators at Millstone Station were shut down by order of the Nuclear Regulatory Commission, a loss of more than 2,600 MWs of generation resources in Connecticut. These generators remained out of service through 1998 into 1999, and only two of the three Millstone units returned to service.

Transmission line outages can also occur. For example, in November 2002, the Norwalk Harbor – Northport, New York submarine cable system went out of service as a result of damage caused by a boat anchor. The cable system was out of service until June, 2003. (The length of this outage reflects the difficulty of diagnosing and repairing damage in submarine and underground transmission systems). Forced outages of overhead transmission lines are typically much shorter in duration than forced outages on underground lines.

IV.B THE NEW ENGLAND BULK-POWER SUPPLY SYSTEM

The New England bulk-power supply system is fully integrated and uses all regional generating resources to serve all regional load (i.e., the demand for electricity measured in MWs) independent of state boundaries. Most of the transmission lines are relatively short and networked as a grid. Therefore, the electrical performance in one part of the system affects all areas of the system.

The New England regional electric system serves 14 million people living in a 68,000 square-mile area. More than 350 generating units produce electricity, representing approximately 31,000 MWs of total generating capacity, with most of these units connected to approximately 8,000 miles of high-voltage transmission lines. Twelve transmission tie lines interconnect New England with its neighbors, New York and the Canadian provinces of New Brunswick and Québec.

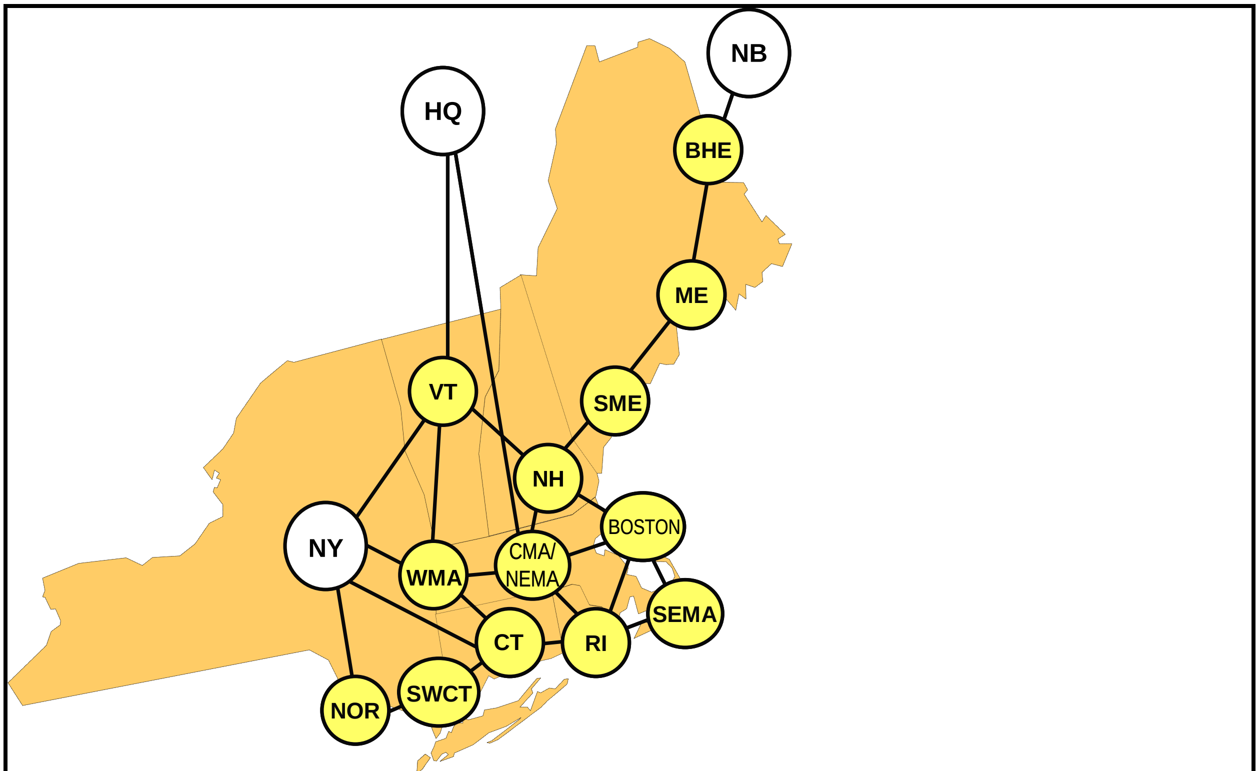
In addition to these power supply resources and transmission interconnections, New England depends upon significant demand-reducing resources. As of July 1, 2008, approximately 1,700 MWs of demand-reducing resources were registered as part of the ISO-NE demand-response and price-response programs. Customers in these programs reduce load quickly to enhance system reliability or in response to price signals for compensation based on wholesale electricity prices.

The New England Region reached a new record summer-peak load of 28,130 MWs on August 2, 2006, which was due to extreme temperatures and humidity throughout the region. In accordance with ISO-NE operating procedures, demand-response programs were activated to reduce the load, and this action reduced the peak by approximately 640 MWs. In the absence of these programs, the peak load would have been 28,770 MWs.

Normal dispatch, considering economics, generation availability, and transactions with neighboring systems, results in multiple intra-New England power transfers of varying direction, magnitude, and duration. The development of about 9,500 MWs of new generation in New England since 1999, without attendant transmission system upgrades, has resulted in situations where surplus generation in one subarea may not be deliverable to other subareas and is not operable simultaneously with other generation in the region as a whole.

Within New England, 13 subsets of the electric power system, called subareas, have been established to assist in modeling and planning electricity resources. Figure IV-1 is a simplified model of the system that shows the ISO-NE subareas and three external control areas. The types of analyses that use the subareas include resource adequacy studies and environmental emission studies. More detailed models are used for other types of analyses, including transmission planning studies, and for the real-time operation of the system.

Figure IV-1: RSP07 Geographic Scope of the New England Bulk Electric Power System



Subarea Designation	Region or State	Subarea or Control Area Designation	Region or State
BHE	Northeastern Maine	WMA	Western Massachusetts
ME	Western and central Maine/ Saco Valley, New Hampshire	SEMA	Southeastern Massachusetts/ Newport, Rhode Island
SME	Southeastern Maine	RI	Rhode Island/bordering MA
NH	Northern, eastern, and central New Hampshire/eastern Vermont and southwestern Maine	CT	Northern and eastern Connecticut
VT	Vermont/southwestern New Hampshire	SWCT	Southwestern Connecticut
Boston	Greater Boston, including the North Shore	NOR	Norwalk/Stamford, Connecticut
CMA/NEMA	Central Massachusetts/ northeastern Massachusetts	NB, NY, and HQ	New Brunswick (Maritimes), New York, and Hydro-Québec external control areas

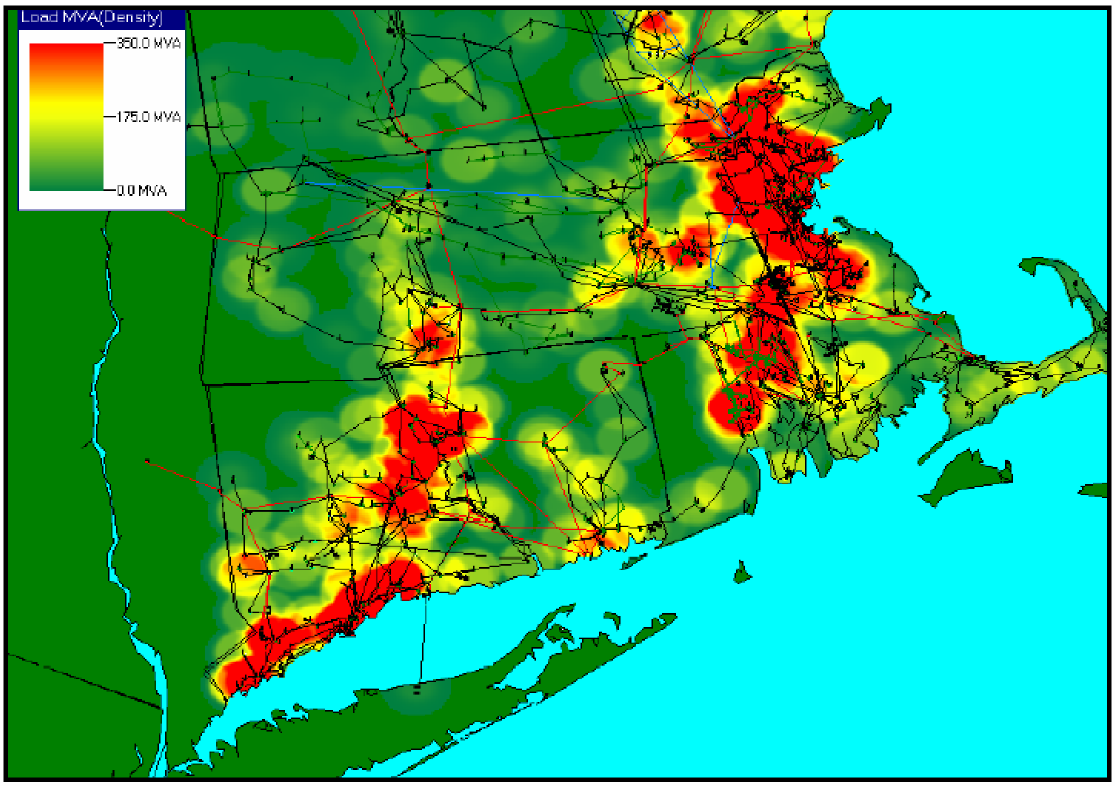
Notes: Some RSP studies investigate conditions in Greater Connecticut, which combines the NOR, SWCT, and Connecticut subareas. This area has similar geographic boundaries to the State of Connecticut but is slightly smaller because of electrical system limitations near the borders with western Massachusetts and Rhode Island. Greater Southwest Connecticut includes the southwest and western portions of Connecticut and consists of the NOR and SWCT subareas. NB includes New Brunswick, Nova Scotia, and Prince Edward Island (i.e., the Maritime provinces).

IV.C BULK-POWER SUPPLY IN SOUTHERN NEW ENGLAND

The geographic area of southern New England (SNE) encompasses Massachusetts, Rhode Island, and Connecticut. The SNE area accounts for approximately 80 percent of the New England load.

As shown in Figure IV-2, the SNE load is concentrated in Boston and its suburbs, central Massachusetts, Springfield, Rhode Island, Hartford, and Southwest Connecticut. These areas of load concentration are called "load pockets" if the transmission system is not adequate to reliably import power from other parts of the system, and some demand must be met by relying on local generation. Although the Southwest Connecticut area will no longer be a "load pocket" when the Middletown to Norwalk project is in-service, Connecticut as a whole will remain a "load pocket."

Figure IV-2: Southern New England Load Concentrations



Customer load in SNE as a whole exceeds available generation capacity. Accordingly, power is transmitted to SNE from the north, from generators in northern New England and Canada. However, the eastern New England area currently has a surplus of generating capacity, and that surplus exists in both northern New England and the southeastern Massachusetts and Rhode Island area (SEMA/RI). In addition, most of this generation, as well as most of the generation in SNE itself, is located to the east of the load centers in Connecticut and western Massachusetts (Springfield). Accordingly, there is a need for power transfers from east to west across SNE, and particularly across Connecticut.

The 345-kV transmission network provides the "backbone" for these north-south and east-west transfers into and across SNE. In recent years, ISO-NE and the companies serving load in SNE have developed several major 345-kV transmission projects to ensure the continued adequacy and reliability of the bulk-power supply system by reducing bottlenecks in transferring power into load pockets throughout the region and relieving the dependence on local generation within these pockets. Two such major projects were placed in service in 2006 - the first phase of the NSTAR 345-kV Reliability Project from Stoughton to Boston in Massachusetts; and CL&P's Bethel to Norwalk transmission project in Connecticut. CL&P and The United Illuminating Company are now constructing the Middletown to Norwalk (Connecticut) transmission project, which is expected to be in service in 2009, when it will complete a 345-kV "loop" serving southwest Connecticut (SWCT). The latter project will be complemented by CL&P's Glenbrook to Norwalk 115-kV cables project, which will enter service in late 2008.

IV.D DEVELOPMENT OF THE INTERSTATE RELIABILITY PROJECT AND THE NEEWS PLAN

The existing 345-kV line on the ROW between CL&P's Card Street Substation in Lebanon, Connecticut and the Rhode Island border was constructed in 1970 and was looped into the Lake Road and Killingly Substations when those facilities were constructed in 2005 and 2006 respectively. Prior to that construction, CL&P had acquired a ROW that was generally 300 feet wide because it then anticipated a future need to construct a second 345-kV line. In 2004, CL&P began planning and routing studies for a possible second line from Card Street Substation to National Grid's Millbury Switching Station in Millbury, Massachusetts, with a potential connection to National Grid's West Farnum Substation in North Smithfield, Rhode Island, and with a connection to the Lake Road Substation in Killingly, Connecticut.

This transmission system planning effort soon became part of a group of coordinated studies of the deficiencies of the SNE electric supply system, which were conducted by the transmission system planning staffs of ISO-NE, NUSCO and National Grid, under the leadership of ISO-NE and with the assistance of outside consultants. ISO-NE is a not-for-profit corporation that is responsible for operating New England's bulk power generation and transmission system, overseeing and administering the region's wholesale electricity markets, and managing the regional bulk-power system planning process. In 2004, the ISO-NE, in conjunction with the transmission system Working Group, embarked on a coordinated series of studies of the deficiencies in the SNE electric supply system. These studies were collectively called the Southern New England Transmission Reliability (SNETR) study.

When the SNETR study was undertaken, the major New England transmission system improvements described in the previous section were planned or under construction, and were expected to be in-service by 2009. The SNETR study therefore assumed the completion of these projects and sought to identify additional improvements that would be required to assure electric system compliance with applicable reliability standards, by addressing problems expected to arise at least through 2016. Initially, these studies considered limitations on east-west power transfers across SNE and transfers between Connecticut and southeast Massachusetts and Rhode Island - limitations that are addressed in large part by the proposed Project. These limitations were first identified as interdependent (that is, as affecting one another) in ISO-NE's 2003 Regional Transmission Expansion Plan (RTEP03).

In the course of studying these interstate transfer limitations, the Working Group determined that other, previously identified reliability problems in Greater Springfield and Rhode Island were not simply local issues, but also affected interstate transfer capabilities. In addition, the planners discovered constraints in transferring power generated in – or imported into – eastern Connecticut across central Connecticut to the concentrated load in SWCT. As finally developed, the SNETR study addressed all of these interrelated problems and recommended transmission solutions. The transmission projects that emerged from this planning process are collectively referred to as the New England East-West Solution, or NEEWS.

The four principal projects that comprise the NEEWS Plan are:

- **The Interstate Reliability Project**, which is the subject of this municipal consultation document, includes the construction of 345-kV line along existing overhead line ROW extending 15 miles in Massachusetts, 22 miles in Rhode Island, and 38 miles in Connecticut, together with related improvements to existing 345-kV and 115-kV facilities, including substations.
- **The Greater Springfield Reliability Project**, which includes the construction of new 345-kV lines along approximately 35 miles of overhead line ROW (23 miles in Massachusetts and 12 miles in Connecticut); the construction, reconstruction and upgrade of 115-kV lines along approximately 27 miles of existing and new overhead line ROW in Massachusetts; and related substation improvements in both Massachusetts and Connecticut. A separate but related project, the separation of a 345-kV circuit and a 115-kV circuit between Manchester Substation and Meekville Junction in Manchester, Connecticut for a distance of 2.7 miles, will be proposed in the same application as the Greater Springfield Reliability Project.
- **The Rhode Island Reliability Project**, which, as proposed by National Grid, would include the construction of a new 345-kV line along 21 miles of existing overhead line ROW, extending from its West Farnum Substation in North Smithfield, Rhode Island to its Kent County Substation in Warwick, Rhode Island, together with related improvements to existing 115-kV and 345-kV facilities.
- **The Central Connecticut Reliability Project**, which, as currently under consideration, would include the construction of a new 345-kV line along 38 miles of existing overhead line ROW, extending from CL&P's North Bloomfield Substation in the Town of Bloomfield to its Frost Bridge Substation in the Town of Watertown, together with related improvements to existing 345-kV and 115-kV facilities.

The Working Group's analysis and conclusions are summarized in two reports, copies of which are provided in Volume 4 of this Municipal Consultation Filing[3]. The first of these reports is entitled *Southern New England Transmission Reliability Report – Needs Analysis* (the *Needs Analysis).* That report was first published in draft form for stakeholder comment on the ISO-NE website in 2006, and was issued in final form dated January, 2008. The *Needs Analysis* describes the related problems in Southern New England that the NEEWS projects have been planned to address. The second report is entitled *New England East-West Solutions (Formerly Southern New England Transmission Reliability) Report 2, Options Analysis* (the *Options Analysis*). The *Options Analysis* was issued in final form April 2008. It describes four sets of transmission "Options" that the Working Group had determined could provide solutions for the problems identified in the Needs Report.

Each set of options relates to a transmission system component that would address at least one of the identified system deficiencies by itself, and would work together with other components to provide a co-ordinated resolution of region-wide issues. ISO-NE tasked the Northeast Utilities and National Grid operating companies as transmission owners (TO's) to develop a set of compatible preferred Options for each component of the Plan by further analyzing the technical advantages and disadvantages of the options identified in the *Options Analysis,* and their comparative cost, constructibility, and routing aspects, so that selections could be made on the basis of all pertinent information. That further analysis, as it pertains to the Project, is described in a third report, "*Solution Report for the Interstate Reliability Project*" dated August, 2008, a copy of which is also provided in Volume 4 of this filing.

IV.E THE PROJECT'S CONTRIBUTION TO ELECTRIC SYSTEM RELIABILITY

The Project will strengthen the electrical connections between Massachusetts, Rhode Island and Connecticut. It will significantly improve the reliability of electric supply to Connecticut consumers by increasing the ability of the Connecticut system to import power generated outside of the state in order to meet growing demands within the State of Connecticut, and it will provide access to competitive power markets and potential access to renewable energy sources. At the same time, the Project will assist the Connecticut system in complying with local resource requirements by making two of the three units (totaling 488 MWs of summer capacity) of the Lake Road Generating Station, which is located near the Connecticut/Rhode Island border, eligible for consideration as local Connecticut resources. Moreover,

[3] The version of each report that is provided has been slightly redacted by ISO-NE, in accordance with federal Homeland Security regulations, to avoid the disclosure of information determined to be Confidential Energy Infrastructure Information.

the Project will provide a link required for the reliable transfer of power from east to west across the New England region.

IV.E.1 Addressing the Deficiency in Connecticut's Import Capacity

To serve load reliably, an electric supply system must be able to access multiple generation sources, so that the unavailability of some generation by reason of planned or unplanned outages or retirement, or the loss of access to some generation by reason of the loss of one or more transmission lines, will not interrupt the supply of power. The bulk-power supply system integrates load and generation on a regional basis, so that any given area within the region can import generation from outside of that area if needed to maintain continuity of service (particularly during peak load periods and/or when local generation is unavailable); for economic reasons (such as when lower-cost power is available from remote sources); or for other reasons (such as to meet obligations to supply power from low-emission or renewable sources when such power is not available in sufficient quantity from local generation). Of all the New England states, Connecticut is the least able to import power to supplement its internal supply resources. For example, New Hampshire, Vermont, and Rhode Island have enough import capacity to serve 100 percent of their peak load. Massachusetts and Maine can import slightly less than 50 percent of their peak load. Currently, Connecticut can only import approximately 30 percent of its peak load. ISO-NE has determined that the capacity to import power may fall short of the state's reliability need as early as 2009 and that if improvements are not made by 2016, the import deficiency is likely to be greater than 1,500 Megawatts assuming no additional capacity is added. In order to reliably serve its peak load in the future, Connecticut must increase its capacity to import power.

The principal limitation on Connecticut's import capabilities is insufficient available 345-kV transmission capacity. In particular, Connecticut is tied to Rhode Island though a single 345-kV line path that extends from CL&P's Card Street Substation in Lebanon to the Lake Road Substation and Killingly Substation (both in Killingly), and across the Connecticut/Rhode Island state border to National Grid's Sherman Road Substation in Burrillville, Rhode Island. Southeastern Connecticut is also tied to southern Rhode Island by a 115-kV line of very limited capacity. Under normal dispatch conditions, approximately 60 percent of Connecticut imports are shared between the Card Street to Rhode Island 345-kV line path and a 345-kV line between north-central Connecticut and western Massachusetts. Computer simulations of system performance under anticipated 2009 peak loads show that in the event of a loss of the 345-kV connection between Connecticut and Rhode Island, the power that was flowing on this path would instantaneously redistribute to other paths, overloading the Connecticut to western Massachusetts 345-kV line and several 115-kV lines. In order to avoid such overloads, an independent 345-kV transmission connection must be constructed to increase the import capacity of the Connecticut-Rhode Island interface, or else imports would have to be kept to a level below that necessary to reliably serve the peak load.

Construction of a second 345-kV line paralleling the existing 345-kV line between Connecticut and Rhode Island will significantly increase the Connecticut import capacity and assure that the bulk-power transmission system will be able to carry sufficient power to meet peak needs even in the event of the loss of one of those 345-kV lines, or in the event of other design contingencies that the system is required to withstand.

The import (i.e. “transfer”) capacity across a system “interface” – such as that between the Connecticut and Rhode Island/Massachusetts/New York systems – depends on the power flows that the facilities crossing the interface can carry without creating the risk of an overload in the event of a system disturbance. Transfer capacities are expressed both in terms of the power flow that the facilities can safely carry under normal conditions, and that they can carry under defined contingency conditions. The power flow under normal conditions is limited to a level that will not result in a system overload when the flow is automatically redistributed instantaneously following the sudden loss of any system element (transmission line or generator). This value is called the N-1 transfer capacity. Should such loss of a system element occur, the transfer capacity of the interface will then be the level that the facilities can carry without causing an overload on any system element immediately following the loss of any additional system element. This value is called the N-1-1 transfer capacity. When a single value is used to describe the range of transfer capacity across an interface, it will usually be the N-1 capacity.

Transfer limits are not single values and will vary according to the generation that is running at any given time. Therefore, to estimate transfer capacity by computer modeling, planners must make generation dispatch assumptions. In the SNETR studies, the Working Group estimated the “Base” Connecticut import capacity by assuming the existing system and additions to it which are expected to be in place by 2009, and by assuming representative generation dispatches. They then estimated what the Connecticut import would be after implementation of all of the NEEWS projects, which were designed to work together. In particular, each of the Greater Springfield and the Interstate Reliability projects would increase the Connecticut import capacity standing alone, but they provide a greater increase when considered together. However, the Project provides by far the most significant improvement to the Connecticut import capacity. The SNETR studies estimated a “Base” N-1 Connecticut import capacity, using the assumptions described above, of approximately 2,600 MWs, and an import capacity after implementing all of the NEEWS projects, including the Project built as proposed, of 4,400 MWs. However, adding the proposed Project alone to the Base system and using the same generation assumptions, provides about 60 percent of the increase to the Connecticut import limit that is provided by all of NEEWS.

IV.E.2 Improving New England East – West Transfers

Much of the generation that serves the peak load in the SNE area is located outside of that area, to the north and east. In order to serve peak loads in SNE, large power transfers across New England from east to west are required. However, these east-west power flows are limited due to the potential overloading of existing 345-kV lines that traverse Rhode Island, Massachusetts, and Connecticut from east to west and potential voltage violations at substations served by those lines. Given the export limitations for generation-rich areas in New England, there is a surplus capacity in Eastern New England of nearly 3,000 MWs. The existing transmission system does not allow for delivery of this surplus capacity to all load centers in SNE. Regional east-west transfer limits and Connecticut power-transfer limitations do not allow all of this surplus capacity to be delivered to the load centers within Connecticut.

This surplus generation cannot be moved across New England because of the potential overloading of the existing 345-kV lines that traverse southern Massachusetts from east to west and potential voltage violations at substations served by those lines. Construction of the Project will provide an additional 345-kV path for power flowing across SNE from East to West, which will share the load with the existing lines and thus allow higher power flows. In order to complete this additional path, the Central Connecticut Reliability Project (CCRP) and the Greater Springfield Reliability Project (GSRP) would have to be constructed as well.

IV.E.3 Increasing Connecticut's Generation Resources

In addition to increasing Connecticut's import capacity, the Project will increase the state's local generation. For import-constrained areas such as Connecticut, the ISO-NE sets a Local Sourcing Requirement (LSR). The LSR is the minimum amount of generation capacity that must be located within an import-constrained load zone to meet the system-wide resource adequacy requirements. The Lake Road Generating Station, as previously mentioned, is physically located in Killingly, Connecticut, but because of the limitations of the existing transmission system it cannot be counted as part of the Connecticut sourcing requirement. It is expected that system improvements that will be implemented before the Project is constructed will bring one of the Lake Road Generating units into the Connecticut system; and the construction of the Project, which will provide a second 345-kV path in and out of the Lake Road Substation, will make the remaining two units (totaling 488 MWs) eligible for consideration as local Connecticut resources.

IV.F ADDITIONAL BENEFITS OF THE PROJECT

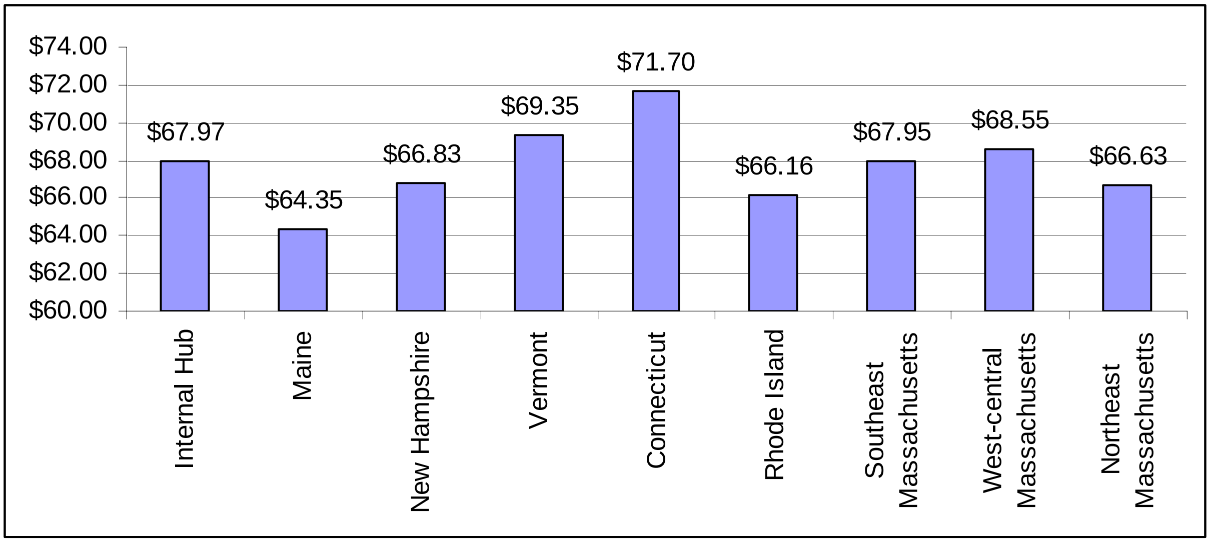
While the Project (like the other NEEWS projects) is designed and proposed to comply with mandatory reliability criteria, it is also likely to provide substantial economic and environmental value by enhancing competition and increasing access to cleaner generation and renewable resources that are built outside of Connecticut.

IV.F.1 Economic Benefits

The previously described transmission constraints on the movement of power across New England and into Connecticut have an economic, as well as, a reliability significance. Transmission congestion increases electricity prices by preventing or impeding access to the lowest cost sources of electric power. Instead, more expensive electricity must be produced within the congested area from older and less efficient generating plants.

Before the restructuring of the electric markets in New England, such expenses and losses were distributed among all New England consumers. Now, electricity prices are designed to reflect the true cost of delivering and supplying electricity at every location on the grid, with the intent of providing incentives for the construction of new transmission infrastructure and generating facilities in those areas where they are most needed. The pricing mechanism designed to achieve this result is known as "locational marginal pricing" (LMP). There are eight different LMP zones in New England. As shown in Figure IV-3, in 2006, LMP prices were similar across all of these zones except Maine, where surplus generation is "bottled up" because of insufficient transmission capacity to export it, and Connecticut, which was and continues to be import constrained. The price difference between these two states in 2007 was $7.35 per megawatt hour (MWh), or about 11 percent.

Figure IV-3: Average LMP Statistics by Zone for 2007, All Hour, $/MWh



Source: ISO New England, "2007 Annual Markets Report", June 2008

CL&P can not predict the congestion cost savings that the Project and the other NEEWS projects will bring, because that amount will depend on many variables including changing market rules, generation additions and retirements, load growth, and the success of increased conservation efforts. However, it is clear that these projects will be addressing the condition – transmission congestion – that has caused disproportionately high prices to Connecticut consumers since 2003. Moreover, the economic benefits of relieving congestion can be estimated retrospectively. It has been estimated that in 2007, its first full year in service, the Bethel to Norwalk 345-kV project reduced congestion costs by approximately $150 million. These savings far exceed the annual carrying cost of the Project's capital investment.

IV.F.2 Environmental Benefits

Many recent government policy initiatives require access to low-emission and/or renewable energy sources. These include the Regional Greenhouse Gas Initiative (RGGI), an agreement by 10 northeastern states, including Connecticut, to cap the carbon dioxide emissions from electric power generators in those states which have capacities equal to or greater than 25 MWs in capacity starting on January 1, 2009; and the Renewable Portfolio Standards (RPS) adopted by all of the New England states except Vermont. The Connecticut RPS require that, starting in 2007, escalating annual percentages of retail load must be served by each of three classes of renewable generation including, for instance, wind and solar energy.

The existing fleet of Connecticut generators cannot comply with these limits, and it is highly doubtful that sufficient low-emission and/or renewable generation to enable compliance will be built in Connecticut. On the other hand, there is growing interest in the prospects for building substantial hydroelectric, nuclear and wind-power capacity in northern New England and eastern Canada, along with transmission that could enable energy delivery into the rest of New England in order to satisfy the growing renewable and low-emission energy demands in New England. While the Project would not by itself provide access to such sources from Connecticut, it would provide an essential link in a new regional transmission network necessary to do so.

IV.G SELECTION OF A PREFERRED SOLUTION FROM THE FIVE INTERSTATE OPTIONS IDENTIFIED IN THE *OPTIONS ANALYSIS*

The *Options Analysis* identified five options as meeting the basic performance requirements of the study for the Interstate component of NEEWS - strengthening the ties between the southern New England states, and increasing the ability to move power between eastern and western New England. These five options were briefly described as:

- **Interstate Option A –** a new 345 kV line from the Millbury, MA, Substation to the West Farnum, RI, Substation and then to the Lake Road, CT, Substation and terminate at the Card Street, CT, Substation
- **Interstate Option B** – a new 345 kV line from the West Farnum Substation to the Kent County, RI, Substation and then to the Montville, CT, Substation. (The line from the West Farnum Substation to the Kent County Substation is part of the Rhode Island component.)
- **Interstate Option C –** a new 345 kV line from the Millbury Switching Station to the Carpenter Hill, MA, Substation and terminate at the Manchester, CT, Substation
- **Interstate Option D –** a new 345 kV line from the Millbury Switching Station to the Carpenter Hill Substation to the Ludlow, MA, substation to the Agawam, MA, substation to the North Bloomfield, CT, Substation. (The line from the Ludlow Substation to the Agawam Substation to the North Bloomfield Substation is part of the Springfield component.)
- **Interstate Option E –** a new 1,200 MW high-voltage direct-current (HVDC) tie between the Millbury, MA, Switching Station and the Southington, CT, Substation

The *Options Analysis* recognized that each of the five Interstate Reliability options would meet a set of threshold system objectives, but also noted that each option “offers different advantages and disadvantages compared with the other options in terms of system performance.” In addition, the *Options Analysis* did not consider the cost, constructibility, and routing aspects of each option. Accordingly, the TOs further analyzed the technical merits of each of the options, before developing cost, routing, and environmental information as needed to fairly compare them. In the course of this analysis, the TOs identified two distinct routes for one of the electrical options (Option C), so that the total number of options evaluated became six. These six Interstate Options are illustrated on the following page;

Figure IV-4: Interstate Option A

Figure IV-5: Interstate Option B

Figure IV-6: Interstate Option C-1

Figure IV-7: Interstate Option C-2

Figure IV-8: Interstate Option D

Figure IV-9: Interstate Option E

The *Solution Report* in Volume 4 of this filing provides a detailed description of the analysis by which the TO's selected Option A as their preferred solution. A compressed summary of this analysis is provided here.

The technical and cost characteristics of each of the options were evaluated first, and then their potential environmental and social impacts.

Winnowing down the options did not require the development of equally detailed routing and environmental information for all options. Where technical and/or cost analyses were sufficient to eliminate an option, a full environmental analysis was not required.

The TOs first eliminated Option E – the HVDC solution - on grounds of inferior performance and excessive cost. (*See, Solution Report,* and Appendix 2). They then went on to comparatively evaluate the four AC options. Option A was recognized as a likely preferred solution because;

- It comfortably exceeds the objective design criteria or "targets" of the *Needs Analysis* and its system performance, measured by these metrics it was substantially equivalent to or better than that of the other AC options;
- It reinforces the electrical connection between Massachusetts and Rhode Island and between Connecticut and Rhode Island for the benefit of all, providing each with access to competitive power markets and potential access to renewable energy sources.
- It improves access to newer more efficient generation resources in southeastern Massachusetts – an area known to have excess generation.
- By extending to Millbury, it creates a platform for accessing lower cost, low-emission, and renewable generation sources in Northern New England and Canada.
- It also provides access to the natural gas pipeline paths in northeastern Connecticut, northern Rhode Island and southern Massachusetts, near where future generation is proposed.
- It establishes a new supply source to Rhode Island, thereby increasing the reliability of the Rhode Island system.
- It establishes a 345-kV loop around several large generators in central Massachusetts, by connecting National Grid's Millbury Switching Station with its West Farnum and West Medway Substations.
- By providing a second 345-kV source to the Lake Road Substation, Option A should make all units at Lake Road Generating Station in Killingly eligible to be considered as fulfilling Connecticut's local sourcing requirement. (The Local Sourcing Requirement is a measure of resource adequacy. It is the minimum amount of capacity that must be located within an import-constrained load zone to meet the system-wide loss of load expectation of one day in 10 years.)
- It was preferred by the system operations personnel.
- It could be constructed for almost its entire length within existing transmission line rights-of-way.
- The Connecticut segment of the project would not be adjacent to numerous facilities or land uses that would trigger the rebuttable "underground presumption" of section 16-50p(i) of the General statutes.
- It was the least costly of all of the Options.

A detailed review of the advantages of Option A is provided in Section 2.3.1 and Appendix 3 of the *Solution Report.*

Option B was eliminated for inferior performance and high cost (*Solution Report.,* §2.4). Option C-1, which would have been in large part on new ROW adjacent to an interstate highway corridor, was found to be impractical and excessively costly. (*Id.* §§ 2.5, 2.6) Option D was determined to be impractical in the form envisioned in the *Options Analysis,* and virtually indistinguishable from one of the variants of Option C when modified to be constructible. (*Id.,* § 2.7) Option C-2 was evaluated in detail, because its performance and cost were close to that of Option A. (*Id.,* 2.8, App. 4) Ultimately, a comparative analysis of Option A and Option C-2 showed that, although both potential solutions had merit, Option A performed better, cost less, and had fewer environmental and social impacts. (*Id.*, §2.8, App. 4) Accordingly, Option A was selected as the preferred transmission solution.

V. APPROACH FOR IDENTIFYING THE BEST ROUTES/SITES FOR THE NEEDED TRANSMISSION SYSTEM IMPROVEMENTS

As described in this Municipal Consultation Filing, CL&P has identified an overhead transmission line route, which would be aligned within existing CL&P transmission line ROWs, as the Primary Route Under Consideration for the Connecticut segment of the Project. This section summarizes the criteria that CL&P applied in order to first identify and evaluate alternative routes and configurations (e.g., overhead vs. underground transmission) for the Project and then to select from among these the Primary Route Under Consideration, as well as five potential underground and four potential overhead transmission line variations to portions of this route which are presented below.

V.A OVERHEAD LINE-ROUTE ANALYSIS CRITERIA

The configuration of overhead transmission lines allows flexibility, provided that a continuous ROW of adequate width is available. Individual structures can often be located to avoid or span conductors over sensitive environmental areas (e.g., wetlands, streams, steep slopes). However, overhead lines require relatively wide ROWs, within which certain land uses and tall-growing vegetative community types are precluded.

Taking these issues into account, the following criteria were given primary consideration in evaluating the selection of an overhead transmission line route for the Connecticut segment of the new Project facilities.

- **Availability of Existing ROW for the New Line to Follow**. The potential collocation of the 345-kV transmission line along existing ROWs (e.g., transmission lines, highways, railroads, pipelines), where linear uses are already established, was a primary routing consideration. Using CL&P design standards, an entirely new 345-kV overhead line would require a minimum 150-foot-wide ROW, based on a horizontal line configuration using H-frame structures. The placement of the same 345-kV line on an existing corridor (parallel to existing transmission lines) may entail a lesser expansion of an existing ROW or may not require any additional ROW at all. Use of an existing available ROW minimizes both environmental impacts and Project cost.
- **Engineering Considerations.** Whether on existing or new ROWs, the length of the route and constructibility issues must be considered. These include the ability to avoid or minimize the location of transmission structures along steep slopes or embankments, in areas of rock outcroppings, or within environmentally sensitive areas, such as wetlands. Engineering requirements for crossing streams, railroads, and other facilities also must be assessed. These considerations are important determinants of cost and, in many cases, environmental effects as well.
- **Avoidance or Minimization of Conflicts with Developed Areas.** Where possible, it is preferable to avoid conflicts with residential, commercial, and public facilities such as homes, businesses and airports. Given the density of development in Connecticut, a primary routing concern was to minimize conflicts with residential, commercial, and industrial land uses. In Connecticut, statutory provisions discourage the construction of a new 345-kV overhead line

"adjacent to" certain land uses including residential areas, private or public schools, licensed child daycare facilities, licensed youth camps or public playgrounds.
- **Consideration of Visual Effects.** Structure visibility is a significant public concern. It is desirable to avoid areas of visual or historic sensitivity; to identify designs for minimizing structure height; and to consider the potential impacts associated with having to remove mature trees that presently serve as visual buffers.
- **Avoidance or Minimization of Impacts to Environmental Resources.** In accordance with federal, state, and municipal environmental protection policies, the avoidance or minimization of new or expanded corridors through sensitive environmental resource areas such as parks, wildlife areas, and wetlands is desired.
- **Accessibility.** An overhead line route must be accessible to both construction and maintenance equipment. Although continuous access to all locations along an overhead line route is typically not required, vehicular access to each structure location is mandatory for construction and maintenance.

V.B UNDERGROUND LINE AND SEGMENTS – ROUTE ANALYSIS CRITERIA

The vast majority of transmission circuits in Connecticut and in the United States consist of overhead lines. However, underground transmission cables may warrant consideration when overhead line configurations are impractical or undesirable due to site-specific environmental, social, construction, or regulatory factors.

Compared to overhead transmission lines, an underground cable system requires a narrower ROW, but more continuous disturbance along that ROW. An underground cable system typically requires the excavation of a continuous trench (i.e., environmentally sensitive areas cannot be spanned) and the installation of underground splice vaults, which must be accessible for maintenance purposes. Careful siting is required in order to avoid or minimize significant impacts to environmental resources and other utilities in developed areas as a result of trenching activities, as well as to ensure that the cable is immediately accessible in the event that maintenance is required during the operation of the facility. The largest available underground transmission cables have between 25 percent and 33 percent of the current-carrying capacity of CL&P's standard overhead 345-kV transmission line. As a result, three or four underground cables are required to equal the current-carrying capability of a single overhead 345-kV transmission line.

Given typical cable-system design, installation, and maintenance considerations, the following additional evaluation criteria were considered in the identification and evaluation of potential underground line-route options:

- **Environmental Considerations.** Whereas an overhead transmission line can span steep slopes, rock outcroppings, greenery/vegetation, wetlands, and watercourses, an underground cable route must be excavated through or placed beneath such resources. Steep terrain poses serious problems for underground cable construction and may cause down-hill migration and overstressing of the cable and splices (the point where two cables are physically connected together). Underground construction requires access to every foot of the route for trenching equipment and for trucks delivering ductwork, splice vaults, backfill, concrete, cable and other heavy construction materials and equipment. After construction is complete, road access along the entire cable route must be maintained in order to provide entry should there be a cable failure that requires repair work. Because cable installation requires continuous trenching, the use of existing transmission gas pipeline ROWs and railroad corridors could result in potential effects to wetlands, watercourses, cultural resources, soils, and other environmental resources located within or adjacent to such areas. Similarly, compared to overhead line construction, blasting is more likely to be required to install underground cable systems through areas of shallow depth to bedrock. Consequently, existing road corridors, which typically are relatively level and avoid most natural resource impacts, are usually considered for the installation of underground cables where existing overland ROWs are not suitable for that use. In evaluating underground cable-routes, the environmental objective is to minimize, where possible, underground cable installation through environmentally sensitive areas, water crossings, and cultural resources.

- **Availability of Useable ROW.** A new 345-kV underground line typically requires a 40-foot-wide work area for construction; this includes a 15-foot-wide permanent easement[4] and a 25-foot-wide temporary construction area. In addition, land must be available for burying splice vaults, each approximately 10 feet wide by 10 feet deep and up to 32 feet in length. Such vaults, which must be placed at approximately 1,600-foot intervals along the cable route, are required to allow the individual cable lengths to be spliced together.
- **Engineering Considerations.** One of the primary engineering objectives for an underground cable is to identify routes that are relatively straight, direct, and have gradual slopes to minimize construction and maintenance costs, and to avoid downhill cable migration.
- **Social Considerations.** The social objective is to minimize, where possible, the length of cable installation through residential areas and central business districts due to the potential for significant impacts to residents and businesses and general traffic disruptions during construction, as well as the potential for conflicts with other in-ground utilities.
- **Land Availability for Line Transition Stations.** Unless terminated at a substation, 345-kV underground transmission systems require above-ground transition stations at locations where the underground cables must interconnect to overhead transmission lines. Such transition stations require approximately two to four acres of fenced and graded area, depending on topography, equipment, and other site-specific factors, and consist of above-ground facilities within a fenced area, similar in appearance to a transmission substation. The potential of terminating underground line segments at substations and, if transition stations are required, the availability of land, surrounding land uses, and potential effects on natural resources and the visual environment in these required locations must be considered in evaluating potential underground options.
- **Technical Considerations.** Several technical issues are evaluated when considering an underground transmission cable system. Unlike overhead lines, underground 345-kV cable systems draw significant capacitance charging currents and have lower capacities unless multiple cables are employed. When more cables are employed to make up for the capacity difference, this adds to the capacitive charging currents. For most underground 345-kV cable systems, special switching devices and large shunt reactors are required to compensate for the capacitive charging of the underground cables so as to prevent unacceptably high system voltages during normal operating conditions. These devices add operating complexity, decrease system reliability, require additional land, and add appreciable cost to the Project.

[4] Understreet construction would not require permanent easements.

Transition Station Site Selection Criteria

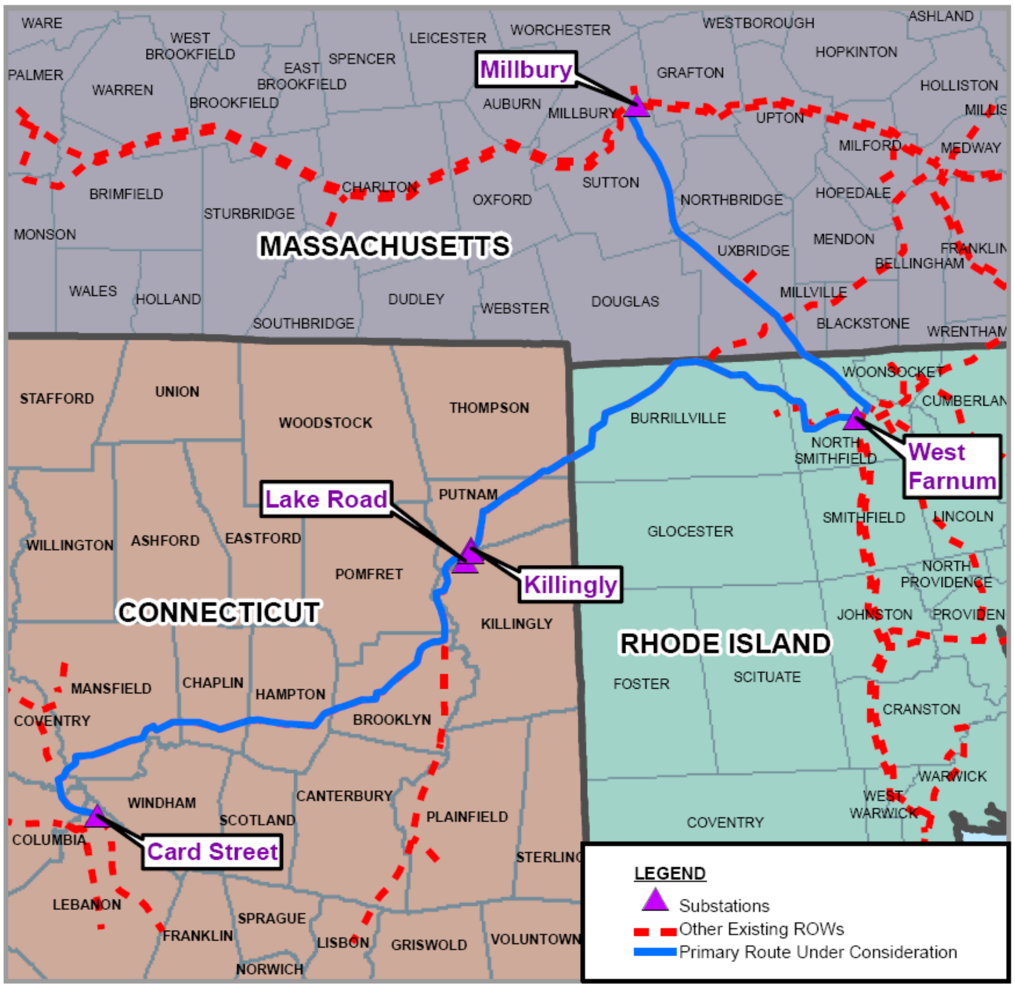
Certain underground line-route variations have been identified to date for segments of the Project. A crucial element of any underground cable variation is the need for adequate land at both ends of the cable system for the development of "transition stations" that are required to accommodate the interconnection of the underground cables with overhead transmission line components. Depending on specific condition and equipment requirements, transition stations will require two to four acres of fenced land area. Similar to electrical substations in appearance, a number of criteria were considered in the siting of potential locations for transition stations. These criteria include:

- **Minimize Underground Line Construction Between Transition Stations.** As underground line construction options were developed to address specific issues, it was generally desirable to keep underground construction to the least amount necessary to respond to the issue of concern. As such, transition stations were sited so as not to unduly lengthen the amount of underground line construction.
- **Availability of Existing ROW and CL&P Property**. In order to avoid conflicts with existing and adjacent land uses and to minimize any new land requirements for the proposed transition stations, preference is given to property owned or under easement by CL&P. Such areas included existing substations, transmission line ROWs, and other property along existing ROWs owned by CL&P. In some instances, transition stations may not be located completely on CL&P property. However, efforts would be made to minimize new land requirements by configuring the transition station so as to maximize the portion within CL&P property or existing ROW. Where location of cables and ducts, vaults, or above-ground transition stations within a ROW is not feasible, CL&P would likely have to acquire additional rights from the fee owner in order to construct them.
- **Consideration of Visual Impacts**. Structure visibility is a significant public concern. It is desirable to avoid areas of visual or historic sensitivity, consider the potential impacts of removing trees that provide screening, and identify areas providing natural screening between a potential transition station site and observation points, such as roads or residences.
- **Avoidance or Minimization of Impacts to Environmental Resources**. In accordance with federal, state, and municipal environmental protection policies, the avoidance or minimization of potential effects on parks, wildlife areas, wetlands, historic resources, or other areas of environmental concern is a priority.
- **Accessibility**. A transition station must be accessible for construction, operation, and maintenance. Locations that avoid or minimize steep slopes, embankments, rock outcroppings, environmentally sensitive areas, or distance from existing all-season roads are preferred. These considerations may also impact the cost and environmental impacts of a transition station.

V.C USE OF ROUTING OBJECTIVES AND CRITERIA TO IDENTIFY THE PRIMARY ROUTE UNDER CONSIDERATION

As previously described, the NUSCO and National Grid system planners first determined that the preferred solution to the identified interstate transfer problems would be to construct new 345-kV lines that would connect CL&P's Card Street Substation and Lake Road Substation to National Grid's West Farnum Substation in Rhode Island and Millbury Switching Station in Massachusetts, together with associated improvements to the 345-kV and 115-kV facilities in Massachusetts, Rhode Island, and Connecticut. There are existing ROWs between these substations (see Figure V-1). NUSCO and National Grid project planners then determined that the existing ROWs could accommodate a new 345-kV line, for the most part without expansion of the width of the ROW.

Figure V-1: Card Street-West Farnum-Millbury 345-kV Line Route on Existing ROWs



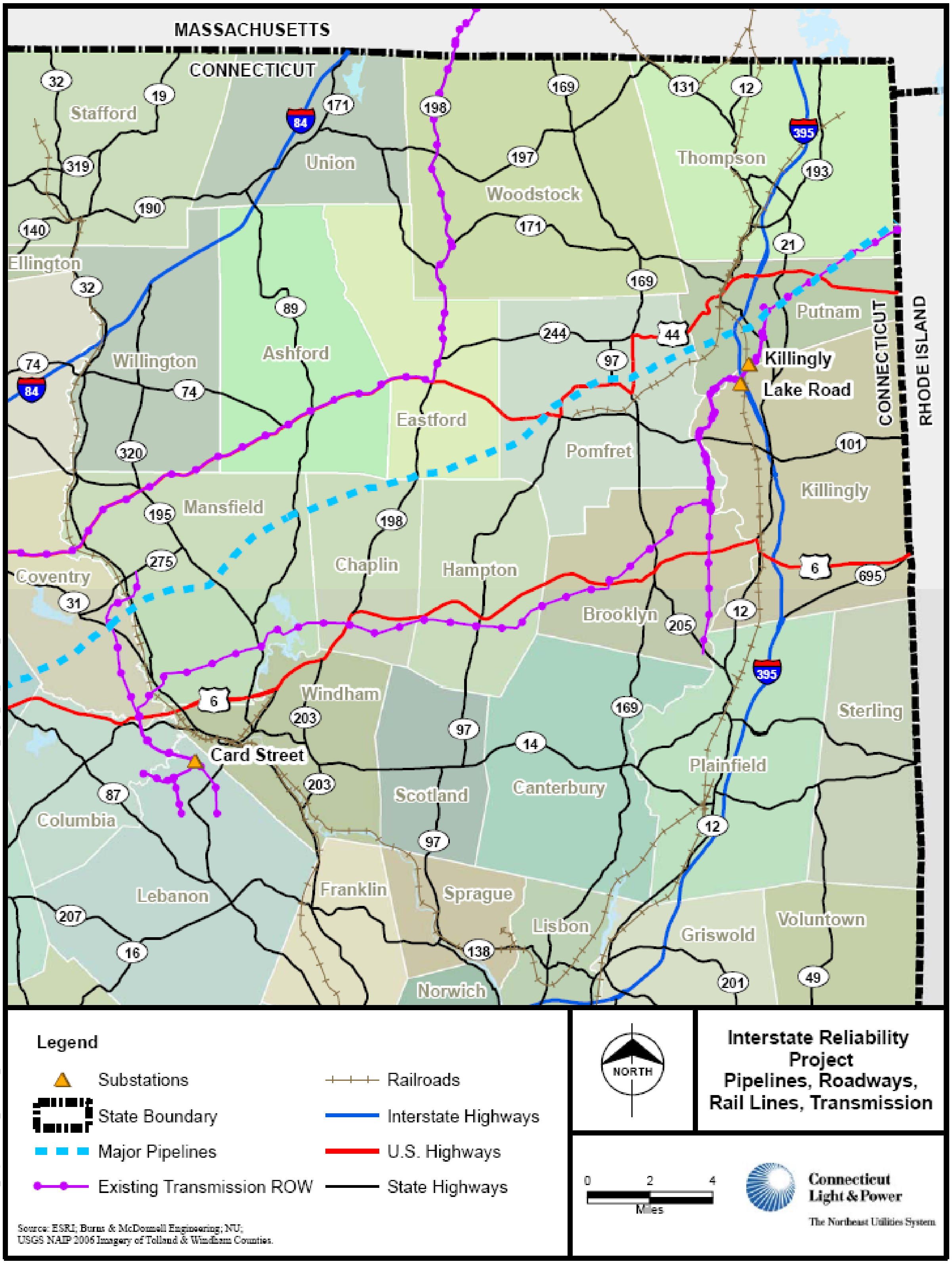
The Connecticut segment of this route is described in detail in Sections VI and VII of this volume, and a summary of the environmental evaluation of that segment is set out in Sections VIII and IX and in Volume 2.

Before selecting the Primary Route Under Consideration, Project planners considered whether there were any potentially superior routes. Therefore, they conducted preliminary evaluations of various potential routes or route segments using a combination of field reconnaissance, aerial photography review, and baseline data interpretation. The alternative routes that were investigated included both overhead and underground/under-street transmission line alignments. While several of the alternatives investigated were retained in whole or in part for further consideration and evaluation, most were found to be unsuitable for 345-kV transmission line development based on unacceptable engineering constraints or unacceptable levels of potential environmental, social, or economic impacts. The following sections describe the routes in Connecticut that were considered and eliminated in that preliminary evaluation.

V.C.1 Overhead 345-kV Transmission Line Routes in Connecticut Considered But Eliminated

Overhead construction of the proposed Project would require a width of approximately 150 feet on a new ROW, or about 90 feet to 100 feet of additional width on an existing ROW with a single 345-kV line supported on H-frame structures. The new line would require installation of structures generally ranging from 65 to 140 feet in height, depending on topography and final structure selection and design. Based on these line characteristics, CL&P evaluated a number of alignment options for the Project, including the consideration of both entirely new ROWs and the alignment of the transmission line adjacent to a variety of existing ROWs (e.g., natural gas pipelines, railroads, highways). The following options for overhead line construction were considered and evaluated:

Figure V-2: Pipeline, Highway, Roadway, Rail Line, and Transmission Line ROWs



V.C.1.1 New Corridor Options

These options included potential alignments, at least in some part, along entirely new ROW ("greenfield" corridors) not within or adjacent to any existing linear ROW. An entirely new corridor for a single 345-kV overhead transmission line would require a minimum 150-foot ROW if H-frame structures were employed. The development of an overhead 345-kV transmission line along an entirely new corridor was found to be impractical in many areas due to residential development, potential private property impacts, and adverse social and environmental effects. However, a number of options using at least some new corridor were identified and retained for further investigation. In general, these options use substantial portions of the existing CL&P ROW between Card Street Substation and Lake Road Substation while creating shorter overall routes that would avoid potential constraints (e.g., restricted ROW, Statutory Facilities, etc.) along the existing ROW (See Section VI.C).

V.C.1.2 Pipeline ROW Options

Route options along the Algonquin Gas Transmission Pipeline ROW across the northern portion of the study area were identified and considered (Figure V-2). Options along the pipeline were subsequently eliminated for the following reasons:

- The narrow width of the pipeline ROW (approximately 50 feet) substantially reduces the benefits associated with location of the transmission line along the pipeline as no sharing of ROW would be possible. The entire 150 feet of ROW would still be required, resulting in substantial acquisition of new ROW.
- Numerous homes are located near the pipeline ROW. The proximity of these homes to the pipeline ROW, along with the ROW requirements would require acquisition of a substantial number of homes.
- Extensive vegetation removal would be required in order to meet minimum clearance requirements for conductors and to provide access to each structure site for construction and maintenance.

V.C.1.3 Limited-Access Highway Options

These options would involve the alignment of the proposed 345-kV overhead transmission line either within or near existing limited-access highways. In order to locate any part of the line within the Interstate 84 highway ROW, CL&P would have been required to obtain the consent of the Connecticut Department of Transportation (ConnDOT), pursuant to ConnDOT's "Policy on the Accommodation of Utilities on Highway Rights-of-Way." This policy does not allow longitudinal installation of transmission lines unless it is not feasible to accommodate them elsewhere. Although a portion of U.S. Highway 6 west of Windham is limited access, the only fully limited-access highway located within the study area is Interstate 395 and this highway does not extend along the path that would allow for a new transmission line between the Card Street Substation and the Connecticut/Rhode Island border. However, a route variation that would utilize a portion of Interstate 395 was considered. This route option would be approximately 6 miles in length and would extend from Lake Road Substation along Route 395 near Route 6 in Danielson. This north-south route variation would be located in the eastern portion of the study area and would not provide a connection between the Project endpoints and therefore would not meet the Project objectives.

V.C.1.4 Public Road Options

These options would involve the alignment of the proposed 345-kV overhead transmission line either within or near existing public roadway ROWs. The principal roadways that are aligned in the general direction required for the Project are:

- U.S. Highway 6 - extending from Willimantic eastward through Brooklyn and Danielson and beyond
- Brooklyn Turnpike - extending from near Windham, southeast of Willimantic, and connecting to U.S. Highway 6 near the Town of Brooklyn

These roadways (Figure V-2) provide extended corridors that could be followed by the proposed 345-kV transmission line. Additional local, state, and interstate roadways are present but they are not direct, which results in routes winding through the area using sections of numerous roads, increasing project length, complexity, and cost.

The investigation of the roadway corridors was based on construction feasibility and potential social impacts. The primary determinant of construction feasibility was adequate space for the transmission line ROW. Investigations showed that substantial residential development occurs near these roadways. Most homes and businesses are within 200 feet of the roadway. As a result, numerous homes and business would likely need to be acquired to accommodate a new overhead line ROW. Location of an overhead 345-kV transmission line along these roadways would also result in conversion of substantial amounts of front yards into utility ROW and substantial removal of large, mature shade trees.

Proximity to the line and its visual impact for local residents would be significant if a new overhead transmission line were sited along existing roadways. While overhead distribution lines and telephone lines can be configured to follow such winding roads, high voltage transmission lines, which are designed for mostly straight-line and longer-span construction would be difficult to construct along winding roads. Additionally, transmission line structures may need to be taller along roadways to maintain conductor clearances over existing distribution and telephone lines. Overall, the social effects (traffic, noise, dust, etc.) associated with construction and operation of a new overhead line along roads in the study area were considered unreasonable, and these options were dropped from further consideration.

V.C.1.5 Railroad Options

Multiple railroad lines cross eastern Connecticut (Figure V-2). These railroad lines are owned and operated by the Providence & Worcester Railroad and New England Central Railroad and generally run in a north-south direction through the study area. While portions of these railroad lines can be combined with other routes to create a continuous corridor connecting the Card Street Substation and Lake Road Substation, extensive use of the existing railroad corridors for an overhead line is impractical for the location of the proposed 345-kV transmission line for several reasons. There is no direct all-railroad ROW alignment, and any transmission line route along an existing railroad ROW would be much longer than other routes under consideration, increasing construction, operation, and maintenance costs. Additionally, there is insufficient width alongside portions of these railroad corridors for a new ROW where a new overhead 345-kV transmission line could be safely installed and operated. Thus, acquisition of additional property and numerous adjacent homes and businesses would be required.

Given the significant amount of development near the railroad lines, their narrow ROWs (50 to 100 feet), and the excessive route length involved with using an all-railroad alignment between Card Street Substation and Lake Road Substation, this option was determined to be environmentally, socially, and economically impractical. While short portions of railroad lines in the study area, particularly in the Willimantic and Danielson areas, were evaluated in conjunction with other overhead or underground line-route opportunities, the use of railroad line corridor extending continuously from Card Street Substation to Lake Road Substation was dropped from further consideration.

V.C.2 All-Underground Route Considered But Eliminated

While overhead circuits are the reliable method for delivering power over long distances (and usually the most economic method), CL&P also considered underground cable options for the Connecticut portion of the Project – both an all-underground line route and hybrid overhead – underground line routes.

CL&P considered an all-underground 345-kV transmission solution notwithstanding that an addition of long lengths of underground 345-kV cables to a transmission system can have several adverse effects on the safe and reliable operation of the transmission system. Some of these concerns are as follows:

Technical Considerations

- Alternating current transmission cables have typically been applied for short distances in urban environments, which characteristically have very strong electrical sources. Where long lengths of underground extra high voltage cables are installed in suburban or rural settings, which usually are remote from strong sources, the large amounts of cable charging associated with the long cable lengths, combined with moderate system strength relative to the cable-charging currents, require careful consideration to prevent damage and disruptions to the transmission system and potential damage to customer equipment. Proposed extra high voltage cable installations must therefore be carefully analyzed by power-system engineers, taking into account the design limitations of the cables and substation equipment at the cable terminations.
- Underground 345-kV cables have much lower current-carrying capability compared to typically sized overhead 345-kV transmission line conductors. At 345-kV, to achieve the same power-transfer capacity as an overhead transmission line, multiple underground cables must be installed (three or more).
- Due to the electrical characteristics of the insulations employed in all designs of underground transmission cables, and the proximity of the cables to each other when buried, the capacitive charging currents of an underground cable system are significantly higher than that of overhead lines. For most medium and long length underground 345-kV transmission systems, special switching devices and large shunt reactors are required to compensate for the capacitive charging of the underground cables so as to prevent unacceptably high system voltages during normal operating conditions. These devices add operating complexity, decrease system reliability, require additional land, and add appreciable cost.
- When underground cables are installed in isolated segments of an overhead 345-kV transmission circuit a transition station must be installed at the location where the overhead transmission line conductors are connected to the underground cables. Within the transition station, switching equipment to isolate the underground cables from the overhead line conductors and large shunt reactors may be installed, depending upon the underground cable segment's location in the circuit and its length. It is expected that the Rhode Island portion of the Project will be all overhead. Therefore, for an all underground Connecticut segment, a transition station would be constructed in Connecticut near the Rhode Island. For any overhead/underground hybrid line route, transition stations would be required anywhere the line converts from overhead to underground at locations away from a substation.
- When transmission lines or transformers are switched in a transmission system which has a combination of overhead line and underground cable circuits, potential problems can arise because of traveling wave reflections. Switching transient voltages traveling along a line will reflect at points of characteristic impedance change, such as where an overhead line and an underground cable are connected one on one. The voltage reflections can lead to excessive voltages which could damage the cable itself or other electrical equipment associated with the overhead transmission system.
- System engineers need to be concerned with the magnification of harmonic voltages and currents, which are predominately generated by customer loads and during the energization of three-phase transformers. System harmonic resonances arise for applications of longer cables where the transmission system's local strength is moderate relative to the cable charging currents. Low-order harmonic resonances can cause system failures, including cascading outages, and damage to equipment, including power transformers. Daily switching events, like the energization and de-energization of transmission circuits and transformers that occur in the normal operation of the transmission system, can cause amplification of harmonic voltages and currents that can lead to system component failures and severe power-quality problems. The amplified harmonic voltages and currents propagate down to the customer level, and can have a detrimental effect on customer

equipment and processes. A standard developed by the Institute of Electrical and Electronics Engineers (IEEE) establishes the maximum levels of harmonic voltages and currents that are allowed to exist on the transmission system at different voltage levels to ensure that electric utility and customer equipment and processes are not subject to damage.

- Because of these technical considerations and the lower electrical impedance of cables, detailed 60-Hertz (Hz) and harmonic transient voltage studies would have to be conducted by planning engineers to determine the maximum length of 345-kV underground cables that could be installed at any location on the transmission grid without adversely affecting the New England transmission system.

Transmission System Operational Considerations

- The operation of an all-underground 345-kV cable transmission circuit, or a hybrid line combining an overhead 345-kV transmission circuit with one or more underground segments, introduces transmission system operational complexity. When a long underground cable circuit or segment is initially energized, even though it may not be carrying any load, all associated shunt reactors need to be energized to maintain voltages within acceptable levels. When the underground cable circuit starts to carry load, the voltage on portions of the system will instantaneously drop until a sufficient percentage of shunt reactors can be disconnected. If the shunt reactors are not sized properly, or the steps in which a shunt reactor’s impedance is changed are too large, unacceptable voltage swings can occur on the system.
- At normal loading, typically only about one-third of the shunt reactors necessary to maintain the voltages at the terminals of the underground cable circuit within acceptable levels may be in-service. For some contingencies on the interconnected transmission system, current flow through the underground cables may instantaneously drop to nearly zero. Because only a portion of the shunt reactors are in-service and the remaining portion of the shunt reactors cannot be connected instantaneously to increase their compensation for the capacitive charging of the cables, voltages could rise to unacceptably high levels within portions of the transmission system. Unlike an all-overhead transmission system, when long underground cables are present, system operators must be thoroughly trained on the sequential steps that must be followed when placing a system element in-service or removing it from service and the interdependence of their actions on the transmission system to ensure that voltages remain within acceptable levels. In critical or emergency situations, the time required to perform these crucial operating steps could be detrimental to the integrated transmission system.

System Reliability Considerations

- When an outage occurs on an all-underground transmission circuit or a combination overhead – underground transmission circuit, it will take a significantly longer time to locate the faulted segment of cable before repairs may commence. Transmission circuits with multiple short underground sections further complicate and extend the time it takes to locate precisely where within the overhead or underground cable segment the problem exists. Once located, repair times on the underground cable segment can take weeks to complete, as compared to hours for most overhead transmission line failure modes. Historically, most underground cable-system failures are associated with cable-splice failures or with termination equipment. The long outage of the transmission circuit negatively impacts system operations and reduces the overall reliability of the transmission system.

Cost

- CL&P determined that an all-underground line from the Card Street Substation to West Farnum Substation or from the Card Street Substation to the Connecticut/Rhode Island border would, if it were electrically feasible at all, have to be comprised of a minimum of three cable systems. Each cable system would likely be comprised of three XLPE cables, each having a continuous rating of approximately 600 MVA. HPFF cable systems of similar capacity could be employed, but these cables have much higher capacitive charging requirements and large volumes of a pressurized insulating fluid that could leak if their steel-pipe housing were punctured or corroded. As a planning grade estimate, the per-mile installed cost of such 345-kV underground cable systems would be in the range of $33 to $35 million, as compared to $3.5 to $4.5 million for a mile of overhead line that it would replace. In addition, given the long length of the line (37 plus miles to the Connecticut/Rhode Island border), shunt reactors at a cost of approximately $2 million each would likely have to be installed at a number of transition station locations along the transmission line. Finally, each transition station would cost between $13 and $14 million.

V.C.2.1 Underground Routing Alternatives

CL&P considered the following potential routes for an all-underground cable circuit between the Card Street Substation and the Connecticut/Rhode Island border. One route option involved the development of the proposed underground transmission circuit along a new ROW (sometimes referred to as a "greenfield" route), not within or adjacent to any existing transmission or distribution line ROW. An entirely new corridor for a new cross-country (non-street) underground transmission cable circuit would require a 15-foot-wide permanent easement and an additional 25-foot temporary construction work area.

V.C.2.1.1 Installation Along Existing Overhead Transmission Line ROWs

This underground line-route option would involve use of CL&P's existing overhead line ROW (Figure V-2) continuously between the Card Street Substation and the Connecticut/Rhode Island border for underground construction. Although the existing easement is wide enough to accommodate underground line construction, this route was determined to be impractical due to physical constraints that would adversely impact construction, operation and maintenance of the proposed transmission line. These physical constraints include:

- Rough terrain including steep slopes, embankments, rock outcroppings, and swamps that would make trenching difficult
- Long and/or steep grades that could cause overstressing of the cable and cable splices
- Excavation through rock that would require slow and costly mechanical removal or special provisions for blasting
- Long waterway crossings and wetlands would require slow and costly trenchless cable-installation technologies
- Maintaining continuous access roads along the underground cable route for installation of the duct bank, and splice vaults, and for cable pulling equipment and future cable maintenance
- Increased impacts on wetlands and cultural resources

V.C.2.1.2 Limited-Access Highway Options

Interstate 395 is the only fully limited-access highway in the study area. The highway traverses north-to-south through the eastern portion of the study area. An underground cable-route option along Interstate 395 was investigated. This route option would be approximately 6 miles in length and would extend from Danielson in the Town of Killingly to Lake Road Substation. For the limited-access highway option, it was assumed that the underground cables would not be placed directly under the pavement, to avoid traffic disruptions during construction or future maintenance.

The use of Interstate 395 was determined to be infeasible for several reasons, including the ConnDOT policy of not allowing the collocation of transmission lines within and parallel to the ROWs of any controlled-access highway. In addition, certain physical constraints adversely impact the feasibility of constructing the underground cable system parallel to the highway. These constraints include:

- Safety of motorists and construction workers
- Steep sideslopes, embankments, and elevated portions of the highway that would make trenching difficult
- Excavation through rock that may require closure of the highway for blasting
- Long waterway crossings and wetlands
- Traffic delays that would be caused during construction or future maintenance

V.C.2.1.3 Public Road Options

Public road options would involve an alignment of the 345-kV transmission cables underground within existing road ROWs. The Project area encompasses a network of state and municipal roads. The public road options that traverse in the southwest – northeast direction required for the Project are:

- U.S. Route 6 - extending from Willimantic eastward through Brooklyn and Danielson and beyond
- Brooklyn Turnpike - extending from near Windham, southeast of Willimantic, and connecting to U.S. Route 6 near Brooklyn

In addition, underground line routing options along portions of certain municipal roads were considered.

The analysis of potential public road ROWs as routes for an underground cable system was based on construction feasibility (i.e., space for cable installation) and potential environmental and social impacts. Installation of an underground 345-kV cable system would require a minimum width of 40 feet. Steep side slopes, shallow depth to bedrock, and large wetlands/water resource crossings were considered major construction limitations. The major social constraints were the availability of adequate ROW without having to displace homes or businesses located adjacent to the road ROWs, as well as the availability of space to install the cables without having to affect private property. The potential traffic effects (e.g., availability of detours, capability for maintenance of traffic flow during in-road cable installation) also were considered. For the purposes of this routing analysis, it was assumed that the underground cable facilities (cables and splice vaults) would be located within developed portions of road ROWs (e.g., beneath the paved travel lane or road shoulder).

Roads throughout the study area were investigated as potential underground cable-route options. A number of roadway sections were eliminated as potential routes due to engineering, environmental, social, and economic factors and no feasible options were identified for routing the transmission line entirely underground within road ROWs. However, portions of certain road ROWs were determined to be feasible for the location of an underground transmission cable system and these were retained for further investigation (See Section VI.C).

V.C.2.1.4 Railroad Options

Multiple railroad lines (Figure V-2) cross eastern Connecticut. For the same reasons discussed previously for potential overhead lines, the installation of an underground cable system using only existing railroad ROWs was rejected because it is not constructible, and would in any case be environmentally, socially, and economically unacceptable. However, short sections of railroad ROWs in the study area, particularly in the Willimantic and Danielson areas, were retained for evaluation as route-segment options (in conjunction with other overhead or underground line routing opportunities). These were later dropped from consideration for the same reasons use of an all-railroad route was determined unacceptable.

V.C.2.1.5 Routing Summary

After taking into consideration the length of the line and construction impacts, the development of an underground transmission facility along an entirely new corridor was determined to be impractical. Off-roadway issues, such as accessibility for construction and future maintenance, steep slopes, wetlands, designated natural areas, and the costs of acquiring a new easement are of significant concern. Combined with technical considerations, these issues present insurmountable barriers for a long underground 345-kV cable system. To qualify for approval by the Council, an underground cable system and route must be "technically, environmentally, and economically practical." For this Project, no route that was entirely or largely underground would pass that test. The underground cable circuit option, while feasible for short segments, was determined to be impractical for the entire length of the Project.

With the myriad of technical and operational concerns associated with an all-underground line between the Card Street, Lake Road and West Farnum Substations, or between Card Street Substation, Lake Road Substation and a transition station at the Rhode Island/Connecticut border, a 37-plus-mile 345-kV underground cable circuit, comprised of multiple cable systems, would be significantly inferior to an overhead transmission line, and may not be technically practical at all. The ability to effectively and efficiently operate an underground 345-kV cable circuit of such a length with its inherent technical issues: cable charging, transient and harmonic overvoltages, switching overvoltages, under- and over-voltage swings associated with the operation of reactive compensation shunt reactors and the length of time required to make repairs following a failure raise substantial concerns and collectively may never be overcome. However, other factors – primarily cost, routing, and constructibility issues – by themselves support CL&P's decision to remove an all-underground line from consideration before undertaking the time-consuming, complex, and costly testing that would be required to establish whether or not such a line would be electrically feasible.

VI. DETAILED DESCRIPTION OF CONNECTICUT PORTION OF THE PROJECT AND POTENTIAL ROUTE VARIATIONS

This section of the filing provides a closer look at the Primary Route Under Consideration for new 345-kV transmission lines from Card Street Substation to Lake Road Substation and from there to the Rhode Island border that would comprise the Connecticut portion of the Project (including improvements to existing lines and substations), and potential variations of the Primary Route Under Consideration to address specific areas of potential concern. The loop of Manchester to Millstone 310 line into Card Street Substation (310 Line Loop) and substation modifications required as part of the Project are also discussed. The fully escalated cost of the Connecticut portion of the Project is approximately $251 million[5].

VI.A PRIMARY ROUTE UNDER CONSIDERATION

Figure VI-1 shows the Connecticut portion of the Project along existing CL&P ROW from the Card Street Substation to Lake Road Substation to the Rhode Island state border, which currently supports one existing 345-kV line with connections to the Lake Road and Killingly Substations. With the exception of two locations where this existing ROW crosses Mansfield Hollow Reservoir and the Mansfield Hollow State Park for an aggregate distance of slightly under 1.5 miles, the existing ROW contains vacant area suitable for construction of the proposed adjacent 345-kV transmission line.

In addition, the Connecticut portion of the Project would include improvements to substations and to other lines. The following text summarizes the characteristics of the Primary Route Under Consideration for new 345-kV line sections and necessary modifications to certain other facilities.

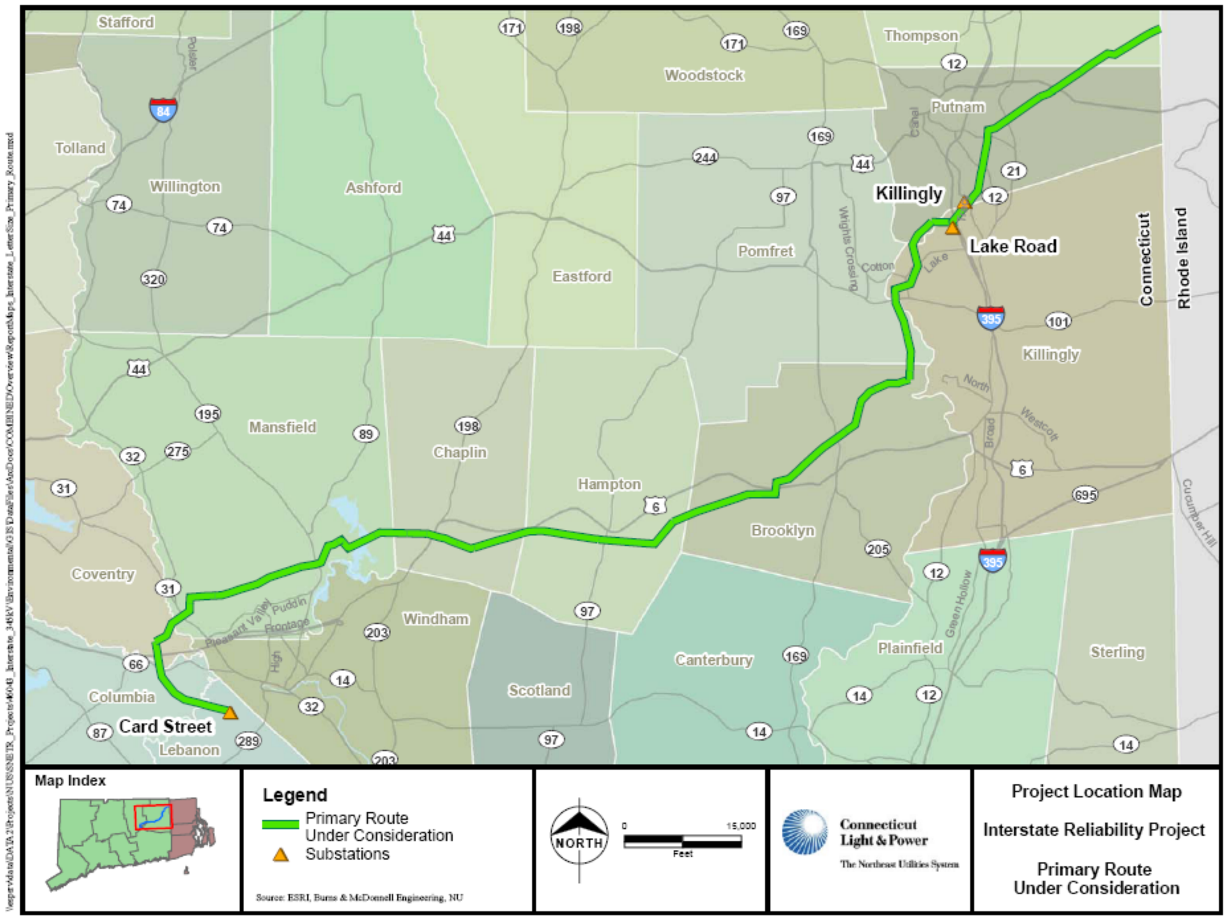
Principal Features of the Primary Route Under Consideration

- Total length of the route is 36.8 miles
- Existing ROW width generally varies from 150 to 400 feet
- Existing ROW predominantly supports one existing 345-kV circuit, mostly on wood-pole H-frame structures with a typical height of 80 feet, with some taller steel-pole structures in limited areas
- No additional ROW is required except for 1.5 miles in the Mansfield Hollow area, where an existing 150-foot wide ROW may be expanded by up to 150 feet.
- The proposed support structures for the new line would be steel- or wood-pole H-frames with a typical height of 85 to 90 feet

[5] The total cost of the Project is $460 million. See the *Solutions Report* in Volume 4

- Taller steel monopoles could be considered to minimize the ROW expansion in the Mansfield Hollow area and to support reduced magnetic field line designs adjacent to Statutory Facilities.
- None of the existing line structures are to be removed
- New line structure placement along the ROW would be adjacent to existing line structure locations as much as possible

Figure VI-1: Primary Route Under Consideration



VI.A.1 Transmission Line Structure Design

The existing ROWs on which CL&P proposes to install the new 345-kV overhead line all presently contain an existing 345-kV CL&P transmission line, supported for the most part by wood-pole H-frame structures ranging in height from 66 feet to 103 feet (above ground). In a few sections, the existing circuit is supported by steel monopoles ranging in height from 106 feet to 137 feet (above ground). Table VI-1 provides detailed information concerning the existing ROW and structures.

CL&P is considering installing the 345-kV transmission line on three different types of structures. The basic structure type would be wood- or steel-pole H-frames, with heights ranging from 65 to 140 feet, which would be visually compatible with the most common structures already on the ROW, thereby reducing the visual “clutter” associated with multiple structure types. CL&P will also consider using steel monopoles in specific areas, as follows:

- Steel “delta configuration” monopoles averaging 130 feet in height (Mansfield Hollow Reservoir)
- Steel “vertical configuration” monopoles averaging 125 feet in height at the Lake Road Substation
- Steel “vertical configuration” monopoles averaging 125 feet in height for the 310 Line Loop.
- Steel three-pole deadend structures averaging 90 feet in height at line angles
- Steel monopoles of a height to be determined (but likely more than 120 feet), if the Council determines that reduced magnetic field line designs should be constructed near Statutory Facilities

Typical structure heights listed above are based on lines over flat terrain. The actual height of each structure is dependent upon its location, span lengths, and the topography along the route. The primary characteristics of each type of structure, and the typical ROW configuration for lines using each type, are depicted on the cross-section drawings in Volume 5. Table VI-1 summarizes the typical structure types and ROW requirements along each portion of the Primary Route Under Consideration, as currently proposed. The Council will determine the locations and design configuration of any line sections where magnetic field levels should be reduced in accordance with the Council’s Electric and Magnetic Field Best Management Practices for the Construction of New Electric Transmission Lines in Connecticut (December 14, 2007). To assist the Council in this determination, CL&P will submit a Magnetic Field Management Design Plan to the Council. A copy of the Council’s EMF Best Management Practices document is included in Volume 4 of this municipal consultation package.

Steel poles can be furnished either in galvanized or self-weathering finishes. Specifics concerning pole finish will be determined after a final route for the Project is certified, during the preparation of the detailed Development and Management (D&M) Plan, which the Council will require for the Project.

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Table VI-1 Primary Route Under Consideration: Summary of Characteristics (above ground)

Transmission Line By Cross-Section (Municipality)	Approx. ROW Mileage	Existing Line Configurations and Typical ROW Width: Typical Structure Type and Height	Typical ROW Width (feet)	Proposed 345-kV Line Reference Case Configurations and Typical ROW Width: Typical Structure Type and Height	Typical ROW Width (feet)
XS-1 (Lebanon, Columbia & Coventry)	2.8	One 345-kV circuit supported on wood- or steel-pole H-frame structures, heights vary, ranging from 66 to 119 feet (above ground), with a typical height of 80 to 85 feet (above ground). Two 69-kV circuits, both supported on self-supporting steel monopoles, heights vary, ranging from 72 to 115 feet (above ground) with a typical height of 93 feet (above ground).	350	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 75 to 140 feet (above ground), with a typical height of 85 to 90 feet (above ground). Structures would be installed between the existing 345-kV and 69-kV circuits.	350 (No additional ROW required)
XS-2 (Coventry & Mansfield)	5.6	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 59 to 90 feet (above ground), with a typical height of 75 to 80 feet (above ground).	300	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 65 to 125 feet (above ground), with a typical height of 85 to 90 feet (above ground).	300 (No additional ROW required)
XS-3 (Mansfield Hollow Reservoir, Mansfield)	1.0	One 345-kV circuit supported on tubular steel monopole structures, heights vary, ranging from 106 to 137 feet (above ground) with a typical height of 115 to 120 feet (above ground).	150	Install one 345-kV circuit on steel self-supported monopoles, heights vary, from 115 to 145 feet, with a typical height of 130 feet (above ground).	300 (up to 150 feet of additional ROW required)
XS-4 (Mansfield & Chaplin)	0.8	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 68 to 103 feet (above ground), with a typical height of 80 to 85 feet (above ground).	300	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 75 to 140 feet (above ground), with a typical height of 85 to 90 feet (above ground).	300 (No additional ROW required)
XS-5 (Mansfield Hollow State Park, Chaplin)	0.5	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 73 to 81 feet (above ground), with a typical height of 75 to 80 feet (above ground).	150	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 75 to 80 feet (above ground), with a typical height of 75 to 80 feet (above ground).	300 (up to 150 feet of additional ROW required)
XS-6 (Chaplin, Hampton, & Brooklyn)	13.6	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 64 to 102 feet (above ground), with a typical height of 80 to 85 feet (above ground).	300	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 70 to 120 feet (above ground), with a typical height of 85 to 90 feet (above ground).	300 (No additional ROW required)
XS-7 (Brooklyn, Pomfret & Killingly)	2.3	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 66 to 95 feet (above ground), with a typical height of 80 to 85 feet (above ground). Two 115-kV circuits supported on wood-pole H-frame structures, heights vary, ranging from 51 to 86 feet (above ground), with a typical height of 68 feet (above ground).	360	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 70 to 100 feet (above ground), with a typical height of 85 to 90 feet (above ground).	360 (No additional ROW required)
XS-8 (Killingly & Putnam)	2.6	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 74 to 89 feet (above ground), with a typical height of 80 to 85 feet (above ground). Two 115-kV circuits supported on wood-pole H-frame structures, heights vary, ranging from 51 to 86 feet (above ground), with a typical height of 64 feet (above ground).	360	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 70 to 115 feet (above ground), with a typical height of 85 to 90 feet (above ground).	360 (No additional ROW required)
XS-9 (Killingly)	0.2	Two 345-kV circuits supported on self-supporting steel monopoles, heights vary, ranging from 109 to 150 feet (above ground), with a typical height of 130 feet (above ground).	250	Install two 345-kV circuits on self-supporting steel monopoles, heights vary, ranging from 120 to 135 feet (above ground), with a typical height of 125 feet (above ground).	250 (No additional ROW required)
XS-10 (Killingly & Putnam)	0.7	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 74 to 105 feet (above ground), with a typical height of 85 to 90 feet (above ground). Two 115-kV circuits supported on wood-pole H-frame structures, heights vary, ranging from 51 to 86 feet (above ground), with a typical height of 68 feet (above ground).	400	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 85 to 115 feet (above ground), with a typical height of 100 feet (above ground). Structures would be installed between the existing 345-kV and 115-kV circuits.	400 (No additional ROW required)
XS-11 (Putnam)	1.7	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 72 to 95 feet (above ground), with a typical height of 80 to 85 feet (above ground). Two distribution circuits supported on single wood pole structures, with a typical height of 35 feet (above ground).	340	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 75 to 115 feet (above ground), with a typical height of 85 to 90 feet (above ground). Structures would be installed between the existing 345-kV and distribution circuits.	340 (No additional ROW required)
XS-12 (Putnam & Thompson)	4.9	One 345-kV circuit supported on wood-pole H-frame structures, heights vary, ranging from 63 to 93 feet (above ground), with a typical height of 80 to 85 feet (above ground).	300	Install one 345-kV circuit on steel- or wood-pole H-frame structures, heights vary, ranging from 70 to 100 feet (above ground), with a typical height of 90 feet (above ground).	300 (No additional ROW required)

Note: This page is intentionally left blank.

VI.A.2 ROW Requirements for the Primary Route Under Consideration

The width of the existing ROW along which CL&P proposes to construct the new 345-kV line varies significantly, ranging from 150 feet to 400 feet. The typical ROW widths along different portions of the existing transmission corridor are shown on the cross-section drawings in Volume 5 and summarized in Table VI-1.

CL&P will design the new sections of 345-kV line to minimize the amount of new ROW required. Except for a 1.0-mile crossing of the Mansfield Hollow Reservoir in the Town of Mansfield and a 0.5-mile crossing of the Mansfield Hollow State Park in the Town of Chaplin, no additional ROW width will be needed. Along this segment, up to 150 feet of additional ROW may have to be acquired to accommodate the installation of a 345-kV line (refer to Typical XS-3 and XS-5 in Volume 5). Overall, up to 27 additional acres of land may have to be acquired for the ROW expansion in this area. With the acquisition of this additional ROW, the proposed width of the transmission line corridor will range from 300 to 400 feet.

Much of the new ROW needed is across land owned by the U.S. Army Corps of Engineers (USACE) and leased by the USACE to the Connecticut Department of Environmental Protection (DEP). CL&P would require a voluntary conveyance of additional easement rights from the USACE, with the consent of the DEP.

VI.A.3 Line Voltages, Capacities, and Conductor Sizes/Clearances

The new circuits will be designed for nominal 345-kV operation and will consist of three phases, each of which will consist of a bundle of two 1,590,000 circular mil (1590-kcmil) aluminum conductors with steel reinforcement (ACSR). The circuits will be protected by an overhead lightning shield wire of 19 No. 10 Alumoweld, plus an additional shield wire which will contain optical glass fibers for communications purposes.

The bundled 1,590-kcmil ACSR conductors will provide approximately 2,040 MVA of summer normal line capacity at 345 kV. This is a design choice made to reduce conductor corona, thereby holding audible noise and radio-frequency noise production in wet weather to very low levels. For 345-kV lines, using two conductors per phase, and then using conductors with larger diameters, greatly reduces electric fields, and therefore corona, on conductor surfaces.

Structure locations and heights will be designed so that the space between the lowest 345-kV line conductors and the ground surface will provide for a 29-foot minimum mid-span clearance with the conductors sagging at their maximum allowed temperature.

Different conductor arrangements and/or clearances may be implemented in specific areas near Statutory Facilities, as directed by the Council.

VI.A.4 Access Roads

Continuous access along the existing transmission line ROW is not required for the 345-kV overhead transmission line, although access will be required to each transmission structure location. The types of access required along the transmission line route would depend on the configuration of the transmission facility (overhead or underground).

Access roads are already established along most of the Primary Route Under Consideration. The ROW has been in use for approximately 36 years. Either temporary or permanent access roads may be established during construction, depending on the terrain, environmental features, and the need for permanent access to a particular location. To allow the safe passage of heavy construction equipment, some of these existing roads may have to be improved or extended to reach each new structure sites. Access roads must have appropriate grades, and sufficient width and capacity to support heavy construction equipment such as oversize tractor trailers, cranes, and concrete trucks. Typically, grades must be less than 10 percent.

Access road improvements, if needed, may include removal of vegetation along the road and increasing the width of travel surfaces to between 15 and 20 feet. Access roads may be graveled where streams or wetlands must be crossed; culverts and construction mats may be used or if already present, improved. Erosion and sediment controls will be installed before the commencement of any work on access roads.

CL&P completed a review of existing access roads that lead to the transmission line ROW for the Project. Based on that review, an inventory of possible access roads was prepared. Table VI-2 identifies the local town and city streets, or sites, that may be used for access to the transmission ROW. Included for reference, is the corresponding Sheet Number from the Aerial Segment Photos of Volume 5, which illustrates, via aerial photography, the location of these roadways with respect to the access roads, transmission lines, substations, and transmission junctions. A complete and detailed evaluation for access will be conducted as part of the D&M Plan.

Table VI-2: List of Existing Access Roads Along Primary Route Under Consideration

Town	Map Sheet No.[1]	Existing Access to ROW via the Following Town/City Streets or Sites
Lebanon	1 of 40	Card Street
Lebanon/Columbia	1 & 2 of 40	Baker Hill Road
Columbia	2 of 40	Cards Mill Road
Columbia	2 & 3 of 40	Old Willimantic Road
Columbia	3 of 40	(Route 66) Willimantic Road
Coventry	3 & 4 of 40	Route 6 (Willimantic Road)
Coventry	4 of 40	Babcock Hill Road
Coventry	5 of 40	Flanders River Road
Mansfield	5 of 40	Route 32 (Stafford Road)
Mansfield	6 of 40	Highland Road
Mansfield	7 of 40	Mansfield City Road
Mansfield	8 of 40	Route 195 (Storrs Road)
Mansfield	8 & 9 of 40	Bassetts Bridge Road
Mansfield	9 of 40	Hawthorne Lane
Mansfield	10 of 40	Bedlam Road
Chaplin	10 of 40	Shuba Lane (Not Shown on Map)
Chaplin	11 of 40	Route 6 (Willimantic Road)
Chaplin	12 of 40	Chewink Road
Chaplin	12 of 40	Fiske Road
Hampton	13 of 40	South Brook Street
Hampton	13 & 14 of 40	Parker Road
Hampton	15 of 40	Route 97 (Pudding Hill Road)
Hampton	15 of 40	Cemetery Road
Hampton	15 of 40	South Bigelow Road
Hampton	16 of 40	Drain Street
Brooklyn	18 of 40	Stetson Road
Brooklyn	19 of 40	Windham Road
Brooklyn	19 of 40	Route 6 (Hartford Road)
Brooklyn	19 of 40	Appell Road
Brooklyn	20 of 40	Laurel Hill Road
Brooklyn	20 of 40	Wolf Den Road
Brooklyn	21 of 40	Costello Road
Brooklyn	21 & 22 of 40	Route 169 (Pomfret Road)
Brooklyn	23 of 40	Barret Hill Road
Brooklyn	24 of 40	Darby Road
Brooklyn	24 of 40	Church Street
Brooklyn	24 of 40	Day Street
Brooklyn	25 of 40	Woods Hill Road
Pomfret	27 of 40	Route 101 (Killingly Road)
Killingly	28 & 29 of 40	Lake Road
Putnam	30 of 40	River Road
Killingly	30 of 40	Louisa Viens Road
Killingly	31 of 40	Interstate 395
Putnam	32 of 40	Park Road
Putnam	33 of 40	Route 12 (Killingly Avenue)

Town	Map Sheet No.[1]	Existing Access to ROW via the Following Town/City Streets or Sites
Putnam	34 of 40	Heritage Road
Putnam	34 & 35 of 40	Tourtellotte Road
Putnam	35 of 40	Route 21 (Liberty Highway)
Putnam	35 of 40	Aldrich Road
Putnam	36 of 40	Fox Road
Putnam	37 of 40	Route 44 (Providence Turnpike)
Putnam	37 of 40	Munyan Road
Thompson	38 & 39 of 40	Quaddick Town Farm Road
Thompson	38 & 39 of 40	Elmwood Hill Road
Lebanon	1 & 2 of 2	Village Hill Road
Lebanon	1 & 2 of 2	Card Street

[1]: Mapsheets are in Volume 5 DR.5 of the Interstate Reliability Project's Municipal Consultation Filing

VI.A.5 Construction Support and Staging Areas

Equipment storage and/or staging areas, along with pole stockpile sites and wire stringing locations (for pulling and tensioning equipment), will be necessary to support the proposed construction. The locations of such areas will not be determined until a final route for the Project is certified. However, the typical characteristics of each support area are summarized as follows:

- Equipment storage or staging sites, typically ranging in size from two to five acres, will be used to store construction materials, equipment, supplies, and to park vehicles. They may also be used to stockpile new and old poles. These sites are selected for their proximity to the actual work site.
- Potential pole stockpile and lay-down locations, for the temporary storage of poles and material, will be required along each of the construction segments. These potential stockpile sites will generally be less than two acres in size.
- Temporary wire stringing locations will be required at intervals along each transmission line segment. Each stringing site will require approximately one acre and, except as otherwise specified, will be located within the overhead transmission line ROW.

VI.B RELATED IMPROVEMENTS TO CONNECTICUT 345-KV LINES AND SUBSTATIONS

Modifications to the existing 345-kV Manchester to Millstone line and related modifications to several substations will be required. This section describes this proposed line modification, and related work at the Killingly, Card Street, and Lake Road Substations, for which approval from the Council will be sought in the Project application.

VI.B.1 Loop of the Manchester to Millstone Line into Card Street Substation

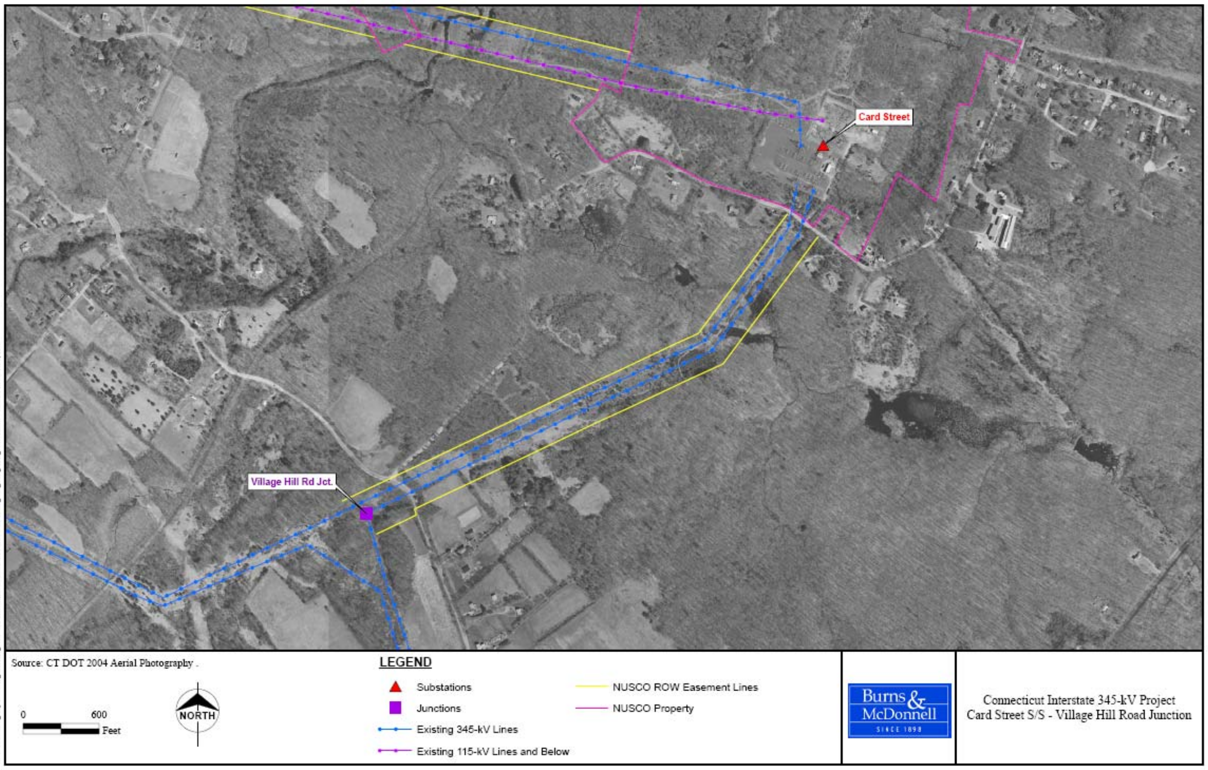
One of the two existing CL&P 345-kV lines from Manchester Substation to Millstone Switching Station, the 310 line, currently bypasses the Card Street Substation. A part of the Project is to add two one-mile-long 345-kV line segments to loop the 310 circuit through the Card Street Substation (310 Line Loop). To make room on the existing one-mile-long ROW from Village Hill Road Junction to Card Street Substation for these two line segments, CL&P is proposing the relocation and rebuild of the 368 line segment and the 383 line segment.

The existing 368 and 383 line sections between Village Hill Road Junction and Card Street Substation are each currently supported horizontally on single-circuit wood-pole H-frame structures. These line segments and the two new 345-kV line segments for the 310 Line Loop would be rebuilt on steel monopoles with vertical configurations of the conductors. The two new 345-kV line segments for the 310 loop will also be built on steel monopoles with vertical configurations of the conductors to make space available on the ROW for the segments of the 310 Line Loop. This design will allow CL&P to re-position four single-circuit 345-kV line sections and stay within CL&P's existing ROW.

The required expansion of Card Street Substation would be within the boundaries of CL&P property (see Volume 5 for proposed new Card Street Substation layout and 310 Line Loop XS-13). Additional ROW for the 310 Line Loop would be required where CL&P's existing transmission line ROW for the 368 and 383 lines approaches the Card Street Substation. A residential property may have to be acquired in order to enable the needed ROW expansion. The existing configuration of the 368 and 383 lines is shown on Figure VI-2.

Upon completion of this construction, there would be two separate circuits between Manchester and Card Street and two between Card Street and Millstone. If one of the circuits south of Card Street were interrupted, both circuits to the north could remain intact; and if one of the circuits to the north of Card Street were interrupted, both circuits to the south could remain intact. This arrangement would increase the reliability of the key Card Street to Manchester transmission path.

Figure VI-2: Village Hill Road Junction – Card Street Substation (310 Line Loop)



VI.B.2 Killingly Substation

The new construction at Killingly Substation would require the installation of two 345-kV transmission line deadend structures, one 345-kV circuit breaker, bus work, and protection and control equipment. The new 345-kV line from Lake Road Substation to West Farnum Substation will traverse Killingly Substation, but not connect to it.

VI.B.3 Card Street Substation

The work at the Card Street Substation will convert the existing 345-kV ring bus to a four-bay, 345-kV breaker-and-a-half substation with three new 345-kV line-terminal positions for a total of six 345-kV line terminal positions. The scope of work includes demolition of the existing 345-kV substation facilities, installation of six new 345-kV circuit breakers and relocation of two existing 345-kV circuit breakers, installation of twenty new disconnect switches, bus work, surge arresters, CCVTs, modifications to the existing control building and the installation of new protection and control equipment.

The substation's fenced area would be extended approximately 145 feet to the south on existing substation property. Clearing and grading at the Card Street Substation will be required to allow for the expansion south of the existing substation.

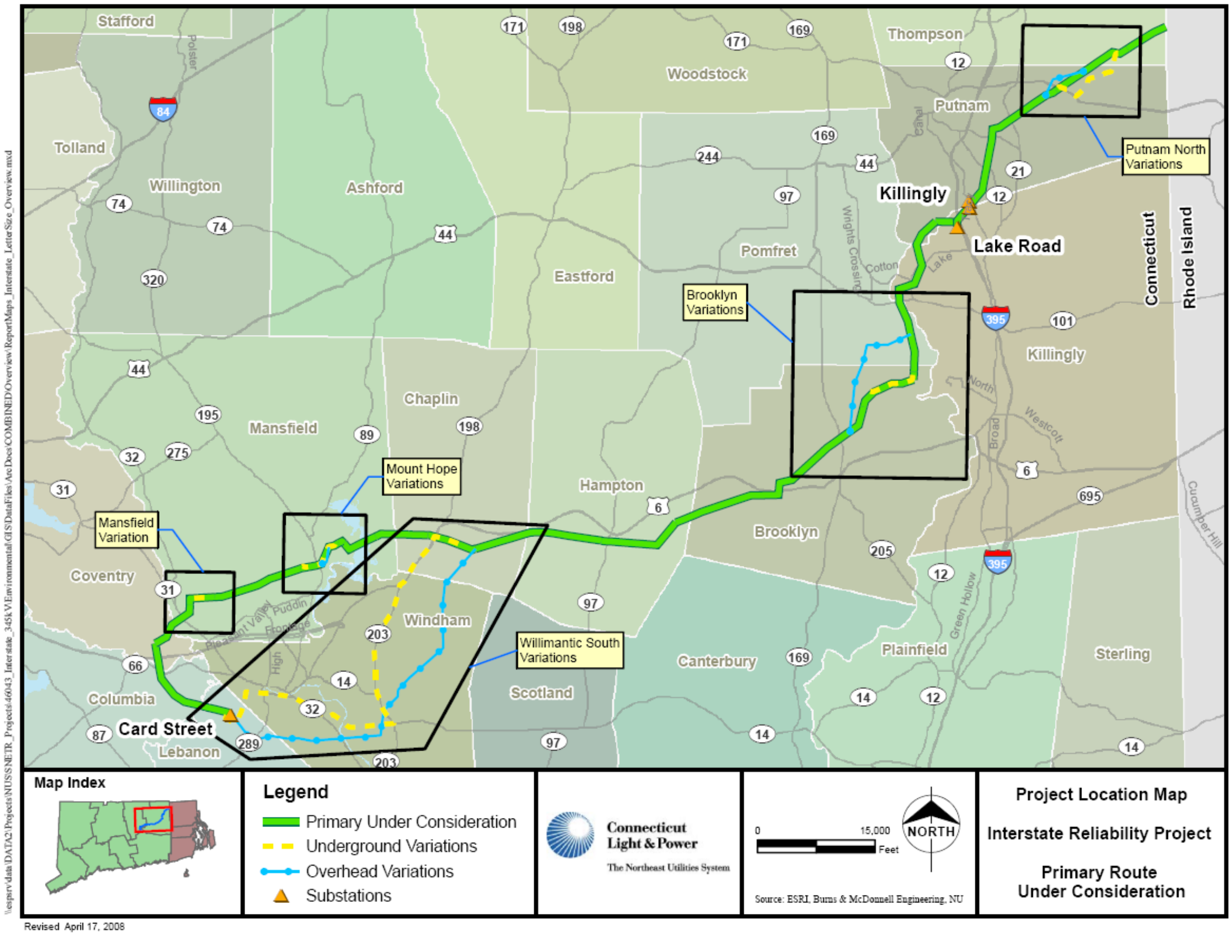
VI.B.4 Lake Road Substation

New construction work at the Lake Road Substation, which is adjacent to the Lake Road Generating Station, includes the addition of three 345-kV circuit breakers, six 345-kV disconnect switches, one deadend structure, bus work, six surge arresters, six CCVTs , two new 345-kV line-terminal positions, and new protection and control equipment. The work requires no expansion of the substation fence.

VI.C POTENTIAL VARIATIONS TO PORTIONS OF THE CONNECTICUT SEGMENT OF THE PRIMARY ROUTE UNDER CONSIDERATION

CL&P has developed for the consideration of the Council potential 345-kV line-route variations where a new overhead 345-kV line along the Primary Route Under Consideration may be determined to be adjacent to Statutory Facilities and where federal and state lands may need to be avoided. The locations of these potential route variations are illustrated in Figure VI-3.

Figure VI-3: Overview Map: Connecticut Portion of Primary Route Under Consideration and Locations of Potential Route Variations



VI.C.1 Willimantic South Variations

The Willimantic South Variations would replace a section of the Primary Route Under Consideration, in order to avoid crossing Mansfield Hollow State Park and the Mansfield Reservoir property (Figure VI-4) and to avoid adjacency of the new 345-kV line to a group of homes in the Mansfield area and to a Statutory Facility (Mount Hope Montessori School). Both an overhead and an underground variation, illustrated in Figure VI-4, have been identified. Each of them would traverse the south side of Willimantic starting at the Card Street Substation; hence their designation as the "Willimantic South" variations. The overhead variation would replace approximately 12 miles of the Primary Route Under Consideration, and the underground variation would replace approximately 11.5 miles of the Primary Route Under Consideration.

VI.C.1.1 Willimantic South Overhead Variation

The overhead variation would require a new ROW approximately 150 feet wide and 9.4 miles long through the Towns of Lebanon, Windham, and Chaplin. It would extend from the Card Street Substation in Lebanon, generally east, for a distance of approximately 4.0 miles, through a mixture of woodland, agricultural fields, and scattered rural residential developments, including a crossing of the Shetucket River. It would then turn north for a distance of approximately 5.4 miles, through mostly wooded area, crossing Plains Road and State Route 203 in Windham, and mostly wooded area, before joining the existing 345-kV line ROW approximately 5,000 feet east of Route 6 in Chaplin.

Principal Features of Willimantic South Overhead Variation

- Total ROW length would be approximately 9.4 miles
- Final design will be based on the Field Management Design Plan
- New ROW width would be 150 feet wide
- Approximately 170 acres of new ROW would be required
- Approximately 148 acres of woodland clearing would be required
- Approximately 45 homes would be within 400 feet of the new route
- New road crossings, include Beaumont (Route 289), Gates, Bush Hill, Plains, Windham, Ballamahack, Beaver Hill, Lynch, and Chewink roads would be required
- New stream crossings, including the Shetucket River and 6 additional streams
- One recorded archaeological site would potentially be crossed
- ROW would contain approximately 27 acres of wetland based on data from the DEP
- The estimated cost of this variation is $78.4 million

VI.C.1.2 Willimantic South Underground Variation

The Willimantic South Underground Variation would require the installation of 10.7 miles of underground cables under streets and the construction of a new 345-kV line transition station, in part within the existing ROW and in part on adjacent land. The underground route would extend from the Card Street Substation north within Card Street to Pleasant Street, then east along Pleasant Street to follow Windham Road (State Road 32) to Plains Road, continuing east across the Shetucket River to State Route 14/203. It would then turn north and follow Route 203 to Route 6 (Boston Post Road), to join with the existing 345-kV line ROW, where the new transition station would be constructed.

Principal Features of Willimantic South Underground Variation

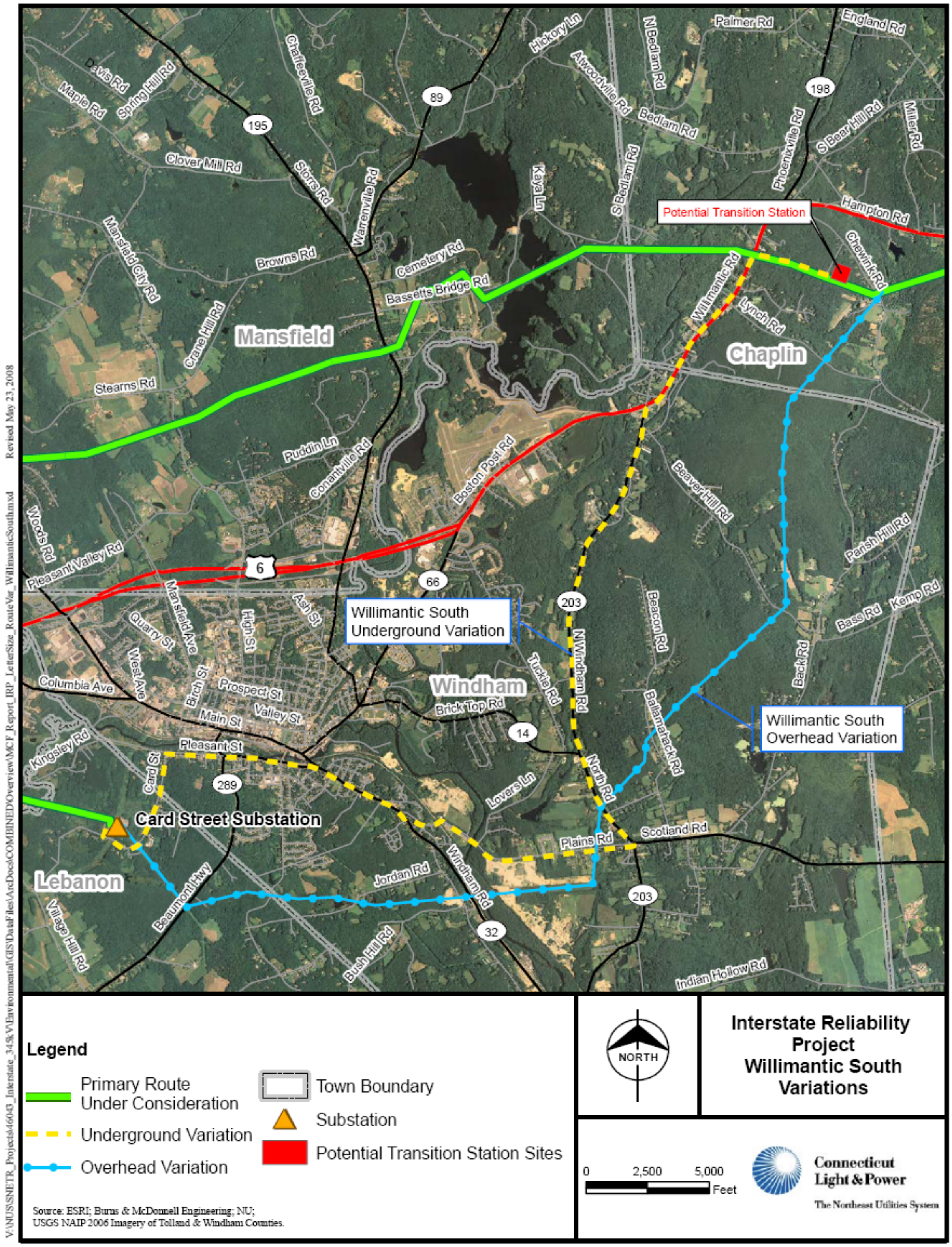
- Eight Statutory Facilities would be within 600 feet of the underground line variation including: two residential daycares, two licensed daycare centers, and the Windham Center School, playground, and North Windham Elementary School and playground.
- Total length of underground line would be approximately 10.7 miles

- All but a short segment of the 10.7 miles of new underground line construction would occur within public roadways
- One 345-kV line transition station would be required where the variation joins the existing ROW
- Easements for splice vaults on private property next to the underground street route are likely to be required
- Two to four fenced acres of property would be required for the new transition station
- A crossing of the Shetucket River, by either HDD or jack and bore
- ROW would contain approximately 1.9 acres of wetland based on data from the DEP
- One rail line crossing (a trenchless crossing) would be required
- The cost of this variation is estimated at $564 million including, construction labor and material, engineering, and contingency.

Table VI-3: Comparison of Willimantic South Variations to Section of Primary Route Under Consideration Each Would Replace

	Overhead Variation		**Underground Variation**	
	Primary Route Segment Replaced	**Variation**	**Primary Route Replaced Segment**	**Variation**
Length (miles)	12	9.4	11.5	10.7
Above Ground Structures	Approximately 111 structures	Approximately 80 structures	Approximately 108 structures	-
New ROW or Land (acres)	Up to 27	170	Up to 27	7
Woodland Clearing (acres)	80	148	76	4
Wetlands	37.8	26.5	36.6	1.9
River & Stream Crossings	Shetucket River	Shetucket River	Shetucket River	Shetucket River
Cost ($) million	61.0	78.4	58.9	564.0

Figure VI-4: Willimantic South Variations



VI.C.2 Mansfield Underground Variation

Homes have been developed near each side of CL&P's existing ROW in western Mansfield, which is part of the Primary Route Under Consideration. There are 26 homes located within 500 feet of the existing ROW along Highland Road, Woodmount Drive, and Stone Ridge Road. Due to surrounding residential development, an overhead line-route variation would be near as many or more homes as would be avoided by the relocation. Accordingly, no overhead line-route alternative was identified. A potential underground line-route variation is shown in Figure VI-5. This variation would be located primarily within the existing ROW, although some additional area outside the ROW may be required for new transition stations. This variation would extend for approximately 0.7 miles from a new transition station located along the existing ROW, approximately 1,500 feet east of Route 31 to a new transition station also located along the existing ROW.

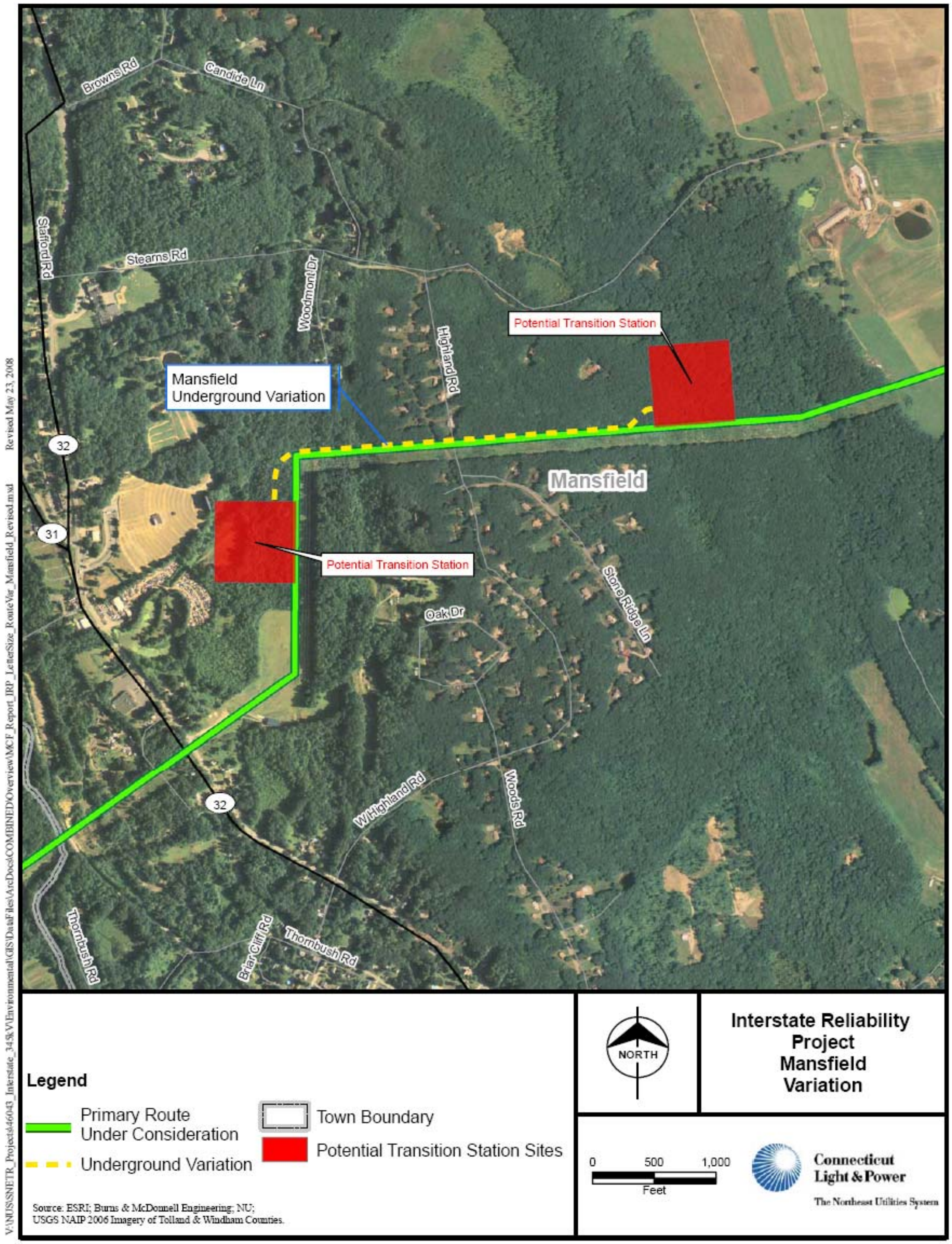
Principal Features of Mansfield Underground Variation

- Total length of the underground line would be approximately 0.7 miles
- The underground cables would be installed primarily within CL&P's existing ROW
- Easements for splice vaults on private property next to the ROW are likely to be required
- Two new 345-kV line transition stations would be required
- Two to four fenced acres of property would be required for each of the new transition station
- One crossing of Highland Road would be required
- ROW would contain less than one acre of wetland based on data from the DEP
- The cost of this variation is estimated at $74.2 million including, construction labor and material, engineering, and contingency.

Table VI-4: Comparison of Mansfield Underground Variation to Sections of Primary Route Under Consideration that Would be Replaced

	Underground Variation	
	Primary Route Segment Replaced	**Variation**
Length (miles)	0.7	0.7
Above Ground Structures	Approximately 7 structures	-
New ROW or Land (acres)	0	8
Woodland Clearing (acres)	7	8
Wetlands	5	<1
Cost ($) in millions	3.1	74.2

Figure VI-5: Mansfield Underground Variation



VI.C.3 Mount Hope Variations

The Mount Hope Montessori School Inc. on Bassetts Bridge Road is near CL&P's existing ROW, the Primary Route Under Consideration. The existing 345-kV line is located on the eastern side of the ROW, with the nearest conductor approximately 325 feet from the nearest actively used portion of the school property (a play yard). Were the new line to be built in a horizontal configuration in the vacant position on the ROW, it would be located between the existing line and the school property, with the nearest conductor approximately 240 feet from the play yard. CL&P has identified both overhead and underground line-route variations that would avoid this proximity, which are illustrated in Figure VI-6.

VI.C.3.1 Mount Hope Overhead Variation

The potential overhead line-route variation would place a section of the new line, approximately 2,650 feet long, on a new ROW that would be approximately 200 feet to the east of the location of the existing ROW. In order to re-route the new line off of the existing ROW, it would be necessary to move the existing line to the new ROW as well. The nearest conductor would be approximately 450 feet from the school play yard.

Principal Features of Mount Hope Overhead Variation

- Total length of the new line is approximately 2,650 feet
- The relocation of approximately 2,350 feet of existing 345-kV line would be required
- Final design will be based on the Field Management Design Plan
- Approximately 18 acres of new ROW would need to be acquired
- The total width of the new proposed ROW would be approximately 300 feet
- The new ROW would be near the Mansfield Historic District
- Approximately 4.8 acres of vegetation removal would be required
- Five homes would be within 400 feet of the new ROW, which are now further away from the existing ROW
- A new crossing of Bassetts Bridge Road would be required
- ROW would contain approximately 3.2 acres of wetland based on data from the DEP
- The cost of this variation would be approximately $11.6 million including construction labor and material, engineering and contingency.

VI.C.3.2 Mount Hope Underground Variation

The underground line-route variation would be constructed within CL&P's existing overhead line ROW except for two transition stations, which would be constructed in part outside of the existing ROW. The underground segment would begin at a new transition station approximately 1,600 feet west of State Route 195, and extend along the ROW to a new transition station approximately 800 feet north of

Bassetts Bridge Road. Additional easement rights to install the cables would have to be acquired, and up to 10 acres would have to be acquired for each of the transition stations.

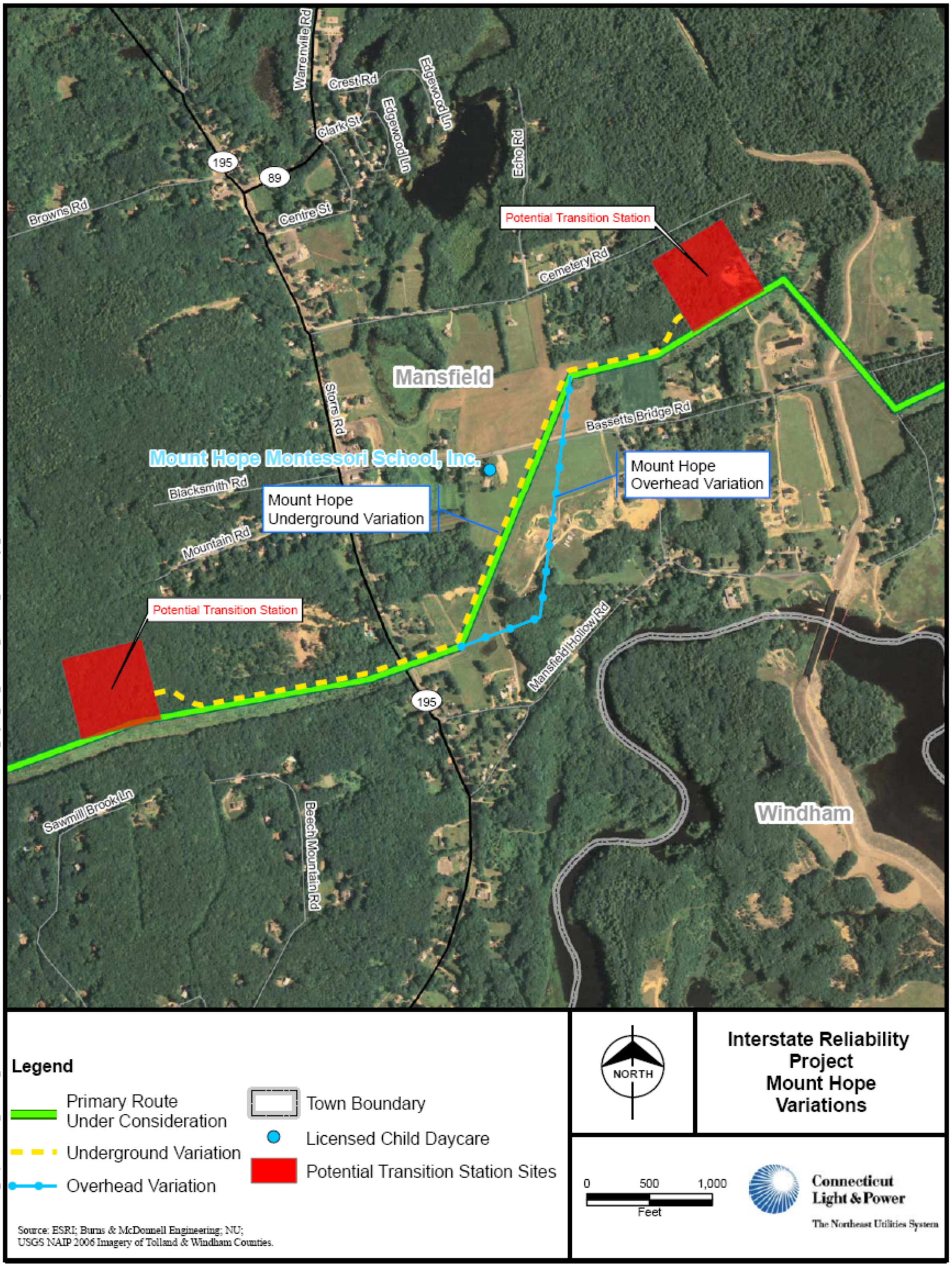
Principal Features of Mount Hope Underground Variation

- Total length of underground line would be approximately 1.2 miles
- The cables and vaults would be installed primarily within CL&P's existing ROW
- Easements for splice vaults on private property next to the existing ROW may be to be required
- Two new 345-kV line transition stations would be required
- Two to four fenced acres would be required for each new transition station
- New crossings of State Route 195 and Bassetts Bridge Road would be required
- The ROW would contain approximately less than an acre of wetland based on data from the DEP
- The cost of this variation is estimated at $93.6 million including construction labor and material, engineering and contingency.

Table VI-5: Comparison of the Mount Hope Variations to the Segment of the Proposed Route Under Consideration that Each Would Replace

	Overhead Variation		**Underground Variation**	
	Primary Route Segment Replaced	**Variation**	**Primary Route Segment Replaced**	**Variation**
Length (miles)	0.5	0.5	1.2	1.2
Above Ground Structures	Approximately 6 structures	Approximately 10 structures	Approximately 12 structures	-
New ROW or Land (acres)	0	18	0	8
Vegetation Removal (acres)	4	4.8	9	8
Wetlands (acres)	1.9	3.2	1.2	<1
Cost ($) million	3.4	11.6	7.9	93.6

Figure VI-6: Mount Hope Variations



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VI.C.4 Brooklyn Variations

An isolated group of homes is located along CL&P's existing Primary Route Under Consideration ROW in the Town of Brooklyn, near Day Street Junction. Within the area are 45 homes within 400 feet of the existing ROW along Church Street, Darby Road, and Meadowbrook Lane, including a residential daycare facility. Line-route variations avoiding this area are shown on Figure VI-7.

VI.C.4.1 Brooklyn Overhead Variation

The overhead line-route variation would extend north from the existing line ROW for a distance of approximately 2.1 miles, through a generally wooded area, crossing Barrett Hill Road and then would turn east for a distance of an additional 1.2 miles, crossing Spaulding and Searles roads before rejoining the existing ROW.

Principal Features of the Brooklyn Overhead Variation

- The total length of the variation would be approximately 3.3 miles
- The new ROW would be 150 feet wide
- The existing ROW would continue to contain the existing 345-kV line and two 115-kV lines
- Final design will be based on the Field Management Design Plan
- Approximately 60 acres of new ROW would be required
- Approximately 55 acres of vegetation removal would be required
- New crossings of Barrett Hill, Spaulding, and Searles roads would be required
- There would be approximately 14 homes within 400 feet of the proposed new ROW
- ROW would contain approximately 5.1 acres of wetland based on data from the DEP
- The cost of this variation is estimated at $28.3 million, including construction labor and material, engineering, and contingency.

VI.C.4.2 Brooklyn Underground Variation

The underground line-route variation would be located within CL&P's existing ROW, except for the two transition stations, which would be located in part on private property outside the ROW. The line would extend from a new transition station located approximately 2,000 feet west of Church Street eastward, to a new transition station located approximately 2,000 feet east of Church Street. The following summarizes the features of this variation:

Principal Features of Brooklyn Underground Variation

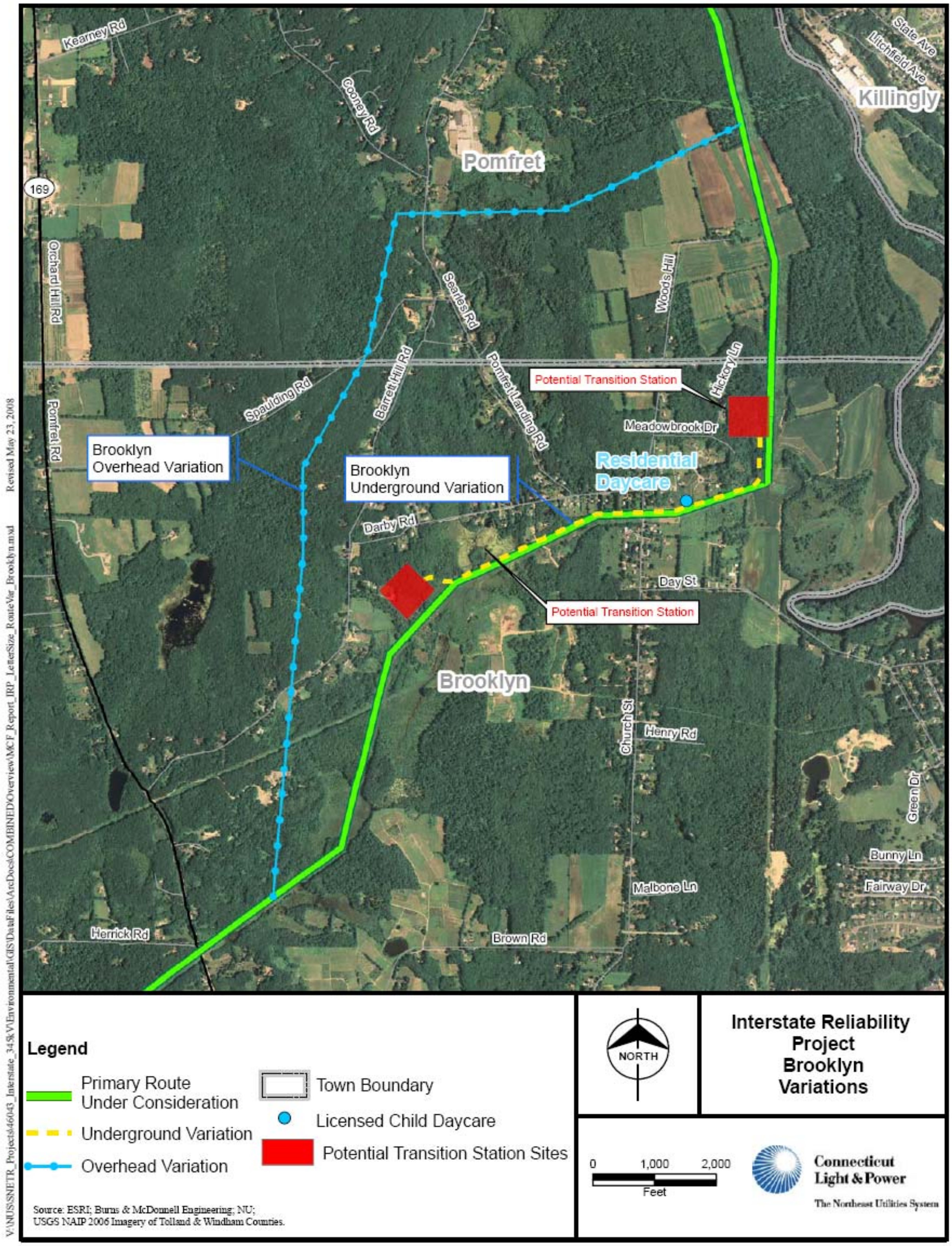
- The variation is adjacent to one residential daycare facility located along Church Street
- The total length of underground line would be approximately 1.3 miles
- The cables and vaults would be located primarily within CL&P's existing ROW
- Easements for splice vaults on private property next to the existing ROW are likely to be required

- Two new 345-kV line transition stations would be required
- Two to four fenced acres would be required for each of the two transition stations
- A crossing of Church Street would be required
- The ROW would contain approximately less than one acre of wetland based on data from the DEP
- The cost of this variation is estimated at $102.6 million including construction labor and material, engineering and contingency.

Table VI-6: Comparisons of Brooklyn Variations to Segment of Proposed Line Under Consideration Each Would Replace

	Overhead Variation		**Underground Variation**	
	Primary Route Segment Replaced	**Variation**	**Primary Route Segment Replaced**	**Variation**
Length (miles)	3.3	3.3	1.3	1.3
Above Ground Structures	Approximately 30 structures	Approximately 28 structures	Approximately 12 structures	-
New ROW or Land (acres)	0	60	0	8
Vegetation Removal (acres)	31	55	8	8
Wetlands	15.6	5.1	3.4	<1
Cost ($) million	15.3	28.3	6.3	102.6

Figure VI-7: Brooklyn Variations



VI.C.5 Putnam North Variations

An isolated group of homes is located along CL&P's existing ROW in the Town of Putnam, which is part of the Primary Route Under Consideration. Along this section of the existing ROW there are 15 homes on Elvira Heights Road located within 400 feet of the ROW. To avoid this area, potential overhead and underground line-route variations were identified and are shown in Figure VI-8.

VI.C.5.1 Putnam North Overhead Variation

This overhead line-route variation would branch from the existing ROW approximately 2,300 feet west of Highway 44 (Providence Pike), extending northeast to cross the highway approximately 1,400 feet north of the current crossing. It would extend through a wooded area to rejoin the existing ROW north and east of the residences located along Elvira Heights Road.

Principal Features of Putnam North Overhead Variation

- The total length of the new section of line would be approximately 1.26 miles
- Final design will be based on the Field Management Design Plan
- The new ROW would be 150 feet wide
- This variation would require approximately 23 acres of new ROW
- New structure types proposed would be steel- or wood-pole H-frame with a typical height of 90 feet
- Approximately 23 acres of vegetation removal would be required
- Approximately three homes would be within 400 feet of the new route
- One new crossing of Highway 44 would be required
- ROW would contain approximately 8.1 acres of wetland based on data from the DEP
- The cost of this variation is estimated at $11.4 million.

VI.C.5.2 Putnam North Underground Variation

This line-route variation would extend from a new transition station adjacent to Highway 44, southward within the highway ROW, turning northeast within Munyan Road to Quaddick Town Farm Road. It would continue north along Quaddick Town Farm Road to rejoin the existing ROW at a new transition station located north of Elmwood Hill Road.

Principal Features of Putnam North Underground Variation

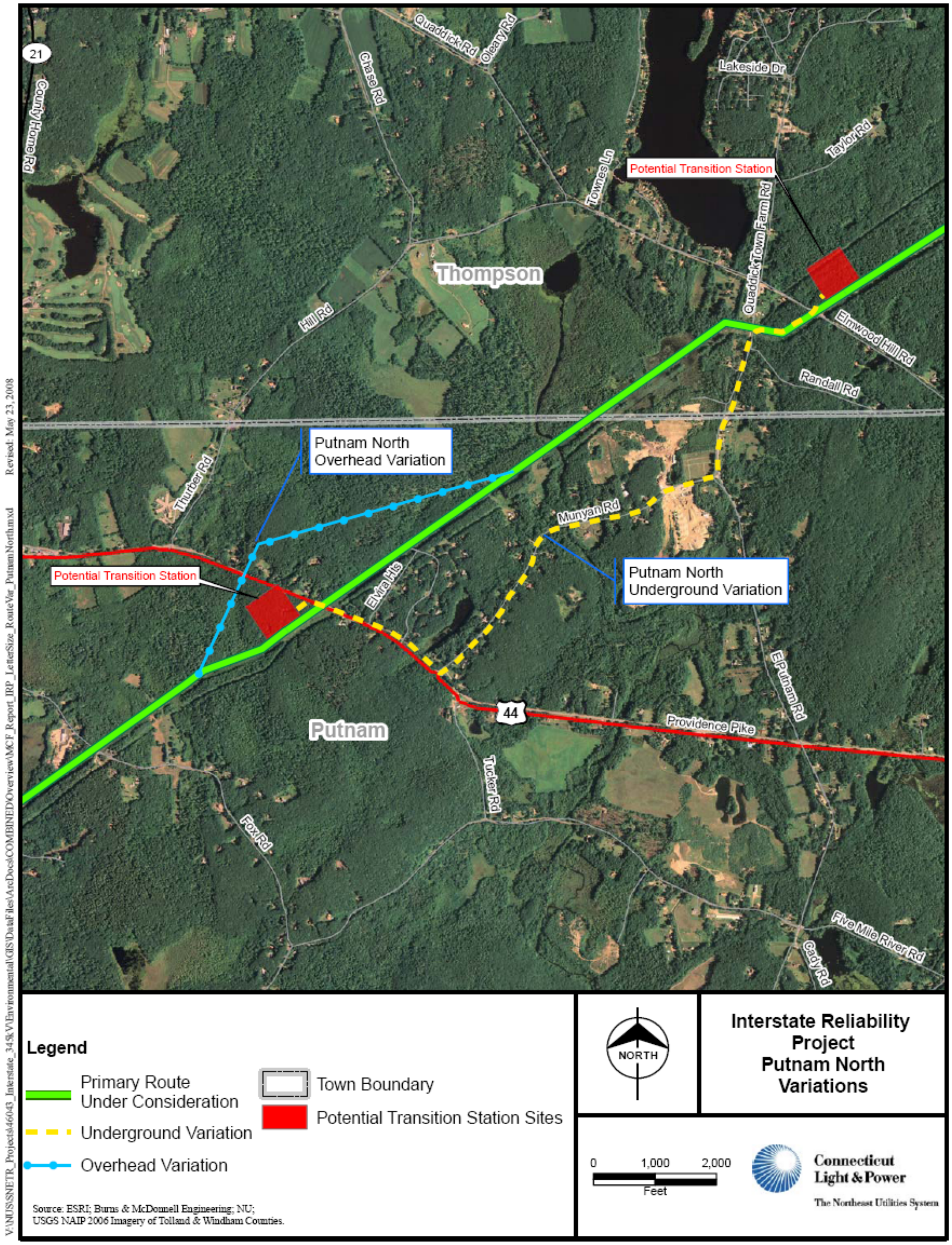
- Total length of underground line would be approximately 2.4 miles
- All but a short segment of the new underground line construction would occur within road ROW
- Two new 345-kV transition stations would be required
- Easements for splice vaults on private property next to the existing ROW are likely to be required
- Two to four fenced area would be required for each transition station

- The cost of this variation is estimated at $164.5 million including construction labor and material, engineering and contingency.

Table VI-7: Comparisons of Putnam North Variations to Segment of Primary Route Under Consideration Each Would Replace

	Overhead Variation		**Underground Variation**	
	Primary Route Segment Replaced	**Variation**	**Primary Route Segment Replaced**	**Variation**
Length (miles)	1.1	1.3	1.9	2.4
Above Ground Structures	Approximately 12 structures	Approximately 11 structures	Approximately 19 structures	-
New ROW or Land (acres)	0	23	0	9
Vegetation Removal (acres)	10	23	14	9
Wetlands	8.8	8.1	13.5	0
Cost ($) million	5.1	11.4	7.9	164.5

Figure VI-8: Putnam North Variations



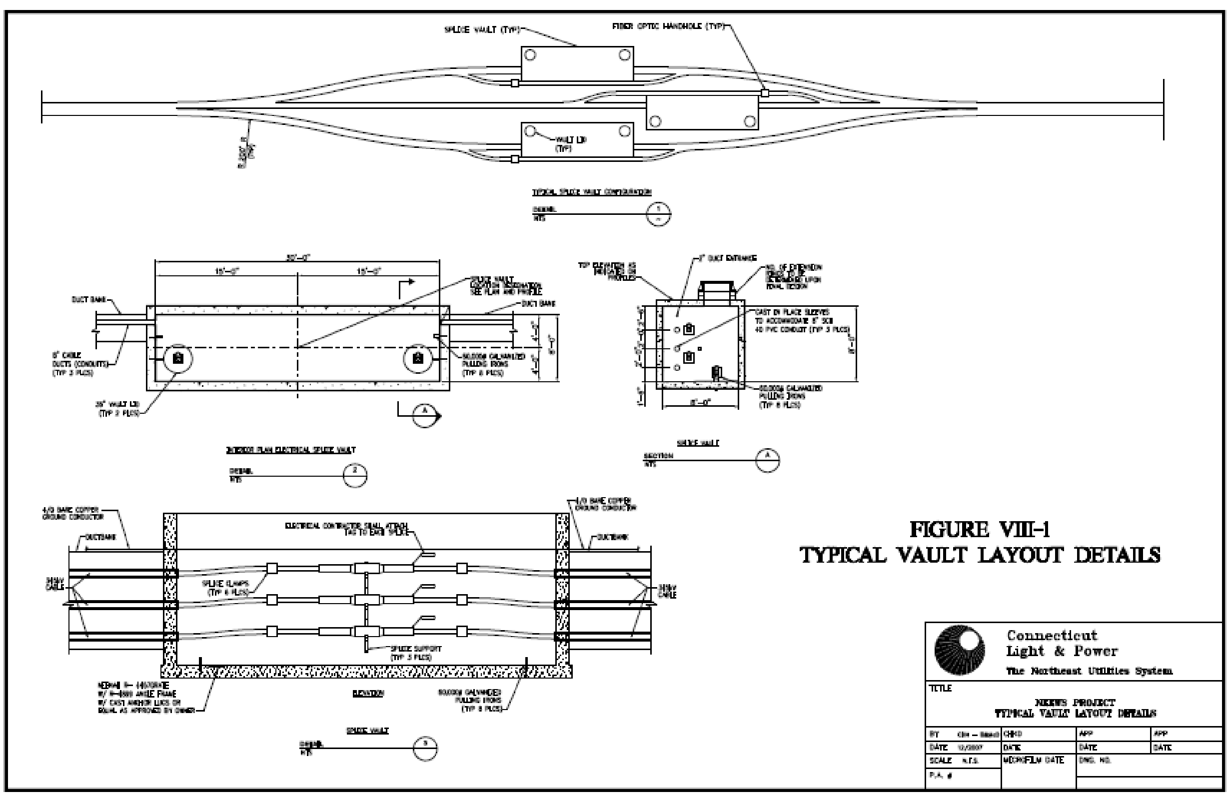
VI.D CONFIGURATION AND ROW REQUIREMENTS OF UNDERGROUND LINE SEGMENTS

Any underground line segments that may be required would be designed and constructed as generally described below.

VI.D.1 Underground Cable Design

The technology that would most likely be employed for underground line segments would be cross-linked polyethylene (XLPE)-insulated cables. The 345-kV cable system would then consist of nine cables (three parallel sets of three XPLE cables), contained within approximately 3-foot-wide by 3-foot-tall concrete-encased duct banks, as well as concrete splice vaults. To install the cable-duct bank, a trench 7 to 10 feet deep and approximately 5 feet wide would be excavated. Splice vaults are required for pulling the transmission cable through PVC conduits, for the splicing of each cable length, and ultimately to provide access to portions of the cable system to perform maintenance and repair activities. Three splice vaults (one per each set of three XLPE cables) would be buried at locations which are approximately 1,600 feet apart along the cable route.

Figure VI-9: Cross Sections for UG Vaults



In addition, two fiber optic cables per circuit would be installed in the duct bank. One fiber optic cable is required for remote operation and control of the cable system and associated equipment and the other fiber optic cable is for monitoring the operating temperature of the cables. One ground-continuity conductor will also be installed per circuit to ground the cable sheaths and equipment within the proposed splice vaults. For more information on the types of underground cable system technology, an Underground Electric Power Transmission Cable Systems tutorial is provided in Volume 3.

VI.D.2 ROW Requirements

CL&P would install the underground cables primarily within existing CL&P ROW and public road ROW. The exact locations of the cables and the splice vaults within or adjacent to such ROWs would be determined based on final engineering designs, taking into consideration constraints posed by existing buried utilities and the location of other physical features. Based on previous recent experience with underground cable system design and construction, it is likely that some adjacent private property would have to be acquired and used for some of the cable system facilities, and it is likely that buried utilities or other objects in some locations would require deeper trenching depths or high-cost trenchless construction methods.

VI.D.3 Duct-Bank Requirements

The installation of the cable system within a public road typically requires a 40-foot-wide work area for construction; this includes a 15-foot-wide permanent easement and a 25-foot-wide temporary construction area. Installation of the cable system within public roads would not require acquisition of a permanent easement, but would require coordination with other underground and overhead utilities as well as coordination from the agency with jurisdiction over the roadway regarding the location of the cable facilities, and the methods and schedule to be used to install the cable system.

VI.D.4 Splice-Vault Requirements

The outside dimensions of splice vaults for 345-kV XLPE cables are approximately 10 feet wide by 10 feet deep and up to 32 feet in length (one per each set of three XLPE cables). The installation of each splice vault therefore requires an excavation area approximately 14 feet wide, 13 feet deep, and 36 feet long. At approximately 1,600-foot intervals along the cable route, pre-cast splice vaults will be installed below ground. Splice vaults located on private property require a minimum of 12,000 square feet of permanent easement for future access for maintenance and repairs, and an additional minimum 4,300 square feet of temporary easement for construction. The burial depth of each vault would vary, based on site-specific topographic conditions and the cable depth (based on factors such as the avoidance of other buried utilities). Vaults may be installed within public roadways or, in order to avoid conflicts with other utilities buried beneath the roadways, may be installed in other suitable locations adjacent to such roads (e.g., beneath parking lots, sidewalks, road shoulders, or road medians). However, when vaults are installed off-road for this reason, while duct banks are within the road, the duct bank must cross other parallel buried utilities twice for each vault, which greatly complicates the design and construction.

VI.D.5 Construction Support Areas

Similar to overhead line construction requirements, during underground cable system construction, areas for storing and staging construction materials and equipment would be required along and in the vicinity of the transmission cable-route. These construction yards and staging areas will typically be sited (where possible) on previously disturbed property (e.g., existing parking lots, properties formerly used for other types of construction staging such as highway work). Landowner and regulatory approvals will be obtained for the temporary use of such sites.

Typically, the construction contractor will establish one or more primary construction yards near the Project area. Such yards, each of which usually encompasses two to five acres, will be used to store construction equipment, materials (including the conduits and splice vaults, as well as backfill and asphalt patch), and supplies, and to park contractor vehicles. Materials also may be assembled in the yards, before they are delivered to work sites. After the completion of construction, the contractor yard sites will be restored.

VI.D.6 Design Voltage

The proposed lines will be designed for nominal 345-kV operation. Each of the proposed 345-kV circuits will be comprised of three phases consisting of three 3,500-kcmil XLPE cables with copper conductors. Three parallel sets of three XLPE-insulated cable circuits would provide a summer normal capacity rating of approximately 1,800 MVA.

VI.D.7 Line Transition Stations

A 345-kV line transition station is required whenever an underground cable segment of the line connects to an overhead section of the line. Such transition stations typically require a fenced and graded area approximately two to four acres in size. Within the line transition station would be a terminal structure, pothead stands, potheads and surge arresters, circuit breakers, and a control enclosure. The protective relaying systems and System Control and Data Acquisition (SCADA) equipment, battery systems, etc.

would reside inside the control enclosure. Shunt reactors that resemble large power transformers may also be required in some transition stations.

VII. CONSTRUCTION PROCEDURES SUMMARY

CL&P's construction, operation, and maintenance of its facilities and ROW are performed in accordance with *Northeast Utilities' Construction and Maintenance Environmental Requirements* (2007). These requirements outline the best management practices (BMPs) that are to be implemented along CL&P's ROW to minimize or eliminate potential adverse environmental impacts which may result from construction activities.

VII.A TYPICAL OVERHEAD TRANSMISSION LINE CONSTRUCTION PROCEDURES

CL&P expects that all or most of the Project line facilities would be constructed overhead. The following sections describe typical overhead construction.

VII.A.1 Overhead Line Construction Sequence

CL&P will construct the Project in several stages, some of which will overlap in time. Construction will typically consist of activities such as:

- Surveys to stake monumented line of corridor, ROW boundaries, and future structure locations
- Identification and marking of wetland and watercourse areas
- Identification and marking of areas of cultural resources concern
- Identification and marking of sensitive environmental resource areas to be avoided
- Establishment of field construction areas and preparation of staging and lay-down areas
- Preparation of ROWs (including the installation of erosion and sedimentation controls, removal of vegetation in accordance with CL&P's management guidelines, access-road improvement/installation)
- Preparation of work areas at structure sites
- Excavation and installation of foundations and new structure erection
- Installation of conductors and wires
- Removal of existing transmission structures and associated conductors and wires, where applicable
- Clean-up and restoration, including re-vegetation of disturbed sites

The following construction activities, materials, and equipment are generally expected to be involved in the construction of the overhead 345-kV line on or adjacent to the existing transmission ROWs:

- Establish erosion and sediment controls – pickups and other small trucks.
- Remove vegetation from areas for new access roads or to improve existing roads – flatbed truck, brush hog, bulldozer, bucket trucks for canopy trimming, and wood chipper.
- Build new access road or improve existing roads to provide a travel way of approximately 15 to 20 feet in width – bulldozer or front loader, dump trucks for crushed stone or gravel, pickups or stake-body trucks for culverts, wetland mats, mat installer; roads may be surfaced with

woodchips or gravel, using culverts or crushed stone for wet areas; roads may be temporary or permanent. Roads would have sufficient width and capacity for heavy construction equipment, both over-the-road and off-road vehicles, including oversize tractor trailers. The need for access for flatbed trailers and concrete trucks often determines the scope of access road improvements. Road grades would be negotiable for over-the-road trucks with 10 percent maximum grade, and less if wet weather or surface conditions provide traction problems. Vehicles with either tracks or tires would be used.

- Prepare staging and lay-down areas if they are to be off the ROW. Same process and equipment for access roads unless existing areas with sufficient grade and access are to be used. Establish field office trailer, sanitary facilities, and parking areas.
- Grade and surface work areas at sites of existing and new structures, if necessary, for access and construction. Typically, work at structure sites will be contained within the existing ROW. The same equipment is needed as for access road preparation and staging areas.
- Construct new structures and line – for foundation, structure erection and conductor pulling the following are required: flatbed trucks for structure components, auger, excavator, cranes, other trucks for reinforcing rods, concrete trucks for structures requiring concrete pads or foundations, bucket trucks for installing hardware, conductor reels, and conductor pulling rigs. Dump trucks are needed for the foundation work if excess excavated material has to be removed from the ROW. In wet conditions or if groundwater is encountered, the water is pumped to a temporary settling basin with erosion and sedimentation controls including geotextile fabric, silt fence, hay bales, and crushed stone. As with all other activities, this would require Council approval and would have to comply with any applicable regulation.
- Remove existing structures – bucket trucks for dismantling existing lines, with reel trailers to haul conductors, trucks to haul dismantled hardware, flatbed trucks with cranes to remove structures, trucks with welding equipment to cut steel supports or components, and stake or dump trucks to haul smaller dismantled components.
- Restore ROW – all debris would be hauled off the ROW for disposal; but brush may be piled, scattered, or chipped. Disturbed ground is back bladed to its preconstruction contours unless directed otherwise. If the work site is in an agricultural field, the soil can be decompacted by disking. Erosion controls would be left in place until vegetation is established. Steep areas would be stabilized with jute netting or pre-made erosion control fabric containing seed, mulch, and fertilizer. Access roads where culverts or crushed stone fords are needed will be left in place or removed as directed by the Council. Periodic monitoring and reporting with on-site inspection by the Council would be required until it is determined that restoration has been achieved.

VII.A.2 Materials Handling and Management (Soils Handling and Dewatering)

During the construction of the transmission facilities the effective management of soils and groundwater will be a key consideration. As part of the final Project design, CL&P will develop specific plans for characterizing the soils and groundwater (i.e., presence/absence of oil or hazardous materials) and subsequently for handling and managing such materials. Such plans will be developed based on the results of agency file reviews, pre-construction sampling and analyses along the approved Project routes, and the incorporation of applicable permit requirements. The following summarizes the approach that CL&P expects to apply in developing such plans.

CL&P will follow the guidance issued by the DEP for Utility Company Excavation. The DEP currently recommends the following procedure to be followed by utilities that encounter contaminated soil during repair or construction activities. This applies to cases where the contaminated soil/waste is encountered on property not owned by CL&P, and the contamination was not created by the utility.

The utility may reuse the contaminated soil in the same excavation within the same area of concern without prior approval by the DEP provided:

- Any condition that would be a significant environmental hazard as defined in Connecticut General Statutes Section 22a-6(u) is reported by the utility and that the location is identified on a map submitted to the DEP, Remediation Division.
- Any excess contaminated material is disposed in accordance with solid and hazardous waste regulations, as appropriate.
- The upper one foot of the excavation is filled with clean fill material or paved.
- Any sampling required to make a determination as to whether a significant environmental hazard exists or how excess spoils will be disposed will be the responsibility of the public or private entity performing the excavation.

Pre-Construction Studies

Prior to construction of the Project, CL&P will commission a due-diligence review of existing data regarding the current and historical uses of areas along the ROWs, properties along the ROWs, and nearby off-site sources. The scope of the due-diligence work will comply with Sections 8.1 and 8.2 of the ASTM Standard E1527-05. The objective of the work will be to identify known locations of potential sources of past or current contamination, such as leaking underground storage tanks, sites designated as hazardous by federal or state government, locations of reported spills of oil or hazardous material, etc.

Based on the results of the due-diligence review, a sampling and analysis plan will be developed to characterize the soils and groundwater along the Project route. This plan will identify the locations and depths of the samples that will be collected, as well as the analytical tests that will be performed on the samples. The field investigations will be completed in accordance with an In-Situ Soil and Groundwater Characterization Work Plan (Characterization Work Plan) that will be developed subsequent to the completion of the due-diligence work. The objective of this Characterization Work Plan will be to obtain in-situ soil and groundwater data for the purpose of obtaining future approval for disposal/reuse of soil and planning/permitting for discharge of water. In-situ characterization data will be collected in the vicinity of sites of environmental concern identified in the due-diligence review and at appropriate intervals along the route to support approval of future soil reuse/disposal activities.

The results of the field investigations will be used to determine where oil and/or hazardous material is present in the soil or groundwater at levels equal to or greater than the applicable reportable concentration values. Iterative sampling and analysis may be completed, as needed, to define the extent of such areas along the ROW. Such investigation will not extend beyond the ROW or construction limits of the Project.

VII.A.2.1 Soils Handling and Management Approach

Locations Where In-Situ Levels Exceed Applicable Reportable Concentrations of Oil and/or Hazardous Materials

A material handling plan will be prepared, as necessary, to notify DEP of CL&P's intent to undertake handling or potential impacted soils at various locations along the Project, as necessary. The material handling plan would be implemented in areas where excavation of potentially contaminated soils and dewatering of potentially contaminated groundwater may be necessary during construction/installation activities. The material handling plan will define how to properly handle and manage soil and groundwater that is excavated during proposed site activities in order to minimize exposure to the general public and the environment.

Excavated materials to be transported from the site will be loaded directly onto trucks for off-site disposal at an appropriate facility or stockpiled temporarily at a permitted facility before being disposed at a permanent facility. Soil transported from the Project site will be transported under Bill of Lading or a Hazardous Waste Manifest as appropriate. These soils will be disposed of in accordance with the applicable federal, state and local regulations.

Locations Where In-Situ Levels Do Not Exceed Applicable Reportable Concentrations of Oil and/or Hazardous Materials

Construction of portions of the Project will occur in areas where known or observed historical contamination does not exist. In such areas, a material handling plan is not required. A Material Handling Guideline (MHG) will be developed to direct future management and disposal of solid and liquid Excess Materials generated during construction of the Project in these areas.

VII.A.2.2 Construction Site Dewatering Approach

Neither the construction nor the operation of the Project is expected to result in adverse impacts on groundwater resources or public water supplies. During construction, care will be taken to avoid impacts to municipal water lines that may be located in proximity of the Project.

It is possible that groundwater may be encountered during excavations for overhead structure foundations, for cable system installation (if underground route variations are selected) or during subsurface activities at the substations.

If groundwater is encountered during excavation, the water will be pumped from the excavated areas and discharged in accordance with applicable local and state requirements. Depending on regulatory authorizations, the water may be discharged directly on-site, into municipal storm water catch basins; pumped first to a temporary fractionization (frac) tank and then discharged to the municipal storm water system, or pumped into a tanker truck for disposal at appropriate wastewater treatment facilities located outside of the Project area. Residual silt/sediment collected at the bottom of the frac tanks will be disposed off-site at an appropriately designated disposal facility. Proper catch-basin inlet protection will be installed at catch-basin grates to prevent construction-generated soil excavate and debris from entering the existing roadway stormwater system.

VII.A.3 Spill Response

As part of the final plans for the Project, CL&P will develop a spill prevention and response plan. The plan will detail the procedures to be used during construction to minimize the potential for a spill and, if a spill occurs, to control and minimize the potential effects of a release of oil or hazardous substances.

VII.A.4 Vegetation Removal for Line Construction

CL&P is currently maintaining the vegetation along the existing ROW corridors within or adjacent to where another overhead 345-kV transmission line will be proposed. Since April 7, 2006, CL&P's ROW vegetation maintenance practices have been required to comply with mandatory standards adopted by the National Electric Reliability Council following the August 14, 2003 Northeast Blackout, which was found to have been triggered by line outages caused by overgrown vegetation. Such vegetation management is designed to allow the safe operation of the transmission facilities by preventing the growth of trees or invasive vegetation that would interfere with the transmission facilities or access along the right-of-way. As a result, the vegetation on the ROW within the maintained portions of the right-of-way typically consists of shrubs herbaceous species, and other low-growing species. Presently unused or non-maintained portions of the ROW that are not proximate to the existing line may support taller vegetation.

To accommodate the new 345-kV facilities, vegetation removal will be required. Vegetation along the ROW will only be removed where necessary to allow construction, to provide and maintain access to and, as needed, along the ROW, or to provide safe distances between the 345-kV conductors/wires and woody vegetation. For much of its length, the entire width of the ROW will not need to be cleared in order to accommodate the new line.

While undesirable tall-growing woody species, within the ROW and proximate to the existing or new lines will be removed, desirable species will be preserved to the extent practical. In selected cases, certain desirable low-growing trees may be kept on the ROW in certain locations and only trimmed to assure adequate clearance from wires and structures pursuant to CL&P's *Right of Way Vegetation Initial Clearance Standard for 115-kV and 345-kV Transmission Lines*. Generally, all tall growing trees species will be removed from the right-of-way and low-growing tree species and taller shrub species will be retained in the areas outside of the conductor zones (the area directly under the conductors extending outward a distance of 15 feet from the outermost conductors).

These activities will modify, but will not eliminate vegetation and wildlife habitat. In general, the principal effect of vegetation clearing along the ROWs will be to forested habitat, which will be removed (where required) and will be replaced over time with native shrubs, forbs and grasses resulting in an old field and brush habitat.

Vegetation removal for construction will be performed using mechanical methods. Appropriate erosion and sediment controls will be deployed as necessary (refer to Section VII.A.5).

During and following the 345-kV line construction, off-ROW "danger" trees, that have been determined to present an imminent hazard to the integrity of the transmission line, also will be identified and removed. Hazardous danger trees are weak, broken, decaying or infested trees that could contact the structures or conductors or violate the conductor clearance zones if they were to fail and fall towards the ROW.

Where removal of woody vegetation is required, vegetation will be cut flush with the ground surface to the extent possible. Where practical, trees will be felled parallel to the ROW to minimize the potential for off-ROW vegetation damage.

To stabilize disturbed sites after the installation of the transmission facilities, CL&P may seed disturbed areas with appropriate grass-type mixes. Vegetative species compatible with the use of the corridor for transmission line purposes are expected to regenerate naturally, over time. CL&P will promote the regrowth of desirable species by implementing vegetative maintenance practices to control tall-growing tree and undesirable invasive species, thereby enabling native plants to dominate.

CL&P will take particular care to maintain vegetation along streams and within wetlands to the extent possible. In general, CL&P may alter, to some degree, its vegetation management activities in the following areas:

- Areas of visual sensitivity where vegetation removal will be limited for aesthetic purposes
- Steep slopes and valleys which are spanned by transmission lines
- Agricultural lands
- Residential areas where maintained landscapes do not interfere with the construction or operation of the facilities

VII.A.5 Temporary Erosion and Sedimentation Controls

Temporary erosion controls (e.g., silt fence, hay/straw bales, filter socks, mulching, temporary and/or permanent reseeding) would be installed as needed, at any time during the vegetation removal operation:

- Slope (steepness, potential for erosion, and presence of resources such as wetlands or streams at bottom of slope)
- Type of vegetation removal method used and extent of vegetative cover remaining after removal (e.g., presence/absence of understory or herbaceous vegetation that would minimize the potential for erosion and degree of soil disturbance as a result of the movements of equipment)
- Type of soil
- Soil moisture regimes
- Schedule of future construction activities
- Proximity of cleared areas to water resources, roads, or other sensitive environmental resources
- Time of year; the types of erosion and sedimentation control methods for a particular area would depend on the time of year. For example, reseeding would not typically be effective during the winter months. In winter, with frozen ground, controls other than re-seeding (such as wood chips, straw and hay, geotextile fabric, waterbars, or crushed stone) would be used to stabilize disturbed areas until seeding can be performed.
- Extreme weather conditions during or immediately following soil disturbance.

VII.A.6 Foundation Site Preparation, Structure Installation, and Conductor Work

Construction of the foundations for the new structures involves mechanical excavation, including some controlled rock drilling and blasting, if required, and installation of form work, supporting/reinforcing and anchor bolt steel, pouring concrete, and installation of backfill material.

Most excavation for overhead line structure foundations is expected to be accomplished using mechanical excavators and pneumatic hammers. Controlled drilling and blasting, if required, would conform to CL&P specifications and state and local regulations. Neighboring residents would be consulted in advance of the blasting and pre-blast surveys would be performed, as appropriate. The specific locations where blasting will be required would be determined by conducting field studies (borings) at the proposed structure locations.

Any blasting plan would be provided to the local Fire Marshal for approval. Blasting charges would be designed to loosen only the material that must be removed to provide a stable foundation, and to avoid fracturing other rock. A certified blasting specialist would develop site-specific blasting procedures, taking into account geologic conditions and nearby structures and assuring compliance with State regulations

Additional field reviews will be conducted, during the preparation of the D&M Plan, to verify the specific pole and access road locations that have been identified. In determining these locations, CL&P will seek to avoid wetlands, watercourses, steep slopes, and other environmentally sensitive areas to the extent possible. Details of the mitigation measures that will be implemented to minimize impacts at specific locations will be included in the D&M Plan. CL&P's construction specifications will incorporate the Council-approved D&M Plan, and methods to minimize impacts on sensitive areas will comply with CL&P's BMPs. CL&P will monitor the construction contractor for conformance to D&M Plan requirements.

VII.B TYPICAL SUBSTATION CONSTRUCTION PROCEDURE

The proposed modifications at the Card Street Substation will require expansion of the existing fenced area, but it will not require the purchase of additional property to accommodate the planned substation facilities. Required substation work at the Killingly and Lake Road Substations will be accomplished within the existing fenced yards.

The following summarizes the sequential approach that will be used to modify the existing substations. The actual sequence of construction activities and methods of construction may vary based on the specific engineering design ultimately developed. Furthermore, it is anticipated that more detailed construction techniques and, as appropriate, environmental mitigation measures specific to the substation may be defined during the Council's review process.

Site Preparation: Various activities will be required to prepare the site. Such site preparation work may include, as necessary:

- Installation of temporary soil erosion and sedimentation controls (e.g., silt fence, straw bales). Such controls will be maintained, as necessary, throughout the construction process. The primary objective of these controls will be to minimize the potential for off-site erosion.
- Demolition of existing buildings or structures
- Removal of vegetation from work areas
- Creating temporary access to the sites for heavy construction equipment
- Grading to create a level work area
- Installation of temporary fencing around the construction site (if appropriate).
- Typical construction equipment is expected to include bulldozers, backhoes, man-lift vehicles, compressors, trucks (various sizes), large capacity crane (e.g., 100-ton), and flat-bed trailers.

Foundations: Foundation construction typically commences after the completion of rough grading. The foundation installation process typically involves excavation, form work, use of steel reinforcement, and concrete placement. If larger boulders or bedrock are encountered, controlled blasting may be required. Excavated material will either be reused on-site or disposed of off-site in accordance with applicable requirements.

Bus Structures, Electrical Components, Conduits, and Splice Vaults: After the foundations are installed, construction activities will shift to the erection of including insulators, buses, and disconnect switches. In addition, control and power conduits, splice vaults, and a ground grid will be installed.

Final Wiring and System Testing: The remaining electrical equipment and components will then be installed, along with power cables. All of the substation equipment will be tested prior to final connection to the transmission grid.

Transmission Line Interconnections: New structures and associated conductors and wires will be installed, as necessary, to connect the substation to the new 345-kV transmission lines.

Final Cleanup, Site Security and Landscaping: The modifications to the substation will be enclosed within the expanded fenced area to prevent unauthorized access. The exact type of enclosure will be specified in the final engineering designs. After the completion of construction, any remaining construction debris will be collected and removed from the site. Temporary erosion controls will be maintained until the disturbed areas are stabilized. The need for landscaping typically will be discussed during the D&M Plan development phase of the siting process. Landscape plans and specifications, if appropriate, typically will be identified as part of the final engineering and design of the substation facilities.

VII.C TYPICAL UNDERGROUND TRANSMISSION CABLE CONSTRUCTION PROCEDURES

Should the Council order that any portion of the Project be constructed underground, CL&P would employ typical underground transmission cable construction procedures, which are summarized as follows:

- The first step in the construction process is to deploy appropriate erosion and sedimentation controls (e.g., catch basin protection, silt fence or straw bales) at locations where pavement or soils will be disturbed. Within roads and other paved areas, the pavement would then be saw cut and removed.
- To install the duct bank for the XLPE-insulated cables, a trench 7 to 10 feet deep and approximately 5 feet wide would be excavated. This trench would typically be stabilized using trench boxes or other type of shoring. Excavated material (e.g., pavement, subsoil) would be placed directly into dump trucks and hauled away to a suitable disposal site or hauled to a temporary storage site for screening/testing prior to final disposal or re-use in the excavations for backfill. If groundwater is encountered, dewatering would be performed in accordance with authorizations from applicable regulatory agencies and may involve discharge to catch basins, temporary settling basins, frac tanks, or vacuum trucks. Since underground cable installation would involve both the excavation of a continuous trench and areas for splice vaults, it is very probable that rock would be encountered. Such rock would have to be removed using mechanical methods, or possibly mechanical methods supplemented by controlled drilling and blasting. Should drilling and controlled blasting be necessary for the underground cable, it would be performed only pursuant to a plan incorporating multiple safeguards that would be subject to specific approval by the Council, and in consultation with local authorities.
- The duct bank system would consist of nine 8-inch PVC conduits for the XLPE-insulated cables; three 2-inch PVC conduits for the ground-continuity conductors; three 2-inch PVC conduits for the fiber optic relaying cables; and three 2-inch conduits for the temperature-sensing fiber optic cables. The conduit is installed in sections, each of which will be about 10 to 20 feet long, and would have a bell and spigot connection. Conduit sections are joined by swabbing the bell and spigot with glue then pushing the sections together. After installation in the trench, the conduits are encased in high-strength concrete. The duct bank would then be backfilled with a low-strength fluidized thermal backfill (FTB) or native backfill with sufficient thermal characteristics to dissipate the heat generated by the cable system.
- Trenching, conduit installation, and backfilling will proceed progressively along the route such that relatively short sections of trench (under favorable conditions, typically 200 feet per crew) will be open at any given time and location. During non-work hours, temporary cover (steel plates) will be installed over the open trench within paved roads to maintain traffic flow over the work area. After backfilling, the trench area will be repaved using a temporary asphalt patch or equivalent. Disturbed areas will be permanently repaved as part of final restoration.
- At approximately 1,600-foot intervals along the cable-route, pre-cast concrete splice vaults (one for each set of three XLPE cables) will be installed below ground. The length of an underground cable section between splice vaults (and therefore the location of the splice vaults) is determined based on engineering requirements (such as maximum allowable pulling tensions; the cable weight/length that can fit on a reel and be safely shipped) and land constraints. The specific locations of splice vaults will be determined during final engineering design and in some areas could be significantly closer than the 1,600-foot interval stated above.

- For safety purposes, the splice vault excavations are shored and fenced. Vault sites also may be demarcated by concrete (Jersey) barriers or equivalent. Vault installation within roadways may require the closure of two travel lanes in the immediate vicinity of the vault construction.
- Each vault will have two entry points to the surface. After backfilling, these entry points are identifiable as manhole covers, and are set flush with the ground or road surface.
- After the vaults and duct bank are in place, the conduits are swabbed and tested (proofed), using an internal inspection device (mandrel) to check for defects. Mandrelling is a testing procedure in which a ‘pig’ (a painted aluminum or wood cylindrical object that is slightly smaller in diameter than the conduit) is pulled through the conduit. This is done to ensure that the ‘pig’ can pass easily, verifying that the conduit has not been crushed, damaged, or installed improperly. After successful proofing, the transmission cables and ground continuity conductors will be installed and spliced. Cable reels will be delivered by special tractor trailers to the vaults, where the cable will be pulled into the conduit using a truck-mounted winch and cable handling equipment.
- To install each transmission cable and ground-continuity conductors within the conduits, a large cable reel will be set up over a splice vault, and a winch will be set up at one of the adjacent splice-vault locations. The cables and ground-continuity conductors (during separate mobilizations) will then be pulled into their conduits by winching a pull rope attached to the ends of each cable. The splice vaults will also be used as pull points for installing the temperature-sensing fiber optic cables under a separate pulling operation. In addition, pull boxes will be installed near the splice vaults for the pulling and splicing operations required for the remaining fiber optic cables.
- After the transmission cables and ground-continuity conductors are pulled into their respective conduits, the ends will be spliced together in the vaults. Because of the time-consuming and precise nature of spicing high-voltage transmission cables, the sensitivity of the cables to moisture (moisture is detrimental to the life of the cable), and the need to maintain a clean working environment, splicing XLPE-insulated cables involves a complex procedure and requires a controlled atmosphere. The ‘clean room’ atmosphere will be provided by an enclosure or vehicle that must be located over the manhole access points during the splicing process. It typically takes 10 to 14 days to complete the splices in each vault (three 345-kV XLPE cable splices in each splice vault). Each cable and associated splice will be stacked vertically and supported on the wall of the splice vault.
- At the ends of the cable routes, terminations are connected to the cables at 345-kV line transition stations where they transition to overhead transmission lines. Further discussion on the transition station facilities can be found in Section V.C Substation Facilities.

Vegetation

To accommodate the construction of the underground line-route variations, there would be some locations where trees or other vegetation within the existing ROW or on private or public property will have to be trimmed or removed.

Wherever possible the actual construction will occur within the street, but equipment, such as excavators and cranes, will still need the necessary overhead clearances to work safely or physical space is needed for the proposed facilities. Therefore, trees with limbs overhanging the roadway will have to be pruned and some trees adjacent to the road ROWs or within CL&P’s ROW will have to be removed.

If it is necessary to install splice vaults along the side of the roadway, off the paved road surface, trees or vegetation on private property could be affected. In such instances, any vegetation within the construction workspace would have to be removed, and it is possible that trees outside the workspace would have to be pruned to provide the necessary clearances to allow safe operation of construction equipment.

At any trenchless crossing sites (e.g., locations where jack and bore or horizontal directional drilling may be used), trees will likely have to be removed in order to provide the necessary work space for the specialized equipment.

VIII. ENVIRONMENTAL SUMMARY

VIII.A EXISTING ENVIRONMENTAL CONDITIONS

As part of the planning for the Project, CL&P has conducted a wide range of research and field investigations to characterize the existing environment along and in the vicinity of the Primary Route Under Consideration, as well as the potential overhead and underground line variations to that route. In addition, environmental features along the route for the loop of the Manchester to Millstone Line into Card Street Substation (310 Line Loop) were evaluated. This environmental information has subsequently been used to conduct an initial assessment of the potential effects of the Project on natural and cultural resources, and to identify potential measures to minimize or avoid such effects.

To characterize the Project region, data was compiled for the following resources:

- Topography, geology, and soils
- Water resources, water quality, and wetlands
- Biological resources (vegetative communities, wildlife resources, fisheries, amphibians, birds, and rare, threatened or endangered species)
- Land uses and development
- Recreational/scenic resources
- Cultural (archaeological and historic) resources
- Air quality
- Noise
- Transportation systems and utility crossings

This section summarizes some of the key existing environmental features in the Project area and then provides an overview of the Project's potential environmental effects and the measures that CL&P has identified to date to mitigate such effects. Detailed environmental information regarding the Primary Route Under Consideration and the route variations are provided in Volume 2. The purpose of the summary is to provide general data concerning the environmental setting in the Project area. CL&P expects that more specific environmental data will be compiled as a result of the Municipal Consultation Process. In addition, CL&P's environmental consultant has been commissioned to conduct further biological field studies along the Project ROW during 2008, thereby updating field investigations that were originally performed in 2004. The results of the 2004 studies also are included in Volume 2.

Tables VIII-1 through VIII-3 present information regarding the existing environmental features along the Primary Route Under Consideration, the route of the 310 Line Loop, the overhead line-route variations, and the underground line-route variations respectively. Volume 2 presents more detailed information regarding the existing environmental resources found along the Primary Route Under Consideration as well as the potential overhead and underground line-route variations. Furthermore, for each of the Project components, existing environmental features (e.g., wetlands and watercourses, land uses, parks, wildlife management areas, floodplains) are illustrated on the 1"= 400' aerial photograph-based maps presented in Volume 5.

VIII.A.1 Topography, Geology, Soils

Topography in the Project area is characterized by a series of hills and valleys. Elevations generally range from approximately 200 feet National Geodetic Vertical Datum (NGVD) to approximately 600 feet NGVD. In general, because of its length and the fact that it is a cross-country route, more topographic relief is found along the Primary Route Under Consideration than the overhead or underground route variations. The 310 Line Loop traverses relatively level topography.

Bedrock geology in the vicinity of the Project (the Primary Route Under Consideration, the 310 Line Loop, and the potential overhead and underground line-route variations) consists mainly of Paleozoic Era igneous granites, gneisses, quartzites, and metamorphic schists folded into north-south belts. Surficial geology within the Project area is varied and consists of different thicknesses of tills, sand, gravel, fines, alluvium, and elongated hills called drumlins.

VIII.A.2 Water Resources

The primary water resources crossed by the Primary Route Under Consideration include the Tenmile River, Hop River, Willimantic River, Mansfield Hollow Lake, Natchaug River, Little River, Quinebaug River, and Fivemile River. As shown in more detail in Volume 2, the following variations cross a smaller subset of these water resources:

- Mansfield Underground Variation
- Mount Hope Overhead Variation
- Mount Hope Underground Variation
- Brooklyn Overhead Variation
- Brooklyn Underground Variation
- Putnam North Overhead Variation
- Putnam North Underground Variation

Both the Willimantic South Overhead and Underground line-route variations would avoid crossing the Mansfield Hollow Lake in the Town of Mansfield. The primary water resources crossed by these two route variations include the Shetucket River, in addition to some smaller perennial and intermittent watercourses. Table VIII-4 identifies the number of water crossings and floodplains crossed by each route.

Wetlands

Field studies to document wetlands along the Primary Route Under Consideration, which follows CL&P's existing ROW, were conducted in 2004. These field studies are currently being updated and verified. No wetland field studies were conducted along those overhead or underground line-route variations that do not share portions of the existing CL&P ROW because CL&P does not have access permission along these potential corridors. Wetland information for the variations is based on the Connecticut Department of Environmental Protection (DEP) wetlands Geographic Information System (GIS) datalayer unless otherwise noted.

Approximately 270 acres of wetlands are located within the existing CL&P ROW along which the Primary Route Under Consideration is aligned. Table VIII-4 presents a summary of wetlands along the route variations in comparison to wetlands along the portion of the Primary Route Under Consideration which each variation would replace.

Field studies to identify wetlands along the route of 310 Line Loop component of the Project were conducted in 2008. Approximately 11.3 acres of wetlands are located within the existing CL&P ROW along which the 310 Line Loop is aligned.

VIII.A.3 Vegetation

Along the existing ROW that the Primary Route Under Consideration follows, as well as the 310 Loop component of the Project, CL&P currently performs routine maintenance in order to assure that the vegetation growth does not interfere with transmission line use. As a result, in general, the predominant vegetative types within the existing transmission line corridor consist of dense scrub-shrub communities and herbaceous growth. The predominant vegetative types adjacent to the existing maintained portions of the ROW are deciduous (hardwood) and mixed hardwood (in varying successional stages), intermixed with areas of agricultural use, maintained lawn and wetlands.

The overhead line-route variations are generally located in areas of deciduous or mixed hardwood forest cover. The underground variations are located within existing roadway ROW or within CL&P's existing transmission line ROW where the vegetative cover is the same as described above.

VIII.A.4 Wildlife

The Primary Route Under Consideration, the 310 Line Loop, and the potential overhead and underground line-route variations can be expected to provide productive habitat for a variety of wildlife species ranging from white-tailed deer, various species of birds, to turtles and snakes. The Primary Route Under

Consideration can be expected to support a greater number and diversity of birds than the overhead line-route variations, which are not aligned in the existing CL&P ROW, as the existing ROW functions as "edge" habitat. The existing ROW of the 310 Line Loop also can be expected to support a diverse number of bird species similar to the Primary Route Under Consideration.

VIII.A.5 Land Use

In general, the Project area in northeastern Connecticut is largely characterized by rural or semi-rural towns containing large areas of farmland, rivers and lakes, and state forests. As listed in Table VIII-1, the Primary Route Under Consideration would follow CL&P's existing ROW through portions of 11 towns.

The Primary Route Under Consideration and the 310 Line Loop are aligned entirely within existing CL&P transmission line ROWs while the overhead line-route variations are generally aligned on private land across which CL&P would have to obtain easements. The Primary Route Under Consideration traverses several areas of protected open space and/or preserved land, including the Mansfield Hollow State Park/Mansfield Hollow Wildlife Management Area. Both the Willimantic South Overhead and Underground variations would avoid this area. However, the Willimantic South Overhead Variation would traverse other protected resources such as the Pomeroy State Park Scenic Reserve.

A new overhead 345-kV line on the Primary Route Under Consideration passes by two Statutory Facilities, as defined by the Connecticut law (adjacent schools, licensed child daycare facilities, licensed youth camps, public playgrounds, and residential areas), one in the Town of Mansfield and one in the Town of Brooklyn. Both the Willimantic South Overhead and Underground line-route variations would avoid these areas. However, other Statutory Facilities are located adjacent to the Willimantic South Underground Variation. In addition, in the Town of Mansfield, the Mount Hope Overhead and Underground line-route variations were designed to align the transmission line farther away from the Statutory Facility in the area. Within the Town of Brooklyn, the Brooklyn Overhead and Underground line-route variations were also designed to avoid the Statutory Facility.

Table VIII-1: Summary Information Regarding Existing Environmental Conditions for the Primary Route Under Consideration and 310 Line Loop

Features*	PRUC Route (OH)	310 Line Loop (OH)	Total Project
Miles by Town:			
Lebanon	0.6	0.9	1.5
Columbia	1.7	--	1.7
Windham	--	--	--
Coventry	1.2	--	1.2
Mansfield	6.4	--	6.4
Chaplin	3.3	--	3.3
Hampton	4.3	--	4.3
Brooklyn	7.2	--	7.2
Pomfret	1.7	--	1.7
Killingly	3.0	--	3.0
Putnam	5.6	--	5.6
Thompson	1.9	--	1.9
Total Miles	36.8	0.9	37.7
Road Crossings (No.)	48	3	51
Stream Crossings (No.)	60	2	62
Railroad Crossings (No.)	2	0	2
Wetlands Within ROW (acres)	270.1	11.3	281.4
Threatened and Endangered Species within ROW (No. of NDDB occurrence areas)	9	0	9
Adjacent Land Use (acres based on land use extent within 100 feet of the ROW)			
Residential	42.6	0.4	43
Rural or Agricultural	41.4	1.6	43
Commercial/Industrial	9.5	0	9.5
Statutory Facilities within 600’ of ROW	2	0	2
Cultural Resource Sites within or close to ROW			
Native American Archaeological Sites within 300’ of ROW Center Line (No.)	5	0	5
Euroamerican Archaeological Sites within 300’ of ROW Center Line (No.)	1	0	5
Significant Historic Resource Sites (NRHP Listed/Eligible) within .25 Mile of ROW (No.)	7	0	7
National Scenic Byways (No.)	1	0	1
Cemeteries Subject to Ancient Burying Ground Protection within .25 Mile of ROW (No.)	7	0	7
Length not parallel to existing linear facilities (miles)	0	0	0
* Estimated			

Note: Statistics on existing environmental resources for the Primary Route Under Consideration and the 310 Loop were tabulated based on the extent of the existing ROW unless otherwise noted.

Table VIII-2: Summary Information Regarding Existing Environmental Conditions Overhead Line Variations

Features*	**Willimantic South**	**Mount Hope**	**Brooklyn**	**Putnam North**
Miles by Town:				
Lebanon	1.5	--	--	--
Columbia	0	--	--	--
Windham	6.9	--	--	--
Coventry	--	--	--	--
Mansfield	--	0.5	--	--
Chaplin	1	--	--	--
Hampton	--	--	--	--
Brooklyn	--	--	1.7	--
Pomfret	--	--	1.6	--
Killingly	--	--	--	--
Putnam	--	--	--	1.3
Thompson	--	--	--	--
Total Miles	9.4	0.5	3.3	1.3
Road Crossings (No.)	14	3	1	1
Stream Crossings (No.)	16	3	1	2
Railroad Crossings (No.)	2	0	0	0
Wetlands Within ROW (acres)	26.9	3.2	5.1	8.1
Threatened and Endangered Species within ROW (No. of occurrence areas)	0	0	0	0
Adjacent Land Use (acres)				
Residential	9.3	0	0.3	0.2
Rural or Agricultural	3	0.4	4.1	0
Commercial/Industrial	13.3	0.9	0	0
Statutory Facilities within 600' of Centerline	0	1	0	0
Cultural Resource Sites within or close to ROW				
Native American Archaeological Sites within 300' of Center Line (No.)	0	0	0	0
Euroamerican Archaeological Sites within 300' of Center Line (No.)	1	0	0	0
Significant Historic Resource Sites (NRHP Listed/Eligible) within .25 mile of Center Line (No.)	2	1	0	0
National Scenic Byways (No.)	0	0	0	0
Cemeteries Subject to Ancient Burying Ground Protection within .25 Mile of Center Line (No.)	2	0	0	0
Length not parallel to existing linear facilities (miles)	9.3	0.3	3.2	1.1
* Estimated				

Note: Statistics on existing environmental resources for the Overhead Variations were tabulated based on a 150 foot buffer around the route centerline (75 feet to each side of the line), unless otherwise noted.

Table VIII-3: Summary Information Regarding Existing Environmental Conditions Underground Line Variations

Features*	Willimantic South	Mansfield	Mount Hope	Brooklyn	Putnam North
Miles by Town:					
Lebanon	0.8	--	--	--	--
Columbia	--	--	--	--	--
Windham	8.2	--	--	--	--
Coventry	--	--	--	--	--
Mansfield	--	0.7	1.2	--	--
Chaplin	1.7	--	--	--	--
Hampton	--	--	--	--	--
Brooklyn	--	--	--	1.3	--
Pomfret	--	--	--	--	--
Killingly	--	--	--	--	--
Putnam	--	--	--	--	1.8
Thompson	--	--	--	--	0.5
Total Miles	10.7	0.7	1.2	1.3	2.4
Road Crossings (No.)	70	1	2	1	20
Stream Crossings (No.)	15	0	1	2	6
Railroad Crossings (No.)	3	0	0	0	0
Wetlands Within ROW (acres)	15.7	2.1	2.5	2	3.4
Threatened and Endangered Species within ROW (No. of occurrence areas)	2	0	0	0	0
Residential	118.6	0.6	0.5	4.4	12.3
Rural or Agricultural	4.2	0.0	2.8	0.0	0.0
Commercial/Industrial	9.5	0.0	0.0	0.0	1.7
Statutory Facilities within 600’ of ROW	8	0	1	1	0
Cultural Resource Sites within or close to the ROW					
Native American Archaeological Sites within 500’ of Center Line (No.)	0	0	0	0	0
Euroamerican Archaeological Sites within 500’ of Center Line (No.)	0	0	0	0	0
National Scenic Byways within 500’ of Center Line (No.)	0	0	0	0	0
Significant Resource Sites (NRHP Listed/Eligible) within 500 feet of Center line (No.)	7	0	0	0	0
Cemeteries Subject to Ancient Burying Ground Protection within 500’ of Center Line (No.)	1	0	0	0	1
Length not parallel existing linear facilities (miles)	10	0	0	0	1.9
* Estimated					

Note: Statistics on existing environmental resources for the Underground Variations were tabulated based on a 150 foot buffer around the route centerline (75 feet to each side of the line), unless otherwise noted.

Table VIII-4: Summary Comparison of Estimated Water Resources Along Overhead/Underground Line-Route Variations and Comparable Portion of Primary Route Under Consideration

Variation/PRUC	Estimated Wetland Crossing Miles	Number of Watercourse Crossings	Miles of 100 Year Floodplain Crossed
Willimantic South OH	1.4 (CTDEP Wetlands)	16	0.3
PRUC Replaced	2.0 (CTDEP Wetlands) 2.1 (2004 Field Survey)	23	1.9
Willimantic South UG	0.8 (CTDEP Wetlands)	15	0
PRUC Replaced	1.6 (CTDEP Wetlands) 1.9 (2004 Field Survey)	21	1.9
Mansfield UG	0.3 (2004 Field Survey)	0	0
PRUC Replaced	0.2 (2004 Field Survey)	0	0
Mount Hope OH	0 (2004 Field Survey)	1	0
PRUC Replaced	0.1 (2004 Field Survey)	1	0
Mount Hope UG	0.1 (2004 Field Survey)	1	0
PRUC Replaced	0.1 (2004 Field Survey)	1	0
Brooklyn OH	0.3 (CTDEP Wetlands)	3	0.1
PRUC Replaced	0.9 (CTDEP Wetlands) 0.9 (2004 Field Survey)	6	1.0
Brooklyn UG	0.1 (2004 Field Survey)	2	0.1
PRUC Replaced	0.2 (2004 Field Survey)	2	0.1
Putnam North OH	0.5 (CTDEP Wetlands)	2	0.2
PRUC Replaced	0.4 (CTDEP Wetlands) 0.5 (2004 Field Survey)	1	0.5
Putnam North UG	0.2 (CTDEP Wetlands)	5	0.1
PRUC Replaced	0.6 (CTDEP Wetlands) 0.8 (2004 Field Survey)	2	0.7

Note: Connecticut wetlands are defined based on soil type only. CTDEP wetland datalayers were used to identify potential wetland resources along the route variations, which are located on private property where CL&P does not have survey access permission. In contrast, wetlands along the Primary Route Under Consideration (which would be located entirely on CL&P's existing ROW) were field surveyed.

IX. SUMMARY OF ENVIRONMENTAL EFFECTS AND MITIGATION

Based on the environmental data compiled to date, CL&P has taken care in the planning and design of the Project to identify line routes and/or measures that would minimize environmental effects. CL&P has considered and addressed the potential short-term and long-term of the Project on topography, geology, and soils; water resources, water quality, and wetlands; biological resources (vegetative communities, wildlife resources, fisheries, amphibians, birds, and rare, threatened or endangered species); land uses and development; recreational/scenic resources; cultural (archaeological and historic) resources; air quality; noise; and transportation systems and utility crossings. A summary and comparison of the potential effects using the Primary Route Under Consideration and potential route variations is provided in Table IX-5.

The construction of the Project using the Primary Route Under Consideration would have both short-and long-term environmental effects. However, compared to other options, this line route would minimize adverse environmental effects because the new line would be located along an existing CL&P transmission line ROW that is already devoted to utility use. The Project's potential environmental effects, as well as the mitigation measures that CL&P has identified thus far to minimize such effects, are discussed in Volume 2. The potential consequences of both overhead transmission line and underground cable construction and operation are discussed in Volume 2.

The potential environmental effects and mitigation measures along the route of the 310 Line Loop component of the Project are expected to be the same as those presented for the Primary Route Under Consideration. The only exception is the additional ROW that would be required at the northwest corner of the existing CL&P ROW on the west side of Card Street for the overhead line entries to Card Street Substation.

The Primary Route Under Consideration traverses several designated parks, wildlife management areas, forests, or other scenic/recreational areas. However, the development of the 345-kV line along the Primary Route Under Consideration would minimize the potential impacts to these facilities by following CL&P's currently maintained ROW. Along this ROW, potential effects would occur primarily due to the additional forested vegetation removal that would be required to construct the new transmission line; operation of the Project would require that the ROW be maintained in low-growth vegetation.

In addition, through the Mansfield Hollow State Park and portions of the adjacent Mansfield Hollow Wildlife Management Area, the existing CL&P ROW is too narrow to accommodate the new 345-kV line and may have to be expanded through the acquisition of additional ROW from the state or the USACE. This proposed expansion will require vegetation removal along an approximately 1.0-mile segment in Mansfield (encompassing about 15.8 acres) and an approximately 0.5-mile segment in Chaplin (encompassing about 8.9 acres) adjacent to the existing ROW. This proposed expansion will accommodate the installation and operation of additional transmission facilities.

In order to avoid areas where potential alignments of the overhead transmission line would be in proximity to certain Statutory Facilities (i.e., adjacent schools, licensed child daycare facilities, public playgrounds, and residential areas), several overhead and underground line-route variations have been identified to portions of the Primary Route Under Consideration. The use of these variations generally would require CL&P's acquisition of private property for the development of the Project facilities. Further, the development of the overhead line-route variations will conflict with existing land uses (i.e. preserved open space, forested, and residential areas) because new transmission line ROW would have to be established in areas where no transmission facilities currently exist. The overhead line-route variations will also result in greater impacts to biological resources (such as vegetation and wetlands) associated with the development of the overhead 345-kV facilities along such new "greenfield" ROW.

The underground line-route variations would be aligned within or adjacent to existing roadway ROW or within the existing CL&P ROW. Potential impacts from underground line-route variations within existing roadway ROW could be minimal and limited primarily to the construction period; however, typically, private land is required for off-road splice vaults and temporary equipment and material staging areas are required. Transition stations also would be required for each of the underground line-route variations in order to link the underground and overhead components of the Project. Typically, each transition station (a station would be required on either end of any underground variation) would need two to four fenced acres. The development of such transition stations may result in the removal of forested and wetland areas. Establishment of the transition stations would result in long-term land use conversions and would create localized adverse effects on the visual environment.

Table IX-1: Summary of Potential Environmental, Cultural, and Land-Use Effects and Mitigation Measures

Potential Effects			
Resource	**Primary Route Under Consideration (and 310 Line Loop)**	**Overhead Variations**	**Underground Variations**
Topography, Geology and Soils	Erosion and sediment controls would control construction related effects to these resources.		
Water Resources and Water Quality			
Wetlands	Minimal effects anticipated from presence of overhead facilities. Wetlands would be spanned wherever practical. Forested wetland vegetation would have to be removed along the ROW. Erosion and sediment controls would control construction related effects.	Minimal effects anticipated from presence of overhead facilities. Wetlands would be spanned wherever practical. However, forested wetland vegetation would have to be removed along the ROW, resulting in a change of wetland type. Erosion and sediment controls would control construction related effects.	UG portion aligned in or adjacent to roadways or transmission ROW. However, some forested clearing is typically required along roads to accommodate the construction equipment. UG construction methods for crossings (e.g., HDD, jack-and-bore) could avoid most effects to wetlands. Transition stations may need to be sited in wetlands.
Watercourses	Minimal effect anticipated from presence of overhead facilities. Watercourses would be spanned. Erosion and sediment controls would control construction related effects.	Minimal effect anticipated from presence of overhead facilities. Watercourses would be spanned. Less shading will be provided on watercourses as a result of tree removal. Erosion and sediment controls would control construction related effects.	UG construction methods for crossings (e.g., HDD, jack-and-bore) would avoid most effects to watercourses. Erosion and sediment controls would control construction related effects.
Groundwater Resources	There are no public drinking water supply wells near the Primary Route Under Consideration or overhead/underground variations. Construction unlikely to affect private wells or water table. Preventative measures would be taken to prevent fuel spills during construction.		
Flood Zones	OH structures may be sited in floodplains.		UG structures may cross beneath floodplains.
Biological Resources			
Vegetative Communities	Vegetation removal in existing CL&P ROW.	More woodland would need to be cleared than for the Primary Route Under Consideration.	Vegetation removal in existing ROWs. May require vegetation removal at transition station locations.
Wildlife	Shrubland created along the ROW would be desirable to many wildlife species.	May result in change in habitat types as forested areas would be converted to shrubland.	UG portion aligned in roadway or transmission ROW. Transition stations may result in minimal impacts to wildlife habitat.
Fisheries	Minimal effect anticipated	Watercourses would be	UG construction methods

Potential Effects			
Resource	**Primary Route Under Consideration (and 310 Line Loop)**	**Overhead Variations**	**Underground Variations**
	from presence of overhead facilities. Watercourses would be spanned. Erosion and sediment controls would control construction related effects.	spanned. Less shading will be provided on watercourses as a result of vegetation removal. Erosion and sediment controls would control construction related effects.	for crossings (e.g., HDD, jack-and-bore) would avoid most effects to watercourses. Erosion and sediment controls would control construction related effects.
Potential Amphibian Breeding Habitat	Wetland-dependent. See Wetlands above.		
Birds	Shrubland habitat that would be created is regionally rare and desirable to many bird species.		
Protected Species	See Wetlands, Wildlife, Amphibian Breeding Habitat, and Birds above. Special efforts would be made to avoid sensitive habitat areas through bypassing, spanning, or limiting construction to time of year when species/sensitive life stages are not present.		
Land Use	Consistent with existing uses and land use as transmission line ROW is currently utilized and maintained. Crosses several state parks, forests, preserved open space and scenic/recreation areas.	New utility ROWs would be created, causing a change in land use. May conflict with existing land uses. Crosses several state parks, forests, preserved open space and scenic/recreation areas.	Would be aligned beneath roads or adjacent areas. Temporary nuisance land use effects due to comparatively long construction timeframes. Consistent with existing uses and land use plans. Crosses fewer state parks, forests, and scenic/recreation areas.
Cultural Resources	No visual effect on historic districts anticipated. Archaeologically sensitive areas would be avoided to the extent possible and appropriately documented if avoidance is not feasible. All ROWs would require further cultural resource analyses and field testing, based on area-specific sensitivities for the location of as yet undiscovered archaeological (buried) sites.		
Air Quality	Not anticipated to be a substantial issue. Controls would be in place during construction to control dust.		
Noise	Not anticipated to be a substantial issue. Controls would be in place during construction.		Construction noise may be more substantial due to UG construction methods.
Transportation, Traffic and Utility Crossings	OH construction in existing ROW or new cross-country ROW would not substantially interfere with existing transportation patterns. Existing utilities would be spanned.		Potentially significant, but localized, impacts due to degree of work in roadways.

X. ELECTRIC AND MAGNETIC FIELDS

Electric and magnetic fields (EMF) are forms of energy that surround an electrical device. Transmission lines are common sources of EMF, as are other substantial components of electric power infrastructure, ranging from transformers at substations to the wiring and appliances in a home. However, any piece of machinery run by electricity can be a source of EMF.

To address a range of concerns regarding potential health risks from exposure to transmission line EMF, in December of 2007, the Council issued a policy document entitled "*Best Management Practices for the Construction of Electric Transmission Lines in Connecticut*" (the BMP Document.) This document summarized the latest information regarding scientific knowledge and consensus on EMF health concerns, and it adopted policies concerning the reduction of electric and magnetic fields associated with proposed new transmission lines.

In the BMP Document, the Council recognized "that a causal link between power-line MF exposure and demonstrated health effects has not been established, even after much scientific investigation in the U.S. and abroad," and that "timely additional research is unlikely to prove the safety of power-line MF to the satisfaction of all." Accordingly, the Council decided "to continue its cautious approach to transmission line siting that has guided its Best Management Practices since 1993." As the Council states in the BMP Document, "this continuing policy is based on the Council's recognition of and agreement with conclusions shared by a wide range of public health consensus groups, and also, in part, on a review which the Council commissioned as to the weight of scientific evidence regarding possible links between power-line MF and adverse health effects. Under this policy, the Council will continue to advocate the use of effective no-cost and low-cost technologies and management techniques on a project-specific basis to reduce MF exposure to the public while allowing for the development of efficient and cost-effective electrical transmission projects.

Pursuant to this policy, the Council's EMF BMPs "require an applicant proposing to build an overhead electric transmission line to develop and present a 'Field Management Design Plan'" that identifies measures to reduce magnetic field levels that would otherwise occur along an electric transmission right of way, particularly where the line will be "adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds.

The BMP also require transmission line applicants to present calculations of magnetic fields under pre-project and post project conditions, assuming the use of different transmission line design alternatives. The purpose of this requirement is to "allow for an evaluation of how MF levels differ between alternative power line configurations," so that the Council can direct the applicant to "achieve reduced MF levels when possible through practical design changes." However, the reduction of magnetic fields is only one of the factors that the Council will consider in approving particular line designs. Others include "cost, system reliability, aesthetics, and environmental quality."

CL&P is in the process of developing the information about the proposed line required by the BMP, including a Field Management Design Plan. Detailed and time-consuming computer modeling of line current flows over large portions of the Connecticut electric system is needed to perform the required calculations. CL&P will present its Field Management Design Plan to the Council and to interested landowners in the course of the proceedings on its application.

In addition to specific information about a proposed transmission line, the Council considers certain general EMF information in the course of a proceeding on a transmission line application, including "evidence of any new developments in scientific research addressing MF and public health effects or changes in scientific consensus group positions regarding MF." Accordingly, CL&P commissioned an independent expert to prepare a report concerning any such developments, which it will present with its application. A copy of that report is also included in this municipal consultation filing.

Volume 4 of this MCF includes the following information concerning EMF, some of which has been referenced in the preceding discussion:

- Connecticut Siting Council, Best Management Practices for the Construction of Electric Transmission Lines in Connecticut (December 14, 2007)
- World Health Organization, Electromagnetic Fields and Public Health fact sheet, (June 2007)
- Connecticut Department of Public Health, Fact Sheet, Electric and Magnetic Fields (April 2008)
- National Institute of Environmental Health Sciences, Electric and Magnetic Fields Associated with the Use of Electric Power, Questions and Answers, (June 2002)

XI. PROJECT SCHEDULE

Major milestones established for the Project are as follows:

- Municipal Consultation Filing Submittal – 3rd Quarter, 2008
- Open Houses and Town Meetings – 3rd Quarter, 2008
- Connecticut Siting Council Filing Submittal – 4th Quarter, 2008
- Decision and Order – 2nd Quarter, 2010
- Construction Start – 3rd Quarter, 2010
- Construction Complete – 4th Quarter, 2012